Cretaceous Angiosperm Leaf Floras from Antarctica

Volume Two

Appendix

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

Contents

For each leaf there is a description and a line drawing obtained using a stereo research microscope and a drawing tube. With repeated observations with lighting at various angles and evidence from photographs, it was attempted to distinguish between veins and preservational features and to designate different vein orders with colour:

primary – red; secondary – blue; tertiary – green.

In the descriptions, 'leaf area' refers to estimates of leaf area calculated using the equation:

Area = 2/3 x length x width

Hidden Lake Formation Flora

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Santa Marta Formation Flora

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D8754.8.1a

Preservation: Excellent. The venation is very clear. The remaining organic material is of medium thickness and fairly even coverage. There are holes in the leaf which may be a result of insect damage. In some parts of the leaf the organic material has a slightly thinner appearance and here the higher order venation patterns are especially clear. The leaf is almost whole and its whole shape can be described. Most of the margins are present. Only part of the lower LHS of the leaf is missing. The apex is clear and the base of the leaf can be described from the lower RHS of the leaf. There is no petiole.

Dimensions: Max. length 45.2mm. Max. width 19.5mm min. Area 519.6sq.mm min. Max. length along 1° 43.2mm – different to the max. length because the 1° is slightly curved and the leaf base is cordate. RHS of leaf is complete, lower left portion of leaf is missing. Max. width of RHS only 11.4mm. Assuming leaf is symmetrical, max. width of leaf is 22.8mm. Although the leaf is incomplete, this appears to be a fairly accurate estimate of the max. leaf width. Assuming leaf is symmetrical, max. area of missing portion of leaf is 164.3sq.mm. and estimated max. area 683.9sq.mm. 'Leaf area' 687sq.mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Whole lamina appears roughly symmetrical, but lower LHS is missing so this is not certain. Symmetry of base cannot be described because LHS is missing. Apex appears roughly symmetrical.

Form: Point of max. width is 11.7mm from leaf base, which is 26% of the leaf length. The leaf form is therefore termed ovate. Using the estimated max. width, the length/width ratio is 1.98:1. The leaf form is therefore described as ovate.

Apex: Apical angle 50°. Apex is described as attenuate.

Base: Only RHS of base is preserved, but assuming base is symmetrical, basal angle is 101°. Base is described as cordate and although only RHS is preserved, this appears to be an accurate description of the leaf base.

Margin: There are two clearly preserved projections on RHS of leaf. Measured perpendicular to the midvein, the margin is indented 1.9-2.8mm, average 2.4mm, 19.9% of the distance to the midvein. There are also projections on the less clearly preserved LHS, indented 0.9mm, 11.7% of the distance to the midvein. The apices of the projections are rounded, so the margin is described as crenate. Sinus closest to base on RHS appears slightly angular, but all others are rounded, so sinuses between crenations are described as rounded. Spacing of crenations is 7.7-13.4mm, average 9.7mm, standard deviation 2.6mm, and spacing is described as irregular.

Petiole: Absent or not preserved.

Venation type: Basal, imperfect, marginal actinodromous, with three primary veins diverging from the leaf base. Lateral primary vein diverges from base at 36° to midvein.

1° vein:
Size: Midpoint is 22.6mm from leaf base. At this point, 1° vein width is 0.4mm and leaf width is 19.3mm. LHS is incomplete at this point and width of RHS only is 11.4mm. Assuming leaf is symmetrical leaf width is 22.8mm. Size of 1° is therefore 1.75% and is termed moderate.
Course: Markedly curved.

2° veins:
Number: 16.
Pairs are alternate/opposite.
Angle of divergence: Wide acute (59-93°, average 73°). (Average on LHS 65°, average on RHS 80°).
Basal vein angle: Moderate acute (63°).
Variation: Lowest pair of secondaries more acute than pairs above. Divergence angle more acute on LHS than RHS.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 121°). Enclosed by 2°, 3° and 4° arches.
Intersecondary veins: None.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.5:1.
Average vein length: 5.5mm.
Average spacing: 4.4mm.

3 veins:
Average angle of origin on admedial side of 2°s: 80°.
Average angle of origin on exmedial side of 2°s: 86°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 95°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.2a&3a

Part and counterpart.

D8754.8.2a

Preservation: Excellent. The counterpart 3a shows better preservation. The venation is clear. The remaining organic material is of thin and even appearance. There is a split in the rock meaning that part of the middle of the leaf is missing, which is not the case with the counterpart. The leaf is almost whole and its whole shape can be described. Most of the margins are present. Part of the lower LHS of the leaf is missing; - part of this appears to be covered by sediment, so it may be possible to reveal more of the leaf by removing this rock. The apex is clear and the base of the leaf can be described from the lower RHS of the leaf. There is no petiole.

Dimensions: Max. length 46.2mm. Max. width 23.5mm (point of max. width is closer to the base on RHS). Area 423.3sq.mm min. Filling in missing areas across middle of leaf and estimating lower left margin, area is 528.4sq.mm. Max. length along 1° 46.4mm. 'Leaf area' 726.9sq.mm.

D8754.8.3a

Preservation: Excellent. The venation is very clear. The remaining organic material is of medium thickness and fairly even coverage. The leaf is almost whole and its whole shape can be described. Most of the margins are present. Only part of the lower RHS of the leaf is missing. The apex is clear and the base of the leaf can be described from the lower LHS of the leaf. There is no petiole.

Dimensions: Max. length 47.4mm. Max width 24.1mm (point of max. width is closer to base on LHS.) Area 504.8sq.mm min. Filling in missing portion from lower RHS, area is 556.8sq.mm. Max. length along 1° 47.6mm. 'Leaf area' 764.8sq.mm.

D8754.8.2a&3a

Dimensions: These measurements are averages of the measurements for 2a and 3a. Max. length 46.8mm. Max. width 23.8mm (point of max. width is closer to base on one side of the leaf than the other). Area 464.1sq.mm min. Estimated area 542.6sq.mm. Max. length along 1° 47mm. 'Leaf area' 745.9sq.mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The whole lamina appears asymmetrical, although this is not pronounced and may be a preservational feature, the projections on the central parts of one side of the leaf appear blunted and the largest projection near the base is higher on one side than the other. The base appears asymmetrical, but part of one side of the base is missing. The apex appears roughly symmetrical.

Form: The point of max. width is 12.4mm from the base of the leaf. Expressed as a percentage of the total leaf length, the point of max. width is 26% of the distance from the leaf base. The leaf is therefore termed ovate. The length width ratio is 1.97:1, measuring the length along the 1° vein. The leaf form is therefore defined as ovate.

Apex: Apical angle 29°. Apex is described as attenuate.

Base: One side of base is incomplete, so angle is measured for one side of base only and assuming base is symmetrical, basal angle is 98°. However, base is not symmetrical and sketched minimum outline of whole base appears to give a better representation of leaf base. Basal angle is therefore estimated to be 91°. Base is described as obtuse and cuneate and although

one side of base is incomplete, this appears to be an accurate description.

Margin: There are three projections on each side of the leaf. Measured perpendicular to the midvein, the margin is indented 0.4-2.6mm, average 1.4mm, 12.4% of the distance to the midvein. The apices of the projections are rounded, so the margin is described as crenate. Sinuses between crenations are rounded. Spacing of crenations is 6.9-11.7mm, average 9.1mm, standard deviation 1.8mm, and spacing is described as regular.

Petiole: Absent or not preserved.

Venation type: Basal, imperfect, marginal actinodromous, with three primary veins diverging from the leaf base. Lateral primary veins diverge from base at 28° to midvein on one side and 38° on the other.

1° vein:
Size: Midpoint is 23.4mm from leaf base. At this point, 1° vein width is 0.41mm and leaf width is 15.8mm. Size of 1° is therefore 2.6% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 22.
Pairs are alternate/opposite.
Angle of divergence: Wide acute (36-108°, average 75°).
(Average on one side 70°, average on other side 80°).
Basal vein angle: Wide acute (75°).
Variation: Divergence angle varies irregularly. Divergence angle asymmetrical.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 103°). Enclosed by 2°, 3° or 4° arches.
Intersecondary veins: None.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.8:1.
Average vein length: 5mm.
Average spacing: 3.1mm.

3 veins:
Average angle of origin on admedial side of 2°s: 87°.
Average angle of origin on exmedial side of 2°s: 85°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 82 °.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.4a&5a

Part and counterpart.

D8754.8.4a

Preservation: Good. The venation is very clear. The remaining organic matter has a fairly even coverage in the parts of the leaf which remain. Most of the LHS of the leaf is missing, only the apical portion is present. The very tip of the leaf is missing. The base of the leaf is absent. Only a very small percentage of the margin is present. However, it may be the case that part of this leaf specimen is covered by sediment and removing this cover may reveal a greater proportion of this very well preserved leaf.

Dimensions: Max. length 48.7mm min. Max. width 18mm min. Since leaf apex and base are incomplete, max. length is a minimum estimate. The max. length is estimated to be at least 49.7mm. The RHS is more complete than the LHS and the max. width of RHS only is 13.4mm min. Assuming that the leaf is symmetrical, max. width is 26.8mm, a minimum estimate because the margins are incomplete. Area 518.3sq.mm min. Roughly sketching in minimum estimates for margins of RHS, area of RHS only is 451.7sq mm min. Assuming leaf is symmetrical, area is 903.4sq.mm min. Max. length along 1° 47.7mm. This is a minimum estimate, max. length along 1° is at least 50mm. 'Leaf area' 893.3sq.mm min.

D8754.8.5a

Preservation: Fairly good. This specimen appears to be slightly less well preserved than the counterpart 4a. The venation is fairly clear. The remaining organic matter has a fairly even coverage in the parts of the leaf which are present. The apex is present, except that the very tip of the leaf appears to be missing. Most of the RHS of the leaf is missing, only its apical portion is present. The base of the leaf is absent. Only a very small percentage of the margin is present.

Dimensions: Max. length 48mm min. Max. width 19.8mm min. Since the apex and base are incomplete, the max. length is a minimum estimate. The LHS is more complete than the RHS and max. width of LHS only is 13mm. Assuming leaf is symmetrical, max. width is 26mm, a minimum estimate of max. leaf width because much of the margins are not present. Area 511.8sq.mm min. Roughly sketching in minimum estimates for margins of LHS, area of LHS only is 446.7sq.mm min. Assuming leaf is symmetrical, area is 893.4sq.mm min. Using this sketched outline, the max. leaf length is estimated to be at least 49.1mm. Max. length along 1° 46.8mm, but base of 1° is incomplete, so this is a minimum estimate. Max. length along 1° is at least 49.3mm min. 'Leaf area' 851.1sq.mm min.

D8754.8.4a&5a

Dimensions: Although 4a shows slightly better preservation than the counterpart 5a, the leaf completeness is roughly the same, so the measurements given here are averages for 4a and 5a. Max. length 48.4mm min. Max. width 18.9mm min. Area 515.1sq.mm min. Estimated max. length 49.4mm min. Estimated max. width 26.4mm min. Estimated max. area 898.4sq.mm min. Max. length along 1° 47.3mm min. Estimated max. length along 1° 49.7mm min. 'Leaf area' 798.5sq.mm min.

Organisation: Cannot be determined for this fragmentary specimen.

Symmetry: This leaf is rather incomplete so the symmetry of the whole lamina cannot be confidently described. The parts present in the apical portion of the leaf appear roughly symmetrical. The base is too incomplete for its symmetry to be described.

Form: The point of max. width is 19mm from the leaf base. The maximum length of the leaf fragment is 48.4mm, meaning that the point of max. width from the leaf base is at 39% of the total leaf length and that the leaf is ovate. However, this is a fragmentary specimen, so using the sketched minimum leaf outline, the distance of the max. width from the base is 19.8mm. With an estimated max. length along the 1° of 49.7mm min., the point of max. width from the leaf base is at 40% of the total leaf length, and the leaf is still termed ovate. Using the estimated max. width and length, the length/width ratio is 1.88:1 and so the leaf form is described as ovate. However, it must be noted that only a small part of the margins are present and both the length and width are minimum estimates, so this is just an estimate for the length/width ratio and leaf form.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Assuming apex is symmetrical, apical angle appears to be 73° and apex appears to be acute, but apex is incomplete, so these are just estimates.

Base: Basal margins not preserved.

Margin: Only a small percentage of the margin is preserved, in apical portion of leaf. Margin appears to be entire, but there are tiny projections, some appearing pointed, along the margin. Measured perpendicular to the midvein, the margin is indented 0.1-1.4mm, average 0.2mm, 3.1% of the distance to the midvein. The margin is still tentatively classed as entire, however, because it appears that these projections are too small to be confidently described as teeth at this level of preservation and at this magnification. Higher magnification observations are required.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation is described as actinodromous, but it is not possible to assess the position or development from these fragmentary specimens.

This description is based on 5a, but in 4a, venation appears to be pinnate camptodromous and may be described as brochidodromous, or possibly eucamptodromous, but the specimen is too incompletely preserved for the venation pattern to be described confidently.

It is also possible that the venation may be described as acrodromous, with strongly developed secondary veins running in convergent arches towards the leaf apex. Since the base of the leaf is incomplete, it is not possible to determine whether the position is basal or suprabasal, or whether the development is

perfect or imperfect. Only one side of the leaf is preserved, but there are three strongly developed secondary veins forming arches, the first arising at the base of the specimen (although the point where it branches from the primary is not preserved), the second 8.6mm above the base and the third 20.8mm from the base. However, the base is incomplete, so it must be emphasised that this refers to the base of the specimen rather than the base of the leaf. The lowest secondary vein arch appears to run approximately 63% of the distance to the leaf apex, but since the leaf is incomplete, this is just an estimate. The position and development therefore appears to be basal and imperfect, respectively, but this is not certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 24.8mm from base. At this point, 1° vein width is 0.37mm and leaf width is 14.2mm, but this is a minimum estimate because here the margin is not preserved. From curvature of margin present, the side of the leaf showing greater preservation is estimated to be at least 12.1mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 24.2mm. Size of 1° is therefore 1.53% max. and is termed moderate.
Course: Straight and appears to be unbranched.

2° veins:
Number: 11 min.
Pairs are alternate.
Angle of divergence: Moderate acute (40-67°, average 58°). (Average on one side 58°, average on other side 58°).
Basal vein angle: Cannot be clearly measured.
Variation: Upper 2° veins more acute than lower. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 100°).
Intersecondary veins: Present. It is not clear whether these are composite or simple.
Intramarginal vein: No intramarginal vein can be clearly observed.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2.1:1.
Average vein length: 9.4mm.
Average spacing: 5.4mm.

There are three enclosing arching secondaries, segmented by other secondaries, with external looping secondaries and tertiaries. The arching secondaries are segmented by secondaries arising from the midvein and also by secondary branches diverging from the lower secondary and joining the superadjacent secondary, while the continuation of the arching secondary goes on to form another loop. The secondary arches may form an intramarginal vein. These veins roughly follow the outline of the leaf and into them the secondary and intersecondary veins merge, possibly as a result of the fusion and straightening of the exmedial brochidodromous secondary arch segments to form a vein which is approaching appearing independent.

3 veins:
Average angle of origin on admedial side of 2°s: 88°.
Average angle of origin on exmedial side of 2°s: 72°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 72 °.
It may be significant that this is equal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.4b&5b

Part and counterpart.

D8754.8.4b

Preservation: Fairly good. The venation is very clear. The remaining organic matter has a fairly even coverage in the parts of the leaf which are present. Both the apex and base of the leaf are missing. None of the margins are present. However, it appears that part of the LHS of the leaf is covered by sediment and removal of this cover may reveal much more of the leaf.

Dimensions: Max. length 31.4mm min. Max. width 26.4mm min. This is a fragmentary specimen without any margins, so these are minimum estimates. RHS shows slightly greater preservation than LHS and max. width of RHS only is 13.8mm min. Assuming leaf is symmetrical, max. width is 27.6mm min. Area 376.6sq.mm min. Roughly sketching in a minimum outline for LHS, area of LHS only is 376.4sq.mm min. Assuming leaf is symmetrical, area is 752.8sq.mm min. Using this sketched outline gives an estimate of max. length of 34.3mm min. Max. length along 1° is 17.1mm, but the central portion of the leaf is incomplete. The estimate of max. length from the sketched outline, 34.3mm, is more realistic, but still a minimum estimate. 'Leaf area' 631.1sq.mm min.

D8754.8.5b

Preservation: Fair. This specimen appears slightly less well preserved than the counterpart 4b. The venation is clear. The remaining organic matter has a fairly even coverage in the parts of the leaf which are present. Both the apex and base of the leaf are missing. None of the margins are present. However, it appears that part of the leaf is covered by sediment and removal of this cover may reveal much more of the leaf.

Dimensions: Max. length 32mm min. Max. width 23.8mm min. This is a fragmentary specimen without any margins so these are minimum estimates. LHS shows slightly greater preservation than RHS and max. width of LHS only is 12.4mm min. Assuming leaf is symmetrical, max. width is 24.8mm min. Area 352sq.mm min. Roughly sketching in a minimum outline for LHS, area of LHS only is 351.1sq.mm min. Assuming leaf is symmetrical, area is 702.2sq.mm min. Using this sketched outline gives an estimate of max. length of 33.4mm min. Max. length along 1° is 17mm, but the central portion of the leaf is incomplete, so the estimate of max. length from the sketched outline, 33.4mm, is more realistic, but still a minimum estimate. 'Leaf area' 552.2sq.mm min.

D8754.8.4b&5b

Dimensions: Although 4b shows slightly better preservation than the counterpart 5b, the leaf completeness is roughly the same, so the measurements given here are averages for 4b and 5b. Max. length 31.7mm min. Max. width 25.1mm min. Area 364.3sq.mm min. Estimated max. length 33.9mm min. Estimated max. width 26.2mm min. Estimated max. area 727.5sq.mm min. Max. length along 1° 17.1mm min. Estimated max. length along 1° 33.9mm min. 'Leaf area' 591.7sq.mm min.

Organisation: Leaf is too fragmentary to describe its organisation.

Symmetry: The leaf is too incomplete for the symmetry of the whole lamina to be described confidently. The base is also too incomplete for its symmetry to be described and the apex is not present.

Form: The point of max. width is 28.8mm from the leaf base. The maximum length of the leaf is 31.7mm min., meaning that the point of max. width from the leaf base is at 91% of the total leaf length. This would make the leaf form obovate, but this is a fragmentary specimen, with no clearly preserved margins, so this is not a good estimate of the leaf form. Using the sketched minimum leaf outline, the distance of the max. width from the base is 29.7mm. With an estimated max. length of 33.9mm min., the point of max. width from the leaf base is at 88% of the total leaf length, and the leaf is still termed obovate. Using the estimated max. width and length, the length/width ratio is 1.29:1. This would make the leaf form wide obovate. However, since there are no margins preserved, this is not a good estimate of leaf form. It is not really possible to estimate the form of this fragmentary leaf.

Apex: Not preserved.

Base: Basal margins too incomplete to be described.

Margin: No clear margins preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Leaf margin is not preserved and leaf is too incomplete to describe venation pattern confidently. It appears that it may be pinnate, camptodromous, brochidodromous or possibly acrodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 17mm from leaf base. At this point, 1° vein is incompletely preserved, but its width is estimated to be 0.66mm. The leaf width is 18.5mm, but this is a minimum estimate because here the margin is also not preserved. The side of the leaf showing greater preservation is estimated to be at least 12.1mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 24.3mm. Size of 1° is therefore estimated to be 2.72% and is termed stout, but the specimen is too fragmentary for the 1° size to be described confidently.

Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Number: 3 min.
Pairs are alternate.
Angle of divergence: Moderate acute (54-72°, average 63°).
(Average on one side 61°, average on other side 65°).
Basal vein angle: Not preserved.
Variation: Leaf is too fragmentary for variation along length of lamina to be assessed. Divergence angle roughly symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 72°).
Intersecondary veins: Appears to be a simple intersecondary present, but this is not very clear.
Intramarginal vein: No intramarginal vein can be clearly observed.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2.3:1.
Average vein length: 20.2mm.
Average spacing: 8.8mm.

There may be enclosing arching secondaries, segmented by other secondaries and tertiaries.

3 veins:
Average angle of origin on admedial side of 2°s: 79°.
Average angle of origin on exmedial side of 2°s: 83°.
Combination: RA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 69°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.4c

Preservation: Very good. The venation is very clear. The remaining organic matter has a fairly even coverage in the parts of the leaf which are present. The apex is present, but appears distorted. Only a small part of the leaf base (on the RHS) is preserved. Very little of the margins are present. Parts of the leaf appear to be covered by sediment and removal of this cover may reveal much more of the leaf.

Dimensions: Max. length 43.1mm. Max. width 21.9mm min. The leaf length appears to be complete, so this is a good estimate of max. leaf length. This is a fragmentary specimen, so the max. width is a minimum estimate. RHS appears more complete that LHS and max. width of RHS only is 13.8mm min. Assuming leaf is symmetrical, max. width is 27.6mm min. This is a minimum estimate of max. width because there are only margins present in the apical portion of the leaf. The margins are unclear in the central and basal parts of the leaf. Area 404.1sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 345.4sq.mm min. Assuming leaf is symmetrical, area is 690.8sq.mm min. Max. length along 1° 40.7mm, but the basal part of 1° is unclear. Max length along 1° is actually the same as max. length of leaf, 43.1mm. 'Leaf area' 793sq.mm min.

Organisation: Cannot be determined for this fragmentary specimen.

Symmetry: Since very little of the margins are present and the leaf is incomplete, it is not possible to describe the symmetry of the whole lamina. Only part of the RHS of the base is preserved, so the symmetry of the base cannot be described. The apex appears to be asymmetrical, but this may be caused by the nature of the preservation.

Form: The point of max. width is 25.7mm from the leaf base. The max. length of the leaf is 43.1mm, meaning that the point of max. width from the leaf base is at 60% of the total leaf length. This would make the leaf form obovate. Using the estimated max. width, the length/width ratio is 1.56:1. Since the max. width is a minimum estimate, this is a maximum estimate for the length/width ratio. These estimated measurements would mean that the leaf could be described as wide obovate. However, this is a fragmentary specimen, with only a small percentage of the margins preserved, so this is just an estimate of the leaf form. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Assuming apex is symmetrical, apical angle appears to be 59° and apex appears to be acuminate (possibly short acuminate), but this may have been accentuated by distortion of the leaf fossil. Leaf apex is incomplete, so these are just estimates.

Base: Leaf base is too incomplete for basal angle to be estimated. Base appears to be cordate, but since base is incomplete, this is just an estimate.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Absent or not preserved.

Venation type: Only RHS of base is preserved, but venation appears to be basal actinodromous, with three primary veins preserved diverging from the leaf base. Assuming that the leaf is symmetrical, there may be five primary veins diverging from the leaf base. It is not possible to describe the development of the venation because the leaf is too fragmentary. The primary veins diverge from base at angles of 40° and 72° from the midvein.

1° vein:
Size: Midpoint is 21.6mm from leaf base. At this point, 1° vein width is 0.22mm and leaf width is 18.2mm, but this is a minimum estimate because here the margin is not preserved. RHS, showing greater preservation, is estimated to be at least 13mm wide. Assuming leaf is symmetrical, leaf width is estimated to be at least 26.1mm. Size of 1° is therefore 0.84% max. and is termed weak.
Course: Straight and unbranched.

2° veins:
Number: 6.
Pairs are alternate.
Angle of divergence: Moderate acute (38-75°, average 53°).
(Average on LHS 67°, average on RHS 40°).
Basal vein angle: Moderate acute (average 47°).
Variation: Upper secondary veins more obtuse than lower. Divergence angle more acute on RHS.
Thickness: Moderate.
Course: Abruptly curved and branched. Lowest 2° on RHS is recurved but the 2° on the other side of the midvein cannot be compared with this because it is incompletely preserved.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 113°). Enclosed by 3° or 4° arches.
Intersecondary veins: May be a composite intersecondary present, but this is not very clear.
Intramarginal vein: None.
Intercostal shape: Slightly elongated parallel to midvein, average vein length/spacing ratio 0.9:1.
Average vein length: 10.3mm.
Average spacing: 9.5mm.

3 veins:
Average angle of origin on admedial side of 2°s: 90°.
Average angle of origin on exmedial side of 2°s: 74°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 97°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.4d

Preservation: Fairly good. The venation is fairly clear. The remaining organic material has a thick and patchy appearance. Only the lower RHS of the leaf is preserved so the shape of the whole leaf cannot be described. In the part of the leaf preserved the margin is clear. The apex is not present and so cannot be described. The base can be described from the lower RHS of the leaf. There is no petiole.

Dimensions: Max. length 31.4mm min. Max. width 22.6mm min. This is just a fragment of the lower RHS of the leaf, so these are minimum estimates. Max. width of RHS only is 20.1mm min. Assuming leaf is symmetrical, max. width is 40.2mm min. This is still a minimum estimate because the upper portion of the leaf is missing. Area 425.4sq.mm min. Area of RHS only is estimated to be at least 429.7sq.mm. Assuming leaf is symmetrical, max. area is 859.4sq.mm min. This is still a minimum estimate for the leaf

because much of the apical portion of the leaf is missing. Max. length along 1° 21.3mm min., but 1° is incomplete. Estimate of max. length, 31.4mm, is more realistic, but still probably a minimum estimate. 'Leaf area' 841.5sq.mm min.

Organisation: The leaf is too fragmentary for the organisation to be described.

Symmetry: This is just a part of the lower RHS of the leaf so features of symmetry cannot be described.

Form: The point of max. width is 28.9mm from the leaf base. The max. length of the leaf is 31.4mm min., meaning that the point of max. width from the leaf base is at 92% of the total leaf length. This would make the leaf form obovate. Using the estimated max. width, the length/width ratio is 0.78:1. This would mean that the leaf form could be described as very wide obovate. However, since this is a fragmentary specimen, this is not a good estimate of the leaf form. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Leaf specimen is incomplete and it was not possible to sketch a minimum outline for leaf, so extent of basal portion is just an estimate. LHS of leaf is missing so assuming base is symmetrical, basal angle appears to be 108°. Since leaf is fragmentary, this is just an estimate. Base appears to be obtuse and normal and although this is a fragmentary specimen, this appears to be a fairly accurate description.

Margin: There are clear projections preserved along RHS of leaf, in two distinct size classes. Measured perpendicular to the midvein, the margin is indented 0.2-1.8mm, average 0.7mm, 5% of the distance to the midvein. The average indentation of the 1° projections is 0.8mm, 6.9% of the distance to the midvein, and the 2° projections 0.3mm, 1.7% of the distance to the midvein. Size of projections decreases towards base of leaf. The apices of the projections are pointed, so the margin is described as toothed. Teeth are serrate. The serrations are compound, in two definite size groups, and are described as double serrations. Apical angle of 1° serrations is acute (average 89°) and apical angle of 2° serrations is obtuse (average 131°). Overall, apical angle of serrations is obtuse (range 61-149°, average 105°). Dominant serration type is convex on basal side and concave on apical side. Sinuses are rounded. Including both 1° and 2° serrations, spacing is 1-6.2mm, average 3.2mm, standard deviation 1.6mm, and spacing is described as irregular. Spacing of 1° projections only is 2.9-8.4mm, average 5.4mm, standard deviation 1.9mm, and spacing is still described as irregular.

Petiole: Base of leaf is incomplete so it cannot be determined whether a petiole is present or not.

Venation type: This specimen is a fragment from the base of a leaf, the midvein is only partially preserved and there is one prominent branch from the midvein close to the base of the leaf. It is unclear, therefore, whether this branch is a primary or secondary vein. This fragmentary specimen is very close in size and shape to the basal part of D8754.8.60a, and both specimens have a toothed margin. The lowest branch from the midvein in D8754.8.60a is clearly a secondary vein. It is also thicker than the vein branch in question in D8754.8.4d. For this reason, it is estimated that the branch from the midvein in D8754.8.4d is a secondary vein. This would indicate that the venation was pinnate or possibly suprabasal acrodromous, but the leaf is too fragmentary to describe the venation pattern further. This leaf is too incomplete for venation type to be described confidently.

1° vein:
Size: Width of 1° vein is not completely preserved at any point and leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be at least 15.7mm from leaf base. At this point, 1° vein width is at least 0.23mm and leaf width is 17.7mm, but this is a minimum estimate because only RHS of leaf is preserved. Assuming leaf is symmetrical, leaf width is estimated to be 35.4mm. Size of 1° is therefore 0.65% min. and is termed weak, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Leaf is fragmentary and only one 2° is preserved on the RHS of the leaf.
Number: 1 min.
No pairs are preserved.
Angle of divergence: Not preserved, only basal 2° is present.
Basal vein angle: Narrow acute (37°).
Variation: Cannot be assessed because only one 2° is preserved.
Thickness: Moderate.
Course: Appears to be straight and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None.
Intercostal shape: Leaf is too fragmentary for intercostal shape to be described.
Average vein length: Cannot be measured for this fragmentary specimen.
Average spacing: Cannot be measured for this fragmentary specimen.

3 veins:
Average angle of origin on admedial side of 2°s: 77°.
Average angle of origin on exmedial side of 2°s: 62°.
Combination: AA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 87 °.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.5d

Preservation: Fairly poor. The venation is unclear. The primary vein appears thick and raised. The remaining organic material has a thick, dark and patchy appearance. The leaf is fragmentary and so the shape of the leaf cannot be described. The margins are only present in the basal part of the leaf. The apex is not present, but the base of the leaf can be described from the lower RHS where the margins are slightly more complete. The base may be described as petiolate.

Dimensions: Max. length 42mm min. Max. width 13.4mm min. This is a fragmentary specimen so these are minimum estimates. LHS shows slightly greater preservation than RHS and max. width of LHS only is 8.2mm min. Assuming leaf is symmetrical, max. width is 16.4mm min. Area 235.1sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 195sq.mm min. Assuming leaf is symmetrical, area is 390sq.mm min. Using this sketched outline gives an estimate of max. length of 42.2mm min. Max. length along 1° 41.6mm min., but 1° is incomplete. Estimate of max. length, 42.2mm, is more realistic, but still a minimum estimate. 'Leaf area' 461.4sq.mm min. These estimates include the petiole, which cannot be clearly distinguished from the lamina.

Organisation: Appears simple but it is not possible to be certain for this fragmentary specimen.

Symmetry: The specimen is too fragmentary for the symmetry of the whole lamina to be described. Only the very lowest parts of the base are clearly preserved and these appear symmetrical, but since this is only a small part of the base, this is not a confident definition. The apex is not present.

Form: The point of max. width is 35.6mm from the leaf base. The max. length of the leaf is 42mm min., meaning that the point of max. width from the leaf base is at 85% of the total leaf length. This would make the leaf form obovate, but this is just a fragment from the base of the leaf, so this is just an estimate of the leaf form. Using the sketched minimum outline, the point of max. width is 35.6mm from the leaf base and the max. length is 42.2mm min. The point of max. width from the leaf base is therefore at 84% of the total leaf length and the leaf form is still described as obovate. Using the estimated max. width and length, the length/width ratio is 2.57:1. This would mean that the leaf form could be described as narrow obovate. However, since this is just a fragment from the base of the leaf, this is just an estimate of the leaf form. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Assuming base is symmetrical, basal angle is 19°. Since leaf is fragmentary, this is just an estimate. Base appears to be acute and decurrent and although it is a fragmentary specimen, this appears to be a fairly accurate description.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a completely confident definition.

Petiole: Appears to be a winged petiole present, but it is not clearly distinguished from the lamina. It is approximately 1.8mm wide and 9mm in length.

Venation type: Appears to be pinnate, camptodromous, brochidodromous, but the specimen is fragmentary so this is not a confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be at least 16.6mm from leaf base. At this point, 1° vein width is 0.72mm. The leaf width is 8.4mm, but this is a minimum estimate because here the margin is not preserved. The side of the leaf showing greater preservation is estimated to be at least 7.5mm wide. Assuming leaf is symmetrical, leaf width is estimated to be at least 14.9mm. Size of 1° is therefore estimated to be 4.83% max. and is termed massive, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched.

2° veins:
Leaf is quite poorly preserved and 2° veins are difficult to describe.
Number: 7 min.
Pairs appear to be opposite and alternate.
Angle of divergence: Moderate acute (42-67°, average 49°). (Average on LHS 47°, average on RHS 51°).
Basal vein angle: Moderate acute (average 62°).
Variation: Upper secondary veins appear to be more acute than lower, but leaf is fragmentary so this is not a confident description of the variation along the length of the lamina. Divergence angle symmetrical.
Thickness: Moderate.
Course: Appears to be abruptly curved and unbranched, but specimen is too fragmentary for this to be a confident description.
Behaviour of loop-forming branches: Appear to join superadjacent 2° at an obtuse angle (average 131°), but specimen is too fragmentary for this to be certain.
Intersecondary veins: None preserved.
Intramarginal vein: None preserved.
Intercostal shape: Specimen is too fragmentary for intercostal shape to be described.
Average vein length: Cannot be measured for this fragmentary specimen.
Average spacing: Cannot be measured for this fragmentary specimen.

3 veins: Not clearly preserved.

D8754.8.6a

Preservation: Fair. The venation is clear. The remaining organic material is of thin and fairly even appearance. The leaf is just a fragment and so the shape of the leaf cannot be described. It is not clear that there are any margins preserved, there may be a very small proportion. Neither the apex nor base is present.

Dimensions: Max. length 18.4mm min. Max. width 14.3mm min. This is a fragmentary specimen, so these are minimum estimates. LHS is more complete than RHS and max. width of LHS only is 8.6mm min. Assuming leaf is symmetrical, max. width is 17.2mm min. Area 109.9sq.mm min. Roughly sketching in a minimum outline for LHS, area of LHS only is 123.5sq.mm min. Assuming leaf is symmetrical, area is 247sq.mm min. Using this sketched outline gives an estimate of max. length of 19.2mm min. Max. length along 1° is 13.3mm min., but the central portion of the leaf is incomplete, so this is just a fraction of the actual max. length along 1°. The estimate of max. length from the sketched outline, 19.2mm, is more realistic but still a minimum estimate. 'Leaf area' 220.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen is too fragmentary for elements of symmetry to be described.

Form: The point of max. width is 4.6mm from the leaf base. The max. length of the leaf is 18.4mm min., meaning that the point of max. width from the leaf base is at 25% of the total leaf length. This would make the leaf form ovate, but this is a fragmentary specimen, so this is just an estimate of the leaf form. Using the sketched minimum outline, the point of max. width is 5.1mm from the leaf base and the max. length is 19.2mm min. The point of max. width from the leaf base is therefore at 27% of the total leaf length and the leaf form is still described as ovate. Using the estimated max. width and length, the length/width ratio is 1.12:1. This ratio falls within the size bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form can be described as wide ovate. However, since this is a fragmentary specimen, this is just an estimate of the leaf form. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Not preserved.

Margin: It is unclear, but a very small percentage of the margin may be preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, but it is not possible to confidently describe the venation type of this fragmentary specimen.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 9.6mm from base. At this point, 1° vein width is 0.87mm. The leaf width is 8.7mm, but this is a minimum estimate because here the margin is not preserved. LHS, which shows greater preservation than RHS, is estimated to be at least 7.6mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 15.1mm. Size of 1° is therefore estimated to be 5.75% max. and is termed massive, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Leaf is fragmentary and only one 2° diverging from the midvein is preserved on the LHS of the leaf.
Number: 1 min.
No pairs are preserved.
Angle of divergence: Wide acute (70°).
Basal vein angle: Not preserved.
Variation: Cannot be assessed because only one 2° is preserved.
Thickness: Moderate.
Course: Leaf is too fragmentary for course of 2° to be described.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: None preserved.
Intramarginal vein: None.
Intercostal shape: Leaf is too fragmentary for intercostal shape to be described.
Average vein length: Cannot be measured for this fragmentary specimen.
Average spacing: Cannot be measured for this fragmentary specimen.

3 veins:
Average angle of origin on admedial side of 2°s: 87°.
Average angle of origin on exmedial side of 2°s: 87°.
Combination: RR.
There are no clear 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.6b&65a

D8754.8.6b

Preservation: Fairly good. This specimen is unusual in that it is a true impression; the veins are raised. There is only a very thin pale and uneven carbon film. The venation is clear; along the 1°'s and 2°'s there is either no carbon film or very patchy, darker carbon deposits. It is possible that more of the specimen will be revealed by removal of sediment cover. The specimen is rather incomplete and so it is very difficult to describe the overall shape of the leaf. The margins are present along much of the LHS of the leaf and are fairly clear. Neither the apex nor base of the leaf is present.

Dimensions: Max. length 46mm min. Max. width 33.9mm min. This is a fragmentary specimen so these are minimum estimates. LHS is more complete than RHS and max. width of LHS only is 19.4mm. Assuming leaf is symmetrical, max. width is 38.8mm.

This appears to be a fairly good estimate of max. leaf width because much of the margins of the central portion of the LHS are present. Area 958.5sq.mm min. Attempting to 'repair' possible tears in leaf and roughly sketching in a minimum outline for LHS, area of LHS only is 755.2sq.mm min. Assuming leaf is symmetrical, area is 1510.4sq.mm min. Using this sketched outline gives an estimate of max. length of 44.7mm min., smaller than the measurement above because of the 'repairs'. Max. length along 1° is 33.4mm min., but the central portion of the leaf is incomplete, so this is just a fraction of the actual max. length along 1°. Using the sketched outline, estimated max. length along 1° is 42.7mm min. 'Leaf area' 1104.5sq.mm min.

D8754.8.65a

Preservation: Fairly good. The counterpart, 6b, is shows slightly greater preservation. The venation is fairly clear. The remaining organic material is rather patchy and uneven and appears to be of medium thickness. The specimen is incomplete so the overall shape of the leaf cannot be described. The margins are fairly clear along the RHS of the specimen and along a small portion of the LHS of the leaf. Neither the apex nor base are present and cannot be described.

Dimensions: Max. length 45.2mm min. Max. width 35.8mm min. (points of max. width are on roughly the same horizontal plane). The leaf is incomplete so these are minimum estimates. RHS is more complete than LHS and max. width of RHS only is 20.4mm. From the curvature of the margins present, this appears to be a fairly good estimate for max. width of RHS. Assuming leaf is symmetrical, max. width is 40.8mm. Area 876.2sq.mm min. Using the counterpart, 6b, to roughly sketch in a minimum outline for the RHS of the leaf, area of RHS only is 874.6sq.mm min. Assuming leaf is symmetrical, area is 1749.2sq.mm min. Using this sketched outline gives an estimate of max. length of 51.6mm min. Max. length along 1° 36.9mm min. Using the sketched outline gives an estimate of max. length along 1° of 51.9mm min., slightly longer than the estimated max. length because the 1° is slightly curved. 'Leaf area' 1411.7sq.mm min.

D8754.8.6b&65a

Dimensions: The measurements given are taken from whichever specimen shows the greatest preservation or from a composite of both part and counterpart. Max. length 46mm min., measured from 6b. Max. width 35.8mm min, measured from 65a. Area 958.5sq.mm min., from 6b. Estimated max. length 51.6mm min, from 65a and 6b together. Estimated max. width 39.8mm, which is an average measurement because 6b and 65a show roughly the same completeness at the max width on one side of the leaf. Estimated area 1749.2sq.mm min., from 65a and 6b together. Max. length along 1° 36.9mm min., from 65a. Estimated max. length along 1° 51.9mm min., from 65a and 6b together. 'Leaf area' 1377.1sq.mm min., from 65a and 6b together.

Organisation: The specimen is too fragmentary to describe the leaf organisation.

Symmetry: The leaf is too incomplete for confident description of symmetry of the whole lamina. At the one point where the margins are preserved on both sides of the leaf, the lamina appears asymmetrical, but the leaf is rather broken up and this may be a feature of the nature of the preservation. The base and apex are nor present so their symmetry cannot be assessed.

Form: The point of max. width is an average of 29.6mm from the leaf base. The max. length of the leaf is 45.6mm min., an average for 6b and 65a. This means that the point of max. width from the leaf base is at 65% of the total leaf length, making the leaf form obovate. Using the average estimated max. width, the length/width ratio is 1.15:1. Since the max. width appears to be a fairly good estimate and the max. length is a minimum, this is a minimum estimate for the length/width ratio. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme so the nearest definition is used. This means that the leaf form would be described as wide obovate, but this is a fragmentary specimen, so this is not a good estimate of leaf form. Using the sketched minimum outline for the composite of 6b and 65a together, the point of max. width is 33.8mm from the leaf base and the estimated max. length along 1° is 51.9mm min. The point of max. width from the leaf base is therefore at 65% of the total leaf length and the leaf form is still described as obovate. Using this estimated max. length and the average estimated max. width, the length/width ratio is 1.30:1, which is again a minimum estimate. This would mean that the leaf form could be described as wide obovate, but because this is a fragmentary specimen this is just an estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: There are projections clearly preserved along the margin of the better preserved side of the leaf and in 65b there is also one clear projection preserved on the very small amount of margin preserved on the other side of the leaf. Measured perpendicular to the midvein, the margin is indented 0.1-0.5mm, average 0.3mm, 1.5% of the distance to the midvein. These projections are difficult to describe because the majority are very small and in 65a most are not very clearly preserved. The apices of the projections appear to be pointed in some cases, rounded in others, and they appear to be irregular, so the margin is described as erose. Projections are simple. The majority of the projections, the larger ones in particular, appear to be serrate. Apical angle of serrations is obtuse (range 53-161°, average 116°). Dominant serration type is convex on basal side and convex on apical side. Most sinuses are rounded. Spacing is 0.4-3.8mm, average 1.7mm, standard deviation 0.9mm, and spacing is described as irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation: Venation appears to be pinnate, simple craspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 25.8mm from base. At this point, 1° vein width is 0.94mm and leaf width is 31.3mm, but this is a minimum estimate because here the margin is not preserved on one side of the leaf. The side of the leaf with margin preserved is 19.3mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be 38.5mm. Size of 1° is therefore 2.44% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 8 min.
Most pairs are alternate, one is opposite.
Angle of divergence: Moderate acute (50-76°, average 61°).
(Average on one side 61°, average on other side 61°).
Basal vein angle: Not preserved.
Variation: Upper secondary veins appear to be more acute than lower, but specimen is too fragmentary for this to be certain.
Divergence angle symmetrical.
Thickness: Moderate.
Course: Appears to be uniformly curved and unbranched. Near the margin the 2°s are recurved.
Behaviour of loop-forming branches: None.
Intersecondary veins: Appears to be simple intersecondary veins present.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 3.7:1.
Average vein length: 26.7mm.
Average spacing: 7.7mm.

3 veins:
Average angle of origin on admedial side of 2°s: 93°.
Average angle of origin on exmedial side of 2°s: 76°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 104 °.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.7a

Preservation: Fairly good. The venation is clear in the part of the leaf preserved. The remaining organic material is of medium and rather uneven appearance. The leaf is just a fragment and so the shape of the leaf cannot be described. Slightly more of the specimen may be revealed by removal of sediment cover. The margins are clear in the lower RHS of the leaf. The apex is not present and the base can be described from the RHS of the leaf, although even here the base is incomplete. There is no petiole preserved.

Dimensions: Max. length 32.2mm min. Max. width 10.3mm min. This is just a fragment from the RHS of the leaf, so these are minimum estimates. Max. width of RHS only is 10.3mm min. Assuming leaf is symmetrical, max. width is 20.6mm min. Area 204.7sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 240sq.mm min. Assuming leaf is

symmetrical, area is 480sq.mm min. Using this sketched outline gives an estimate of max. length of 33.5mm min. Max. length along 1° is 16.3mm min, but 1° is very incomplete, so this is just a fraction of the actual max. length along 1°. The estimate of max. length from the sketched outline, 33.5mm, is more realistic but still a minimum estimate. 'Leaf area' 460.1sq.mm min.

Organisation: This specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Since this is just a fragment from the RHS of the leaf features of symmetry cannot be described.

Form: The point of max. width is 20.5mm from the leaf base. The max. length of the leaf fragment is 32.2mm min., meaning that the point of max. width from the leaf base is at 64% of the total leaf length. This would make the leaf form obovate. Using the estimated max. width, the length/width ratio is 1.56:1, meaning that the leaf form would be described as wide obovate. Since this is a fragmentary specimen, this is not a good estimate of leaf form. Using the sketched minimum outline, the point of max. width is 20.8mm from the leaf base and the estimated max. length is 33.5mm min. The point of max. width from the leaf base is therefore at 62% of the total leaf length and the leaf form is still described as obovate. Using the estimated max. width and length, the length/width ratio is 1.63:1, but because both the max. length and width are minimum estimates, it is not really possible to estimate the l/w ratio of the leaf. This would make the leaf form wide obovate, but since this is just a fragmentary specimen with much of the apical part of the leaf missing, this is not a good estimate of leaf form. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. LHS of specimen is missing, so assuming base is symmetrical, basal angle is 67°. Since leaf is fragmentary, this is just an estimate. Base appears to be acute and cuneate. It is fairly clear that the base is acute, but since it is incomplete, it is not completely certain that the leaf base can be described as cuneate.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a completely confident definition.

Petiole: Base of leaf is incomplete so it cannot be determined whether a petiole is present or not.

Venation type: Leaf is too incomplete to describe venation pattern confidently. It appears that it may be pinnate, camptodromous, brochidodromous or possibly acrodromous.

1° vein:
Size: 1° is not well enough preserved to estimate its size.
Course: Appears to be straight and unbranched, but 1° is not really well enough preserved for its course to be described.

2° veins:
Leaf is fragmentary and only one 2° diverging from the midvein is preserved on the RHS of the leaf.
Number: 1 min.
No pairs are preserved.
Angle of divergence: Wide acute (72°).
Basal vein angle: Not preserved.
Variation: Cannot be assessed because only one 2° diverging from midvein is preserved.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 61°).
Intersecondary veins: There appears to be composite intersecondaries present, but leaf is too incomplete for this to be certain.
Intramarginal vein: No intramarginal vein can be clearly observed.
Intercostal shape: Elongated parallel to 2° veins, average vein length/spacing ratio 1.5:1.
Average vein length: 14.9mm.
Average spacing: 10.1mm.

There may be an enclosing arching 2° vein. The arching 2° is segmented by secondary branches diverging from it and joining the superadjacent secondary, while the continuation of the arching secondary goes on to form another loop. The secondary arches may form an intramarginal vein, roughly following the outline of the leaf.

3 veins:
Average angle of origin on admedial side of 2°s: 80°.
Average angle of origin on exmedial side of 2°s: 84°.
Combination: RA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.8a and 9a

D8754.8.8a

Preservation: Excellent. The venation is very clear, better preserved than in the counterpart 9a. The remaining organic material has a patchy appearance and in places appears very dark and thick. There are holes in the leaf which may be the result of insect damage. The leaf is almost whole and the whole shape can be observed. About 50% of the margins are present and are clear on the LHS of the leaf. The very tip of the apex is not preserved and the basal margin is incomplete.

Dimensions: Max. length 30mm. Max. width 18.1mm (points of max. width are on roughly the same horizontal plane, just slightly higher on the RHS). The leaf is almost complete so the max. length and width appear to be fairly accurate estimates. Area 369.1sq.mm, a minimum estimate because the RHS of the apex is incomplete. Sketching in a minimum outline for this part of the leaf, this missing portion has an area of 0.8sq.mm. This gives a fairly good estimate of leaf area of 369.9sq.mm. Max. length along 1° is 30.1mm, slightly longer than the max. length because the 1° is slightly curved. This appears to be a fairly accurate estimate of max. length along 1°. 'Leaf area' 363.2sq.mm.

D8754.8.9a

Preservation: Good. The venation is less clear than in the counterpart, 8a, which shows very good preservation. The remaining organic material has a patchy appearance and in places appears much darker and thicker – along the 1° and 2° veins and along the margins. There are holes in the leaf which may be the result of insect damage. The majority of the margins are present and the full shape of the leaf can be observed. Both the apex and the base appear complete.

Dimensions: Max. length 28.7mm. Max. width 17.2mm (point of max. width is slightly closer to apex on RHS). This leaf is almost complete, so these appear to be fairly accurate estimates of max. length and width. Area 341.7sq.mm. This appears to be a fairly accurate estimate. Max. length along 1° 28.7mm. 'Leaf area' 329.1sq.mm.

D8754.8.8a and 9a

Dimensions: Although the preservation of the venation is better in 8a and the apex is clearer in 9a, the leaf completeness is roughly the same in the part and counterpart, so the measurements given here are averages for 8a and 9a. Max. length 29.4mm. Max. width 17.7mm. Area 355.4sq.mm. Estimated max. area 355.8sq.mm. Max. length along 1° 29.4mm. 'Leaf area' 346.2sq.mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Although the whole lamina appears roughly symmetrical, a slight 'bulging' in the lower part of one side of the leaf means that the lamina is categorised as asymmetrical. The base is classed as asymmetrical because of this slight 'bulging'. The apex appears slightly asymmetrical.

Form: The point of max. width is 11mm from the leaf base. The max. length of the leaf is 29.4mm, meaning that the point of max. width from the leaf base is at 37% of the total leaf length. The leaf form is therefore ovate. Using the estimated max. width, the length/width ratio is 1.66:1, meaning that the leaf form is described as ovate.

Apex: Apical angle 75°. Apex is described as acute.

Base: Basal angle 98°. Base is described as obtuse and normal.

Margin: There are projections clearly preserved along the margins of both sides of the leaf, in two distinct size classes. Measured perpendicular to the midvein, the margin is indented 0.1-0.8mm, average 0.3mm, 4.7% of the distance to the midvein. The average indentation of the 1° projections is 0.4mm, 5.8% of the distance to the midvein, and the 2° projections 0.2mm, 2.9% of the distance

to the midvein. Largest projections are at central part of leaf margin and size decreases towards apex and base. Most of the projections have pointed apices, so the margin is described as toothed. Some of the teeth appear to have quite rounded apices but this may be a preservational feature. Teeth are serrate. The serrations are compound, in two definite size groups, and are described as double serrations. Apical angle of 1° serrations is acute (average 77°) and apical angle of 2° serrations is obtuse (average 95°). Overall, apical angle of serrations is acute (range 30-149°, average 84°). Dominant serration type is convex on basal side and convex on apical side. Most of the sinuses appear to be angular. Including both 1° and 2° serrations, spacing is 0.4-3.6mm, average 1.4mm, standard deviation 0.7mm, and spacing is described as irregular. Spacing of 1° projections only is 0.7-4.5mm, average 2.3mm, standard deviation 0.9mm, and spacing is still described as irregular.

Petiole: Absent or not preserved.

Venation: Pinnate, simple craspedodromous.

1° vein:
Size: Midpoint is 14.7mm from leaf base. At this point, 1° vein width is 0.47mm and leaf width is 16.3mm. Size of 1° is therefore 2.89% and is termed stout.
Course: Markedly curved.

2° veins:
Measurements include intersecondary veins.
Number: 24.
Pairs are alternate and opposite.
Angle of divergence: Moderate acute (24-73°, average 53°).
(Average on one side 48°, average on other side 57°).
Basal vein angle: Moderate acute (average 51°).
Variation: Divergence angle varies irregularly. Divergence angle more acute on one side of the leaf.
Thickness: Moderate.
Course: Appears to be uniformly curved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: Simple intersecondary veins present.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 5.5:1.
Average vein length: 12.2mm.
Average spacing: 3.5mm.

3 veins:
Average angle of origin on admedial side of 2°s: 94°.
Average angle of origin on exmedial side of 2°s: 98°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 119°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.8b

Preservation: Fairly good. The venation is fairly clear. The remaining organic material has a fairly thick and dark appearance. The leaf is just a fragment and so the shape of the leaf cannot be described. The lower LHS of the leaf is the only part preserved. The margins are clear in the part of the leaf preserved. The apex is not present and the base can be described from the lower LHS of the leaf. There is no petiole present.

Dimensions: Max. length 24.9mm min. Max. width 12.7mm min. This is just a fragment from the lower LHS of the leaf, so these are minimum estimates. Max. width of LHS only 12.7mm min. Assuming leaf is symmetrical, max. width is 25.4mm min. Area 191.9sq.mm min. Assuming leaf is symmetrical, area is 383.8sq.mm, which is still a minimum estimate because the apical portion of the leaf is missing. Max. length along 1° is 16.2mm min., but the central portion of the leaf is incomplete, so this is just a fraction of the actual max. length along 1°. The max. length, 24.9mm, is more realistic, but still a minimum estimate. 'Leaf area' 421.6sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This is just a fragment from the LHS of the leaf so features of symmetry cannot be described.

Form: The point of max. width is 19mm from the leaf base. The max. length of the leaf fragment is 24.9mm min., meaning that the point of max. width from the leaf base is at 76% of the total leaf length. This would make the leaf form obovate. Using the estimated max. width, the length/width ratio is 0.98:1, but because both the max. length and width are minimum estimates, it is not really possible to estimate the l/w ratio of the leaf. This would make the leaf form very wide obovate, but since this is just a fragmentary specimen with much of the apical part of the leaf missing, this is not a good estimate of leaf form. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Leaf specimen is incomplete and it was not possible to sketch a minimum outline for leaf, so extent of basal portion is just an estimate. RHS of leaf is missing so assuming base is symmetrical, basal angle appears to be 93°. Since leaf is fragmentary, this is just an estimate. Base appears to be obtuse and normal and although this is a fragmentary specimen, this appears to be a fairly accurate description.

Margin: There are clear projections preserved along LHS of leaf. Measured perpendicular to the midvein, the margin is indented 0.1-0.5mm, average 0.3mm, 3.1% of the distance to the midvein. Most of the projections appear to have quite pointed apices, so the margin is described as toothed. Some of the teeth appear to have quite rounded apices but this may be a preservational feature. There appears to be two size classes of projections, but this is not clear from the small proportion of the margin preserved. Since there is no clear distinction, the tooth series is described as simple. Teeth are serrate. Apical angle of serrations is obtuse (range 58-152°, average 107°). Dominant serration type is convex on basal side and straight on apical side. Most of the sinuses appear to be rounded. Spacing between serrations is 2-4mm, average 2.5mm, standard deviation 0.7mm, and spacing is described as irregular.

Petiole: Absent or not preserved.

Venation type: This specimen is a fragment from the base of a leaf, the midvein is only partially preserved and there is one prominent branch from the midvein close to the base of the leaf. It is unclear, therefore, whether this branch is a primary or secondary vein. This fragmentary specimen is fairly close in size and shape to the basal part of D8754.8.60a, and both specimens have a toothed margin. The lowest branch from the midvein in D8754.8.60a is clearly a secondary vein. It is also thicker than the vein branch in question in D8754.8.8b. For this reason, it is estimated that the branch from the midvein in D8754.8.8b is a secondary vein. This would indicate that the venation was pinnate or possibly suprabasal acrodromous, but the leaf is too fragmentary to describe the venation pattern further. This leaf is too incomplete for venation type to be described confidently.

1° vein:
Size: Width of 1° vein is not completely preserved at any point and leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be at least 12.5mm from leaf base. At this point, 1° vein width is at least 0.08mm and leaf width is 11.2mm, but this is a minimum estimate because only LHS of leaf is preserved. Assuming leaf is symmetrical, leaf width is estimated to be 22.4mm. Size of 1° is therefore 0.36% min. and is termed weak, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Leaf is fragmentary and only one 2° is preserved on the LHS of the leaf.
Number: 1 min.
No pairs are preserved.
Angle of divergence: Not preserved, only basal 2° present.
Basal vein angle: Narrow acute (38°).
Variation: Cannot be assessed because only one 2° is preserved.
Thickness: Moderate.
Course: Appears to be straight and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None.
Intercostal shape: Leaf is too fragmentary for intercostal shape to be described.
Average vein length: Cannot be measured for this fragmentary specimen.
Average spacing: Cannot be measured for this fragmentary specimen.

3 veins:
Average angle of origin on admedial side of 2°s: 73°.
Average angle of origin on exmedial side of 2°s: 76°.
Combination: AA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.11b

Preservation: Fair. The venation is fairly clear. The remaining organic material has a medium thickness and fairly even appearance. The specimen is just a very small fragment and so the shape of the leaf cannot be described. The margins are clear in the part of the leaf preserved. Neither the apex nor the base of the leaf can be described.

Dimensions: Max. length 7.8mm min. Max. width 5.1mm min. (points of max. width are on roughly the same horizontal plane). This specimen is just a small fragment of a leaf, so these are minimum estimates. Area 22.2sq.mm min. The specimen is too fragmentary to make estimates on the possible outline of the leaf. Max. length along 1° 7mm min. (although this may not be a 1°). The max. length, 7.8mm, is a better estimate, but is still a minimum. 'Leaf area' 26.5sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: The only margins preserved are along the LHS of the leaf, so this specimen is too fragmentary for its symmetry to be described.

Form: The point of max. width is 1.7mm from the leaf base. The max. length of the leaf fragment is 7.8mm min., meaning that the point of max. width from the leaf base is at 22% of the total leaf length. This would make the leaf form ovate. The length/width ratio is 1.53:1, but because both the max. length and width are minimum estimates, it is not really possible to estimate the l/w ration of the leaf. This ratio would mean that the leaf form could be described as ovate, but since this is just a fragmentary specimen, this is not a good estimate of leaf form. It is not really possible to described the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Not preserved.

Margin: There are clear projections preserved along LHS of leaf, but only a very small percentage of the margin is preserved. There are only two clearly preserved projections. Measured perpendicular to the midvein, the margin is indented 0.2mm, 9.7% of the estimated distance to the midvein. Projections have quite pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 73-74°, average 74°). Dominant serration type is convex on basal side and straight on apical side. Sinuses appear quite rounded. Spacing between serrations is 1.5-1.8mm, average 1.7mm, standard deviation 0.2mm, and spacing is described as regular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison with D8754.8.8b, it appears that the highest order vein preserved is a secondary. This specimen is therefore too fragmentary for venation type to be assessed.

1° vein: Does not appear to be preserved.

2° veins:
Leaf is too fragmentary for 2° veins to be described.

3 veins:
Average angle of origin on admedial side of 2°s: 92°.
Average angle of origin on exmedial side of 2°s: 80°.
Combination: AR.
The 1° is not preserved so there are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.14b

Preservation: Fair. The venation is clear in the part of the leaf preserved. The remaining organic material has a fairly thin and uneven appearance. The specimen is just a fragment so the overall shape of the leaf cannot be described. It is possible that a very little bit more of the specimen may be revealed by removal of sediment cover. There are no margins preserved. Neither the apex nor the base of the leaf is present and so cannot be described.

Dimensions: Max. length 17.9mm min. Max. width 10.1mm min. This specimen is just a small fragment of a leaf, so these are minimum estimates. The fragment appears to be a piece from the LHS of the leaf, so the max. width is probably at least 20.2mm min. Area 88.5sq.mm min. The specimen is too fragmentary to make estimates on the possible outline of the leaf, but it appears that the area of this side of the leaf is at least 122.9sq.mm. Assuming leaf is symmetrical, area is 245.8sq.mm min. 1° is not preserved. 'Leaf area' 241.1sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen is just a fragment so the symmetry of the leaf cannot be described.

Form: It is not possible to estimate the form of this leaf fragment. Using the estimated max. width, the length/width ratio is 0.89:1, but since both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: No margins preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison with D8754.8.67a, it appears that the highest vein order preserved in D8754.8.14b is the second. This specimen is therefore too fragmentary for venation type to be assessed.

1° vein: Not preserved.

2° veins:
Course appears to be abruptly curved and branched, but specimen is too fragmentary to say anything further about the 2° veins.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.15a

Preservation: Fair. The venation is clear in the part of the leaf preserved. The remaining organic material has a medium and fairly uneven appearance. The specimen is fragmentary so the overall shape of the leaf cannot be described. It is possible that a bit more of the specimen may be revealed by removal of sediment cover. A very small percentage of the margins are present on the RHS of the leaf. Neither the apex nor the base of the leaf is present and so cannot be described.

Dimensions: Max. length 25.6mm min. Max. width 21.8mm min. This specimen is just a fragment, so these are minimum estimates. RHS is more complete than LHS and max. width of RHS only is 17.4mm min. Assuming leaf is symmetrical, max. width is 34.8mm min. Area 320.4sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 352.9sq.mm min. Assuming leaf is symmetrical, area is 705.8sq.mm, which is a minimum estimate because much of the apex and base appears to be missing. Using this sketched outline gives an estimate of max. length of 27.1mm min. Max. length along 1° 24mm min. Using the sketched outline gives an estimate of max. length along 1° 27.2mm min. 'Leaf area' 631sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: The LHS of the leaf is too incomplete for the lamina symmetry to be described.

Form: The point of max. width is 23.3mm from the leaf base. The max. length of the leaf fragment is 25.6mm min., meaning that the point of max. width from the leaf base is at 91% of the total leaf length. This would make the leaf form obovate. Using the estimated max. width, the length/width ratio is 0.74:1, but because both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio would mean that the leaf could be described as very wide obovate, but this is a fragmentary specimen, so this is not a good estimate of leaf form. Using the sketched minimum outline, the point of max. width is 23.3mm from the leaf base and the estimated max. length is 27.2mm min. The point of max. width from the leaf base is therefore at 86% of the total leaf length and the leaf form is still described as obovate. Using the estimated max. length and width, the length/width ratio is 0.78:1, which would mean that the leaf form could be described as very wide obovate. However, since this is a fragmentary specimen, this is just an estimate of leaf form. It is not really possible to described the leaf form and length/width ratio of this fragmentary specimen.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous, but since this is a fragmentary specimen, this is not a confident definition.

1° vein:
Size: Leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be approximately 13.6mm from base and here 1° vein width is 0.95mm. However, since at this point there are no clear margins, measurements are made further towards apex, 16.5mm from leaf base. At this point, 1° vein width is 0.8mm and leaf width is 19mm, but this is a minimum estimate because here margin is only present on RHS. RHS is 16.2mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be 32.5mm. Size of 1° is therefore 2.46% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 4 min.
Pairs may be opposite, but specimen is too fragmentary for this to be certain.
Angle of divergence: Right-angle (71-95°, average 87°). (Average on LHS 95°, average on RHS 79°).
Basal vein angle: Not preserved.
Variation: It appears that the upper 2°s may be more acute, but leaf is too fragmentary for variation along length of lamina to be described confidently. Divergence angle appears to be more acute on RHS, but LHS is too complete for this to be certain.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (143°).
Intersecondary veins: Appears to be a composite intersecondary present, but this is not completely certain.
Intramarginal vein: No intramarginal vein can be clearly observed.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.4:1.
Average vein length: 15.1mm.
Average spacing: 10.7mm.

3 veins:
Average angle of origin on admedial side of 2°s: 75°.
Average angle of origin on exmedial side of 2°s: 92°.
Combination: RA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.16a

Preservation: Fairly good. The venation is clear. The remaining organic material has a dark and patchy appearance. The specimen is incomplete so the shape of the leaf cannot be described. The margins are only present in the base of the leaf. The apex is not present and the base of the leaf can be described from the RHS which is more complete. There may be a petiole present.

Dimensions: Max. length 27.1mm min. Petiole is approximately 1.6mm in length. Max. width 17.8mm min. (point of max. width is closer to base on LHS). This is just a fragment from the lower portion of the leaf so these are minimum estimates. RHS is more complete and max. width of RHS only is 12.8mm min. Assuming leaf is symmetrical, max. width is 25.6mm min. Area 249sq.mm min. Roughly sketching in a minimum outline for the RHS, area of RHS only is 228.2sq.mm min. (including petiole). Assuming leaf is symmetrical, area is 456.4sq.mm min. (including petiole). Not including petiole, area is 452.8sq.mm min. These are minimum estimates because much of the upper parts of the leaf are missing. Using this sketched outline gives an estimate of max. length of 27.4mm min. Max. length along 1° is 27.2mm min. (including petiole), 25.6mm min. (not including petiole). Using the sketched outline gives an estimate of max. length along 1° of 27.5mm min. (including petiole), 25.9mm min. (not including petiole). 'Leaf area' 442sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The specimen is too incomplete for the symmetry of the whole lamina to be described. Only the very lowest parts of the base are clearly preserved on both sides of the leaf (the LHS is rather incomplete), and these parts appear asymmetrical, but since there is only a small part of the base clearly preserved this is not a confident definition. The apex is not present, so its symmetry cannot be described.

Form: The point of max. width is 7.4mm from the leaf base. The max. length of the leaf is 25.5mm min., meaning that the point of max. width from the leaf base is at 29% of the total leaf length. This would make the leaf form ovate. Using the estimated max. width, the length/width ratio is 1:1, but because both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio would mean that the leaf could be described as very wide ovate, but this is a fragmentary specimen with much of the apical part of the leaf missing, so this is not a good estimate of leaf form. Using the sketched minimum outline, the point of max. width is 7.4mm from the leaf base and the estimated max. length is 25.9mm min. The point of max. width from the leaf base is therefore still at 29% of the total leaf length and the leaf form is still described as ovate. Using the estimated max. length and width, the length/width ratio is 1.01:1. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form would be described as very wide ovate, but since this is fragmentary specimen, this is just an estimate of the leaf form and length/width ratio.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. RHS of leaf is more complete, so assuming base is symmetrical, basal angle is 129°. Since leaf is fragmentary, this is just an estimate. Base appears to be obtuse and cuneate, but since the specimen is fragmentary this is just an estimate.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Appears to be a normal petiole present. It is approximately 2.2mm wide and 1.6mm in length.

Venation type: Venation is pinnate and appears to be camptodromous, brochidodromous, but since this is a fragmentary specimen, this is not a confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 13.7mm min. from leaf base. At this point, 1° vein width is 1.02mm. The leaf width is 10.8mm, but this is a minimum estimate because here the margin is not preserved. RHS, which shows greater preservation than LHS, is estimated to be at least 10.9mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 21.7mm. Size of 1° is therefore estimated to be 4.7% max. and is termed massive, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Number: 9 min.
Pairs opposite/alternate.
Angle of divergence: Wide acute (61-91°, average 77°). (Average on LHS 86°, average on RHS 67°).
Basal vein angle: Moderate acute (average 64°).
Variation: Divergence angle appears to vary irregularly. Divergence angle more acute on RHS of leaf.
Thickness: Moderate.
Course: Appear to be branched and straight but specimen is too fragmentary for 2° course to be described confidently.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: Appears to be composite intersecondaries present, but this is not completely certain.
Intramarginal vein: None preserved.
Intercostal shape: Appears to be elongated parallel to 2°s, but leaf is too incomplete for intercostal shape to be measured.
Average vein length: Cannot be measured for this fragmentary specimen.
Average spacing: 4.9mm.

3 veins:
Average angle of origin on admedial side of 2°s: 73°.
Average angle of origin on exmedial side of 2°s: 64°.
Combination: AA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 87°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.16b

Preservation: Good. The venation is clear. The preservation is best in the lower portions and LHS of the leaf and deteriorates towards the apex and on the RHS of the leaf. The remaining organic material is rather patchy and holed. The margins are present along the LHS of the leaf and a very small percentage of the margin is present on the RHS of the leaf. The petiole is present. The margins of the base are not present but on the LHS it appears that the shape of the base can be made out. The apex is not present. However, parts of the apex of the leaf appear to be covered by sediment and removal of this cover may reveal much more of the leaf.

Dimensions: Max. length 16mm min. (including petiole). Petiole is approximately 3.1mm in length. Max. length of lamina only 12.9m min. Max. width 13.5mm min. (points of max. width are on roughly the same horizontal plane). LHS is more complete than RHS and max. width of LHS only is 7.7mm. Assuming leaf is symmetrical, max. width is 15.4mm, which appears to be a fairly accurate estimate. Area 129.7sq.mm min. (including petiole). Roughly sketching in a minimum outline for LHS, area of LHS only is 83.6sq.mm min. (not including petiole). Assuming leaf is symmetrical, area is 167.2sq.mm min. (not including petiole). Max. length along 1° 12.7mm min. (not including petiole). Using the sketched outline to measure the max. length gives the same results. Measured along the petiole, its length is 3.2mm, a little longer than the above measurement because it is slightly curved. 'Leaf area' 130.4sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The leaf margins of this specimen are not sufficiently complete to allow the symmetry of the leaf to be described confidently.

Form: The point of max. width is 7mm from the leaf base. The max. length of the leaf is 12.9mm min., meaning that the point of max. width from the leaf base is at 54% of the total leaf length. This would make the leaf form elliptic. Since the max. length is a minimum estimate, although this appears to be a good estimate of the leaf form, it is not possible to eliminate the possibility that the leaf is ovate. Using the estimated max. width, the length/width ratio is 0.84:1, but since the max. width appears to be a fairly good estimate and the length is a minimum, this is a minimum estimate for the length/width ratio. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form is described as oblate. However, since the max. length is a minimum estimate, the possibility that the leaf is orbiculate or very wide ovate cannot be eliminated.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal margins are missing in RHS, so angle is measured from LHS and assuming base is symmetrical, basal angle is 133°. Since leaf is incomplete, this is just an estimate. Base is rounded and although leaf is incomplete, this appears to be an accurate description.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: A petiole is present and there appears to be small fragments of foliar tissue on RHS of petiole so it is described as winged. Petiole is curved and approximately 1.2mm wide and 3.4mm in length.

Venation type: Acrodromous, with two strongly developed secondary veins running in convergent arches toward leaf apex. Position is basal and development appears to be perfect, but since leaf apex is incomplete this is not absolutely certain.

1° vein:
Size: Midpoint is at least 6.5mm from leaf base. At this point, 1° vein width is 0.33mm and leaf width is 13.2mm min. RHS is incomplete at this point and width of LHS only is 7.6mm. Assuming leaf is symmetrical leaf width is 15.2mm. Size of 1° is therefore 2.18% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 2.
Pair is opposite.
Angle of divergence: Only one pair of 2° veins diverging from leaf base.
Basal vein angle: Wide acute (average 66°). (Angle on LHS 58°, angle on RHS 75°).
Variation: There is only one pair of 2°s so there is no variation along the length of the lamina to be described. However, it appears that the divergence angle is more acute on the LHS of the leaf.
Thickness: Thick.
Course: Uniformly curved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None.
Intramarginal vein: None.
Intercostal shape: Not applicable since there is only one pair of 2°s.
Average vein length: Cannot be measured for this fragmentary specimen.
Average spacing: Not applicable.

3 veins:
Average angle of origin on admedial side of 2°s: 90°.
Average angle of origin on exmedial side of 2°s: 82°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 89°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.16e

Preservation: Fairly poor. The venation is fairly clear. The remaining organic material appears to be of medium thickness and is very uneven. The specimen is just a fragment so the shape of the leaf cannot be described. There are no margins present and neither the apex nor base of the leaf is preserved.

Dimensions: Max. length 14.3mm min. Max. width 9.4mm min. this is just a fragment so these are minimum estimates for the leaf. LHS is more complete than RHS and max. width of LHS only is 7.4mm min. Assuming leaf is symmetrical, max. width is 14.8mm min. (assuming the most prominent vein is the 1°). Area 72sq.mm min. It is nor possible to sketch in a minimum outline for this fragmentary specimen, but the area of the LHS only is 64.9sq.mm min. Assuming leaf is symmetrical, area is 129.8sq.mm min. Max. length along 1° is 13mm min., but the estimate of max. length, 14.3mm, is a more realistic but still minimum estimate. 'Leaf area' 141.1sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This is just a scrappy fragment from the LHS of a leaf so elements of symmetry cannot be described.

Form: The point of max. width is 4.2mm from the leaf base. The max. length of the leaf is 14.3mm min., meaning that the point of max. width from the leaf base is at 29% of the total leaf length. This would make the leaf form ovate. Using the estimated max. width, the length/width ratio is 0.97:1, but because both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio would mean that the leaf could be described as very wide ovate, but since this is just a scrappy fragment, this is not a good estimate of the leaf form and length/width ratio. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Not preserved.

Margin: No margins preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: This specimen is too fragmentary for venation type to be assessed.

1° vein: Not clearly preserved.

2° veins: Specimen is too poorly preserved for 2° veins to be described.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.16f

Preservation: Fairly poor. The venation is fairly clear. The remaining organic material has a medium and uneven appearance. The specimen is split in two. The specimen is just a fragment so the shape of the leaf cannot be described. There are no margins present and neither the apex nor base of the leaf is preserved.

Dimensions: Max. length 26.9mm min. Max. width 19.3mm min. This is just a fragment so these are minimum estimates for the leaf. 1° is not preserved. Area 331.6sq.mm min. the specimen is too fragmentary to make estimates on the possible outline of the leaf and although the 1° is not preserved, assuming the leaf is symmetrical, it would appear that the area is at least 663.2sq. mm min. The leaf width is probably at least 38.6mm, assuming that this fragment is a piece of the RHS of the leaf. 'Leaf area' 692.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This is just a scrappy fragment so elements of symmetry cannot be described.

Form: It is not possible to estimate the form of this leaf fragment. Using the estimated max. width, the length/width ratio is 0.70:1, but since both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: No margins preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: This specimen is too fragmentary for venation type to be assessed. It may be pinnate, camptodromous, brochidodromous, but this is not at all clear.

1° vein: Not clearly preserved.

2° veins: Specimen is too poorly preserved for 2° veins to be described.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.17b

Preservation: Poor. The venation is unclear. The remaining organic material has a very patchy and uneven appearance and is of thin to medium thickness. It is possible that more of the specimen may be revealed by removal of sediment cover. The margins are not very clear and neither the apex nor base of the leaf is preserved. The specimen is just a fragment so the shape of the leaf cannot be described.

Dimensions: Max. length 39.1mm min. Max. width 35.1mm min (point of max. width is closer to base on LHS). This is a fragmentary specimen so these are minimum estimates. LHS is more complete than RHS and max. width of LHS only is 20.7mm min. Assuming leaf is symmetrical, max. width is 41.4mm min. Area 779.1sq.mm min. Roughly sketching in a minimum outline for LHS, area of LHS only is 617.1sq.mm min. Assuming leaf is symmetrical, area is 1234.2sq.mm, which is a minimum estimate for the leaf because the apex and base are missing. Using this sketched outline gives an estimate of max. length of 40.3mm min. Max. length along 1° 32.9mm min. Using the sketched outline gives an estimate of max. length along 1° of 40.6mm min. 'Leaf area' 1120.6sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen is too poorly preserved to allow elements of symmetry to be described.

Form: The point of max. width is 17.7mm from the leaf base. The max. length of the leaf is 39.1mm min., meaning that the point of max. width from the leaf base is at 45% of the total leaf length. This would make the leaf form elliptic. Using the estimated max. width, the length/width ratio is 0.94:1, but because both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form would be described as orbiculate, but since this is a fragmentary specimen, this is not a good estimate of leaf form. Using the sketched minimum outline, the point of max. width is 18.2mm from the leaf base and the estimated max. length is 40.6mm min. The point of max. width from the leaf base is therefore still at 45% of the total leaf length and the leaf form is still described as elliptic. Using the estimated max. length and width, the length/width ratio is 0.98:1 and the leaf form is still described as orbiculate. However, since this is a fragmentary specimen, this is just an estimate of the leaf form and length/width ratio. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a very small percentage of the margin is preserved and even this is not clear. There are no clear projections, so it is described as entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous, but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 20.2mm from base and, although it is not clearly preserved, here 1° vein width is 1.03mm. At this point, leaf width is 34.9mm, but this is a minimum estimate because here margin is only present on LHS. LHS is 20.2mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be 40.3mm. Size of 1° is therefore 2.55% and is termed stout. However, since the leaf is fragmentary, this is just an estimate.
Course: Appears to be markedly curved.

2° veins:
Number: 4 min.
Pairs appear to be opposite.

Angle of divergence: Moderate acute (42-83°, average 58°). (Average on LHS 47°, average on RHS 69°).
Basal vein angle: Not preserved.
Variation: Leaf is too fragmentary for variation along length of lamina to be described confidently. However, divergence angle appears to be more acute on LHS.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.8:1.
Average vein length: 30.7mm.
Average spacing: 17.3mm.

3 veins:
Average angle of origin on admedial side of 2°s: 88°.
Average angle of origin on exmedial side of 2°s: 67°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 75°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.
However, this leaf is rather poorly preserved and it is not clear whether the features measured are actually 3° veins.

D8754.8.17c

Preservation: Very poor. The venation is unclear. The remaining organic material appears to be of medium thickness and very uneven. There are no margins preserved and neither the apex nor base of the leaf is present. The specimen is just a fragment so the shape of the leaf cannot be described.

Dimensions: Max. length 29.4mm min. Max. width 15.6mm min. This is a fragmentary specimen so these are minimum estimates. It appears that this is a fragment from the RHS of the leaf, even though the 1° is not preserved. Max. width of RHS only is 15.6mm min. Assuming leaf is symmetrical, max. width is 31.2mm min. Area 272.3sq.mm min. The specimen is too fragmentary to make estimates on the possible outline of the leaf, but although the 1° is not preserved, assuming the leaf is symmetrical, it would appear that the area is at least 544.6sq.mm min. 'Leaf area' 611.5sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This is just a scrappy fragment from the RHS of a leaf so elements of symmetry cannot be described.

Form: The point of max. width is 22.3mm from the leaf base. The max. length of the leaf is 29.4mm min., meaning that the point of max. width from the leaf base is at 76% of the total leaf length. This would make the leaf form obovate. Using the estimated max. width, the length/width ratio is 0.94:1, but because both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio would mean that the leaf could be described as very wide obovate, but since this is just a scrappy fragment, this is not a good estimate of the leaf form and length/width ratio. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Not preserved.

Margin: No margins preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: This specimen is too fragmentary for venation type to be assessed.

1° vein: Not clearly preserved.

2° veins: Specimen is too poorly preserved for 2° veins to be described.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.21a & 46e

D8754.8.21a

Preservation: Fairly good. The venation is clear. In parts the leaf specimen is very patchy, holed and unclear, in others the venation is dark and very clear while the rest of the lamina is of either very thin pale carbon film or no carbon film at all. The specimen is incomplete and so the shape of the leaf cannot be described. Some of the margins are clearly preserved. Neither the apex nor base are present and so cannot be described.

Dimensions: Max. length 14.5mm min. Max. width 11.3mm min. (point of max. width is closer to base on LHS). This is a fragmentary specimen so these are minimum estimates. LHS is more complete than RHS and max. width of LHS is 6.4mm min. Assuming leaf is symmetrical, max. width is 12.8mm min. Area 104.8sq.mm min. Roughly sketching in a minimum outline for LHS, area of LHS only is 84.1mm min. Assuming leaf is symmetrical, area is 168.2sq.mm, which is a minimum estimate for the leaf because the apex and base are missing. Using this sketched outline gives an estimate of max. length of 15.9mm min. Max. length along 1° 11.8mm min. Using the sketched outline gives an estimate of max. length along 1° of 15.9mm min. 'Leaf area' 135.7sq.mm min.

D8754.8.46e

Preservation: Fairly good. The counterpart 21a shows better preservation. The venation is fairly clear. The specimen is obscured by a thick, dark, patchy deposit, particularly in the lower parts of the specimen. The remaining organic material of the lamina is thin to non-existent and the venation is dark. The specimen is incomplete so the overall shape of the leaf cannot be described. Some of the margins are clearly preserved. Neither the apex nor base of the leaf is present and so cannot be described.

Dimensions: Max. length 14.7mm min. Max. width 11.1mm min (point of max. width is closer to base on RHS). This is a fragmentary specimen so these are minimum estimates. The 1° is unclear, making it difficult to make estimates of the max. width of the leaf. It appears that the max. width of the RHS only is 5.9mm min. Assuming leaf is symmetrical, max. width is 11.8mm min. Area 118.1sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 88.6mm min. Assuming leaf is symmetrical, area is 177.2sq.mm, which is a minimum estimate for the leaf because the apex and base are missing. Using the sketched outline gives an estimate of max. length of 17.4mm min. Max. length along 1° is 13.1mm min., but the 1° is unclear in most of the specimen. Using the sketched outline gives an estimate of max. length along 1° of 17.4mm min. 'Leaf area' 136.9sq.mm min.

D8754.8.21a & 46e

Dimensions: Although 46e shows slightly greater preservation than the counterpart 21a, the leaf completeness is roughly the same, so the measurements given here are averages for 21a and 46e. Max. length 14.6mm min. Max. width 11.2mm min. Area 111.5sq.mm min. Estimated max. length 16.7mm min. Estimated max. width 12.3mm min. Estimated max. area 172.7sq.mm min. Max. length along 1° 12.5mm min. Estimated max. length along 1° 16.7mm min. 'Leaf area' 136.3sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: The leaf is incomplete but from the parts of the leaf preserved it appears that the leaf is asymmetrical. Neither the apex nor base are present so their symmetry cannot be described.

Form: The point of max. width is 4.4mm from the leaf base. The maximum length of the leaf is 14.6mm min., meaning that the point of max. width from the leaf base is at 30% of the total leaf length. This would make the leaf form ovate, but from the curvature of the margins present, it appears that the leaf form is oblong. Using the estimated max. width, the length/width ratio is 1.19:1, but since both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio would mean that the leaf form would be described as very wide oblong, but this is a fragmentary specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, the point of max. width is 5.7mm from the leaf base. With an estimated max. length of 16.7mm min., the point of max. width from the leaf base is at 34% of the total leaf length, but the leaf form still appears to be oblong. Using the estimated max. length and width, the length/width ratio is 1.36:1. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf

is described as wide oblong, but since this is a fragmentary specimen, this is just an estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin appears to be entire, but since margin is incomplete, this is not a completely confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous, but since this is just a small fragment, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 8.4mm from base. 1° is not clearly preserved at midpoint of D8754.8.46e, so measurements are made from D8754.8.21a. At approximate midpoint 1° vein width is 0.57mm and leaf width is 9.93mm, but this is a minimum estimate because here margin is only present on LHS. LHS only is 6mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be 12mm. Size of 1° is therefore 4.75% and is termed massive.
Course: Straight and appears to be unbranched, but this is not certain.

2° veins:
Measurements are given for 21a in which the venation is clearer.
Number: 10 min.
Pairs opposite/alternate.
Angle of divergence: Wide acute (66-96°, average 79°). (Average on LHS 79°, average on RHS 79°).
Basal vein angle: Not preserved.
Variation: It appears that the divergence angle varies irregularly. Divergence angle appears to be symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 110°). May possibly form an intramarginal vein but this is not clear.
Intersecondary veins: Appears to be composite intersecondaries present.
Intramarginal vein: May be an intramarginal vein present.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2:1.
Average vein length: 4mm.
Average spacing: 2.5mm.

3 veins:
Measured from 21a which shows clearer preservation.
Average angle of origin on admedial side of 2°s: 91°.
Average angle of origin on exmedial side of 2°s: 107°.
Combination: OR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 59°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.22a

Preservation: Fairly poor. The venation is unclear. The remaining organic material is very patchy and holed and has a medium to dark and thick appearance. The specimen is just a fragment and so the shape of the leaf cannot be described. There may be a small percentage of the margins present. The apex is not present and cannot be described. It is unclear but part of the base may be preserved.

Dimensions: Max. length 26.4mm min. Max. width 18.3mm min (points of max. width are on roughly the same horizontal plane). This is a fragmentary specimen so these are minimum estimates. Max. width of LHS only is 10.5mm min. and max. width of RHS only is 7.8mm min. However, it appears that there are margins present along the RHS of the specimen and the leaf is not symmetrical along the most prominent vein. Area 269sq.mm min. It is not possible to make estimates on the minimum outline of the leaf. Max. length along 1° is 27.4mm min., which is greater than the max. length because 1° is rather curved. 'Leaf area' 334.3sq.mm min.

Organisation: Cannot be determined for this fragmentary specimen.

Symmetry: The margins of this specimen are not very clear but from the parts of this fragmentary specimen preserved it appears that the lamina is asymmetrical. Although the RHS of the leaf base is missing, in fact the base of the leaf is not at all clearly preserved, from the curvature of the margins in the parts of the leaf preserved it does appear that the base is probably asymmetrical. The apex is not present and so its symmetry cannot be described.

Form: The point of max. width is 16.5mm from the leaf base. The max. length of the leaf is 26.4mm, meaning that the point of max. width from the leaf base is at 63% of the total leaf length. This would make the leaf form obovate. The length/width ratio is 1.44:1, but since the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would be described as wide obovate, but since this is a fragmentary specimen, this is just an estimate of leaf form.

Apex: Not preserved.

Base: Leaf specimen is incomplete and it was not possible to sketch a minimum outline for leaf, so extent of basal portion is just an estimate. LHS shows greater preservation than RHS, so angle is measured for LHS only. Assuming base is symmetrical, basal angle appears to be 91°. However, base is not symmetrical and sketched minimum outline of whole base appears to give a better representation of leaf base. Basal angle is therefore estimated to be 93°. Since leaf is fragmentary, this is just an estimate. Base appears to be obtuse and cuneate, but specimen is fragmentary and basal margins are incomplete and unclear so this is just an estimate.

Margin: Only a small percentage of the margin is preserved and even this is not clear. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: No clear petiole preserved, but base is incomplete.

Venation type: Venation appears to be pinnate, but specimen is too poorly preserved to describe the venation pattern confidently.

1° vein:
Size: Leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be approximately 13.2mm from base and here 1° vein width is 0.58mm. At this point, leaf width is estimated to be 17.1mm, but the margins are not clear. Size of 1° is therefore estimated to be 3.4% and is termed stout. However, since the leaf is fragmentary, this is just an estimate.
Course: Appears to be markedly curved.

2° veins:
Number: 2 min.
Specimen is too poorly preserved to observe pairs of 2°s.
Angle of divergence: Narrow acute (36-49°, average 43°). (Average on LHS 49°, average on RHS 36°).
Basal vein angle: Moderate acute (49°), measured from LHS of leaf.
Variation: Specimen is too poorly preserved to describe the variation in divergence angle along the length of the lamina. Divergence angle more acute on RHS of leaf.
Thickness: Moderate.
Course: Appear to be uniformly curved and unbranched, but specimen is too fragmentary for 2° course to be described confidently.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None preserved.
Intercostal shape: Leaf is too poorly preserved for intercostal shape to be measured.
Average vein length: Cannot be measured for this fragmentary specimen.
Average spacing: Cannot be measured for this fragmentary specimen.

3 veins: Specimen is too poorly preserved for 3° vein angles to be measured.

D8754.8.22b

Preservation: Fair. The venation is fairly clear. The remaining organic material has a thin to medium appearance. In some

places the carbon film is very thin and here the venation is clear. The specimen is just a fragment and so the shape of the leaf cannot be described. In some parts the margins are very clear. Neither the apex nor base of the leaf is present and so cannot be described. The specimen surface is very uneven.

Dimensions: Max. length 10.9mm min. Max. width 13.2mm min (point of max. width is closer to base on LHS). This is a fragmentary specimen so these are minimum estimates. Area 96.4sq.mm min. The specimen is too fragmentary to make estimates on the possible outline of the leaf, but the RHS of the leaf shows greater preservation. Assuming leaf is symmetrical, area is at least 122.6sq.mm min. Max. length along 1° 10.1mm min. Max. length, 10.9mm, is slightly closer to true max., but is still a minimum estimate. 'Leaf area' 95.9sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: The leaf is incomplete, but at the one point where the margin is preserved on both sides of the leaf, the lamina appears to be symmetrical. Neither the base nor apex is present so their symmetry cannot be described.

Form: The point of max. width is 10.4mm from the leaf base. The max. length of the leaf is 10.9mm, meaning that the point of max. width from the leaf base is at 95% of the total leaf length. This would make the leaf form obovate. The length/width ratio is 0.83:1, but since the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would be described as very wide obovate, but since this is a fragmentary specimen, this is not a good estimate of leaf form. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a very small percentage of margin is preserved and there is only one clearly preserved projection. Measured perpendicular to the midvein, the margin is indented 0.4-1.4mm, average 0.9mm, 14.2% of the distance to the midvein. The apex of the projection is rounded, so the margin is described as crenate. Sinus is not clearly preserved but it is estimated to be angular. Since only one crenation is clearly preserved, spacing of crenations cannot be measured. From the part of the margin preserved, the spacing is estimated to be at least 3.6mm.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be approximately 5.5mm from base and here 1° vein width is 0.59mm. At this point, leaf width is 12.6mm. Size of 1° is therefore 4.68% and is termed massive. However, since the leaf is fragmentary, this is just an estimate.
Course: Appears to be straight and unbranched, but since leaf is fragmentary this is not certain.

2° veins:
Number: 5 min.
Pairs appear to be opposite/alternate.
Angle of divergence: Wide acute (69-73°, average 71°). (Average on LHS 72°, average on RHS 71°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to be nearly uniform, but leaf is too fragmentary for variation along length of lamina to be described confidently. Divergence angle appears to be symmetrical.
Thickness: Moderate.
Course: Appears to be abruptly curved and unbranched.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: None preserved.
Intramarginal vein: None.
Intercostal shape: Appears to be elongated parallel to 2°s, average vein length/spacing ratio is estimated to be at least 2.1:1.
Average vein length: 5.9mm.
Average spacing: 2.8mm.

3 veins:
Average angle of origin on admedial side of 2°s: 97°.
Average angle of origin on exmedial side of 2°s: 68°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 97°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.24b

Preservation: Fairly poor. The venation is fairly clear. The remaining organic material has a medium thickness appearance. The specimen is just a fragment and so the shape of the leaf cannot be described. A little more of the specimen may be revealed by removal of the sediment cover. There are no clear margins. Neither the apex nor base of the leaf is present and so cannot be described.

Dimensions: Max. length 14.4mm min. Max. width 13.4mm min. This specimen is just a small fragment so these are minimum estimates. Area 89.5sq.mm min. 1° is not clearly preserved. 'Leaf area' 128.6sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This is just a scrappy fragment and so elements of symmetry cannot be described.

Form: It is not possible to estimate the form of this leaf fragment. The length/width ratio is 1.07:1, but since both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: No margins preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: It appears that the highest order vein preserved is the second. This specimen is therefore too fragmentary for venation type to be assessed.

1° vein: Not preserved.

2° veins: Specimen is too poorly preserved for 2° veins to be described.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.25a

Preservation: Fair. The venation is fairly unclear. The remaining organic material appears dark, thick and patchy. The specimen is just a fragment so the shape of the leaf cannot be described. There are margins preserved. The apex may be preserved but it is not possible to be sure that the part of the leaf preserved is the apical portion of the leaf. The base is not preserved.

Dimensions: Max. length 12.1mm min. Max. width 8.6mm min. (point of max. width is slightly closer to base on LHS). This specimen appears to be just a small fragment from the tip of the leaf so these are minimum estimates. Area 61.9sq.mm min. Roughly sketching in a minimum outline, area is 66.6sq.mm, a minimum estimate because this appears to be just a tip from a leaf. Max. length along 1° 11.5mm min. Using the sketched outline gives an estimate of max. length along 1° of 11.9mm min. 'Leaf area' 68.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This is just a fragment of the leaf apex so the symmetry of the whole lamina cannot be described confidently, but the apical part of the leaf preserved appears to be asymmetrical. The base is not present so its symmetry cannot be assessed.

Form: The point of max. width is 7.2mm from the leaf base. The max. length of the leaf is 12.1mm, meaning that the point of max. width from the leaf base is at 60% of the total leaf length. This would make the leaf form obovate. The length/width ratio is 1.41:1, but since the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would be described as wide obovate, but since this is a fragmentary specimen, this is not a good estimate of leaf form. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Leaf specimen is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle appears to be 111° and apex appears to be emarginate, but apex is incomplete, so these are just estimates.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison of vein width with D8754.8.32a, it appears that the highest vein order preserved in D8754.8.25a is the second. This specimen is therefore too fragmentary for venation type to be assessed.

1° vein: Not preserved.

2° veins:
Course appears to be curved and branched, but specimen is too fragmentary to say anything further about the 2° veins.

3 veins:
This specimen is too fragmentary for the 3° veins to be described confidently.
Average angle of origin on admedial side of 2°s: 73°.
Average angle of origin on exmedial side of 2°s: 74°.
Combination: AA.
The 1° is not preserved so there are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.26a

Preservation: Fairly poor. The venation is fairly clear. The remaining organic material has a thin to medium thickness and patchy appearance. The specimen is just a fragment and so the shape of the leaf cannot be described. There are no clear margins preserved. Neither the apex nor base of the leaf is present and so cannot be described.

Dimensions: Max. length 14.2mm min. Max. width 16.7mm min. (point of max. width is closer to base on RHS). This is just a fragment so these are minimum estimates. LHS is more complete than RHS and max. width of LHS only is 10.9mm min. Assuming leaf is symmetrical, max. width is 21.8mm min. Area 154.2sq.mm min. Roughly sketching in a minimum outline for LHS, area of LHS only is 135.2sq.mm min. Assuming leaf is symmetrical, area is 270.4sq.mm, which is a minimum estimate for the leaf because the apex and base are missing. Using this sketched outline gives an estimate of max. length of 16.7mm min. Max. length along 1° 7.2mm min. Using the sketched outline gives an estimate of max. length along 1° of 16.8mm min. 'Leaf area' 244.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen is too incomplete for symmetry features to be described.

Form: The point of max. width is 7.6mm from the leaf base. The max. length of the leaf is 14.2mm min., meaning that the point of max. width from the leaf base is at 54% of the total leaf length. This would make the leaf form elliptic. Using the estimated max. width, the length/width ratio is 0.65:1, but because both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would be described as oblate, but since this is a fragmentary specimen, this is not a good estimate of leaf form. Using the sketched minimum outline, the point of max. width is 9mm from the leaf base and the estimated max. length is 16.8mm min. The point of max. width from the leaf base is therefore still at 54% of the total leaf length and the leaf form is still described as elliptic. Using the estimated max. length and width, the length/width ratio is 0.77:1. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme so the nearest is used. This means that the leaf form would be described as oblate. However, since this is a fragmentary specimen, this is just an estimate of the leaf form and length/width ratio. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Not preserved.

Base: Not preserved.

Margin: No margins preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous, but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 8.4mm from base. At this point, 1° vein width is 0.45mm. The leaf width is 16.1mm, but this is a minimum estimate because here the margin is not preserved. LHS, which shows greater preservation than RHS, is estimated to be at least 10.9mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 21.8mm. Size of 1° is therefore estimated to be 2.06% max. and is termed stout, but the specimen is too fragmentary for the 1° vein size to be described confidently.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Number: 2 min.
Pairs appear to be alternate.
Angle of divergence: Narrow acute (27-30°, average 28°).
(Average on LHS 30°, average on RHS 27°).
Basal vein angle: Not present.
Variation: Specimen is too poorly preserved to describe the variation in divergence angle along the length of the lamina.
Divergence angle appears to be symmetrical.
Thickness: Moderate.
Course: Appear to be curved, but specimen is too fragmentary for 2° course to be described confidently.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: Appears that there may be composite intersecondaries present.
Intramarginal vein: None preserved.
Intercostal shape: Leaf is too poorly preserved for intercostal shape to be measured, but it appears to be elongated parallel to 2°s.
Average vein length: Cannot be measured for this fragmentary specimen.
Average spacing: Cannot be measured for this fragmentary specimen.

3 veins:
Average angle of origin on admedial side of 2°s: 81°.
Average angle of origin on exmedial side of 2°s: 100°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 59°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.26c

Preservation: Fair. The venation is fairly clear. The remaining organic material has a thin to medium thickness and patchy appearance. Only the lower RHS of the leaf is preserved so the shape of the leaf cannot be described. The margins appear clear in the part of the leaf preserved. The apex is not present and so cannot be described. The base of the leaf can be described from the RHS of the leaf. There is no petiole present.

Dimensions: Max. length 16.1mm min. Max. width 7.3mm min. This specimen is just a small fragment from the lower RHS of the leaf, so these are minimum estimates. Max. width of RHS only 6.6mm min. Assuming leaf is symmetrical, max. width is 13.2mm

min. Area 60.7sq.mm min. Area of RHS only 56.7sq.mm min. Assuming leaf is symmetrical, area is 113.4sq.mm, a minimum estimate for the leaf because the apical part is missing. Max. length along 1° is 14.9mm min. Max. length, 16.1mm, is a better estimate, but is still a minimum. 'Leaf area' 141.7sq.mm min.

Organisation: Cannot be determined for this fragmentary specimen.

Symmetry: This specimen is just a fragment from the lower RHS of the leaf so features of symmetry cannot be described.

Form: It is not possible to estimate the form of this leaf fragment. The length/width ratio is 1.22:1, but since both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Leaf specimen is fragmentary and it was not possible to sketch a minimum outline for leaf, so extent of basal portion is just an estimate. LHS is missing so angle is measured for RHS only. Assuming base is symmetrical, basal angle is 55°. Since leaf is fragmentary, this is just an estimate. Base appears to be acute and cuneate, and although leaf is fragmentary, this appears to be a fairly accurate description.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Absent or not preserved.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous, but it is really not clear from this fragmentary specimen.

1° vein:
Size: Leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be at least 8.1mm from leaf base. At this point, 1° vein width is 0.79mm and leaf width is 4.42mm, but this is a minimum estimate because only RHS of leaf is preserved. Assuming leaf is symmetrical, leaf width is estimated to be 8.12mm. Size of 1° is therefore 9.73% and is termed massive, but the specimen is too fragmentary for the 1° vein size to be described completely confidently.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Number: 2 min.
Only RHS of leaf is preserved, so no pairs of 2°s can be observed.
Angle of divergence: Moderate acute (41-54°, average 48°).
Basal vein angle: May be 41°, but this is not definitely the basal vein.
Variation: It appears that lowest 2° may be more acute than those above, but specimen is too fragmentary to describe the variation in divergence angle along the length of the lamina confidently. Since only RHS of leaf is preserved, symmetry of divergence angle cannot be assessed.
Thickness: Moderate.
Course: Appear to be abruptly curved and unbranched but this is not completely certain.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: None preserved.
Intramarginal vein: None preserved.
Intercostal shape: Appears to be slightly elongated parallel to 2°s, average vein length/spacing ratio is estimated to be approximately 1.2:1.
Average vein length: 6.6mm.
Average spacing: 5.4mm.

3 veins: Specimen is too poorly preserved for 3° vein angles to be measured.

D8754.8.27a

Preservation: Fairly good. The venation is very clear. The remaining organic matter has a fairly even coverage in the parts of the leaf that are present. There are a few small holes in the leaf. Only the upper RHS of the leaf is preserved. It appears that the shape of the apex can be made out in this upper RHS of the leaf although the margins do not appear complete. The margin does appear to be present in parts near the apex. However, in the lower half of the preserved lamina the margin is incomplete. The base and the lower portion of the leaf are missing.

Dimensions: Max. length 29.1mm min. Max. width 11.8mm min. This is just a fragment from the upper RHS of the leaf so these are minimum estimates. Max. width of RHS only is 10mm. Assuming leaf is symmetrical, max. width is 20mm min. Area 155.9sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 192.3sq.mm min. Assuming leaf is symmetrical, area is 384.6sq.mm, a minimum estimate for the leaf because the lower parts of the leaf are missing. Max. length along 1° 29mm min. 'Leaf area' 386.7sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen is just a fragment from the upper RHS of the leaf so features of symmetry cannot be described.

Form: The point of max. width is 16.9mm from the leaf base. The max. length of the leaf is 29.1mm min., meaning that the point of max. width from the leaf base is at 58% of the total leaf length. This would make the leaf form obovate. Using the estimated max. width, the length/width ratio is 1.46:1, but because both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would be described as wide obovate, but since this is a fragmentary specimen, this is not a good estimate of leaf form. Using the sketched minimum outline, the point of max. width is 16.3mm from the leaf base and the estimated max. length is 29mm min. The point of max. width from the leaf base is therefore at 56% of the total leaf length and the leaf form is still described as obovate. Using the estimated max. length and width, the length/width ratio is 1.45:1. This means that the leaf form would still be described as wide obovate. However, since this is a fragmentary specimen, this is not a good estimate of the leaf form and length/width ratio. It is not really possible to describe the leaf form of this fragmentary specimen.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Assuming apex is symmetrical, apical angle appears to be 76° and apex appears to be attenuate, but apex is incomplete, so these are just estimates.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, but this is difficult to determine from such a fragmentary specimen. In the apical part of the leaf the venation is camptodromous, brochidodromous, but the venation of the basal part of the leaf cannot be described.

1° vein:
Size: Leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be approximately 14.6mm from base. At this point, 1° vein width is 0.28mm. The leaf width is 10.3mm, but this is a minimum estimate because only RHS of leaf is preserved. Assuming leaf is symmetrical, leaf width is estimated to be at least 20.6mm. Size of 1° is therefore estimated to be 1.36% and is termed moderate, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be moderately curved.

2° veins:
Number: 10 min.
Only RHS of leaf is preserved, so pairs cannot be studied.
Angle of divergence: Right-angle (74-101°, average 89°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly. Since only RHS of leaf is preserved it is not possible to assess divergence angle symmetry.
Thickness: Moderate.
Course: Abruptly curved and unbranched. Some of the 2° also appear that they may be recurved.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 127°). Enclosed by 2°, 3° and 4° arches.
Intersecondary veins: It appears that there may be composite intersecondaries present, but this is not certain.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2.2:1.

Average vein length: 4.5mm.
Average spacing: 2.2mm.

3 veins:
Average angle of origin on admedial side of 2°s: 93°.
Average angle of origin on exmedial side of 2°s: 98°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 93 °.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.28a

Preservation: Good. The venation is quite clear in the parts of the leaf that are well preserved. The remaining organic matter is broken up and thin and patchy in places. The lower parts of the leaf are best preserved and this deteriorates towards the apex of the leaf. The shape of the lower part of the leaf is clear and the margins are present in several locations in the lower half of the leaf. The base of the leaf is almost complete, but the margins are only present on the LHS. The apex of the leaf is not present.

Dimensions: Max. length 33.2mm min. Max. width 17.1mm (points of max. width are on the same horizontal plane). Although the measurement of max. width appears to be fairly accurate, the leaf is incomplete and the max. length is a minimum estimate. Area 249.6sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 181.7sq.mm min. Assuming leaf is symmetrical, area is 363.4sq.mm min. Using this sketched outline gives an estimate of max. length of 34.1mm min. Max. length along 1° 28.6mm min. Using the sketched outline gives a minimum estimate of max. length along 1° of 33.9mm min. 'Leaf area' 386.5sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: There is only a small percentage of the margin preserved so it is not possible to describe the symmetry of the lamina with any certainty. It appears that the leaf may be slightly asymmetrical, but this is not at all clear. The only margins preserved in the leaf base are in the lowest part of the LHS, but from the shape of the leaf parts preserved the base appears to be slightly asymmetrical. The LHS of the apical part of the leaf is missing so its symmetry cannot be described.

Form: The point of max. width is 18.8mm from the leaf base. The max. length of the leaf is 33.2mm min., meaning that the point of max. width from the leaf base is at 57% of the total leaf length. This would make the leaf form obovate. The length/width ratio is 1.94:1, but since the max. width appears to be a fairly good estimate and the max. length is a minimum, this is a minimum estimate for the length/width ratio. This ratio would make the leaf form wide obovate, but this is an incomplete specimen so this is not a good estimate of leaf form. Using the sketched outline, the point of max. width is still 18.8mm from the leaf base and the max. length of the leaf is 33.9mm min. The point of max. width from the leaf base is therefore at 55% of the total leaf length. This would still make the leaf form obovate, but because the max. length is a minimum estimate, the possibility that the leaf form is elliptic cannot be eliminated. Using the estimated max. length, the length/width ratio is 1.98:1, which is again a minimum estimate. This ratio means that the leaf form would be described as wide obovate. However, since the max. length is a minimum estimate and this is a minimum estimate for the length/width ratio, the possibility that the leaf is wide elliptic or elliptic cannot be ruled out. Since this is an incomplete specimen, these are just estimates of the leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Much of basal margins are incomplete, so it is not possible to estimate basal angle. Base appears to be acute and decurrent and although leaf is incomplete, this appears to be a fairly accurate description.

Margin: There are projections clearly preserved along the margin of both sides of the leaf. There are two clear indentations on LHS and one on RHS. Measured perpendicular to the midvein, the margin is indented 1.1-1.8mm, average 1.5mm min., 20.1% (min.) of the distance to the midvein. The apices of the projections are rounded, so the margin is described as crenate. Sinuses between crenations are rounded. Margin is not completely preserved, but spacing of crenations is estimated to be 7.1-8.7mm, average 7.6mm, standard deviation 0.6mm, and spacing is described as regular.

Petiole: Absent or not preserved.

Venation type: Venation appears pinnate. In some places the 2° veins appear to reach the margin, in others they do not, this is difficult to determine due to preservation levels. Venation appears to be mixed craspedodromous, but this is not absolutely certain. The 2° veins are actually very difficult to distinguish in many parts of the leaf.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 17.1mm from base, but here 1° vein is not completely preserved. Measurements are therefore made slightly further towards base, 13.6mm from leaf base. At this point, 1° vein width is 0.4mm and leaf width is 13.3mm. Size of 1° is therefore 3% and is termed stout.
Course: Straight and unbranched.

2° veins:
Number: 6 min.
Pairs are alternate.
Angle of divergence: Moderate acute (33-76°, average 56°).
(Average on LHS 49°, average on RHS 62°).
Basal vein angle: Narrow acute (38°).
Variation: Upper 2°s more obtuse than lower 2°s. Lowest pair of secondaries are also more acute than pairs above. Divergence angle appears to be more acute on LHS than RHS, but apical part of LHS is missing. If average divergence angle is compared in basal part only, where both sides of leaf are preserved, then angle is still more acute on LHS than RHS.
Thickness: Appear to be quite thick, especially in the basal part of the leaf.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (124°).
Intersecondary veins: Appears to be simple intersecondaries present.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.8:1.
Average vein length: 10.9mm.
Average spacing: 6.4mm.

3 veins:
Average angle of origin on admedial side of 2°s: 101°.
Average angle of origin on exmedial side of 2°s: 61°.
Combination: AO.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 86°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.30a

Preservation: Good. The leaf is difficult to draw and describe because the rock surface the leaf impression is preserved on is very curved. This produces a distortion in the drawing. The rock surface is convex with the axis of curving perpendicular to the long axis of the leaf. This produces an apparent shortening in the upper and lower parts of the leaf. The rock the specimen is preserved on is also broken in two and has therefore been glued together with wood glue. There is a small piece of rock carrying part of the specimen missing. Despite all this the venation is clear. The remaining organic matter is fairly thick in the lower part of the leaf. The preservation deteriorates towards the centre of the leaf, where parts of the leaf are missing due to fragmentation of the leaf specimen as well as the loss of a piece of the rock. The preservation is then good towards the apex of the leaf, but the apex is missing. The apex appears to be covered by sediment but removal of some of this cover has revealed much more of the leaf. The base of the leaf is not present near the centre of the leaf, though the curve of the lower basal margins can be observed. The leaf margins are present and quite clear in parts of the leaf.

Dimensions: Max. length 20.5mm min. Max. width 16.4mm min. (point of max. width is closer to base on RHS). The leaf is incomplete so these are minimum estimates. LHS shows greater preservation at the point of max. width, (although RHS shows

better preservation in upper parts of leaf). Max. width of LHS only is 8.4mm min. Assuming leaf is symmetrical, max. width is 16.8mm min. Area 237.5sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 134.6sq.mm min. Assuming leaf is symmetrical, area is 269.2sq.mm min. Max. length along 1° 18.9mm min. The estimate of max. length, 20.5mm, appears more realistic but is still a minimum. 'Leaf area' 229.6sq.mm min. Distortion of the drawing caused by the curvature of the rock surface also means that these estimates are minimums.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The margins of the leaf are not well enough preserved for the symmetry of the lamina to be described confidently. The shape of the preserved central parts of the leaf appears to be roughly symmetrical, but this is not at all clear. The base appears to be slightly asymmetrical and so the lamina is categorised as asymmetrical. Although the base appears slightly asymmetrical, since it is incomplete, this is not a confident definition. The apex is too incomplete for its symmetry to be described.

Form: The point of max. width is 9.6mm from the leaf base. The max. length of the leaf is 20.5mm, meaning that the point of max. width from the leaf base is at 47% of the total leaf length. This would make the leaf form elliptic. Using the estimated max. width, the length/width ratio is 1.22:1, but since the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would be described as suborbiculate, but since this is a fragmentary specimen, this is just an estimate of leaf form.

Apex: Not preserved.

Base: Leaf specimen is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle appears to be 150°, but since leaf is incomplete, this is just an estimate. Base appears to be cordate, but basal margins are incomplete, especially at point of insertion of petiole, so this is just an estimate.

Margin: There are projections clearly preserved along the basal margin of the LHS and along the apical margin of the RHS. Measured perpendicular to the midvein, the margin is indented 0.2-0.6mm, average 0.3mm min., 6.2% of the distance to the midvein. The majority of the projections have rounded apices, so the margin is described as crenate. Sinuses between crenations are angular. Spacing of crenations is 0.7-2mm, average 1.3mm, standard deviation 0.4mm, and spacing is described as irregular.

Petiole: Base of leaf is incomplete so it cannot be determined whether a petiole is present or not.

Venation type: Venation is pinnate and appears to be semicraspedodromous, but the preservation of the leaf does not allow the venation pattern to be described completely confidently.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 10.3mm from base and here 1° vein width is 0.5mm. At this point, leaf width is 13.7mm, a minimum estimate because the margin is incomplete. From curvature of margin present, leaf width at this point is estimated to be 15.9mm. Size of 1° is therefore 3.14% and is termed stout.
Course: Appears to be curved, but since specimen surface is very curved this is not a completely confident description.

2° veins:
Number: 15 min.
Pairs are opposite/alternate.
Angle of divergence: Wide acute (48-135°, average 73°).
(Average on LHS 89°, average on RHS 58°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly.
Divergence angle more acute on RHS than LHS.
Thickness: Moderate.
Course: Abruptly curved and branched. It also appears that 2°s are provided with outer 2° veins.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 58°).
Intersecondary veins: Appears to be simple intersecondaries present.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 3.7:1.
Average vein length: 6.9mm.
Average spacing: 2.1mm.

3 veins:
Average angle of origin on admedial side of 2°s: 88°.
Average angle of origin on exmedial side of 2°s: 75°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 72°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.31a

Preservation: Fairly good. The venation is clear in the parts of the leaf that are well preserved. The remaining organic matter has a fairly thin and uneven appearance. The margins are fairly clear along the LHS of the leaf. Neither the apex nor base of the leaf is present and the overall shape of the leaf is unclear.

Dimensions: Max. length 23.8mm min. Max. width 16.9mm min. (point of max. width is closer to base on LHS). These are minimum estimates because the apex and base of the leaf are missing. LHS is more complete than RHS and max. width of LHS only is 9.6mm min. Assuming leaf is symmetrical, max. width is 19.2mm min. Area 223.3sq.mm min. Roughly sketching in a minimum outline for LHS, area of LHS only is 216.3sq.mm min. Assuming leaf is symmetrical, area is 432.6sq.mm, which is a minimum estimate because the apex and base are missing. Using the sketched outline gives an estimate of max. length of 28.3mm min. Max. length along 1° 12.3mm min. Using the sketched outline gives an estimate of max. length along 1° of 28.3mm min. 'Leaf area' 362.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: The margins of this leaf are insufficiently preserved for features of symmetry to be described.

Form: The point of max. width is 1.4mm from the leaf base. The max. length of the leaf is 23.8mm min., meaning that the point of max. width from the leaf base is at 6% of the total leaf length. This would make the leaf form ovate, but from the curvature of the margins present, it appears that the leaf form is oblong. Using the estimated max. width, the length/width ratio is 1.24:1, but since both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest is used. This means that the leaf form would be described as very wide oblong, but this is an incomplete specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, the point of max. width is 4.8mm from the leaf base and the max. length is 28.3mm min. The point of max. width from the leaf base is therefore at 17% of the total leaf length, but the leaf form still appears to be oblong. Using the estimated max. length and width, the length/width ratio is 1.47:1. Again this ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest is used. This means that the leaf is described as wide oblong, but since this is an incomplete specimen, this is just an estimate of leaf form and length/width ratio.

Apex: Not preserved.

Base: Not preserved.

Margin: There are projections preserved along the LHS margin of the leaf. Measured perpendicular to the midvein, the margin is indented 0.1-0.7mm, average 0.3mm min., 4.7% of the distance to the midvein. Projections have rounded apices, so the margin is described as crenate. Sinuses between crenations are not very well preserved but appear to be quite rounded. The margin is not completely preserved, but spacing of crenations is estimated to be 1.5-4.3mm, average 2.7mm, standard deviation 0.9mm, and spacing is described as irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate semicraspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 14.2mm from base. At this point, 1° vein width is 0.43mm and leaf width is 13.2mm, but this is a minimum estimate

because here the RHS is incomplete. LHS only is 8.9mm wide at this point. Assuming leaf is symmetrical, leaf width is 17.8mm. Size of 1° is therefore 2.42% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 6 min.
Pairs are opposite/alternate.
Angle of divergence: Wide acute (69-92°, average 76°). (Average on LHS 73°, average on RHS 80°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly. Divergence angle more acute on LHS than RHS.
Thickness: Fine.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 45°).
Intersecondary veins: Appears to be simple intersecondaries present.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2.1:1.
Average vein length: 6.3mm.
Average spacing: 3.1mm.

3 veins:
Average angle of origin on admedial side of 2°s: 96°.
Average angle of origin on exmedial side of 2°s: 69°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 105°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.32a&98e

Part and counterpart.

D8754.8.32a

Preservation: Fair. Only the lower order venation is clear, but in most parts of the leaf the venation patterns are difficult to distinguish. The remaining organic material is rather patchy. Margins are present in some parts of the leaf. The base of the leaf is present and the shape of the apex can also be seen on the LHS of the lamina.

Dimensions: Max. length 33.8mm. Max. width. 18.4mm min. (point of max. width is closer to base on RHS). The estimate of max. length appears to be fairly accurate. The max. width is a minimum estimate because the leaf is incomplete. RHS is more complete than LHS and max. width of RHS only is 10.6mm min. Assuming leaf is symmetrical, max. width is 21.2mm min. Area 366.7sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 262.6sq.mm min. Assuming leaf is symmetrical, area is 525.2sq.mm, which is a minimum estimate because the margins are incomplete. Max. length along 1° 33.9mm. 'Leaf area' 479.1sq.mm min.

D8754.8.98e

Preservation: Fair. Only the lower order venation is fairly clear, the higher orders are quite difficult to distinguish. The remaining organic material is of medium thickness, but rather patchy and uneven. Margins are present in the upper and lower parts of the leaf. The apex can be described from the RHS of the lamina. The base is present and can be described. There is no petiole present. The leaf is almost whole, so its overall shape can be described.

Dimensions: Max. length 32.1mm. Max. width 16.6mm min. (point of max. width is closer to base on LHS). The estimate of max. length appears to be fairly accurate. The max. width is a minimum estimate because the leaf is incomplete. LHS is more complete than RHS and max. width of LHS only is 9.1mm min. Assuming leaf is symmetrical, max. width is 18.2mm min. Area 334.8sq.mm min. Roughly sketching in a minimum outline for LHS, area of LHS only is 209.8sq.mm min. Assuming leaf is symmetrical, area is 419.6sq.mm min. Max. length along 1° is 32.6mm, slightly longer than max. length because 1° is curved. 'Leaf area' 395.5sq.mm min.

D8754.8.32a&98e

Dimensions: The differences between the measurements for 32a and 98e appear to be due to inaccuracies of scales and the variable angle of the rock surface, so average measurements are used. Max. length 33mm. Max. width 17.5mm min. Area 350.8sq.mm min. Estimated max. width 19.7mm min. Estimated area 472.4sq.mm min. Max. length along 1° 33.3mm. 'Leaf area 437.3sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: This specimen is too incomplete for the symmetry of the whole lamina to be described confidently, but since the base and apical tip of the leaf appear asymmetrical, the symmetry of the lamina is categorised as asymmetrical. Although the base is incomplete, it appears to be asymmetrical. The apex is rather poorly preserved, but it appears to be asymmetrical.

Form: The point of max. width is 11.7mm from the leaf base. The max. length of the leaf is 33.3mm, meaning that the point of max. width from the leaf base is at 35% of the total leaf length. This would make the leaf form ovate. Using the estimated max. width, the length/width ratio is 1.69:1, but since the max. length appears to be a fairly good estimate and the max. width is a minimum, this is a maximum estimate for the length/width ratio. This ratio means that the leaf form can be described as ovate. Even though the length/width ratio is a maximum estimate, this appears to be a fairly good estimate of leaf form.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle appears to be 87° and apex appears to be acute, but apex is incomplete, so these are just estimates.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal margins are more complete on one side of the leaf, so angle is measured for one side of the base only. Assuming base is symmetrical, basal angle is 112°. Since leaf base is incomplete, this is just an estimate. Base is described as obtuse and normal and although leaf is incomplete, this appears to be an accurate description.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a completely confident definition.

Petiole: Absent or not preserved.

FOLLOWING FURTHER STUDY!

True orientation of leaf is actually rotated 90°! D8754.8.98e is actually clearer.

D8754.8.32a&98e

Part and counterpart.

Preservation: Fair. Venation is fairly clear. The remaining organic material is of medium thickness but rather patchy and uneven. This is just a fragment from one side of the leaf so the overall shape of the leaf cannot be described. Margins are present in some parts of the leaf. The base and apex of the leaf are not preserved.

Dimensions: The differences between the measurements for 32a and 98e appear to be due to inaccuracies of scales and the variable angle of the rock surface, so average measurements are used. Max. length 17.5mm min. Max. width 33mm min. This specimen is just a fragment from one side of a leaf and max. width of this part of the lamina is 33mm min. Assuming leaf is symmetrical, max. width is 66mm min. Area 350.8sq.mm min. It is not possible to sketch in a minimum outline for this fragmentary specimen. Max. length along 1° 9.2mm min. Estimated max. length along 1° 21.5mm min. 'Leaf area' 946sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be described.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 0.33:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Although they are not visible in 32a, there are two projections along the margin of the leaf in 98e. Measured perpendicular to the midvein, the margin is indented 0.2-0.4mm, average 0.3mm, 1.1% of the distance to the midvein. The distance to the midvein is just an estimate because 1° is not clearly preserved. The projections have pointed apices, so the margin is described as toothed. Teeth are serrate. The margin is too poorly preserved to determine whether the teeth are simple or compound. They appear simple, but only a very small percentage of the margin is preserved. Apical angle of serrations appears to be obtuse and is estimated to be 94°. Serration type appears to be concave on basal side and straight on apical side. Sinuses appear to be angular. Spacing of serrations is 5.8mm, but since there are only two preserved, it cannot be determined whether the tooth spacing is regular or irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, simple craspedodromous, but since this is a fragmentary specimen this is not a confident definition.

1° vein:
Size: Width of 1° vein is not completely preserved at any point and leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be approximately 8.8mm from base. At this point, 1° vein width is at least 0.18mm and leaf width is 24mm, but this is a minimum estimate because only RHS of leaf is preserved. Assuming leaf is symmetrical, leaf width is estimated to be 48mm. Size of 1° is therefore 0.38% min. and is termed weak, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Leaf is fragmentary and only one 2° is preserved on one side of the leaf.
Number: 1 min.
Only one side of leaf is preserved so pairs of 2°s cannot be observed.
Angle of divergence: Wide acute (65°).
Basal vein angle: Not preserved.
Variation: Cannot be assessed because only one 2° is preserved.
Thickness: Moderate.
Course: Appears to be recurved near margin and branched.
Behaviour of loop-forming branches: None.
Intersecondary veins: Appears that there may be a simple intersecondary present, but specimen is too fragmentary for this to be certain.
Intramarginal vein: None.
Intercostal shape: Leaf is too fragmentary for intercostal shape to be described.
Average vein length: 33mm.
Average spacing: Cannot be measured for this fragmentary specimen.

3 veins:
Average angle of origin on admedial side of 2°s: 75°.
Average angle of origin on exmedial side of 2°s: 67°.
Combination: AA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.33a

Preservation: Fairly good. The venation is clear in the parts of the leaf that are preserved. The remaining organic material has a patchy appearance and in places appears very dark and thick. The venation is clearer in the upper part of the specimen where the organic material is lighter coloured and appears thinner. Only the lower part of the leaf is preserved so its shape cannot be described. The margins are present in the part of the leaf preserved. The apex is not present but the base and petiole are preserved.

Dimensions: Max. length 34.5mm min. (including petiole). Petiole is approximately 11.3mm in length. Max. length of lamina alone 23.2mm min. Max. width 21.3mm min. (points of max. width are on roughly the same horizontal plane). LHS shows slightly greater preservation than RHS and max. width of LHS only is 11.1mm min. Assuming leaf is symmetrical, max. width is 22.2mm min. Area 271.7sq.mm min. (including petiole). Roughly sketching in a minimum outline for LHS, area of LHS only is 177.9sq.mm min. Assuming leaf is symmetrical, area is 355.8sq.mm, which is a minimum estimate for the leaf because the apical part is missing. This measurement does not include the petiole. Using the sketched outline gives an estimate of max. length of 27.7mm, a minimum estimate for the length of the lamina alone, and an approximate petiole length of 8.1mm. Max. length along 1° is 22.2mm min. (not including petiole). Using the sketched outline, max. length along 1° is 27.7mm min. (not including petiole). 'Leaf area' 410sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The apical portion of the leaf is missing, but, since the part of the leaf preserved appears slightly asymmetrical, the lamina is described as asymmetrical. The base appears to be asymmetrical.

Form: It is not possible to estimate the form of this leaf fragment. Using the estimated max. length and width, the length/width ratio is 1.25:1, but since both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Leaf is fragmentary so extent of basal portion is estimated using sketched minimum outline. Basal angle is 44°. Since leaf base is incomplete, this is just an estimate. Base is described as acute and decurrent and although leaf is incomplete, this appears to be an accurate description.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: A petiole is present and it appears to be normal. It is approximately 0.7mm wide and is estimated to be at least 8.6mm in length.

Venation type: Venation is pinnate, camptodromous, eucamptodromous, but since this is a fragmentary specimen this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 13.9mm from base and here 1° vein width is 0.97mm. At this point, leaf width is 12.8mm, a minimum estimate because the margin is incomplete on RHS. From curvature of margin present, leaf width at this point is estimated to be 13.5mm. Size of 1° is therefore 7.21% and is termed massive. However, since the apical part of the leaf is missing, this is not a confident description.
Course: Appears to be straight and unbranched, but since leaf is fragmentary this is not a completely confident description.

2° veins:
Number: 9 min.
Pairs appear to be opposite.
Angle of divergence: Moderate acute (25-73°, average 56°).
(Average on LHS 55°, average on RHS 56°).
Basal vein angle: Narrow acute (25°).
Variation: Lowest 2° vein appears to be more acute than those above. Divergence angle appears to be symmetrical.
Thickness: Fine.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None.
Intercostal shape: Irregularly shaped. Some are elongated parallel to 2°s, average vein length/spacing ratio 2.4:1.
Average vein length: 9mm.
Average spacing: 3.7mm.

3 veins:
Average angle of origin on admedial side of 2°s: 82°.
Average angle of origin on exmedial side of 2°s: 77°.
Combination: AR.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.34a

Preservation: Fairly good. The venation is fairly clear. The remaining organic material is rather thin and patchy. The margins are clear in the parts of the leaf that are preserved. Neither the apex nor base of the leaf is present and the shape of the leaf is therefore difficult to describe.

Dimensions: Max. length 32.9mm min. Max. width 16.5mm (point of max. width is slightly closer to base on RHS). The estimate of max. length is a minimum because the apex and base are missing, but from the curvature of the margins present it appears that the estimate of max. width is fairly accurate. Area 384.7sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 225.8sq.mm min. Assuming leaf is symmetrical, area is 451.6sq.mm, which is a minimum estimate for the leaf because the apex and base are missing. Using the sketched outline gives an estimate of max. length of 34.7mm min. Max. length along 1° 26.4mm min. Using the sketched outline gives an estimate of max. length along 1° of 34.8mm min, slightly greater than the max. length because 1° is very slightly curved. 'Leaf area' 382.8sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Some parts of the lamina do appear symmetrical, but towards the basal part of the specimen the lamina appears slightly asymmetrical, so the lamina is classed as asymmetrical. The base and apex are missing so their symmetry cannot be described.

Form: The point of max. width is 11.9mm from the leaf base. The max. length of the leaf is 32.9mm min., meaning that the point of max. width from the leaf base is at 36% of the total leaf length. This would make the leaf form ovate. The length/width ratio is 1.99:1, but since the max. width appears to be a fairly good estimate and the max. length is a minimum, this is a minimum estimate for the length/width ratio. This ratio would make the leaf form ovate, but this is an incomplete specimen so this is not a good estimate of leaf form. Using the sketched outline, the point of max. width is 13.7mm from the leaf base and the max. length of the leaf is 34.8mm min. The point of max. width from the leaf base is therefore at 39% of the total leaf length. This would still make the leaf form ovate. Using the estimated max. length, the length/width ratio is 2.11:1, which is again a minimum estimate. This ratio means that the leaf form would be described as narrow ovate, but since this is an incomplete specimen, this is just an estimate of the leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: There are projections clearly preserved along the margins of both sides of the leaf. Measured perpendicular to the midvein, the margin is indented 0.3-0.8mm, average 0.5mm, 7.2% of the distance to the midvein. Most of the projections (the best preserved ones) have pointed apices, so the margin is described as toothed. Some of the teeth appear to have quite rounded apices but this may be a preservational feature. Tooth series is simple. Teeth are serrate. Apical angle of serrations is acute (range 29-92°, average 62°). Dominant serration type is convex on basal side and straight on apical side. Most of the sinuses appear to be angular. Spacing of serrations is 2-4.2mm, average 3mm, standard deviation 0.7mm, and spacing is described as regular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation is pinnate simple craspedodromous, but since the base of the leaf is missing this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 17.4mm from base. At this point, 1° vein width is 0.4mm and leaf width is 16mm. Size of 1° is therefore 2.5% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 11 min.
Pairs are alternate.
Angle of divergence: Wide acute (48-114°, average 68°).
(Average on LHS 69°, average on RHS 67°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle appears to be symmetrical.
Thickness: Fine.
Course: Appears to be uniformly curved and branched. Many of the 2° are recurved. It is also possible that 2°s are provided with outer secondaries.
Behaviour of loop-forming branches: None.
Intersecondary veins: May be simple intersecondary veins present, but this is not certain.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2.8.
Average vein length: 9.1mm.
Average spacing: 3.9mm.

3 veins:
Average angle of origin on admedial side of 2°s: 106°.
Average angle of origin on exmedial side of 2°s: 88°.
Combination: RO.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 80°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.34b

Preservation: Fairly good. The venation is fairly clear. The remaining organic material is of medium thickness and fairly patchy. Only the apical part of the leaf is preserved but the margins of the tip of the leaf are not present. The margins are clear on the RHS of the leaf. The shape of the leaf cannot be determined from this fragmentary specimen.

Dimensions: Max. length 16.8mm min. Max. width 9.3mm min. (point of max. width is closer to base on RHS). These are minimum estimates because this is just a very small fragment from the tip of the leaf. RHS shows greater preservation than LHS and max. width of RHS only is 6.1mm min. Assuming leaf is symmetrical, max. width is 12.2mm min. Area 81.3sq.mm min. It is not possible to sketch a minimum outline for this fragmentary leaf, but area of RHS only is 57.6sq.mm min. Assuming leaf is symmetrical, area is 115.2sq.mm, which is a minimum estimate for the leaf because the basal portion is missing. Max. length along 1° 12.9mm min. The estimate of max. length, 16.8mm, is closer but still a minimum. 'Leaf area' 136.6sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: The only margins of the leaf preserved are along the upper RHS so this specimen is too incomplete for the leaf symmetry to be described.

Form: It is not possible to estimate the form of this leaf fragment. Using the estimated max. length and width, the length/width ratio is 1.38:1, but since both the max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Leaf specimen is just a fragment and it was not ossible to sketch a minimum outline for leaf, so extent of apical portion is just an estimate. Assuming apex is symmetrical, apical angle appears to be 54° and apex appears to be acute, but apex is incomplete, so these are just estimates.

Base: Not preserved.

Margin: Only a very small percentage of the margin is preserved, but there are two clear projections on the RHS of the leaf. Measured perpendicular to the midvein, the margin is indented 0.7mm, 14.9% of the distance to the midvein. Projections have rounded apices, so the margin is described as crenate. Sinuses between crenations appear to be rounded. Spacing of crenations is 3.8mm, but since there are only two crenations preserved, it is not possible to determine whether the spacing is regular or irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison with the apical part of D8754.8.3a, it does appear that the 1° is preserved. The venation appears to be pinnate semicraspedodromous, but since this is just a fragment, this is not a confident description.

1° vein:
Size: Leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be 8.4mm from base. At this point, 1° vein width is 0.15mm and leaf width is 7.65mm, but this is a minimum estimate because LHS is incomplete. Width of RHS only at this point is 4.7mm. Assuming leaf is symmetrical, leaf width is estimated to be 9.4mm. Size of 1° is therefore 1.6% and is termed moderate, but the specimen is too fragmentary for the 1° vein size to be described completely confidently.
Course: Appears to be moderately curved, but specimen is too fragmentary for this to be certain.

2° veins:
Number: 9 min.
Pairs appear to be alternate.
Angle of divergence: Right-angle (68-118°, average 88°). (Average on LHS 82°, average on RHS 94°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly. Divergence angle appears to be asymmetrical.
Thickness: Fine.
Course: Abruptly curved and branched. 2°s may also be described as sinuous.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 106°).
Intersecondary veins: May be simple intersecondary veins present, but this is not certain.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.5:1.
Average vein length: 1.9mm.
Average spacing: 1.6mm.

The 2°s appear to form a network, many enclosing roughly equidimensional areas.

3 veins:
Average angle of origin on admedial side of 2°s: 91°.
Average angle of origin on exmedial side of 2°s: 87°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 96°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.35a&37a

D8754.8.35a

Preservation: Good. The venation is fairly clear. The remaining organic material has a patchy appearance and in places appears very dark and thick. The margins are clear in the parts of the leaf that are preserved. The apex of the leaf is not present. The base of the leaf is preserved and much of the overall shape of the leaf can be seen.

Dimensions: Max. length 41.9mm min. (including petiole). Petiole is approximately 4.6mm in length. Max. length of lamina alone is 37.2mm min. Max. width 26.6mm (point of max. width is slightly closer to base on RHS, but perpendicular to midvein, points of max. width are on same horizontal plane). Although leaf is incomplete, from curvature of margins, this appears to be a fairly accurate estimate of max. width. Area 658.5sq.mm min. (including petiole). The leaf does not appear to be symmetrical, so roughly sketching in a minimum outline for the leaf, area is 715.5sq.mm, which is a minimum estimate for the leaf because the apex is missing. This estimate does not include the petiole. Using the sketched outline gives an estimate of max. length of 37.8mm, a minimum estimate for the length of the lamina alone. Max. length along 1° 25.2mm min. (not including petiole). The estimate of max. length, 37.8mm, is more realistic but still a minimum. 'Leaf area' 670.3sq.mm min.

D8754.8.37a

Preservation: Fairly good. The counterpart 35a shows better preservation. The venation is fairly clear. The remaining organic material appears thin and patchy. The margins are clear in the parts of the leaf preserved. Neither the apex nor base of the leaf is present and so cannot be described. Since the specimen is incomplete the overall shape of the leaf cannot be described.

Dimensions: Max. length 34.3mm min. Max. width 26.7mm (point of max. width is slightly closer to base on LHS). The estimate of max. length is a minimum because the apex and base are missing. Although the leaf is incomplete, from the curvature of the margins present, this appears to be a fairly accurate estimate of max. width. Area 573.1sq.mm min. The leaf does not appear to be symmetrical, so roughly sketching in a minimum outline using the more complete counterpart 35a as a guide, the area is 718.6sq.mm min. This estimate does not include a petiole. Using the sketched outline gives an estimate of max. length of 38.3mm min. Max. length along 1° 20.2mm min. The estimate of max. length, 38.3mm, appears more realistic but is still a minimum. 'Leaf area' 681.7sq.mm min.

D8754.8.35a&37a

Dimensions: Many of these measurements are for 35a alone, which is more complete than 37a; others are for a composite of 35a and 37a together. The differences in estimated measurements for 35a and 37a are mainly due to slight differences in the sketched minimum outlines. Max. length 41.9mm min. (including petiole), measured from 35a. Petiole is approximately 4.6mm in length, measured from 35a. Max. length of lamina alone 37.2mm min., measured from 35a. Max. width 26.7mm, average for 35a and 37a. Area 658.5sq.mm min. (including petiole), from 35a. Estimated max. length 38.1mm min. (not including petiole), average for 35a and 37a. Estimated area 717.1sq.mm min. (not including petiole), average for 35a and 37a. Max. length along 1° 25.2mm min. (not including petiole), from 35a. Estimate of max. length, 38.1mm, appears more realistic but is still a minimum. 'Leaf area' 676sq.mm min., average for 35a and 37a.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The whole lamina is asymmetrical. The base appears roughly symmetrical. The apex is not present so its symmetry cannot be described.

Form: The point of max. width is 16.2mm from the leaf base and the max. length of the leaf is 37.2mm min., both measured from 35a which is more complete. This means that the point of max. width from the leaf base is at 44% of the total leaf length, making the leaf form ovate. Since leaf apex is missing, this percentage is a maximum. From the curvature of the margins present, it appears that this is a fairly confident description of leaf form. Using the average max. width, the length/width ratio is 1.39:1. Since the max. width appears to be a fairly good estimate and the max. length is a minimum, this is a minimum estimate for the length/width ratio. This ratio means that the leaf form would be described as wide ovate, but this is an incomplete specimen, so this is not a good estimate of the length/width ratio and leaf form. Using the sketched minimum outline for the composite of 35a and 37a together, the point of max. width is 17mm from the leaf base and the estimated max. length is 38.1mm min. The point of max. width from the leaf base is therefore at 45% of the total leaf length, which would make the leaf form elliptic. However, since the max. length is a minimum estimate, this percentage is a maximum. The leaf form is therefore described as ovate. Using this estimated max. length and average max. width, the length/width ratio is 1.43:1, which is again a minimum estimate. This would mean that the leaf form could be described as wide ovate, but because this is an incomplete specimen, the possibility that the leaf form is ovate rather than wide ovate cannot be ruled out. These are just estimates of the length/width ratio and leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 103°, but since leaf is incomplete, this is just an estimate. Base is clearly preserved and is described as obtuse and normal.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: A petiole is present and it appears to be normal. It is approximately 1.8mm wide and 4.6mm in length.

Venation type: Venation is pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be at least 19.1mm from lamina base. At this point, 1° vein width is 0.92mm and leaf width is 26mm. Size of 1° is therefore 3.54% and is termed stout.

Course: Course is described as straight and unbranched, although in D8754.8.35a 1° vein appears to be sinuous.

2° veins:
Number: 7 min.
Pairs are opposite/alternate.
Angle of divergence: Moderate acute (33-82°, average 62°). (Average on one side 65°, average on other side 60°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly.
Divergence angle is roughly symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 72°). Also enclosed by 2°, 3°, or 4° arches.
Intersecondary veins: Appears to be simple intersecondaries present, but this is not certain.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 3.4:1.
Average vein length: 13.9mm.
Average spacing: 4.4mm.

3 veins:
Average angle of origin on admedial side of 2°s: 84°.
Average angle of origin on exmedial side of 2°s: 74°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 101°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.36a

Preservation: Good. The venation is fairly clear. The remaining organic material is of medium thickness and a fairly even appearance. Only the apical part of the leaf is missing. There is also a split across the middle of the specimen. Here there is some sediment cover and removal of this may reveal more of the specimen. Removal of sediment cover in the apical LHS of the leaf may also reveal more of the specimen. The leaf is almost complete and apart from the apex, the overall shape of the leaf can be described. Much of the margins are present, especially on the RHS of the leaf. The base is clearly preserved and there is a petiole present.

Dimensions: Max. length 28.9mm min. (including petiole). Petiole is approximately 1.9mm in length. Max. length of lamina alone is 27.1mm min. Max. width 17.3mm (points of max. width are on roughly the same horizontal plane). Although the leaf is incomplete, from the curvature of the margins present, this appears to be a fairly accurate estimate of max. width. Area 313.7sq.mm min. (including petiole). Roughly sketching in a minimum outline for the leaf, area is 353.7sq.mm min., which is a minimum estimate for the leaf because the apex is missing. This estimate does not include the petiole. Using the sketched outline gives an estimate of max. length of 27.4mm, a minimum estimate for the length of the lamina alone. Max. length along 1° 25.3mm min. (not including petiole). Using the sketched outline, max. length along 1° is 27.6mm min. (not including petiole). 'Leaf area' 318.3sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The whole lamina appears to be slightly asymmetrical. The base appears to be slightly asymmetrical. The apex is not present so its symmetry cannot be described.

Form: Point of max. width is 19.9mm from leaf base. Max. length of leaf is 27.1mm min., meaning that point of max. width from leaf base is at 73% of total leaf length. This would make the leaf form obovate, but from curvature of margins present, it appears that leaf form is oblong. Length/width ratio is 1.57:1, but since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This means that the leaf form fits in to the wide oblong subdivision, but this is an incomplete specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 19.9mm from leaf base and max. length is 27.6mm min. Point of max. width from leaf base is therefore at 72% of total leaf length, but the leaf form still appears to be oblong. Using estimated max. length, length/width ratio is 1.60:1, which is again a minimum estimate. This means that the leaf form still fits in to the wide oblong subdivision, but since this is an incomplete specimen, this is just an estimate of leaf form and length/width ratio.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 84°, but since leaf is incomplete, this is just an estimate. Base is clearly preserved and is described as acute and decurrent.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: A petiole is present and it appears to be normal. It is approximately 0.9mm wide and 1.9mm in length.

Venation type: Venation appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be at least 13.7mm from lamina base. At this point, 1° vein width is 0.49mm and leaf width is estimated to be 16.1mm. Size of 1° is therefore 3.04% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 15 min.
Pairs are opposite/alternate.
Angle of divergence: Wide acute (27-93°, average 68°). (Average on LHS 73°, average on RHS 63°).
Basal vein angle: Narrow acute (average 44°).
Variation: Divergence angle appears to vary irregularly.
Divergence angle appears to be asymmetrical.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 148°). Also enclosed by 3° or 4° arches. Loops may also form an intramarginal vein, but preservation does not allow positive confirmation.
Intersecondary veins: None preserved.
Intramarginal vein: May be an intramarginal vein present but this is not certain.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 4.2:1.
Average vein length: 8.4mm.
Average spacing: 2.6mm.

3 veins:
Average angle of origin on admedial side of 2°s: 110°.
Average angle of origin on exmedial side of 2°s: 51°.
Combination: AO.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.38a

Preservation: Fairly good. The venation is clear. The remaining organic material appears to be of medium thickness. The specimen is very fragmentary, holey and is rather split up. It appears that there may be some distortion in the specimen, possibly appearing compressed along the long axis of the leaf. A small percentage of the margins are present. The specimen is too incomplete for the overall shape of the leaf to be described. Neither the apex nor base of the leaf is present and so cannot be described.

Dimensions: Max. length 27.8mm min. Max. width 18.8mm (point of max. width is slightly closer to base on RHS). Leaf appears quite broken up, so pieces are fitted back together. Max. length is then 27.7mm min. and max. width is 18.5mm. Although leaf is incomplete, from curvature of margins present and assuming leaf is symmetrical, this appears to be a fairly accurate estimate of max. width. Area 340.6sq.mm min. Roughly sketching in a minimum outline for RHS of leaf, area of RHS only is 241.7sq.mm. Assuming leaf is symmetrical, area is 475.4sq.mm, which is a minimum estimate for leaf because apex and base are missing. Using sketched outline gives an estimate of max. length of 33.5mm min. Max. length along 1° 26.3mm min. Estimate of max. length, 33.5mm, appears more realistic but is still a minimum. 'Leaf area' 413.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Only in a very small part of the leaf are there margins preserved on both sides, and here it appears that the lamina is asymmetrical. However, since the leaf is rather fragmentary this is not a confident definition. Apex and base are not present so their symmetry cannot be described.

Form: Point of max. width is 6.9mm from leaf base. Max. length of leaf is 27.7mm min., meaning that point of max. width from leaf base is at 25% of total leaf length. This would make the leaf form ovate. Length/width ratio is 1.50:1, but since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This means that the leaf form fits in to the ovate subdivision, but this is a fragmentary specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 11.9mm from leaf base and max. length is 33.5mm min. Point of max. width from leaf base is therefore at 36% of total leaf length, and leaf form is still described as ovate. Using estimated max. length, length/width ratio is 1.81:1, which is again a minimum estimate. This means that the leaf still fits in to the ovate subdivision, but since this is a fragmentary specimen, this is just an estimate of leaf form and length/width ratio.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a completely confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate camptodromous brochidodromous, but specimen is fragmentary and it is possible that venation is acrodromous, with a prominent secondary vein running in a convergent arch toward the leaf apex.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 16.8mm from base. At this point, 1° vein width is 0.54mm and leaf width is 12.1mm, but this is a minimum estimate because here the LHS is incomplete. RHS only is 9mm wide at this point. Assuming leaf is symmetrical, leaf width is 18mm. Size of 1° is therefore 2.99% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 8 min.
Pairs are alternate.
Angle of divergence: Moderate acute (43-72°, average 59°). (Average on LHS 53°, average on RHS 63°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly.
Divergence angle more acute on LHS than RHS.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 55°). Enclosed by 2°, 3°, or 4° arches. May form an intramarginal vein, but this is not at all clear.
Intersecondary veins: It appears that composite intersecondaries are present.
Intramarginal vein: No intramarginal vein can be clearly observed.
Intercostal shape: Appears to be elongated parallel to midvein, average vein length/spacing ratio 0.7:1, but leaf is too fragmentary for this to be a confident description.
Average vein length: 7.8mm.
Average spacing: 12mm.

3 veins:
Average angle of origin on admedial side of 2°s: 77°.
Average angle of origin on exmedial side of 2°s: 69°.
Combination: AA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 54°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.38b

Preservation: Poor. The venation is unclear. The remaining organic material is of medium thickness. The specimen is just a fragment so the shape of the leaf cannot be described. A very small percentage of the margins are present. The apex and base of the leaf are not present and so cannot be described.

Dimensions: Max. length 5.4mm min. Max. width 11.6mm min. This is just a scrappy fragment so these are minimum estimates. RHS shows slightly greater preservation and max. width of RHS only is 9.3mm min. Assuming leaf is symmetrical, max. width is 18.6mm min. Area 39sq.mm min. This specimen is too fragmentary to sketch a minimum outline for the leaf, but area of RHS only is 34.4sq.mm min. Assuming leaf is symmetrical, area is 68.8sq.mm, which is a minimum estimate for the leaf because this is just a scrappy fragment. Max. length along 1° 2.6mm min. Estimate of max. length, 5.4mm, is closer but still a minimum. 'Leaf area' 67sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This is just a scrappy fragment that is too poorly preserved for its symmetry to be described.

Form: It is not possible to estimate the form of this leaf fragment. Using estimated max. width, length/width ratio is 0.29:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a very small percentage of the margin is preserved and even this is not clear. There are no clear projections, so it is described as entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Specimen is too poorly preserved for venation pattern to be described.

1° vein:
Size: This is just a scrappy fragment and it is not clear that the vein preserved is the 1°. Leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be approximately 2.7mm from base. At this point, 1° vein width is 0.29mm and leaf width is 9.6mm, but this is a minimum estimate because LHS of leaf is incomplete. Width of RHS only at this point is 8mm. Assuming leaf is symmetrical, leaf width is estimated to be 16mm. Size of 1° is therefore 1.81% and is termed moderate, but the specimen is really too fragmentary for the 1° size to be described.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins: None preserved.

3 veins: None preserved.

D8754.8.39a

Preservation: Excellent. The venation is clear. The remaining organic material appears to be of dark, thick to medium thickness. The leaf specimen is complete and so the shape of the leaf can be described. The margins are more or less complete. The apex and base are present. There is no petiole present.

Dimensions: Leaf appears complete, so these are fairly accurate measurements. Max. length 21.8mm. Max. width 8.2mm (points of max. width are on roughly the same horizontal plane). Area 128.5sq.mm. Max. length along 1° 21.8mm. 'Leaf area' 119.2sq.mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Base, apex and whole lamina appear roughly symmetrical.

Form: Point of max. width is 7.1mm from leaf base. Max. length of leaf is 21.8mm, meaning that point of max. width from leaf base is at 33% of total leaf length. The leaf form is therefore ovate. Length/width ratio is 2.66:1. This means that the leaf form fits in to the narrow ovate subdivision. The specimen appears to be complete, so this is an accurate description of leaf form.

Apex: Apical angle 52°. Apex appears to be slightly acuminate, possibly described as long acuminate.

Base: Basal angle 82°. Base is described as rounded.

Margin: Margin is entire.

Petiole: Absent or not preserved.

Venation type: Venation is pinnate camptodromous brochidodromous.

1° vein:
Size: Midpoint is 10.9mm from leaf base. At this point, 1° vein width is 0.26mm and leaf width is 7.7mm. Size of 1° is therefore 3.38% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 24
Pairs are opposite/alternate.
Angle of divergence: Right-angle (51-120°, average 84°).
(Average on LHS 88°, average on RHS 79°).
Basal vein angle: Wide acute (average 69°).
Variation: Divergence angle varies irregularly. Divergence angle more acute on RHS than LHS.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 104°). Also appear to be enclosed by 3° or 4° arches.
Intersecondary veins: There may be simple intersecondaries present, but this is not clear.
Intramarginal vein: None present.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2.1:1.
Average vein length: 2.3mm.
Average spacing: 1.6mm.

3 veins:
Average angle of origin on admedial side of 2°s: 85°.
Average angle of origin on exmedial side of 2°s: 52°.
Combination: AR.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.39b

Preservation: Poor. The venation is unclear. The remaining organic material appears to be fairly dark and thick. The specimen is just a fragment so the shape of the leaf cannot be described. It appears that the margins are present in the part of the leaf preserved. The apex and base of the leaf are not present and so cannot be described. The specimen is on a slightly concave surface.

Dimensions: Max. length 13.9mm min. Max. width 9.4mm min. This specimen appears to be just a fragment from apical LHS of leaf, so these are minimum estimates. Max. width of LHS only is 9.4mm min. Assuming leaf is symmetrical, max. width is 18.8mm min. Area 89.1sq.mm min. Roughly sketching in a minimum outline for this part of the LHS, area of LHS only is 101sq.mm min. Assuming leaf is symmetrical, area is 202sq.mm, which is a minimum estimate for the leaf because this is just a scrappy fragment. Using the sketched outline gives an estimate of max. length of 15.2mm min. Max. length along 1° is 5.3mm min., but 1° is not clearly preserved. Estimate of max. length, 15.2mm, is closer but still a minimum. 'Leaf area' 190.5sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This is just a scrappy fragment that is too poorly preserved for its symmetry to be described.

Form: It is not possible to estimate the leaf form of this scrappy fragment. Using estimated max. length and width, length/width ratio is 0.81:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate camptodromous brochidodromous, but specimen is really too poorly preserved for venation pattern to be described.

1° vein:
Size: This is just a scrappy fragment and 1° vein is not clearly preserved. Midpoint is estimated to be approximately 7.6mm from base, but leaf is too poorly preserved at this point, so measurements are made slightly closer to the apex, 8.6mm from base. Here 1° vein width is 0.14mm min. and leaf width is 6.9mm, but this is a minimum estimate because RHS of leaf is incomplete. Width of LHS only at this point is 6.9mm. Assuming leaf is symmetrical, leaf width is estimated to be 13.7mm. Size of 1° is therefore 1.02% and is termed weak, but the specimen is really too fragmentary for the 1° size to be described.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Specimen is too poorly preserved for 2°s to be described confidently.
Number: 2 min.
Only one side of the leaf is preserved so no pairs can be observed.
Angle of divergence: Wide acute (63-85°, average 74°).
Basal vein angle: Not preserved.
Variation: Upper 2°s may be more acute than lower, but specimen is really too fragmentary for the variation across the length of the lamina to be described. Since only LHS of leaf is preserved it is not possible to assess divergence angle symmetry.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 151°). Also appear to be enclosed by 3° or 4° arches. It is also possible that the 2°s form an intramarginal vein, but the specimen is too poorly preserved for this to be certain.
Intersecondary veins: There are no clear intersecondaries preserved.
Intramarginal vein: There may be an intramarginal vein present, but the specimen is too fragmentary for this to be certain.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 3.5:1, but specimen is too fragmentary for this to be a confident description.
Average vein length: 4.2mm.
Average spacing: 1.2mm.

3 veins: Specimen is too poorly preserved for 3° vein angles to be measured.

D8754.8.40a

Preservation: Good. The venation is fairly clear. The remaining organic material appears to be dark and thick in the base of the leaf and thins towards the top of the specimen. The specimen is incomplete and so the shape of the leaf cannot be described. The margins are present in the part of the leaf preserved. Only the apical part of the leaf is missing. The base of the leaf is clear. There is possibly a petiole present.

Dimensions: Max. length 22.7mm min. (including petiole). Petiole is slightly curved and approximately 0.5mm in length. Max. length of lamina alone is 22.4mm min. Max. width 16.4mm (point of max. width is slightly closer to base on RHS). Although leaf apex is missing, from curvature of margins present, this appears to be a fairly accurate estimate of max. width. Area 256.6sq.mm min. (including petiole). Leaf does not appear symmetrical, so roughly sketching in a minimum outline for leaf, area is 283.8sq.mm, a minimum estimate for leaf because apex is missing. This estimate does not include the petiole. Using the sketched outline gives an estimate of max. length of 23.2mm, a minimum estimate for length of lamina alone. Max. length along 1° 21.3mm min. (not including petiole). Using the sketched outline gives an estimate of max. length along 1° of 23.3mm min. (not including petiole), slightly greater than max. length because 1° is quite curved. 'Leaf area' 254.7sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Although apical portion of leaf is missing, whole lamina appears asymmetrical. Leaf base is clearly asymmetrical. Apex is not present so its symmetry cannot be described.

Form: Point of max. width is 18.1mm from leaf base. Max. length of leaf is 22.4mm min., meaning that point of max. width from leaf base is at 81% of total leaf length. This would make the leaf form obovate, but from curvature of margins present, it appears that leaf form is oblong. Length/width ratio is 1.37:1, but since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form fits in to the wide oblong subdivision, but this is an incomplete specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 18.1mm from leaf base and max. length is 23.3mm min. Point of max. width from leaf base is therefore at 78% of total leaf length, but the leaf form still appears to be oblong. Using estimated max. length, length/width ratio is 1.42:1, which is again a minimum estimate. This ratio also falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form still fits in to the wide oblong subdivision, but since this is an incomplete specimen, this is just an estimate of leaf form and length/width ratio.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 88°, but since leaf is incomplete, this is just an estimate. Base is clearly preserved and is described as acute and decurrent.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: A petiole is present and it appears to be normal. It is approximately 0.7mm wide and 0.5mm in length.

Venation type: Venation is pinnate and it appears to be camptodromous eucamptodromous, but the 2° venation is quite difficult to make out so this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be at least 11.6mm from lamina base. At this point, 1° vein width is 0.26mm and leaf width is estimated to be 15.2mm. Size of 1° is therefore 1.72% and is termed moderate.
Course: Markedly curved.

2° veins:
Number: 9 min.
Pairs appear to be alternate.
Angle of divergence: Moderate acute (40-80°, average 58°). (Average on LHS 59°, average on RHS 57°).
Basal vein angle: Wide acute (average 79°).
Variation: Divergence angle varies irregularly. Divergence angle appears to be symmetrical.
Thickness: Moderate.
Course: Appear to be abruptly curved and branched. It also appears that 2°s may be provided with outer 2°s.
Behaviour of loop-forming branches: 2°s appear to join superadjacent 2°, but they do not form clear loops. It appears that they are just gradually diminishing rather than forming a prominent loop. However, they appear to join superadjacent 2° at an obtuse angle (average 113°).
Intersecondary veins: Appears to be simple intersecondaries present.
Intramarginal vein: None present.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 3.9:1.
Average vein length: 8.4mm.
Average spacing: 2.7mm.

3 veins:
Average angle of origin on admedial side of 2°s: 94°.
Average angle of origin on exmedial side of 2°s: 81°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 81°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.41a

Preservation: Excellent. The venation is very clear. The remaining organic material appears fairly even and of medium thickness. The specimen is almost whole so the shape of the leaf can be described. A little bit more of the basal margins may be revealed by removal of sediment cover. The majority of the margins are present. Most of the leaf apex is present but the very tip is missing. The basal margins are not clear but it appears that the shape of the leaf can be clearly described. There is no petiole present.

Dimensions: Max. length 48.4mm min. Max. width 18.6mm (point of max. width is closer to base on RHS). Very tip of leaf may be missing, so although it is close, estimate of max. length is a minimum. Although basal margins are incomplete, from curvature of margins present, this appears to be a fairly accurate estimate of max. width. Area 592.2sq.mm min. Very tip of leaf may be missing and basal margins are unclear, so this measurement is described as a minimum, but leaf is almost complete so this appears to be a fairly good estimate for leaf area. Max. length along 1° 48.6mm min. (slightly greater than max. length because 1° is quite curved). 'Leaf area' 602.2sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Whole lamina appears to be asymmetrical, although it is possible that this is a feature of the preservation of the leaf. Base appears to be asymmetrical but since margins are not clearly preserved in base of leaf this is not a confident description. Apex appears to be asymmetrical but this is not clear because apical tip of leaf is missing.

Form: Point of max. width is 15.4mm from leaf base. Max. length of leaf is 48.6mm, meaning that point of max. width from leaf base is at 32% of total leaf length. The leaf form is therefore ovate. Length/width ratio is 2.61:1, but since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio means that the leaf form fits in to the narrow ovate subdivision. Since only the very tip of the leaf may be missing, this is an accurate description of leaf form.

Apex: Apical angle 51°. Apex is described as acuminate, possibly long acuminate, but since the very tip of the leaf is unclear, these are just estimates.

Base: Basal angle 70°. Base is described as acute and cuneate, but since the basal margins are a little unclear, these are just estimates, although it does appear to be clear that the base is acute.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Venation is pinnate camptodromous eucamptodromous.

1° vein:
Size: Midpoint is 24.2mm from leaf base. At this point, 1° vein width is 0.38mm and leaf width is 17.3mm. Size of 1° is therefore 2.19% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 14.
Pairs are alternate.
Angle of divergence: Moderate acute (34-63°, average 48°). (Average on LHS 49°, average on RHS 47°).
Basal vein angle: Narrow acute (average 40°).
Variation: Divergence angle varies irregularly. Divergence angle appears to be symmetrical.
Thickness: Moderate.
Course: Appear to be abruptly curved and branched. It also appears that 2°s may be provided with outer 2°s.
Behaviour of loop-forming branches: 2°s appear to join superadjacent 2°, but they do not form clear loops. It appears that they are just gradually diminishing rather than forming a prominent loop. However, they appear to join superadjacent 2° at an obtuse angle (average 114°).
Intersecondary veins: Appears to be simple intersecondaries present.

Intramarginal vein: None present.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 3.3:1.
Average vein length: 15.5mm.
Average spacing: 7.1mm.

3 veins:
Average angle of origin on admedial side of 2°s: 81°.
Average angle of origin on exmedial side of 2°s: 89°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 83°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.42a

Preservation: Good. The venation is very clear. The remaining organic material is of thin and even appearance. The specimen is incomplete so the shape of the whole leaf cannot be described. The margins are present in most of the preserved part of the leaf. The apical part of the leaf is missing. Removal of sediment cover may reveal slightly more of the apical portion of the leaf. This is also the case with the base of the leaf. Most of the basal part of the specimen is present, especially on the LHS of the specimen. Just the very basal part of the leaf base is missing. There is no petiole present.

Dimensions: Max. length 35.5mm min. Max. width 21.1mm (point of max. width is slightly closer to base on LHS). Apex is missing and base is incomplete so estimate of max. length is a minimum. Although leaf is incomplete and part of margins at max. width are missing from RHS, from curvature of margins present, this appears to be a fairly accurate estimate of max. width. Area 548.2sq.mm min. Roughly sketching in a minimum outline for RHS of leaf, area of RHS only is 325sq.mm min. Assuming leaf is symmetrical, area is 650sq.mm, which is a minimum estimate for leaf because this is a fragmentary specimen. Using the sketched outline gives an estimate of max. length of 38mm min. Max. length along 1° 35mm min. Using the sketched outline gives an estimate of max. length along 1° of 38mm min. 'Leaf area' 534.5sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Whole lamina appears to be symmetrical, but since leaf is incomplete this is not a confident description. Base appears to be symmetrical, but basal tip of leaf is missing so this is not a confident definition. Apex is not present so its symmetry cannot be described.

Form: Point of max. width is 16.1mm from leaf base. Max. length of leaf is 35.5mm min., meaning that point of max. width from leaf base is at 45% of total leaf length. This would make the leaf form elliptic. Length/width ratio is 1.68:1, but since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio would place the leaf form in the wide elliptic subdivision, but this is an incomplete specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 16.5mm from leaf base and max. length is 38mm min. Point of max. width from leaf base is therefore at 43% of total leaf length. This would make the leaf form ovate. Although the leaf is incomplete, this appears to be an accurate description of leaf form. Using estimated max. length, length/width ratio is 1.80:1, which is again a minimum estimate. This means that the leaf form fits in to the ovate subdivision, but since this is an incomplete specimen, this is just an estimate of leaf form and length/width ratio.

Apex: Not preserved.

Base: Leaf specimen is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle appears to be 93°, but since leaf is incomplete, this is just an estimate. Base appears to be obtuse and normal, but basal margins are incomplete, especially at point of insertion of petiole, so this is just an estimate.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is incomplete so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 19mm from base. At this point, 1° vein width is 0.76mm and leaf width is 20.5mm, but this is a minimum estimate because here the LHS margin is not present. RHS only is 10.5mm wide at this point. Assuming leaf is symmetrical, leaf width is 21.1mm. Size of 1° is therefore 3.61% and is termed stout.
Course: Straight and unbranched.

2° veins:
Number: 16 min.
Pairs are alternate.
Angle of divergence: Wide acute (54-88°, average 75°). (Average on LHS 77°, average on RHS 74°).
Basal vein angle: Moderate acute (average 56°).
Variation: It appears that the lowest pair of 2°s is more acute than those above. Divergence angle roughly symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at a right-angle (average 98°). Also appear to be enclosed by 2°, 3°, or 4° arches.
Intersecondary veins: Present. Appear to be composite.
Intramarginal vein: None preserved.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2.1:1.
Average vein length: 10.3mm.
Average spacing: 5.3mm.

3 veins:
Average angle of origin on admedial side of 2°s: 88°.
Average angle of origin on exmedial side of 2°s: 83°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 85°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.43a

Preservation: Very good. The venation is very clear. The remaining organic material has a thin and even appearance. The specimen is incomplete so the overall shape of the leaf cannot be described. In parts of the leaf the margins are very clear in others they are less so. Only the apex of the leaf is missing and it appears that here there is wound reaction tissue, indicating that the tip of the leaf was lost while still attached to the tree. This may possibly indicate insect damage. The base of the leaf is clearly preserved and can be described. Just a small marginal area in the lower RHS of the leaf is missing. There is no petiole present.

Dimensions: Max. length 32.5mm min. Max. width 16mm (points of max. width are on roughly the same horizontal plane). Leaf apex is missing so estimate of max. length is a minimum. Although leaf is incomplete, from curvature of margins present, this appears to be a fairly accurate estimate of max. width. Area 373.4sq.mm min. Leaf does not appear to be symmetrical, so roughly sketching in a minimum outline for apex, leaf area is 388.1sq.mm min. Using the sketched outline gives an estimate of max. length of 32.9mm min. Max. length along 1° 31.2mm min. Using the sketched outline gives an estimate of max. length along 1° of 33mm min. (slightly greater than max. length because 1° is very slightly curved). 'Leaf area' 352sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Whole lamina appears to be slightly asymmetrical but since apical portion of leaf is missing and margins are unclear in parts of specimen this is not a confident description. Base appears roughly symmetrical but since basal margins are not complete this is not certain. Apex is not present so its symmetry cannot be described.

Form: The point of max. width is 18.9mm from the leaf base and the max. length of the leaf is 32.5mm min. This means that the

point of max. width from the leaf base is at 58% of the total leaf length, making the leaf form obovate. Length/width ratio is 2.03:1. Since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio means that the leaf form would fit in to the narrow obovate subdivision, but this is an incomplete specimen, so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 18.9mm from leaf base and estimated max. length is 33mm min. Point of max. width from leaf base is therefore at 57% of total leaf length. Since leaf apex is missing, this percentage is a maximum. The leaf form is still described as obovate. Using estimated max. length, length/width ratio is 2.06:1, which is again a minimum estimate. This means that the leaf form fits in to the narrow obovate subdivision, but because this is an incomplete specimen, the possibility that the leaf form is elliptic cannot be ruled out. These are just estimates of the length/width ratio and leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 71°, but since leaf is incomplete, this is just an estimate. Base is described as acute and cuneate and although leaf is incomplete, this appears to be an accurate description.

Margin: There are projections along the margins of both sides of the leaf, but not all of the margin is well preserved, with only two clearly defined projections (on LHS). Measured perpendicular to the midvein, the margin is indented 0.2-0.5mm, average 0.3mm, 3.8% of the distance to the midvein. The projections appear to have pointed apices, so the margin is described as toothed. Tooth series is simple. Teeth are serrate. Apical angle of serrations is acute (range 42-82°, average 67°). Dominant serration type is acuminate on basal side and convex on apical side. Most of the sinuses appear to be angular. Spacing of serrations is 3.1-5.3mm, average 4mm, standard deviation 0.9mm, and spacing is described as regular.

Petiole: Absent or not preserved.

Venation type: Venation appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be at least 16.5mm from base. At this point, 1° vein width is 0.27mm and leaf width is estimated to be 15.4mm. Size of 1° is therefore 1.75% and is termed moderate.
Course: Straight and unbranched.

2° veins:
Number: 9 min.
Pairs are alternate.
Angle of divergence: Moderate acute (14-61°, average 49°). (Average on LHS 54°, average on RHS 44°).
Basal vein angle: Narrow acute (average 18°).
Variation: It appears that lowest pair of 2°s is more acute than those above. Divergence angle is more acute on RHS than LHS.
Thickness: Moderate.
Course: Abruptly curved and branched. Some may also be described as sinuous.
Behaviour of loop-forming branches: Join superadjacent 2° at a right-angle (average 94°). Also appear to be enclosed by 2°, 3°, or 4° arches.
Intersecondary veins: None.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.3:1.
Average vein length: 9.9mm.
Average spacing: 7.9mm.

The 2°s appear to form a network, many enclosing roughly equidimensional areas.

3 veins:
Average angle of origin on admedial side of 2°s: 74°.
Average angle of origin on exmedial side of 2°s: 104°.
Combination: OA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 72°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.44a

Preservation: Good. The venation is clear. The remaining organic material has a dark thick and even appearance. The apical part of the leaf is missing so the overall shape of the leaf cannot be described. Removal of sediment cover may reveal a little bit more of the apical portion of the leaf. Most of the margins are clear in the part of the leaf preserved. The apex is not present and so cannot be described. The basal margins are a little unclear in places, but it appears that the shape of the leaf base can be described. The basal tip of the leaf is not preserved. There is no petiole present.

Dimensions: Max. length 58.2mm min. Max. width 21.6mm (point of max. width is slightly closer to base on LHS). Apical portion of leaf is missing so max. length is a minimum estimate. Although leaf is incomplete, from curvature of margins present, this appears to be a fairly accurate estimate of max. width. Area 814.2sq.mm min. Roughly sketching in a minimum outline for the leaf, area is 871sq.mm min. Using the sketched outline gives an estimate of max. length of 60.3mm min. Max. length along 1° 57.5mm min. Using the sketched outline gives an estimate of max. length along 1° of 60.3mm min. 'Leaf area' 868.3sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Although apical portion of leaf is missing, whole lamina appears to be slightly asymmetrical. Leaf base appears roughly symmetrical. Apex is not present so its symmetry cannot be described.

Form: The point of max. width is 48.1mm from the leaf base and the max. length of the leaf is 58.2mm min. This means that the point of max. width from the leaf base is at 83% of the total leaf length, making the leaf form obovate. Length/width ratio is 2.69:1. Since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio means that the leaf form would fit in to the narrow obovate subdivision, but this is an incomplete specimen, so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 48.1mm from leaf base and estimated max. length is 60.3mm min. Point of max. width from leaf base is therefore at 80% of total leaf length. Since leaf apex is missing, this percentage is a maximum. The leaf form is still described as obovate. Using estimated max. length, length/width ratio is 2.79:1, which is again a minimum estimate. This means that the leaf form fits in to the narrow obovate subdivision, but because this is an incomplete specimen, this is just an estimate of length/width ratio and leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 32°, but since leaf is incomplete, this is just an estimate. Base is described as acute and cuneate and although leaf is incomplete, this appears to be an accurate description.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Venation appears to be acrodromous, with two strongly developed 2° veins running in convergent arches toward the leaf apex. The position is suprabasal, with the secondary veins arising an average of 22. 6mm from the base of the leaf, (23mm on LHS and 22.1mm on RHS). The development appears to be perfect, but since the apical part of the leaf is not preserved, the development cannot be described confidently.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be at least 30.2mm from base. At this point, 1° vein width is 0.54mm and leaf width is estimated to be 18.59mm. Size of 1° is therefore 2.9% and is termed stout.
Course: Moderately curved.

2° veins:
Number: 2 min.
Pair is subopposite.
Angle of divergence: Narrow acute (31-42°, average 37°). (Angle on LHS 42°, angle on RHS 31°).
Basal vein angle: Narrow acute (average 37°).

Variation: There is only one pair of 2°s present so there is no variation along the length of the lamina to be described. However, it appears that the divergence angle is more acute on the RHS of the leaf.
Thickness: Moderate.
Course: Appears to be uniformly curved and unbranched, but leaf is too fragmentary for this to be certain.
Behaviour of loop-forming branches: None.
Intersecondary veins: None.
Intramarginal vein: It appears that there may be an intramarginal vein present, produced by the fusion of 3° veins, but this is not clearly an intramarginal vein.
Intercostal shape: Not applicable since there is only one pair of 2°s.
Average vein length: Cannot be measured for this fragmentary specimen.
Average spacing: Not applicable.

3 veins:
Average angle of origin on admedial side of 2°s: 97°.
Average angle of origin on exmedial side of 2°s: 71°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 73°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.44b

Preservation: Fairly good. The venation is clear in the part of the leaf preserved. The remaining organic material appears to be of medium thickness but is very patchy. The specimen is just a fragment so the overall shape of the leaf cannot be described. Part of the margin is clear in the part of the leaf preserved. The apex and base of the leaf are not present and so cannot be described.

Dimensions: Max. length 8.7mm min. Max. width 4.4mm min. This is just a very small fragment so these are minimum estimates for the leaf. RHS shows better preservation and max. width of RHS only is 3mm min. Assuming leaf is symmetrical, max. width is 6mm min. Area 19.8sq.mm min. Area of RHS only is 14.4sq.mm min. Assuming leaf is symmetrical, area is 28.8sq.mm, which is a minimum estimate for the leaf because this is just a small fragment. Max. length along 1° 8.1mm min., but it is not clear that this is actually the 1° vein. Max. length, 8.7mm, is a better estimate but is still a minimum. 'Leaf area' 34.8sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen is too incomplete for its symmetry to be described.

Form: Point of max. width is 2.6mm from leaf base. Max. length of leaf is 8.7mm min., meaning that point of max. width from leaf base is at 30% of total leaf length. This would make the leaf form ovate. Using the estimated max. width, length/width ratio is 1.45:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form would be described as ovate, but this is just a fragment so this is not a good estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved but there are clearly preserved projections along RHS of leaf. Only two projections have a clearly defined shape. Measured perpendicular to the midvein, the margin is indented 0.2-0.3mm, average 0.3mm, 20.2% of the distance to the midvein, which is just an estimate because the most prominent vein preserved may not be the midvein of the leaf. The projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 66-71°, average 68°). Dominant serration type is acuminate on basal side and convex or concave on apical side. Sinuses appear to be quite rounded. Spacing of serrations is 1.6-1.9mm, average 1.8mm, standard deviation 0.2mm, and spacing is described as regular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: It appears that the highest vein order preserved is the second. This specimen is therefore too fragmentary for venation type to be assessed.

1° vein: Not preserved.

2° veins:
Course appears to be sinuous and branched, provided with outer 2° veins, but specimen is too fragmentary to say anything further about the 2° veins.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.45a

Preservation: Excellent. The venation is very clear. The remaining organic material is of medium thickness and appears fairly even. Removal of sediment cover in the basal part of the leaf may reveal more of the basal margin and petiole. The LHS of the leaf is almost complete, enabling the overall shape of the left to be described. Part of the upper RHS of the leaf is missing. The margins are clear in the part of the leaf preserved. The apex of the leaf is present and although the RHS is incomplete the shape of the leaf can be described from the LHS. Most of the base of the leaf is preserved, just a very small part appears to be covered by sediment, and the shape can be clearly described from the RHS of the specimen. There is a petiole present.

Dimensions: Max. length is 41.7mm (including petiole), which is a fairly accurate measurement. Petiole is approximately 3.3mm in length. Max. length of lamina alone is 38.4mm, a fairly accurate measurement. Max. width is 18.9mm, which is a minimum estimate because the apical portion of the RHS is missing. LHS appears almost complete and max. width of LHS only is 10.1mm. Assuming leaf is symmetrical, max. width is 20.2mm, which appears to be a fairly good estimate for max. width. Area 419.6sq.mm min. (including petiole). Roughly sketching in a minimum outline for very base of LHS, area of LHS only is 252.1sq.mm. Assuming leaf is symmetrical, area is 504.2sq.mm, which appears to be a fairly good estimate for leaf area. This estimate does not include the petiole. Max. length along 1° is 38.5mm, a good estimate because this part of the leaf is complete. This measurement is slightly longer than max. length because 1° is slightly curved at its base. 'Leaf area' 518.5sq.mm, a fairly good estimate.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Although it is incomplete, the whole lamina appears to be slightly asymmetrical. The base appears to be asymmetrical. Much of the RHS of the apical part of the leaf is missing so this is not a confident description but it appears to be slightly asymmetrical.

Form: Point of max. width is 21.3mm from leaf base. Max. length of leaf is 38.5mm, meaning that point of max. width from leaf base is at 55% of total leaf length. The leaf form is therefore obovate. Using estimated max. width, length/width ratio is 1.91:1. This ratio means that the leaf form fits in to the wide obovate subdivision. Although the leaf is incomplete, this appears to be an accurate description of leaf form.

Apex: RHS of apical portion of leaf is missing, but assuming apex is symmetrical, apical angle is 38° and apex is described as acute.

Base: Basal angle 73°. Base is described as acute and decurrent and although leaf base is incomplete, this appears to be an accurate description.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: A petiole is present and it appears to be normal. It is approximately 1mm wide and 3.3mm in length.

Venation type: Venation appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Midpoint is 19.2mm from leaf base. At this point, 1° vein width is 0.49mm and leaf width is 17.9mm. Size of 1° is therefore 2.74% and is termed stout.
Course: Straight and unbranched.

2° veins:
Number: 12 min.
Pairs are alternate.
Angle of divergence: Moderate acute (17-68°, average 54°). (Average on LHS 50°, average on RHS 57°).
Basal vein angle: Narrow acute (average 26°).
Variation: Lowest pair of 2°s appears to be more acute than those above. Divergence angle asymmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at a right-angle (average 93°). It appears that they may form an intramarginal vein, but this is not clear.
Intersecondary veins: There may be intersecondaries present, but this is not certain.
Intramarginal vein: It appears that there may be an intramarginal vein present, but this is not a completely confident description.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2.2:1.
Average vein length: 8.2mm.
Average spacing: 4.8mm.

There are enclosing arching secondaries. The arching secondaries are segmented by secondaries arising from the midvein and also by secondary branches diverging from the lower secondary and joining the superadjacent secondary, while the continuation of the arching secondary goes on to form another loop. The secondary arches may form an intramarginal vein, roughly following the outline of the leaf.

3 veins:
Average angle of origin on admedial side of 2°s: 94°.
Average angle of origin on exmedial side of 2°s: 71°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 74°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.45b

Preservation: Fair. The venation is fairly clear in the part of the leaf preserved. The remaining organic material is of dark, thick and slightly uneven appearance. The specimen is just a fragment so the overall shape of the leaf cannot be described. There are clear margins preserved in the part of the leaf present. Slightly more of the specimen may be revealed by removal of sediment cover in the upper part of the specimen. The apex and base of the leaf are not present and so cannot be described.

Dimensions: Max. length 29.2mm min. Max. width 19.1mm min. (point of max. width is closer to base on RHS). This is just a small fragment so these are minimum estimates for the leaf. The prominent vein may not be the 1°; in fact it probably is not, so it is not possible to estimate a minimum outline for the leaf. Area 300.2sq.mm min. 1° is not clearly preserved. 'Leaf area' 371.8sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: The specimen is too fragmentary for the leaf symmetry to be described.

Form: Point of max. width is 9.7mm from leaf base. Max. length of leaf is 29.2mm min., meaning that point of max. width from leaf base is at 33% of total leaf length. This would make the leaf form ovate, but from curvature of margins present, it appears that the leaf form is oblong. Length/width ratio is 1.53:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would be described as wide oblong, but this is just a fragment so this is not a good estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a completely confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison of vein widths with D8754.8.49a, it appears that the most prominent veins preserved are primaries, or possibly a 1° and a prominent 2°. It appears therefore that the venation pattern is acrodromous, but since this is just a small fragment of the leaf this is not a confident description.

1° vein:
Size: 1° vein is not clearly preserved at any point and leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be at least 14.6mm from leaf base. At this point, the width of the estimated midvein is 0.5mm and leaf width is 16.8mm, but this is a minimum estimate because only RHS of leaf is preserved. Width of RHS only is estimated to be 16.4mm. Assuming leaf is symmetrical, leaf width is estimated to be 32.8mm. Size of 1° is therefore estimated to be 1.53% and is termed moderate, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Specimen is too fragmentary for 1° vein course to be described.

2° veins:
Leaf is too fragmentary for 2°s to be described. Course appears to be uniformly curved. There appears to be an intramarginal vein, but it may be produced by 3°s rather than 2°s, it is not clear.

3 veins:
Average angle of origin on admedial side of 2°s: 80°.
Average angle of origin on exmedial side of 2°s: 61°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 69°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.46a

Preservation: Good. The venation is clear in the part of the leaf preserved. The remaining organic material has a dark and thick to medium thickness appearance. The specimen is incomplete, so the overall shape of the leaf cannot be described. The margins are clear in the part of the leaf preserved. The apex is not present and so cannot be described. The LHS of the basal part of the leaf is fairly complete, only a small marginal area close to the base is missing. The outer area of the RHS of the lower part of the leaf is missing, but on this side, the margin is complete near the base. The basal part of the leaf is almost complete, so its shape can be described. There may be a petiole present.

Dimensions: Max. length 20.5mm min. (including petiole). A possible petiole is approximately 1mm in length, but this is not clearly a petiole. Max. length of lamina alone is 19.4mm min. Max. width 14.2mm min. Leaf is incomplete so these are minimum estimates. LHS is more complete than RHS and max. width of LHS only is 8.3mm. Assuming leaf is symmetrical, max. width is 16.6mm. From curvature of margins present, this appears to be a fairly good estimate for max. width. Area 152.8sq.mm min. (including petiole). Roughly sketching in a minimum outline for LHS, area of LHS only is 122.5sq.mm min. Assuming leaf is symmetrical, area is 245sq.mm, which is a minimum estimate for the leaf because the apex is missing. With this sketched outline there is no petiole present. Using the sketched outline gives an estimate of max. length of lamina of 21.4mm min. Max. length along 1° 14.2mm min. Using the sketched outline gives an estimate of max. length along 1° of 21.5mm min., slightly longer than estimate for max. length because base of 1° is slightly curved. 'Leaf area' 237.9sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: This specimen is too fragmentary for the leaf symmetry to be described confidently. The base appears asymmetrical but this is not at all clear. This would mean that the

whole lamina was categorised as asymmetrical. The apex is not present so its symmetry cannot be described.

Form: The point of max. width is 14.9mm from the leaf base and the max. length of the leaf is 19.4mm min. This means that the point of max. width from the leaf base is at 77% of the total leaf length, making the leaf form obovate. Using estimated max. width, length/width ratio is 1.17:1. Since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form would fit in to the wide obovate subdivision, but this is an incomplete specimen, so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 16mm from leaf base and estimated max. length is 21.5mm min. Point of max. width from leaf base is therefore at 74% of total leaf length and the leaf form is still described as obovate. Using estimated max. length and width, length/width ratio is 1.30:1, which is again a minimum estimate. This means that the leaf form fits in to the wide obovate subdivision, but because this is an incomplete specimen, this is just an estimate of length/width ratio and leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. LHS is more complete than RHS, so angle is measured for LHS only. Assuming base is symmetrical, basal angle is 83°. Since leaf is fragmentary and basal margins are incomplete, this is just an estimate. Base is described as acute and decurrent and although leaf is incomplete, this appears to be a fairly accurate description.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: It is not clear but there may be a petiole present. It is approximately 1mm in length and is estimated to be approximately 0.6mm wide.

Venation type: Venation appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 10.7mm from base. At this point, 1° vein width is 0.45mm and leaf width is 11.6mm, but this is a minimum estimate because here the RHS margin is not present. LHS only is estimated to be 6.9mm wide at this point. Assuming leaf is symmetrical, leaf width is 13.8mm. Size of 1° is therefore 3.27% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 6 min.
Pairs are opposite.
Angle of divergence: Moderate acute (39-64°, average 49°).
(Average on LHS 53°, average on RHS 45°).
Basal vein angle: Moderate acute (46°).
Variation: Divergence angle appears to vary irregularly.
Divergence angle asymmetrical.
Thickness: Moderate.
Course: Abruptly curved and appear to be branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 63°). Appear to be enclosed by 3° or 4° arches.
Intersecondary veins: Present. It is not clear whether these are composite or simple.
Intramarginal vein: No intramarginal vein can be clearly observed.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2:1.
Average vein length: 12.6mm.
Average spacing: 6.3mm.

3 veins:
Average angle of origin on admedial side of 2°s: 106°.
Average angle of origin on exmedial side of 2°s: 63°.
Combination: AO.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 82°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.46d

Preservation: Good. The venation is clear. The remaining organic material appears to be fairly even and of medium thickness. It is difficult to ascertain how complete this specimen is; the basal margins are a little unclear. Removal of sediment cover at the apex and base may reveal a little more of the specimen. In parts of the leaf the margins are very clear, in others they are less so. This makes it difficult to describe the overall shape of the leaf. The apex appears to be incomplete, although it can be described from the LHS of the leaf where the margins are more complete. Since the basal margins are unclear and incomplete, it is difficult to describe the base of the leaf.

Dimensions: Max. length 12.2mm min. Max. width 5.8mm min. (point of max. width is slightly closer to base on RHS). The leaf is incomplete so these are minimum estimates. The completeness of LHS and RHS is roughly the same. Area 48.3sq.mm min. Roughly sketching in a minimum outline for the leaf, area is 51.5sq.mm, a minimum estimate. Using this sketched outline gives an estimate of max. length of 12.3mm min. Max. length along 1° 11.3mm min. Using the sketched outline gives an estimate of max. length along 1° of 11.8mm min. 'Leaf area' 45.6sq.mm min.

Organisation: Cannot be determined for this fragmentary specimen.

Symmetry: Whole lamina appears slightly asymmetrical. Base is incomplete so its symmetry cannot be assessed. Apex appears to be asymmetrical.

Form: The point of max. width is 4.5mm from the leaf base and the max. length of the leaf is 12.2mm min. This means that the point of max. width from the leaf base is at 37% of the total leaf length, making the leaf form ovate. Length/width ratio is 2.10:1. Since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the narrow ovate subdivision, but this is an incomplete specimen, so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 4.6mm from leaf base and estimated max. length is 12.3mm min. Point of max. width from leaf base is therefore still at 37% of total leaf length and the leaf form is still described as ovate. Using estimated max. length, length/width ratio is 2.12:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This means that the leaf form is described as narrow ovate, but because this is an incomplete specimen, this is just an estimate of length/width ratio and leaf form.

Apex: Leaf specimen is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle appears to be 101° and apex appears to approach truncate, but apex is incomplete, so these are just estimates.

Base: Not preserved.

Margin: The margin is incomplete, but there is a clear indentation in the basal margin of the LHS and along the apical margin of the RHS there are three clear projections. Measured perpendicular to the midvein, the margin is indented 0.2-0.3mm, average 0.3mm min., 11.5% of the distance to the midvein. The projections have rounded apices, so the margin is described as crenate. Sinuses between crenations are rounded. Spacing of crenations is 0.9-1.3mm, average 1.1mm, standard deviation 0.2mm, and spacing is described as regular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison of vein widths with D8754.8.30a, the most prominent vein preserved does appear to be a primary. The venation therefore appears to be pinnate simple craspedodromous, but since the leaf is incomplete this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 6.2mm from base. At this point, 1° vein width is 0.27mm and leaf width is 5.4mm. Size of 1° is therefore 4.97% and is termed massive.
Course: Markedly curved.

2° veins:
Number: 31.

Pairs are alternate and opposite.
Angle of divergence: Narrow acute (21-68°, average 39°).
(Average on LHS 31°, average on RHS 48°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle more acute on LHS than RHS.
Thickness: Fine.
Course: Sinuous, branched and provided with outer 2°s.
Behaviour of loop-forming branches: None.
Intersecondary veins: Appears to be simple intersecondary veins present.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 6.1:1.
Average vein length: 3mm.
Average spacing: 0.7mm.

3 veins:
Average angle of origin on admedial side of 2°s: 85°.
Average angle of origin on exmedial side of 2°s: 87°.
Combination: RR.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.47a

Preservation: Fairly good. The venation is fairly clear in the part of the leaf preserved. The remaining organic material is uneven, of medium thickness in the basal part of the specimen and becoming paler and thinner towards the apex. The specimen is incomplete so the overall shape of the leaf cannot be described. Removal of sediment cover along much of the LHS of the specimen may reveal more of the leaf. The margins are fairly unclear but appear to be present in places along the RHS of the specimen. The apex is incomplete and therefore cannot clearly be described. It appears that the overall shape of much of the apex can be described from the RHS of the specimen but the very tip is not present. The base of the leaf is incomplete and so cannot be described.

Dimensions: Max. length 33mm min. Max. width 12.1mm min. The leaf is fragmentary so these are minimum estimates. RHS is more complete than LHS and max. width of RHS only is 8.6mm min. Assuming leaf is symmetrical, max. width is 17.2mm min. Area 183.4sq.mm min. It is not clear whether or not RHS of leaf is almost complete. Area of RHS only is 144.6sq.mm min. Assuming leaf is symmetrical, area is 289.2sq.mm, which is a minimum estimate for the leaf. Max. length along 1° 28mm min. Max. length, 33mm, appears to be a better estimate, but is still a minimum. 'Leaf area' 378.4sq.mm min.

Organisation: Cannot be determined for this fragmentary specimen.

Symmetry: Whole lamina is too incomplete for its symmetry to be described, much of LHS of leaf is missing. LHS of base is missing so its symmetry cannot be described. Apex appears roughly symmetrical but since margins are not clearly preserved this is not a confident description.

Form: Point of max. width is 19.5mm from leaf base. Max. length of leaf is 33mm min., meaning that point of max. width from leaf base is at 59% of total leaf length. This would make the leaf form obovate. Using the estimated max. width, length/width ratio is 1.92:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form fits in to the wide obovate subdivision, but this is a fragmentary specimen so this is just an estimate of leaf form.

Apex: Leaf specimen is incomplete and it was not possible to sketch a minimum outline for leaf, so extent of apical portion is just an estimate. Assuming apex is symmetrical, apical angle appears to be 76° and apex appears to be attenuate, but apex is incomplete, so these are just estimates.

Base: Not preserved.

Margin: The margin is not well preserved, so the description of the margin is based on estimates. There appears to be projections along RHS of leaf. Measured perpendicular to the midvein, the margin is estimated to be indented 0.8-2.1mm, average 1.3mm min., 30.3% of the distance to the midvein. The margin is therefore estimated to be lobed. Sinuses between lobes appear to be quite rounded. Spacing of lobes is estimated to be 1-7.9mm, average 3.5mm, standard deviation 2.5mm, and spacing is described as irregular. However, since the preservation of the margin is fairly poor, this is not a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate simple craspedodromous, but specimen is too fragmentary for this to be a confident description.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 16.5mm from base. At this point, 1° vein width is 0.54mm and leaf width is 8.7mm, but this is a minimum estimate because here the LHS margin is not present. RHS only is 7.3mm wide at this point. Assuming leaf is symmetrical, leaf width is 14.7mm. Size of 1° is therefore 3.68% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 5 min.
Pairs appear to be alternate, but 2°s are only clear on RHS of leaf, so this is not a confident description.
Angle of divergence: Narrow acute (29-57°, average 44°).
Basal vein angle: Not preserved.
Variation: It appears that the upper 2°s are more acute than those below, but the specimen is too fragmentary for this to be certain. Divergence angle symmetry cannot be assessed for this fragmentary specimen.
Thickness: Moderate.
Course: Appears to be slightly recurved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.5:1.
Average vein length: 10.9mm.
Average spacing: 7.3mm.

3 veins:
Average angle of origin on admedial side of 2°s: 75°.
Average angle of origin on exmedial side of 2°s: 85°.
Combination: RA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 84°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.47b

Preservation: Fairly poor. The venation is fairly clear in the part of the leaf preserved. The remaining organic material is of medium thickness and of rather patchy and holey appearance. The specimen is just a fragment so the overall shape of the leaf cannot be described. Removal of sediment cover of the LHS of the specimen may reveal slightly more of the leaf. There are no margins preserved. The apex and base of the leaf are not present and so cannot be described.

Dimensions: Max. length 20.3mm min. Max. width 16.8mm min. This is just a small fragment of the leaf so these are minimum estimates. RHS of leaf shows slightly greater preservation than LHS and max. width of RHS only is 10.1mm min. Assuming leaf is symmetrical, max. width is 20.2mm min. Area 181.7sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 151.8sq.mm min. Assuming leaf is symmetrical, area is 303.6sq.mm, which is a minimum estimate for the leaf because this is just a small fragment. Using this sketched outline gives an estimate of max. length of 20.5mm min. Max. length along 1° 20.1mm min. Using the sketched outline gives an estimate of max. length along 1° of 20.5mm min. 'Leaf area' 276.1sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen is too fragmentary for the leaf symmetry to be described.

Form: The point of max. width is 5.4mm from the leaf base and the max. length of the leaf is 20.3mm min. This means that the point of max. width from the leaf base is at 27% of the total leaf length, making the leaf form ovate. Using estimated max. width,

length/width ratio is 1.00:1. Since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the very wide ovate subdivision, but this is just a fragment, so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 5.4mm from leaf base and estimated max. length is 20.5mm min. Point of max. width from leaf base is therefore at 26% of total leaf length and the leaf form is still described as ovate. Using estimated max. length and width, length/width ratio is 1.01:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form is described as very wide ovate, but because this is just a fragment, this is not a good estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: No margins preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison of vein width with D8754.8.50 it appears that the primary vein is preserved in D8754.8.47b. However this specimen is too fragmentary for the venation pattern to be described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 10.3mm from base. At this point, 1° vein width is 0.48mm. The leaf width is 10.3mm, but this is a minimum estimate because here the margin is not preserved. RHS, which shows greater preservation than LHS, is estimated to be at least 8.9mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 17.8mm. Size of 1° is therefore estimated to be 2.69% max. and is termed stout, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Number: 2 min.
Pairs appear to be alternate.
Angle of divergence: Narrow acute (33-47°, average 40°). (Angle on LHS 47°, angle on RHS 33°).
Basal vein angle: Not preserved.
Variation: It is not possible to describe the variation in divergence angle along the length of this fragmentary specimen. Divergence angle appears to be more acute on RHS than LHS.
Thickness: Moderate.
Course: Specimen is too fragmentary to describe the course of the 2° veins.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: It appears that there may be intersecondary veins present, but this is not certain.
Intramarginal vein: None preserved.
Intercostal shape: It is not possible to describe intercostal shape for this fragmentary specimen.
Average vein length: Cannot be measured for this fragmentary specimen.
Average spacing: Cannot be measured for this fragmentary specimen.

3 veins:
Average angle of origin on admedial side of 2°s: 95°.
Average angle of origin on exmedial side of 2°s: 84°.
Combination: RR.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.47c

Preservation: Fairly poor. The venation is fairly unclear. The remaining organic material is of medium thickness and of rather patchy and holey appearance. The specimen is just a fragment so the overall shape of the leaf cannot be described. A small percentage of the margins may be preserved. The apex and base of the leaf are not present and so cannot be described.

Dimensions: Max. length 19.1mm min. Max. width 14mm min. This is just a small fragment from the RHS of the leaf so these are minimum estimates. Max. width of RHS only is 14mm min. Assuming leaf is symmetrical, max. width is 28mm min. Area 166.3sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 242.4sq.mm min. Assuming leaf is symmetrical, area is 484.8sq.mm, a minimum estimate because this is just a small fragment of the leaf. Using this sketched outline gives an estimate of max. length of 20.4mm min. Max. length along 1° 10.4mm min; only a very small part of 1° is preserved. Using the sketched outline gives an estimate of max. length along 1° of 20.2mm min. 'Leaf area' 377.1sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen appears to be just a fragment from RHS of leaf so elements of symmetry cannot be described.

Form: It is not possible to estimate the leaf form of this scrappy fragment. Using estimated max. length and width, length/width ratio is 0.72:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate camptodromous brochidodromous, but this specimen is really too fragmentary for the venation pattern to be described.

1° vein: Too poorly preserved to be described.

2° veins:
Course appears to be abruptly curved, but specimen is too fragmentary to say anything further about the 2° veins.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.48a

Preservation: Fairly good. The venation is very clear in the parts of the leaf preserved. The remaining organic material appears to be dark and thick to medium thickness and is rather uneven. The specimen is incomplete so the overall shape of the leaf cannot be described. Removal of sediment cover from along much of the RHS of the specimen may reveal more of the leaf. It appears that only a very small percentage of the margins are preserved. Although the margins are unclear, it does appear that much of the RHS of the leaf is preserved. Neither the apex nor base of the leaf is complete and so cannot be described confidently.

Dimensions: Max. length 53.4mm min. Max. width 13.5mm min. The specimen is incomplete so these are minimum estimates. RHS of leaf shows greater preservation than LHS and max. width of RHS only is 10mm min. Assuming leaf is symmetrical, max. width is 20mm min. Area 439.4sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 411.3sq.mm min. Assuming leaf is symmetrical, area is 822.6sq.mm, a minimum estimate for the leaf. Using this sketched outline gives an estimate of max. length of 54.5mm min. Max. length along 1° 50.4mm min. Using the sketched outline gives an estimate of max. length along 1° of 54.5mm min. 'Leaf area' 726.7sq.mm min.

Organisation: Cannot be determined for this fragmentary specimen.

Symmetry: Too much of the LHS of the leaf is missing for the symmetry to be described.

Form: The point of max. width is 33.5mm from the leaf base and the max. length of the leaf is 53.4mm min. This means that the point of max. width from the leaf base is at 63% of the total leaf length, making the leaf form obovate. Using estimated max. width, length/width ratio is 2.67:1. Since both max. length and width are

minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the narrow obovate subdivision, but this is an incomplete specimen, so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 34.4mm from leaf base and estimated max. length is 54.5mm min. Point of max. width from leaf base is therefore still at 63% of total leaf length and the leaf form is still described as obovate. Using estimated max. length and width, length/width ratio is 2.73:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This means that the leaf form is still described as narrow obovate, but because this is an incomplete specimen, with the margins at the probable max. width missing, this is just an estimate of length/width ratio and leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is not very well preserved. Very small percentage of margin preserved appears to be entire, but this is a tiny proportion of the margin so this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 27.3mm from base. At this point, 1° vein width is 0.54mm. The leaf width is 8.4mm, but this is a minimum estimate because here the margin is not preserved. RHS, which shows greater preservation than LHS, is estimated to be at least 9.8mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 19.7mm. Size of 1° is therefore estimated to be 2.74% max. and is termed stout, but the specimen is too fragmentary for the 1° size to be described completely confidently.
Course: Markedly curved.

2° veins:
Number: 12 min.
Pairs are opposite/alternate.
Angle of divergence: Moderate acute (35-67°, average 54°).
(Average on LHS 53°, average on RHS 55°).
Basal vein angle: Narrow acute (average 35°).
Variation: Lowest pair of 2°s appears to be more acute than those above. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at a right-angle (average 86°). Appear to be enclosed by 2°, 3°, or 4° arches. It appears that they may form an intramarginal vein, but this is not clear.
Intersecondary veins: There appears to be composite intersecondaries present.
Intramarginal vein: No clear intramarginal vein is observed.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.9:1.
Average vein length: 11.3mm.
Average spacing: 6.5mm.

3 veins:
Average angle of origin on admedial side of 2°s: 78°.
Average angle of origin on exmedial side of 2°s: 102°.
Combination: OA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 78°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.48b

Preservation: Fair. The venation is clear in the part of the leaf preserved. The remaining organic material appears to be fairly thin to medium thickness and fairly uneven. The specimen is just a fragment so the overall shape of the leaf cannot be described. Removal of sediment cover in the upper part of the specimen may reveal more of the leaf. There are no margins preserved. The apex and base are not present and so cannot be described.

Dimensions: Max. length 22.9mm min. Max. width 22.3mm min. The specimen is just a small fragment so these are minimum estimates. This appears to be a small fragment from LHS of leaf. Assuming leaf is symmetrical, max. width is at least 44.6mm min. Area 291.5sq.mm min. Assuming leaf is symmetrical, area is at least 583sq.mm min. It is not possible to sketch in a minimum outline for the leaf fragment. 1° is not clearly preserved. 'Leaf area' 680.9sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen is too fragmentary for the leaf symmetry to be described.

Form: It is not possible to estimate the leaf form of this scrappy fragment. Using estimated max. length and width, length/width ratio is 0.51:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: No margins preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison of vein width in D8754.8.60a, it appears that the most prominent vein preserved in D8754.8.48b is a secondary. This specimen is therefore too fragmentary for the venation pattern to be described, although it is estimated that the venation is acrodromous.

1° vein: Not preserved.

2° veins:
Leaf is too fragmentary for 2° veins to be described.

3 veins:
Average angle of origin on admedial side of 2°s: 85°.
Average angle of origin on exmedial side of 2°s: 71°.
Combination: AR.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.49a

Preservation: Fairly good. The venation is fairly unclear. The remaining organic material is of dark and thick to medium thickness appearance and is fairly patchy and uneven. There are splits in the lamina. It appears that much of the RHS of the leaf is preserved, making it possible to describe the overall shape of the leaf. The lower LHS of the leaf is missing and there are no clear margins preserved along the LHS of the leaf. However, there are clear margins along most of the RHS of the leaf. The apex is incomplete and is therefore difficult to describe. The base can be described from the RHS of the leaf. There is a petiole present.

Dimensions: Max. length 71.5mm min. (including petiole). Petiole is very curved and approximately 7.9mm in length. Max. length of lamina alone 65.3mm min. Max. width 16.1mm (point of max. width is slightly closer to base on RHS). Preservation of RHS is almost complete and from this it appears that the estimate of max. width is fairly good. Area 564sq.mm min. (including petiole). Roughly sketching in a minimum outline for RHS, area of RHS only is 386.3sq.mm min. Assuming leaf is symmetrical, area is 772.6sq.mm min. This estimate does not include the petiole. Using this sketched outline gives an estimate of max. length of 65.8mm, a minimum estimate for length of lamina alone. Max. length along 1° 65.3mm min. Using the sketched outline gives an estimate of max. length along 1° of 66.4mm min (not including petiole), slightly longer than estimated max. length because 1° is slightly curved. 'Leaf area' 712.7sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Preservation of LHS of leaf is too poor to allow symmetry of leaf to be described.

Form: Point of max. width is 28.7mm from leaf base. Max. length of leaf is 65.3mm min., meaning that point of max. width from leaf base is at 43% of total leaf length. This would make the leaf form ovate, but from curvature of margins present, it appears that leaf form is oblong. Length/width ratio is 4.06:1, but since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio means that the leaf form fits in to the narrow oblong subdivision, but this is an incomplete specimen so this is just an estimate of leaf form. Using the sketched minimum outline, point of max. width is 28.7mm from leaf base and max. length is 66.4mm min. Point of max. width from leaf base is therefore still at 43% of total leaf length, but the leaf form is described as oblong. Using estimated max. length, length/width ratio is 4.12:1, which is again a minimum estimate. This means that the leaf form still fits in to the narrow oblong subdivision. Although the leaf is incomplete, this appears to be an accurate description of leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. LHS of base is missing, so angle is measured for RHS only. Assuming base is symmetrical, basal angle is 46°. Since leaf is incomplete, this is just an estimate. Base is described as acute and cuneate and although leaf is incomplete, this appears to be an accurate description.

Margin: Margin appears to be entire, but there are tiny projections, some appearing pointed, along the margin in the apical part of the leaf. These projections are up to 0.2mm in size, but it appears that these projections are too small to be confidently described as teeth at this level of preservation and at this magnification. A significant proportion of the margin is clearly smooth, so the margin is tentatively classed as entire.

Petiole: A petiole is present and it appears to be normal. It is very curved and is approximately 1.3mm wide and 9.2mm in length.

Venation type: Venation appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 32.9mm min. from base. At this point, 1° vein width is 0.55mm and leaf width is 10.1mm, but this is a minimum estimate because here the LHS margin is not present. RHS only is 7.2mm wide at this point. Assuming leaf is symmetrical, leaf width is 14.3mm. Size of 1° is therefore 3.84% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 39 min.
Pairs are opposite/alternate.
Angle of divergence: Wide acute (32-104°, average 69°).
(Average on LHS 73°, average on RHS 65°).
Basal vein angle: Moderate acute (average 46°).
Variation: Divergence angle varies irregularly. Divergence angle more acute on RHS than LHS.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at a right-angle angle (average 81°). Also appear to be enclosed by 3° or 4° arches.
Intersecondary veins: There may be intersecondaries present, but this is not clear.
Intramarginal vein: None present.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 4.4:1.
Average vein length: 6.5mm.
Average spacing: 3.3mm.

3 veins:
Average angle of origin on admedial side of 2°s: 66°.
Average angle of origin on exmedial side of 2°s: 42°.
Combination: AA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.49b

Preservation: Fair. The venation is a little unclear. The remaining organic material appears to be dark, thick and patchy. Only the basal RHS of the leaf is preserved so the overall shape of the leaf cannot be described. There are clear margins preserved along the lower RHS of the specimen. The apex is not present and so cannot be described. The base can be described from the RHS of the leaf. There is no petiole present.

Dimensions: Max. length 31.1mm min. Max. width 19.7mm min. This is just a fragment from basal RHS of leaf so these are minimum estimates. Max. width of RHS only is 19.7mm min. Assuming leaf is symmetrical, max. width is 39.4mm min. Area 309.5sq.mm min. It is not possible to sketch in a minimum outline for the leaf fragment, but assuming leaf is symmetrical, area is 619sq.mm, which is a minimum estimate for the leaf because apical part is missing. Max. length along 1° 22.1mm min. Max. length, 31.1mm, is a better estimate but is still a minimum. 'Leaf area' 816.9sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen is just a fragment from the basal RHS of the leaf so the leaf symmetry cannot be described.

Form: Point of max. width is 31.1mm from leaf base. Max. length of leaf is 31.1mm min., meaning that point of max. width from leaf base is at 100% of total leaf length. This would make the leaf form obovate. Using estimated max. width, length/width ratio is 0.79:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would be described as very wide obovate, but this is a fragmentary specimen so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Leaf specimen is incomplete and it was not possible to sketch a minimum outline for leaf, so extent of basal portion is just an estimate. LHS of leaf is missing, so assuming base is symmetrical, basal angle appears to be 91°. Since leaf is fragmentary, this is just an estimate. Base appears to be obtuse and normal and although leaf is incomplete, this appears to be a fairly accurate description.

Margin: There are clearly preserved projections along margin of RHS of leaf, appearing to fall in to two size classes. There are two clear projections and a series of less clear, smaller ones. Measured perpendicular to the midvein, the margin is indented 0.2-0.8mm, average 0.5mm, 4.5% of the distance to the midvein. The average indentation of the 1° projections is 0.8mm, 5.5% of the distance to the midvein, and the 2° projections 0.4mm, 4.2% of the distance to the midvein. Most of the projections have pointed apices, so the margin is described as toothed. The smaller projections appear quite rounded, but this may be a preservational feature. Teeth are serrate. The serrations are compound, in two size groups, and are described as double serrations. Apical angle of 1° serrations is obtuse (average 97°) and apical angle of 2° serrations is obtuse (average 129°). Overall, apical angle of serrations is obtuse (range 87-146°, average 121°). Dominant serration type is straight on basal side and straight on apical side. Most of the sinuses appear quite rounded. Including both 1° and 2° serrations, spacing is 0.9-8.6mm, average 3.4mm, standard deviation 2.4mm, and spacing is described as irregular. Spacing of 1° projections alone is 8.6mm, but since there are only two, it cannot be determined whether the spacing is regular or irregular.

Petiole: Absent or not preserved.

Venation type: Venation appears to be pinnate simple craspedodromous.

1° vein:
Size: Width of 1° vein is not completely preserved at any point and leaf is too fragmentary to estimate the position of the leaf midpoint, so the measurements are made at the midpoint of the specimen. Midpoint is estimated to be at least 15.6mm from leaf base. At this point, 1° vein width is at least 0.26mm and leaf width is 13.4mm, but this is a minimum estimate because only LHS of leaf is preserved. Assuming leaf is symmetrical, leaf width is estimated to be 26.8mm. Size of 1° is therefore 0.97% min. and is termed weak, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Leaf is fragmentary and only two 2°s are preserved on the RHS of the leaf.
Number: 2 min.

No pairs are preserved.
Angle of divergence: Not preserved except in base of leaf.
Basal vein angle: Moderate acute (58°).
Variation: Appears to be nearly uniform, but variation cannot be described because leaf is too fragmentary. Since only RHS of leaf is preserved it is not possible to assess divergence angle symmetry.
Thickness: Moderate.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be a confident description.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 2:1.
Average vein length: 16.8mm.
Average spacing: 8.3mm.

3 veins:
Average angle of origin on admedial side of 2°s: 87°.
Average angle of origin on exmedial side of 2°s: 59°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 87°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.49c

Preservation: Fairly poor. The venation is a little unclear. The remaining organic material appears to be of medium thickness and is rather patchy. The specimen is just a fragment so the overall shape of the leaf cannot be described. There are margins preserved along the RHS of the specimen. The apex and base of the leaf are not present and so cannot be described.

Dimensions: Max. length 25.4mm min. Max. width 10.5mm min. This is just a fragment from the RHS of the leaf so these are minimum estimates. Max. width of RHS only is 10.5mm min. Assuming leaf is symmetrical, max. width is 21mm min. Area 176.2sq.mm min. It is not possible to sketch in a minimum outline for the leaf fragment, but assuming the leaf is symmetrical, area is 352.4sq.mm, a minimum estimate for the leaf because this is just a fragment. 1° is not clearly preserved, but it appears that max. length along 1° is 20.3mm min. It appears that the max. length, 25.4mm, is a better estimate but is still a minimum. 'Leaf area' 355.6sq.mm min.

Organisation: Cannot be determined for this fragmentary specimen.

Symmetry: Specimen is just a fragment from RHS of leaf so symmetry cannot be described.

Form: Point of max. width is 7.6mm from leaf base. Max. length of leaf is 25.4mm min., meaning that point of max. width from leaf base is at 30% of total leaf length. This would make the leaf form ovate. Using estimated max. width, length/width ratio is 1.21:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form would be described as wide ovate, but this is a fragmentary specimen so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: There are clear projections preserved along margin of RHS of leaf. Measured perpendicular to the midvein, the margin is indented 0.4-1mm, average 0.7mm min., 8.5% of the distance to the midvein, which is an estimate because 1° is not clearly preserved. The projections have rounded apices, so the margin is described as crenate. Sinuses between crenations are rounded. Spacing of crenations is 3.5-4.4mm, average 4.1mm, standard deviation 0.4mm, and spacing is described as regular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate semicraspedodromous, but the specimen is too poorly preserved for this to be certain.

1° vein:
Size: 1° is not well enough preserved to estimate its size.
Course: Appears to be moderately curved, but 1° is too poorly preserved for this to be certain.

2° veins:
Thickness appears to be moderate and course appears to be uniformly curved, branched and provided with outer 2°s, but specimen is too fragmentary to say anything further about the 2° veins. There are no intersecondary veins visible and there is not intramarginal vein.

3 veins: Specimen is too poorly preserved for 3° vein angles to be measured.

D8754.8.50a

Preservation: Fair. The venation is fairly unclear. The remaining organic material appears to be of medium thickness in the base of the specimen, becoming lighter and thinner towards the apex of the specimen. It is rather patchy and uneven. There are no clear margins preserved so it is difficult to describe the overall shape of the specimen with confidence. The apex is not present and so cannot be described. Although the basal margins are unclear it appears that the general shape of the leaf base can be described. There is a petiole present.

Dimensions: Max. length 50.8mm min. (including petiole). Petiole is angularly curved at base of lamina and approximately 15.8mm in length. Max. length of lamina alone 36.5mm min. Max. width 24.2mm min. RHS shows slightly greater preservation than LHS and max. width of RHS only is 12.6mm min. Assuming leaf is symmetrical, max. width is 25.2mm min. Area 460.6sq.mm min. (including petiole). Roughly sketching in a minimum outline for RHS, area of RHS only is 324.7sq.mm min. Assuming leaf is symmetrical, area is 649.4sq.mm, a minimum estimate for the leaf. This estimate does not include the petiole. Using this sketched outline gives an estimate of max. length of 38mm, a minimum estimate for length of lamina alone. Max. length along 1° 32.1mm min. (not including petiole). Using the sketched outline gives an estimate of max. length along 1° of 38.1mm min. (not including petiole). 'Leaf area' 640.1sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf margins are not clear, so it is not possible to described lamina symmetry.

Form: Point of max. width is 27.3mm from leaf base. Max. length of leaf is 36.5mm min., meaning that point of max. width from leaf base is at 75% of total leaf length. This would make the leaf form obovate. Using estimated max. width, length/width ratio is 1.45:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the wide obovate subdivision, but this is an incomplete specimen so this not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 27.3mm from leaf base and max. length is 38.1mm min. Point of max. width from leaf base is therefore at 72% of total leaf length and the leaf form is still described as obovate. Using estimated max. length and width, length/width ratio is 1.51:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This means that the leaf form still fits in to the wide obovate subdivision, but the specimen is incomplete so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 63°, but since leaf is incomplete and basal margins are unclear, this is just an estimate. Base is described as acute and cuneate and although leaf is incomplete, this appears to be an accurate description.

Margin: Margin is not clearly preserved.

Petiole: A petiole is present and it appears to be normal. It has an angular curve and is approximately 1mm wide and 15.2mm in length.

Venation type: Venation is pinnate and may be simple craspedodromous but the specimen is too fragmentary for the venation pattern to be described confidently.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 19mm min. from base. At this point, 1° vein width is 1.04mm. The leaf width is 14.7mm, but this is a minimum estimate because here the margin is not preserved. RHS, which shows greater preservation than LHS, is estimated to be at least 10.9mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 21.9mm. Size of 1° is therefore estimated to be 4.76% max. and is termed massive, but the specimen is too fragmentary for the 1° size to be described completely confidently.
Course: Appears to be straight and unbranched.

2° veins:
Number: 17 min.
Pairs are opposite/alternate.
Angle of divergence: Moderate acute (24-100°, average 61°).
(Average on LHS 54°, average on RHS 68°).
Basal vein angle: Moderate acute (average 50°).
Variation: Divergence angle varies irregularly. Divergence angle more acute on LHS than RHS.
Thickness: Fine.
Course: Appear to be recurved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: There may be intersecondaries present, but this is not clear.
Intramarginal vein: None present.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.9:1, but this is not a completely confident measurement because the margins are unclear.
Average vein length: 8.8mm, but since the margins are unclear, this is just an estimate.
Average spacing: 1.9mm.

3 veins:
Average angle of origin on admedial side of 2°s: 61°.
Average angle of origin on exmedial side of 2°s: 78°.
Combination: AA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.50b

Preservation: Fair. The venation is fairly unclear. The remaining organic material appears to be of medium thickness and is rather patchy, holey and split. The specimen is just a fragment so the overall shape of the leaf cannot be described. They are not clear, but there may be margins preserved. The apex and base are not complete and so cannot be described. It may be possible to describe the apex from the RHS.

Dimensions: Max. length 26.1mm min. Max. width 15.3mm min. This is just a fragment from RHS of leaf, so these are minimum estimates. Max. width of RHS only is 12.4mm min. Assuming leaf is symmetrical, max. width is 24.8mm min. Area 208.7sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 231.7sq.mm min. Assuming leaf is symmetrical, area is 463.4sq.mm, a minimum estimate for the leaf because this is a fragmentary specimen. Max. length along 1° 26.7mm min., slightly longer than estimated max. length because 1° is curved. 'Leaf area' 441.4sq.mm min.

Organisation: Cannot be determined for this fragmentary specimen.

Symmetry: This specimen appears to be a fragment from RHS of leaf so symmetry of lamina cannot be described.

Form: Point of max. width is 18.6mm from leaf base. Max. length of leaf is 26.7mm min., meaning that point of max. width from leaf base is at 70% of total leaf length. This would make the leaf form obovate. Using estimated max. width, length/width ratio is 1.08:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form would be described as very wide obovate, but this is a fragmentary specimen so this is just an estimate of leaf form.

Apex: Leaf specimen is incomplete so extent of apical portion is estimated using sketched minimum outline. Only RHS of leaf is present, but assuming apex is symmetrical, apical angle appears to be 127°. Apex appears to be obtuse, but apex is incomplete, so these are just estimates.

Base: Not preserved.

Margin: The margin is not very clearly preserved, but there appears to be projections along RHS of leaf. Measured perpendicular to the midvein, the margin is indented 0.3-1.4mm, average 0.7mm, 6.3% of the distance to the midvein. The projections appear to have quite rounded apices, so the margin is described as crenate. Sinuses between crenations appear to be rounded. Spacing of crenations is 1.3-3.2mm, average 2.3mm, standard deviation 0.7mm, and spacing is described as irregular. However, there is only a small percentage of the margin preserved, and this is not clear, so this is not a completely confident description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be acrodromous, with a strongly developed 2° vein running in a convergent arch toward the leaf apex, but the specimen is too fragmentary for this to be a confident description.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 13.1mm from base. At this point, 1° vein width is 0.56mm and leaf width is 11.6mm, but this is a minimum estimate because here the LHS is not present. RHS only is 10.9mm wide at this point. Assuming leaf is symmetrical, leaf width is 21.8mm. Size of 1° is therefore 2.57% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 2 min.
Only RHS of leaf is preserved so no pairs can be observed.
Angle of divergence: Moderate acute (43-58°, average 50°).
Basal vein angle: Not preserved.
Variation: Leaf is too fragmentary for variation in divergence angle along the length of the lamina to be described and since only RHS of leaf is preserved it is not possible to assess divergence angle symmetry.
Thickness: Moderate.
Course: Appear to be uniformly curved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None present.
Intramarginal vein: None present.
Intercostal shape: Elongated parallel to 2°s, average vein length/spacing ratio 1.5:1.
Average vein length: 23.4mm.
Average spacing: 15.5mm.

3 veins:
Average angle of origin on admedial side of 2°s: 110°.
Average angle of origin on exmedial side of 2°s: 55°.
Combination: AO.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 87°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.54a

Preservation: Excellent. The venation is very clear. The remaining organic material appears to be fairly thin and even. There are a few holes in the lamina which may be a result of insect attack. The specimen is almost complete so the overall shape of the leaf can be described. There are small areas of the leaf missing near the margins on the LHS and RHS of the leaf. Here more of the leaf may be revealed by removal of sediment cover. About 50% of the margins are clearly preserved. The very tip of the leaf is missing so the shape of the apex cannot be clearly defined. Although the basal margins are a little unclear it appears that the shape of the leaf base can be described. The base of the leaf is clearer on the RHS of the leaf. There is no petiole present.

Dimensions: Max. length 59.5mm min. Max. width 20.5mm (point of max. width is slightly closer to base on RHS). Apical tip of leaf is missing so max. length is a minimum estimate. Although leaf margin is incomplete, from curvature of margins present, it

appears that max. width is a fairly good estimate. Area 738.4sq.mm min. Roughly sketching in a minimum outline for the leaf, area is 842.8sq.mm, a minimum estimate because apical tip of leaf is incomplete. Using this sketched outline gives an estimate of max. length of 59.8mm min. Max. length along 1° 58.8mm min. Using the sketched outline gives an estimate of max. length along 1° of 60mm min., slightly longer than estimated max. length because 1° is curved. 'Leaf area' 820sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Base, apex and whole lamina appear roughly symmetrical but since leaf margins are incomplete this is not certain.

Form: The point of max. width is 31mm from the leaf base and the max. length of the leaf is 59.5mm min. This means that the point of max. width from the leaf base is at 52% of the total leaf length, making the leaf form elliptic. Length/width ratio is 2.90:1. Since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio means that the leaf form fits in to the elliptic subdivision, but this is an incomplete specimen, so this is just an estimate of leaf form. Using the sketched minimum outline, point of max. width is 31mm from leaf base and estimated max. length is 60mm min. Point of max. width from leaf base is therefore still at 52% of total leaf length. Since leaf apex is incomplete, this percentage is a maximum. The leaf form is still described as elliptic and although the leaf is incomplete, this appears to be a good description of leaf form. Using estimated max. length, length/width ratio is 2.93:1, which is again a minimum estimate. This means that the leaf form fits in to the elliptic subdivision, but because this is an incomplete specimen, the possibility that the leaf form is narrow elliptic cannot be ruled out.

Apex: Apical angle 48°. Apex is described as attenuate, but since the very tip of the apex is missing, this is not a completely confident description.

Base: Basal angle 58°. Base is described as acute and cuneate and although part of basal margins are unclear, this appears to be an accurate description.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Venation is acrodromous, with two strongly developed 2° veins running in convergent arches toward the leaf apex. The position is described as suprabasal, with the secondary veins arising an average of 3.7mm from the leaf base (3mm on LHS and 4.3mm on RHS). The development is perfect, with the acrodromous veins reaching the leaf apex.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 29.9mm min. from base. At this point, 1° vein width is 0.55mm and leaf width is 19.4mm, but this is a minimum estimate because here the margin is not preserved. From curvature of margin present, leaf width is estimated to be at least 21mm at this point. Size of 1° is therefore 2.62% max. and is termed stout.
Course: Markedly curved.

2° veins:
Number: 8 min.
Pairs are subopposite.
Angle of divergence: Moderate acute (19-70°, average 52°).
(Average on LHS 50°, average on RHS 54°).
Basal vein angle: Narrow acute (average 26°).
Variation: Lowest pair of 2°s appears to be more acute than those above. Divergence angle symmetrical.
Thickness: Moderate.
Course: Uniformly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 129°). It appears that they may form an intramarginal vein, but this is not a confident description.
Intersecondary veins: None present.
Intramarginal vein: There may be an intramarginal vein, but this is not a confident description.
Intercostal shape: Elongated parallel to midvein, average vein length/spacing ratio 0.6:1.
Average spacing: 13.3mm.

3 veins:
Average angle of origin on admedial side of 2°s: 92°.
Average angle of origin on exmedial side of 2°s: 73°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 75°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.54b

Preservation: Fair. The venation is fairly unclear. The remaining organic material appears pale, thin and patchy. The specimen is incomplete so the overall shape of the leaf cannot be described. The margin appears to be clearly preserved in the basal RHS of the leaf. Only the basal RHS of the leaf is preserved. A little more of the basal part of the specimen may be revealed by removal of sediment cover. The apex is not present and so cannot be described. It is possible that the base of the leaf may be described from the RHS of the leaf. There is no petiole present. The rock surface is very uneven.

Dimensions: Max. length 33.9mm min. Max. width 13.6mm min. These are minimum estimates because this is just a fragment from RHS of leaf. Max. width of RHS only is 10.7mm min. Assuming leaf is symmetrical, max. width is 21.4mm min. Area 285.7sq.mm min. It is not possible to estimate a minimum outline for this leaf fragment. Area of RHS only is 285.7sq.mm min. Assuming leaf is symmetrical, area is 571.4sq.mm min. Max. length along 1° 27.8mm min., but 1° is not clearly preserved. Max. length, 33.9mm, is a better estimate but is still a minimum. 'Leaf area' 483.6sq.mm min.

Organisation: Cannot be determined for this fragmentary specimen.

Symmetry: Specimen is just a fragment from RHS of leaf so lamina symmetry cannot be described.

Form: Point of max. width is 13.7mm from leaf base. Max. length of leaf is 33.9mm min., meaning that point of max. width from leaf base is at 40% of total leaf length. This would make the leaf form ovate. Using estimated max. width, length/width ratio is 1.58:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the ovate subdivision, but this is a fragmentary specimen so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Leaf specimen is incomplete and it was not possible to sketch a minimum outline for leaf, so extent of basal portion is just an estimate. LHS of leaf is missing, so assuming base is symmetrical, basal angle appears to be 103°. Since leaf is incomplete, this is just an estimate. Base appears to be cordate, but since leaf is fragmentary and basal margins are incomplete, this is just an estimate.

Margin: There appears to be projections preserved along margin of RHS of leaf. Measured perpendicular to the midvein, the margin is indented 0.3-0.5mm, average 0.4mm, 4.4% of the distance to the midvein. The projections appear to have quite rounded apices, so the margin is described as crenate. Sinuses between crenations appear to be angular. Spacing of crenations is 2-3.8mm, average 2.9mm, standard deviation 0.7mm, and spacing is described as regular. However, the margin is not very clearly preserved, so this is not a completely confident description.

Petiole: Absent or not preserved.

Venation type: Specimen is too poorly preserved for venation to be confidently described.

1° vein:
Size: Leaf is fragmentary and 1° is not completely preserved in any part of the leaf. Midpoint is estimated to be approximately 17mm from base, but 1° is not preserved at this point, so measurements are made closer to the base, 4.8mm from base. Here 1° vein width is 0.35mm min. and leaf width is 12.9mm, but this is a minimum estimate because LHS of leaf is missing. Assuming leaf is symmetrical, leaf width is 25.8mm. Size of 1° is therefore 1.36% min. and is termed moderate, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Leaf is too fragmentary for 1° vein course to be described.

2° veins:
Thickness appears to be moderate and course appears to be uniformly curved and unbranched, but specimen is too fragmentary to say anything further about the 2° veins. There are no intersecondary veins visible and there is not intramarginal vein.

3 veins:
Average angle of origin on exmedial side of 2°s: 73°.
There are no 3° veins preserved on the admedial side of 2° veins and also therefore no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.56a

Preservation: Not angiospermous? Very good. The venation is clear. The remaining organic material is pale and thin with the venation being dark. The specimen is quite holey. The specimen appears to be almost complete and so the overall shape of the leaf can be described. More of the specimen may be revealed by removal of sediment cover. There are margins preserved along the LHS of the leaf. The apex and base may be described from the LHS of the specimen.

Dimensions: Max. length 35.2mm min. Max. width 13.7mm min. (point of max. width is slightly closer to base on RHS). Leaf is incomplete so these are minimum estimates. Area 268.7sq.mm min. Roughly sketching in a minimum outline for the leaf, area is 317.6sq.mm min. There is no 1°. 'Leaf area' 321.5sq.mm min.

Organisation: Does not appear to be angiospermous.

Symmetry: This specimen is not clearly angiospermous and is too incomplete for the leaf symmetry to be described.

Form: Point of max. width is 15.2mm from leaf base. Max. length of leaf is 35.2mm min., meaning that point of max. width from leaf base is at 43% of total leaf length. This would make the leaf form ovate. Length/width ratio is 2.57:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the narrow ovate subdivision, but this is a fragmentary specimen so this is just an estimate of leaf form.

Apex: Leaf specimen is incomplete so extent of apical portion is estimated using sketched minimum outline. Assuming apex is symmetrical, apical angle appears to be 63°. Apex appears to be acuminate, possibly long acuminate, but apex is incomplete, so these are just estimates.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. LHS is more complete than RHS, so angle is measured for LHS only. Assuming base is symmetrical, basal angle is 72°. Since leaf is incomplete, this is just an estimate. Base is described as acute and decurrent and although leaf is incomplete, this appears to be an accurate description.

Margin: The margin is incomplete, but there is one clear projection on the LHS of the leaf. Measured perpendicular to the midvein, the margin is indented 0.8mm, 10.3% of the distance to the midvein, which is an estimate because there is no clear 1° vein. The projection has a rounded apex, so the margin is described as crenate. Sinus appears to be quite rounded, but this is not clear. Spacing of crenations cannot be measured because only one is preserved.

Petiole: Absent or not preserved.

Venation type: Venation appears to be palinactinodromous. The position appears to be basal and the development is flabellate.

1° vein: No clear midvein.

2° veins: None can be distinguished.

3° veins: None can be distinguished.

D8754.8.56b

Preservation: Fairly poor. The venation is fairly unclear. The remaining organic material appears to be of medium thickness and is rather patchy and uneven. The specimen is just a fragment so the overall shape of the leaf cannot be described. More of the apical part of the specimen may be revealed by removal of sediment cover. There may be a very small percentage of the margins preserved, but it is unclear. The apex and base are not present and so cannot be described.

Dimensions: Max. length 18.1mm min. Max. width 16.4mm min. (point of max. width is closer to base on RHS). These are minimum estimates because this is just a fragment of the leaf. RHS shows slightly greater preservation than LHS and max. width of RHS only is 8.9mm min. Assuming leaf is symmetrical, max. width is 17.8mm min. Area 162.6sq.mm min. Roughly sketching in a minimum outline for RHS of leaf, area of RHS only is 157.7sq.mm min. Assuming leaf is symmetrical, area is 315.4sq.mm, a minimum estimate for the leaf because this is just a fragment. Using this sketched outline gives an estimate of max. length of 19.5mm min. Max. length along 1° 12.9mm min. Using the sketched outline gives an estimate of max. length along 1° of 19.6mm min. 'Leaf area' 232.6sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be described.

Form: Point of max. width is 12.4mm from leaf base. Max. length of leaf is 18.1mm min., meaning that point of max. width from leaf base is at 69% of total leaf length. This would make the leaf form obovate. Using estimated max. width, length/width ratio is 1.02:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form would fit in to the very wide obovate subdivision, but this is an incomplete specimen so this not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 13.1mm from leaf base and max. length is 19.6mm min. Point of max. width from leaf base is therefore at 67% of total leaf length and the leaf form is still described as obovate. Using estimated max. length and width, length/width ratio is 1.10:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form is described as wide obovate, but the specimen is just a fragment so this is not a good estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a very small percentage of the margin is preserved and even this is not clear. There are no clear projections, so it is described as entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be acrodromous but specimen is too fragmentary for venation pattern to be described confidently.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 9.8mm from base. At this point, 1° vein width is 0.28mm. The leaf width is 13.5mm, but this is a minimum estimate because here the margin is not preserved. RHS, which shows greater preservation than LHS, is estimated to be at least 9mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 17.9mm. Size of 1° is therefore estimated to be 1.56% max. and is termed moderate, but the specimen is too fragmentary for the 1° size to be described completely confidently.
Course: Appears to be straight and unbranched, but the specimen is really too fragmentary for the course of the 1° to be described.

2° veins:
Thickness appears to be moderate but specimen is too fragmentary to say anything further about the 2° veins. There are no intersecondary veins visible. It is possible that there is an intramarginal vein, but leaf is too poorly preserved for this to be clear.

3 veins:
Average angle of origin on admedial side of 2°s: 125°.
Average angle of origin on exmedial side of 2°s: 69°.
Combination: AO.

In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 80°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.57a

Preservation: Excellent. The venation is very clear. The remaining organic material appears to be of medium thickness and there are a few holes and a split near the apex. Part of the marginal area near the middle of the RHS has been lost due to bioturbation. The leaf is almost complete so the overall shape of the leaf can be described. Just the very tip of the leaf is missing. Most of the margins are clearly preserved. Since the tip of the leaf is missing the apex cannot be clearly defined. The base is complete and can therefore be described. There is no petiole present.

Dimensions: Max. length 37.3mm min. Max. width 10.6mm (points of max. width are on roughly the same horizontal plane). Tip of leaf is incomplete so estimate of max. length is a minimum. Although margins are incomplete, from curvature of margins present, it appears that max. width is a fairly good estimate. Area 249.8sq.mm min. Roughly sketching in a minimum outline for leaf, area is 264.4sq.mm, a minimum estimate for the leaf because it is incomplete. Max. length along 1° 36.9mm min. It appears that the estimated max. length, 37.3mm, is a better estimate, but is still a minimum. 'Leaf area' 263.6sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Whole lamina appears slightly asymmetrical. Leaf base appears to be roughly symmetrical. LHS of apex is incomplete so its symmetry cannot be described.

Form: Point of max. width is 11.9mm from leaf base. Max. length of leaf is 37.3mm min., meaning that point of max. width from leaf base is at 32% of total leaf length. This leaf form is therefore ovate. Length/width ratio is 3.52:1, but since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio means that the leaf form fits in to the lanceolate subdivision. Although leaf is incomplete, this appears to be an accurate description of leaf form.

Apex: Apical angle 44°. Apex is described as acuminate, possible long acuminate, but since the apex is incomplete, these are just estimates.

Base: Basal angle 58°. Base is described as acute and cuneate.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Venation is acrodromous, with two strongly developed 2° veins running in convergent arches toward the leaf apex. The position is described as suprabasal, with the secondary veins arising an average of 3.9mm from the leaf base (3.8mm on LHS and 4mm on RHS). The development appears to be perfect, with the acrodromous veins appearing to run 69% of the distance to the leaf apex.

1° vein:
Size: Leaf is incomplete but midpoint is 18.7mm min. from base. At this point, 1° vein width is 0.38mm and leaf width is 6.8mm, but this is a minimum estimate because here the RHS margin is not present. LHS only is 3.6mm wide at this point. Assuming leaf is symmetrical, leaf width is 7.3mm. Size of 1° is therefore 5.23% and is termed massive.
Course: Markedly curved.

2° veins:
Number: 12.
Pairs are opposite/alternate.
Angle of divergence: Moderate acute (36-86°, average 54°).
(Average on LHS 61°, average on RHS 48°).
Basal vein angle: Narrow acute (average 40°).
Variation: Lowest pair of 2°s appears to be more acute than those above. Divergence angle asymmetrical.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 77°). Also appear to be enclosed by 3° or 4° arches.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 88°.
Average angle of origin on exmedial side of 2°s: 74°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 70°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.58a

Preservation: Fairly good. The venation is fairly clear in the part of the leaf preserved. The remaining organic material appears to be dark, thick and patchy and is rather holey and split. The specimen is just a fragment of the basal LHS of a leaf so the overall shape of the leaf cannot be described. There are clear margins present in the part of the leaf preserved. The apex is not present and so cannot be described. It is difficult to clearly describe the leaf base because it is incomplete. There is no petiole present.

Dimensions: Max. length 65.9mm min. Max. width 45.4mm min. These are minimum estimates because this is just a fragment from the basal LHS of the leaf. Max. width of LHS only is 45.4mm min. Assuming leaf is symmetrical, max. width is 90.8mm min. Area 1608.7sq.mm min. Roughly sketching in a minimum outline for this part of the LHS, area of basal LHS only is 2462.9sq.mm min. Assuming leaf is symmetrical, area is 4925.8sq.mm, still a minimum estimate because apical part of leaf is missing. Using the sketched outline gives an estimate of max. length of 67.2mm min. 1° is not preserved. 'Leaf area' 4067.8sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This specimen is just a fragment from basal LHS of leaf so symmetry of lamina cannot be described.

Form: Point of max. width is 36.1mm from leaf base. Max. length of leaf is 65.9mm min., meaning that point of max. width from leaf base is at 55% of total leaf length. This would make the leaf form obovate. Using estimated max. width, length/width ratio is 0.73:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the very wide obovate subdivision, but this is just a fragment so this not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 36.1mm from leaf base and max. length is 67.2mm min. Point of max. width from leaf base is therefore at 54% of total leaf length and leaf form is described as elliptic. Using estimated max. length and width, length/width ratio is 0.74:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the oblate subdivision, but the specimen is just a fragment so this is not a good estimate of leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. RHS of leaf is missing, so angle is measured for LHS only. Assuming base is symmetrical, basal angle is 158°. Since leaf is incomplete, this is just an estimate. Base is described as cordate, but since leaf is fragmentary and base is incomplete, this is just an estimate.

Margin: Only a very small percentage of the margin is preserved, but there is a clear indentation on the LHS of the leaf. Measured perpendicular to the midvein, the margin is indented 2.4mm, 5.2% of the distance to the midvein, which is a minimum estimate because the 1° is not clearly preserved. Projections appear to have rounded apices, so the margin is described as crenate. Sinus between crenations appears to be rounded. Spacing between crenations is 27.5mm, but since there are only two crenations preserved, it is not possible to determine whether the spacing is regular or irregular.

Petiole: Base of leaf is incomplete so it cannot be determined whether a petiole is present or not.

Venation type: This specimen is a fragment from the base of a leaf, the midvein is not preserved but there appears to be two prominent branches from the midvein close to the base of the leaf. It is unclear, therefore, whether these branches are 1° or 2° veins. This fragmentary specimen is very close in size and shape to the basal part of D8754.8.100a, and both specimens have a crenate margin. The lowest branch from the midvein in D8754.8.100a is clearly a 1° vein. It is also thinner than the lowest vein branch in D8754.8.58a. For this reason, it is estimated that the lowest branch in D8754.8.58a is a 1° vein. The more apical vein branch appears to be a 2°. This would indicate that the venation was actinodromous, possibly with three veins diverging from a single point, but the leaf is too fragmentary for venation type to be described confidently.

1° vein: Not preserved.

2° veins:
Thickness appears to be moderate and course appears to be uniformly curved and branched, but specimen is too fragmentary to say anything further about the 2° veins. There are no intersecondary veins visible and there is no intramarginal vein.

3 veins:
Average angle of origin on admedial side of 2°s: 93°.
Average angle of origin on exmedial side of 2°s: 66°.
Combination: AR.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.58b

Preservation: Fair. The venation is clear in the part of the leaf preserved. The venation is dark while the rest of the lamina shows very pale and thin to no organic material. The specimen is just a fragment so the shape of the leaf cannot be described. Removal of sediment cover in the apical part of the specimen may reveal more of the leaf. There are no clear margins preserved. The apex and base are not present and so cannot be described.

Dimensions: Max. length 7.7mm min. Max. width 17.8mm min. This is just a fragment of the leaf so these are minimum estimates. RHS is more complete than LHS and max. width of RHS only is 11.6mm min. Assuming leaf is symmetrical, max. width is 23.2mm min. Area 43.6sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 77.2sq.mm min. Assuming leaf is symmetrical, area is 154.4sq.mm, a minimum estimate for the leaf because the apex and base are missing. Using the sketched outline gives an estimate of max. length of 8.4mm min. Max. length along 1° 5mm min. Using the sketched outline gives an estimate of max. length along 1° of 8.4mm min. 'Leaf area' 129.9sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for its symmetry to be described.

Form: Point of max. width is 4.2mm from leaf base. Max. length of leaf is 7.7mm min., meaning that point of max. width from leaf base is at 55% of total leaf length. This would make the leaf form obovate. Using estimated max. width, length/width ratio is 0.33:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the very wide obovate subdivision, but this is just a fragment so this not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 4.2mm from leaf base and max. length is 8.4mm min. Point of max. width from leaf base is therefore at 50% of total leaf length and leaf form is described as elliptic. Using estimated max. length and width, length/width ratio is 0.36:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the oblate subdivision, but the specimen is just a fragment so this is not a good estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, but specimen is too fragmentary for the venation pattern to be described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 4.2mm from base. At this point, 1° vein width is 0.46mm. The leaf width is 14mm, but this is a minimum estimate because here the margin is not preserved. RHS, which shows greater preservation than LHS, is estimated to be at least 11.7mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 23.3mm. Size of 1° is therefore estimated to be 1.97% max. and is termed moderate, but the specimen is too fragmentary for the 1° size to be described completely confidently.
Course: Appears to be straight and unbranched, but the specimen is really too fragmentary for the course of the 1° to be described.

2° veins:
Number: 3 min.
Pairs appear to be opposite.
Angle of divergence: Wide acute (65-78°, average 69°). (Average on LHS 73°, average on RHS 65°).
Basal vein angle: Not present.
Variation: Leaf is too fragmentary for variation in divergence angle along the length of the lamina to be described. Divergence angle is asymmetrical. (However, both sides of leaf are only present in upper part. Looking at these veins alone, the divergence angle appears to be symmetrical.)
Thickness: Moderate.
Course: Leaf is too fragmentary for course of 2°s to be confidently described.
Behaviour of loop-forming branches: None.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 98°.
Average angle of origin on exmedial side of 2°s: 96°.
Combination: RR.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.59a

Preservation: Fair. The venation is fairly unclear. The remaining organic material appears to be dark and thick and rather holed. The specimen is just a fragment of the leaf apex so the overall shape of the leaf cannot be described. The margins appear to be clearly preserved in parts of the specimen. A little more of the margins may be revealed by removal of sediment cover. The apex can be described form this fragment. The base is not present and so cannot be described.

Dimensions: Max. length 11mm min. Max. width 8.9mm min. (point of max. width is slightly closer to base on LHS). This is just a fragment from the tip of the leaf so these are minimum estimates. LHS is more complete than RHS and max. width of LHS only is 5.3mm min. Assuming leaf is symmetrical, max. width is 10.6mm min. Area 51.5sq.mm min. Roughly sketching in a minimum outline for LHS of leaf, area of LHS only is 32.7sq.mm min. Assuming leaf is symmetrical, area is 65.4mm, a minimum estimate for the leaf because this is just a fragment from the leaf apex. Using this sketched outline gives an estimate of max. length of 11.7mm min. Max. length along 1° 11mm min. Using the sketched outline gives an estimate of max. length along 1° of 11.8mm min., slightly longer than estimated max. length because 1° is slightly curved. 'Leaf area' 83.4sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: The only part of this leaf preserved is a small part of the apex, which appears to be asymmetrical. The lamina is therefore classed as asymmetrical, but this is not a clear definition because this is just a small fragment from the leaf. Leaf base is not present so its symmetry cannot be described.

Form: It is not possible to estimate the leaf form of this fragmentary specimen. Using estimated max. length and width, length/width ratio is 1.11:1, but since both max. length and width

are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Leaf specimen is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle appears to be 42° and apex appears to be attenuate, but apex is incomplete, so these are just estimates.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved and the margin is not clear, but there appears to be two projections on each side of the leaf. Measured perpendicular to the midvein, the margin is indented 0.3-0.5mm, average 0.4mm, 16.6% of the distance to the midvein. The projections appear to have quite rounded apices, so the margin is described as crenate. Sinuses between crenations appear to be angular. Spacing of crenations is 2-2.8mm, average 2.4mm, standard deviation 0.4mm, and spacing is described as regular. However, since the margin is not very clearly preserved, this is not a completely confident description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison with vein width in D8754.8.63a, it appears that the most prominent vein in D8754.8.59a is the 1°. The venation may be pinnate simple craspedodromous, but the specimen is really too fragmentary for the venation pattern to be described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 5.9mm from base. At this point, 1° vein width is 0.3mm and leaf width is 5.9mm. Size of 1° is therefore 5.06% and is termed massive, but specimen is too fragmentary for this to be a confident description.
Course: Appears to be markedly curved.

2° veins:
Number: 4 min.
Pairs appear to be alternate.
Angle of divergence: Wide acute (26-76°, average 69°). (Average on LHS 76°, average on RHS 62°).
Basal vein angle: Not present.
Variation: Leaf is too fragmentary for variation in divergence angle along the length of the lamina to be described confidently. Upper 2° may be more acute, but this is not clear. It appears that divergence angle is more acute on LHS than RHS.
Thickness: Moderate.
Course: Leaf is too fragmentary for course of 2°s to be confidently described. 2°s appear to be uniformly curved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 119°.
Average angle of origin on exmedial side of 2°s: 71°.
Combination: AO.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 76°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.59c

Preservation: Fair. The venation is clear in the part of the leaf preserved. The remaining organic material appears to be fairly even and of medium thickness. Along the RHS of the specimen there may be some reaction tissue reflecting insect damage. The specimen is just a fragment so the overall shape of the leaf cannot be described. Removal of sediment cover in the base of the specimen may reveal a little more of the leaf. There are no clear margins preserved. Neither the apex nor base of the leaf is preserved so these cannot be described.

Dimensions: Max. length 31.7mm min. Max. width 16mm min. This is just a fragmentary specimen so these are minimum estimates. LHS shows slightly greater preservation than RHS and max. width of LHS only is 8.3mm min. Assuming leaf is symmetrical, max. width is 16.6mm min. Area 169.6sq.mm min. Roughly sketching in a minimum outline for RHS of leaf, area of RHS only is 250.4sq.mm min. Assuming leaf is symmetrical, area is 500.8sq.mm, a minimum estimate for the leaf because this is a fragmentary specimen. Using this sketched outline gives an estimate of max. length of 33.3mm min. Max. length along 1° 25.6mm min. Using the sketched outline gives an estimate of max. length along 1° of 33.3mm min. 'Leaf area' 368.5sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for leaf symmetry to be described.

Form: It is not possible to estimate the leaf form of this fragmentary specimen. Using estimated max. length and width, length/width ratio is 2.01:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is not clearly preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate but the specimen is too fragmentary for the venation pattern to be described confidently.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 16.7mm from base. At this point, 1° vein width is 0.95mm. The leaf width is 9.2mm, but this is a minimum estimate because here the margin is not preserved. RHS, which shows greater preservation than LHS, is estimated to be at least 8.8mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 17.7mm. Size of 1° is therefore estimated to be 5.38% max. and is termed massive, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched.

2° veins:
Number: 3 min.
Veins can only be clearly observed on RHS of leaf, so no pairs can be studied.
Angle of divergence: Moderate acute (44-61°, average 54°).
Basal vein angle: Not preserved.
Variation: It appears that upper 2°s may be more acute than those above, but leaf is too incomplete for this to be certain. Since veins can only be measured on RHS of leaf, divergence angle symmetry cannot be assessed.
Thickness: Moderate.
Course: Appear to be curved, but it is not really possible to describe 2° vein course for this fragmentary specimen.
Behaviour of loop-forming branches: None present.
Intersecondary veins: It appears that there may be intersecondaries present, but this is not clear.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 87°.
Average angle of origin on exmedial side of 2°s: 61°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 63°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.60a

Preservation: Good. The venation is very clear. The remaining organic material appears to be fairly even and of medium thickness. This specimen is just a fragment from the basal LHS of the leaf so the overall shape of the leaf cannot be described. There may be some reaction tissue along the apical edge of the specimen possibly reflecting insect damage. The margins are clearly preserved along the basal LHS of the leaf. The apex is not present and so cannot be described. The base can be described from the LHS of the specimen. There is no petiole present.

Dimensions: Max. length 53mm min. Max. width 28.1mm min. This is just a fragment from the basal LHS of a leaf so these are

minimum estimates. Max. width of LHS only is 23mm. Assuming leaf is symmetrical, max. width is 46mm. Although margins are incomplete, from curvature of margins present, it appears that this estimate of max. width is fairly good. Area 753.2sq.mm min. Roughly sketching in a minimum outline for LHS of leaf, area of LHS only is 946.5sq.mm min. Assuming leaf is symmetrical, area is 1893sq.mm, a minimum estimate for the leaf because the apical part of the leaf is missing. Using this sketched outline gives an estimate of max. length of 53.3mm min. Max. length along 1° 45.5mm min. Estimated max. length, 53.3mm, is better but is still a minimum. 'Leaf area' 1634.5sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is just a fragment from LHS of leaf so it is not possible to described lamina symmetry.

Form: Point of max. width is 41.5mm from leaf base. Max. length of leaf is 53mm min., meaning that point of max. width from leaf base is at 78% of total leaf length. This would make the leaf form obovate. Using estimated max. width, length/width ratio is 1.15:1, but since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form would be described as wide obovate, but this is an incomplete specimen so this not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 41.5mm from leaf base and max. length is 53.3mm min. Point of max. width from leaf base is therefore still at 78% of total leaf length and the leaf form is still described as obovate. Using estimated max. length and width, length/width ratio is 1.16:1, which is again a minimum estimate. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form is described as wide obovate, but the specimen is incomplete so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. RHS of leaf is missing, so angle is measured for LHS only. Assuming base is symmetrical, basal angle is 100°. Since leaf is incomplete, this is just an estimate. Base is described as obtuse and cuneate and although leaf is incomplete, this appears to be an accurate description.

Margin: There are clearly preserved projections along LHS margin of leaf. Measured perpendicular to the midvein, the margin is indented 0.4-1mm, average 0.7mm, 3.2% of the distance to the midvein. Most of the projections appear to have pointed apices, so margin is toothed. There is only one size class of tooth, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is obtuse (range 76-127°, average 94°). Dominant serration type is convex on basal side and concave on apical side. Sinuses appear to be rounded. Spacing of serrations is 5.9-7.6mm, average 6.7mm, standard deviation 0.7mm, and spacing is described as regular.

Petiole: Absent or not preserved.

Venation type: Only the LHS of the leaf is preserved but the venation can be described as acrodromous, with a strongly developed 2° vein running in a convergent arch toward the leaf apex. The position is basal and the development appears to be perfect, with the acrodromous vein running the full length of the specimen. However, since the apical part of the leaf is missing the development cannot be defined confidently.

1° vein:
Size: Leaf is incomplete, but midpoint is estimated to be approximately 26.7mm min. from base. 1° vein is not preserved at this point, so measurements are made slightly closer to the apex, 30.9mm from base. Here 1° vein width is 0.98mm and leaf width is 24.5mm, but this is a minimum estimate because RHS of leaf is incomplete. Here, width of LHS only is 21.8mm. Assuming leaf is symmetrical, leaf width is 43.5mm. Size of 1° is therefore 2.25% and is termed stout.
Course: Straight and unbranched.

2° veins:
Number: 1 min.
There is just one prominent 2° preserved on LHS, no pairs can be observed.
Angle of divergence: There is only one 2° vein diverging from base of leaf.
Basal vein angle: Narrow acute (40°).
Variation: Since there is only one 2° vein preserved, the variation in divergence angle along the length of the leaf and divergence angle symmetry cannot be assessed.
Thickness: Thick.
Course: Appears to be uniformly curved and unbranched.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 85°.
Average angle of origin on exmedial side of 2°s: 73°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 77°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.
Tertiary venation pattern is percurrent. Percurrent tertiaries are forked and recurved and their relationship to the midvein is approximately right-angled. Their arrangement is predominantly alternate and they are closely spaces with approximately 5 veins/cm. On the exmedial side of the acrodromous vein the tertiary veins form loops.

Higher vein orders:
Higher vein orders are distinct. Quaternary and quinternary veins are orthogonal. Marginal ultimate venation is looped. Quaternary areolation appears imperfect, randomly arranged, irregularly shaped and large to very large (1.5-2.5mm).

Tooth architecture:
There is no evidence of darker material, which may have indicated glands, in the tooth apices, which appear simple. Principal vein of the tooth is a tertiary with a central deflected course. Accessory veins are incomplete or looped.

D8754.8.60b

Preservation: Poor. The venation is unclear. The remaining organic material has a thin, uneven and patchy appearance. The specimen is just a fragment so the overall shape of the leaf cannot be described. Removal of sediment cover from along the apical and RHS of the specimen may reveal more of the leaf. A small portion of the margin may be preserved along the LHS of the specimen. Neither the apex nor base are present and so cannot be described.

Dimensions: Max. length 15.3mm min. Max. width 11.1mm min. These are minimum estimates because this is just a fragment of the leaf. It is not clear whether the most prominent vein is the 1°, it appears that it probably is not, and so it is not possible to determine which part of the leaf this fragment is from. Area 126.6sq.mm min. It is not possible to estimate a minimum outline for this fragmentary specimen. Max. length along most prominent vein is 13.8mm min., but this is probably not the 1°. Max. length, 15.3mm, is a better estimate but is still a minimum. 'Leaf area' 113.2sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for leaf symmetry to be described.

Form: It is not possible to estimate the leaf form of this fragmentary specimen. Length/width ratio is 1.38:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a very small percentage of the margin is preserved and this is not clear, but there appears to be one projection on LHS of leaf. Measured perpendicular to the midvein, the margin is indented 0.6mm, 14.6% of the distance to the midvein, which is just an estimate because the most prominent vein preserved is probably not the midvein of the leaf. The projection appears to be quite pointed, so the margin is described as toothed. Tooth series is described as simple, but since there is only one tooth preserved, this is just an estimate. Tooth is serrate. Apical angle of serration is obtuse (91°), which is just an estimate because tooth is not completely preserved. Serration type is acuminate on

basal side and straight on apical side. Sinus appears to be quite rounded. Spacing of serrations cannot be estimated because there is only one preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison with D8754.8.60a, it appears that the highest order vein preserved is the second. This specimen is therefore too fragmentary for venation type to be assessed.

1° vein: Not preserved.

2° veins:
Leaf is too fragmentary for 2° veins to be described.

3 veins:
Average angle of origin on admedial side of 2°s: 80°.
Average angle of origin on exmedial side of 2°s: 74°.
Combination: AA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.61a

Preservation: Fairly good. The venation is fairly clear. The venation is quite dark and the remaining organic material on the rest of the lamina appears to be pale, thin and uneven. The specimen is incomplete so the overall shape of the leaf cannot be described. A small portion of the margin may be present on the LHS of the specimen. The apex is not present and so cannot be described. The base is incomplete but it may be possible to describe the general shape of the leaf base, which is more complete on the LHS. There is no petiole present.

Dimensions: Max. length 41.7mm min. Max. width 35.4mm min. This leaf is incomplete so these are minimum estimates. LHS is more complete than RHS and max. width of LHS only is 25.5mm min. Assuming leaf is symmetrical, max. width is 51mm min. Area 758.5sq.mm min. Roughly sketching in a minimum outline for LHS of leaf, area of LHS only is 654.7sq.mm min. Assuming leaf is symmetrical, area is 1309.4sq.mm, a minimum estimate for the leaf. Using the sketched outline gives an estimate of max. length of 42.4mm min. Max. length along 1° 40mm min. Using the sketched outline gives an estimate of max. length along 1° of 42.4mm min. 'Leaf area' 1441.6sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is too incomplete for leaf symmetry to be described.

Form: Point of max. width is 22.2mm from leaf base. Max. length of leaf is 41.7mm min., meaning that point of max. width from leaf base is at 53% of total leaf length. This would make the leaf form elliptic. Using estimated max. width, length/width ratio is 0.82:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form would be described as oblate, but this is an incomplete specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 22.2mm from leaf base and max. length is 42.4mm min. Point of max. width from leaf base is therefore at 52% of total leaf length and the leaf form is still described as elliptic. Using estimated max. length and width, length/width ratio is 0.83:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form is described as oblate, but the specimen is incomplete so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. LHS is more complete than RHS, so angle is measured for LHS only. Assuming base is symmetrical, basal angle is 140°. Since leaf is fragmentary and base is incomplete, this is just an estimate. Base may be cordate, but the basal margins are unclear, especially at point of insertion of petiole, so this is just an estimate.

Margin: The margin is not clearly preserved. It appears to be entire, but it is also possible that the complete leaf had a lobed margin.

Petiole: Base of leaf is incomplete so it cannot be determined whether a petiole is present or not.

Venation type: Venation is actinodromous, with four 1° veins diverging from a single point. The specimen is fragmentary, so assuming that the leaf is roughly symmetrical, there were five 1° veins diverging from this point. Although the base of the leaf is incomplete, it appears that the position is basal. The development of the actinodromous venation appears to be perfect, but the leaf is really too fragmentary for the development to be assessed. Lateral primary veins diverge from base at 82° and 49° (LHS) and 41° (RHS) to midvein.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 21.2mm min. from base. At this point, 1° vein width is 0.87mm. The leaf width is 29.1mm, but this is a minimum estimate because here the margin is not preserved. LHS, which shows greater preservation than RHS, is estimated to be at least 25.4mm wide at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 50.7mm. Size of 1° is therefore estimated to be 1.72% max. and is termed moderate, but the specimen is too fragmentary for the 1° size to be described completely confidently.
Course: Appears to be markedly curved.

2° veins:
Number: 2 min.
Pairs appear to be subopposite.
Angle of divergence: Wide acute (65°).
Basal vein angle: Wide acute (65°).
Variation: Since there is only pair of 2° veins preserved, the variation in divergence angle along the length of the leaf cannot be assessed. Divergence angle appears to be symmetrical.
Thickness: Moderate.
Course: Curved. Appear to be uniformly curved and unbranched, but specimen is too incomplete for this to be a confident description.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 88°.
Average angle of origin on exmedial side of 2°s: 111°.
Combination: OR.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.62a&64a

Part and counterpart.

Preservation: Fairly good (62a). Good (64a). Preservation is slightly better in 62a than 64a. The venation is clear in the part of the leaf preserved in 62a and the venation is fairly clear in 64a. In part and counterpart the remaining organic material is rather uneven and patchy and appears to be of medium thickness, but on the LHS of 62a it is of dark and of fairly thick appearance. There is very little organic material remaining along the veins of 64a, while in 62a the veins appear rather dark and thick. Specimen 62a has been glued together along a break in the rock with wood glue. The specimen is incomplete so the overall shape of the leaf cannot be described. The margins are fairly clear along the RHS of 62a. In 64a, the margins are preserved in the basal parts of the specimen, which is not the case in 62a. The apex is not present and so cannot be described. Although the base is not present in 62a, it is present in 64a and can be described. Different parts of the leaf are preserved in the part and counterpart, with the apical part of one side more complete in 64a and the other side much more complete in 62a. There is no petiole present. Some of 62a, particularly on the RHS, has been obscured by 2° crystallisation and if this is calcite, application of HCl may reveal more of the specimen. The surface of 64a is rather uneven.

Dimensions: Part and counterpart preserved different parts of the leaf, so estimates of dimensions are made by putting 62a and 64a together. Max. length of 62a is 33.5mm min. Max. length of 64a is

33.5mm. Using information from 62a and 64a, max. length is 34.7mm min. Max. width of 62a is 32.7mm min. Max. width of 64a is 25.4mm min. Putting 62a and 64a together max. width is 39.3mm min. (point of max. width is slightly closer to base on one side). The leaf is a fragmentary specimen so these are minimum estimates. Area of 62a is 594.1sq.mm min. Area of 64a is 505.8sq.mm min. Area of 62a and 64a together is 788.5sq.mm min. Roughly sketching in a minimum outline for the leaf using both part and counterpart, 62a and 64a, area is 926.3sq.mm, a minimum estimate for the leaf. Using this sketched outline gives an estimate of max. length of 36mm min. Max. length along 1° in 62a is 23.9mm min. Max. length along 1° in 64a is 24.5mm min. Using information from 62a and 64a, max. length along 1° is 28mm min. Using the sketched outline gives an estimate of max. length along 1° of 37.1mm min., slightly longer than estimated max. length because 1° is curved. For 62a and 64a together, 'leaf area' is 972sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Although leaf is incomplete, lamina appears to be asymmetrical. Leaf base appears asymmetrical. Apex is not present so its symmetry cannot be described.

Form: Point of max. width is 28.9mm from leaf base. Max. length of leaf is 34.7mm min., meaning that point of max. width from leaf base is at 83% of total leaf length. This would make the leaf form obovate. Length/width ratio is 0.88:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This means that the leaf form would be described as very wide obovate, but this is a fragmentary specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 28.9mm from leaf base and max. length is 37.1mm min. Point of max. width from leaf base is therefore at 78% of total leaf length and the leaf form is still described as obovate. Using estimated max. length, length/width ratio is 0.94:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This means that the leaf form fits in to the very wide obovate subdivision, but the specimen is incomplete so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 99°, but since leaf is incomplete, this is just an estimate. Base is described as obtuse and normal and although leaf is incomplete, this appears to be an accurate description.

Margin: There is a clear projection on one side of the leaf. Measured perpendicular to the midvein, the margin is indented 7.2mm, 36% of the distance to the midvein. Margin is therefore lobed. Sinus between lobes appears to be angular. The leaf appears to be palmately lobed. There appears to be three lobes, but two of these are not completely preserved. Since only one of the lobes is complete, the spacing between lobes cannot be estimated.

Petiole: Absent or not preserved.

Venation type: The leaf is incomplete but the venation appears to be palinactinodromous. The position is basal or possibly suprabasal, palinactinodromous veins arising approximately 2.8mm above the base of the leaf. The development appears to be marginal perfect, but the leaf is too fragmentary for the venation pattern to be described confidently. It appears that the primary vein terminates at the apex of the lobe.
Three to five primary veins diverging at 15-46° to the midvein, possibly slightly decurrent.

Or the venation may possibly be actinodromous. In that case the position appears to be suprabasal, arising an average of 4.1mm from the leaf base (2.7mm on LHS and 5.4mm on RHS). The development appears to be marginal, perfect, but since the leaf is fragmentary this is not clear.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 18mm min. from base. At this point, 1° vein width is 0.63mm (average for part and counterpart) and leaf width is 34.1mm, but this is a minimum estimate because here the margin is not clear on the LHS. Size of 1° is therefore 1.85% max. and is termed moderate.
Course: Markedly curved.

2° veins:
2° veins are very difficult to distinguish.
Number: 1 min.
There is just one unclear 2° preserved, no pairs can be observed.
Angle of divergence: Wide acute (69°).
Basal vein angle: Wide acute (69°).
Variation: Since there is only one 2° vein preserved, the variation in divergence angle along the length of the leaf and divergence angle symmetry cannot be assessed.
Thickness: Appears to be fine.
Course: Appears to be curved and unbranched, but this is not certain.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 58°.
Average angle of origin on exmedial side of 2°s: 49°.
Combination: AA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.63a

Preservation: Very good. The venation is fairly clear. The remaining organic material is very uneven, appearing quite dark and thick in the apex and base of the specimen and rather pale and thin across the middle of the leaf. It is rather patchy. The specimen is almost complete so it is possible to attempt to describe the overall shape of the leaf. The margins are fairly clear in the apical part of the specimen. The apex is fairly complete, so it is possible to describe the shape of the apex, particularly from the LHS, which is more complete. There is a gap in the lamina near the apex of the leaf on the RHS. The basal margins are unclear and may be incomplete but it may be possible to describe the overall shape of the base quite confidently. There is no petiole present.

Dimensions: Max. length 51.7mm. Max. width 26.3mm min. (point of max. width is slightly closer to base on LHS). Max. length appears to be an accurate estimate for the leaf. Basal margins are incomplete so estimate of max. width is a minimum. Leaf is not symmetrical so it is not possible to make estimates on the actual max. width of the leaf. Area 744.2sq.mm min. Roughly sketching in a minimum outline for the leaf, area is 802.3sq.mm min. Max. length along 1° 52mm, slightly longer than max. length because 1° is slightly curved. Leaf is almost complete so this is an accurate estimate for the leaf. 'Leaf area' 911.7sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Whole lamina appears to be asymmetrical. Although basal margins are incomplete, base appears to be asymmetrical. Apex of leaf appears to be slightly asymmetrical, but since part of RHS of apex is missing, this is not certain.

Form: Point of max. width is 18.8mm from leaf base. Max. length of leaf is 52mm, meaning that point of max. width from leaf base is at 36% of total leaf length. The leaf form is therefore ovate. Length/width ratio is 1.98:1, but since max. length appears to be a fairly good estimate and max. width is a minimum, this is a maximum estimate for length/width ratio. This ratio means that the leaf form fits in to the ovate subdivision. Although leaf is incomplete, this appears to be an accurate description of leaf form.

Apex: Apical angle 45°. Apex is described as acuminate, possibly long acuminate. Although parts of the apex are incomplete, this appears to be an accurate description.

Base: Leaf base is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 88°, but since leaf is incomplete, this is just an estimate. Base is described as acute and normal, but leaf base is incomplete, so this is just an estimate.

Margin: There are projections clearly preserved along the margins of both sides of the leaf. Measured perpendicular to the midvein, the margin is indented 0.2-0.9mm, average 0.4mm, 13.5% of the distance to the midvein. The margin is not completely preserved, but the projections appear to be irregularly shaped and the margin is described as erose. The majority of the projections appear to have quite pointed apices and these are serrate. Apical angle of serrations is obtuse (range 41-148°, average 93°). Dominant

serration type is convex on basal side and straight on apical side. Most sinuses appear to be angular. Spacing is 0.8-2.7mm, average 1.7mm, standard deviation 0.5mm, and spacing is described as irregular.

Petiole: Absent or not preserved.

Venation type: Venation is pinnate and appears to be camptodromous eucamptodromous, but the preservation of the leaf means that this is not a completely confident description.

1° vein:
Size: Midpoint is 25.9mm from leaf base. At this point, 1° vein width is 0.77mm and leaf width is 21.2mm. Size of 1° is therefore 3.63% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 13.
Pairs are opposite/alternate.
Angle of divergence: Moderate acute (23-68°, average 46°). (Average on LHS 43°, average on RHS 50°).
Basal vein angle: Narrow acute (average 23°).
Variation: Lowest pair of 2°s appears to be more acute than those above. Divergence angle appears to be more acute on LHS than RHS.
Thickness: Moderate.
Course: Uniformly curved and appear to be branched. It also appears that some are recurved near margin.
Behaviour of loop-forming branches: No clear loops formed.
Intersecondary veins: Appears to be simple intersecondary veins present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 82°.
Average angle of origin on exmedial side of 2°s: 83°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 81°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.66b

Preservation: Fairly poor. The venation is fairly unclear. The remaining organic material is rather patchy and uneven and appears to be rather pale and thin. The specimen is incomplete so the overall shape of the leaf cannot be described. It appears that there is a very small percentage of the margin present. The apex and base are not present and so cannot be described.

Dimensions: Max. length 42.4mm min. Max. width 24.3mm (point of max. width is slightly closer to base on LHS). Specimen is fragmentary so estimate of max. length is a minimum. Although leaf is incomplete, from curvature of margins present, estimated max. width appears fairly accurate. Area 521.6sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 411.2sq.mm min. Assuming leaf is symmetrical, area is 822.4sq.mm, a minimum estimate for the leaf because the specimen is just a fragment. Using this sketched outline gives an estimate of max. length of 46.4mm min. Max. length along 1° 26.4mm min. Using the sketched outline gives an estimate of max. length along 1° of 46.4mm min. 'Leaf area' 751.7sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for leaf symmetry to be described.

Form: Point of max. width is 24mm from leaf base. Max. length of leaf is 42.4mm min., meaning that point of max. width from leaf base is at 57% of total leaf length. This would make the leaf form obovate. Length/width ratio is 1.74:1, but since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio means that the leaf form would fit in to the wide obovate subdivision, but this is a fragmentary specimen so this not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 26mm from leaf base and max. length is 46.4mm min. Point of max. width from leaf base is therefore at 56% of total leaf length and the leaf form is still described as obovate. Using estimated max. length, length/width ratio is 1.91:1, which is again a minimum estimate. This means that the leaf form would be described as wide obovate, but the specimen is fragmentary so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: It appears that the venation may be acrodromous, but the leaf is really too fragmentary for the venation pattern to be described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 23.2mm from base. At this point, 1° vein width is 1.31mm and leaf width is 22.7mm, but this is a minimum estimate because the margin is not clear. Assuming the leaf is symmetrical, the leaf width at this point is estimated to be 24.1mm, but this is still a minimum because the margin is not clear. Size of 1° is therefore 5.44% max. and is termed massive, but this specimen is too fragmentary to confidently describe 1° size.
Course: Appears to be straight and unbranched, but this is not very clear.

2° veins:
Leaf is too poorly preserved for 2° veins to be described.

3 veins: Specimen is too poorly preserved for 3° vein angles to be measured.

D8754.8.67a

Preservation: Fair. The venation is very clear. The venation is dark against a lamina of pale and thin organic material. The specimen is incomplete so the overall shape of the leaf cannot be described. Attempts to remove some of the sediment cover near the base of the specimen have revealed a little more of the leaf. This part of the leaf needs to be redrawn but it is only a very small part of the leaf. There is also sediment cover in the apical parts of the specimen. There are no clear margins preserved. The apex and base are not present and cannot be described.

Dimensions: Max. length 38.7mm min. Max. width 13.6mm min. This is just a fragment from the RHS of the leaf so these are minimum estimates. Max. width of RHS only is 13.1mm min. Assuming leaf is symmetrical, max. width is 26.2mm min. Area 303.2sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 395.8sq.mm min. Assuming leaf is symmetrical, area is 791.6sq.mm, a minimum estimate for the leaf because the specimen is fragmentary. Using this sketched outline gives an estimated max. length of 42mm min. Max. length along 1° 23.5mm min. Using the sketched outline gives an estimate of max. length along 1° of 42.1mm min., slightly longer than estimated max. length because 1° is very slightly curved. 'Leaf area' 735.3sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is just a fragment from the RHS of the leaf so it is not possible to describe the lamina symmetry.

Form: Point of max. width is 28mm from leaf base. Max. length of leaf is 38.7mm min., meaning that point of max. width from leaf base is at 72% of total leaf length. This would make the leaf form obovate. Using estimated max. width, length/width ratio is 1.48:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the wide obovate subdivision, but this is a fragmentary specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 29.9mm from leaf base and max. length is 42.1mm min. Point of max. width from leaf base is therefore at 71% of total leaf length and the leaf form is still described as obovate. Using estimated max. length and width, length/width ratio is 1.61:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form is

described as wide obovate, but the specimen is fragmentary so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is not clearly preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate camptodromous brochidodromous but the specimen is too fragmentary for the venation to be described confidently.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 21mm from base. At this point, 1° vein width is 0.33mm and leaf width is 10.4mm, but this is a minimum estimate because LHS is missing. Width of RHS only is estimated to be at least 10.7mm at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 21.3mm. Size of 1° is therefore estimated to be 1.55% max. and is termed moderate, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be markedly curved.

2° veins:
Number: 4 min.
Only RHS of leaf is preserved so pairs cannot be studied.
Angle of divergence: Moderate acute (52-67°, average 58°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly but specimen is too fragmentary for this to be a confident description. Since only RHS of leaf is preserved it is not possible to assess divergence angle symmetry.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at a right-angle (average 90°). Also appear to be enclosed by 2°, 3°, or 4° arches.
Intersecondary veins: There may be composite 2°s present, but this is not certain.
Intramarginal vein: None preserved.

3 veins:
Average angle of origin on admedial side of 2°s: 91°.
Average angle of origin on exmedial side of 2°s: 70°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 76°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.67b

Preservation: Good. The venation is clear in the part of the leaf preserved. The remaining organic material appears to be dark, thick, patchy and holey. The specimen is incomplete so it is not possible to describe the overall shape of the leaf with confidence, although it may be possible to get an idea of the leaf shape from the LHS of the leaf. The margins are very clear along the basal LHS of the leaf. The apex is not present so cannot be described. The base is nearly complete so can be described; only the very basal tip is missing from the LHS of the specimen. There is no petiole present.

Dimensions: Max. length 15.9mm min. Max. width 9.7mm min. Specimen is incomplete so these are minimum estimates. LHS is more complete than RHS and max. width of LHS only is 8.2mm. Assuming leaf is symmetrical, max. width is 12.4mm. From curvature of margins present this appears to be a fairly good estimate of max. width. Area 107.5sq.mm min. Roughly sketching in a minimum outline for LHS, area of LHS only is 77.1sq.mm min. Assuming leaf is symmetrical, area is 154.2sq.mm, a minimum estimate for the leaf because the specimen is incomplete. Max. length along 1° 12.8mm min. Max. length, 15.9mm, is a better estimate but is still a minimum. 'Leaf area' 131.4sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Margins are not preserved in RHS of leaf so lamina symmetry cannot be described.

Form: The point of max. width is 5.6mm from the leaf base and the max. length of the leaf is 15.9mm min. This means that the point of max. width from the leaf base is at 35% of the total leaf length, making the leaf form ovate. Since leaf apex is incomplete this percentage is a maximum, so although leaf is incomplete this is an accurate description of leaf form. Using the estimated max. width, length/width ratio is 1.28:1. Since max. width appears to be a fairly good estimate and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio means that the leaf form fits in to the wide ovate subdivision, but because this is an incomplete specimen, the possibility that the leaf form fits in to the ovate subdivision cannot be ruled out.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. LHS is more complete than RHS, so angle is measured for LHS only. Assuming base is symmetrical, basal angle is 111°. Since leaf is incomplete, this is just an estimate. Base appears to be obtuse and normal. It is fairly clear that the base is obtuse, but basal margins are incomplete, especially at point of insertion of petiole, so it is not certain that the leaf base can be described as normal.

Margin: There is one clear projection on LHS margin of leaf. Measured perpendicular to the midvein, the margin is indented 2.3mm, 42.6% of the distance to the midvein. Margin is therefore lobed. Sinus between lobes is rounded. The leaf appears to be possibly palmately lobed, but this is not clear. Since only one of the lobes is preserved, spacing between lobes cannot be estimated.

Petiole: Absent or not preserved.

Venation type: Venation is described as acrodromous, with two strongly developed 2° veins running in convergent arches toward the leaf apex. The position is basal and the development appears to be perfect, but the specimen is too fragmentary for the development of the acrodromous veins to be described confidently.

It is also possible that the venation is actinodromous, with three 1° veins diverging radially from a single point, but it is not completely clear. If this is the case then the position is basal and the development appears to be marginal perfect, but the specimen is too fragmentary for the development to be described confidently. Primary veins diverge from base at angles of 33° (LHS) and 29° (RHS) to the midvein.

1° vein:
Size: Leaf is incomplete but midpoint is 8mm min. from base. At this point, 1° vein width is 0.25mm and leaf width is 9mm, but this is a minimum estimate because here the RHS margin is not present. LHS only is 5.8mm wide at this point. Assuming leaf is symmetrical, leaf width is 11.6mm. Size of 1° is therefore 2.15% and is termed stout.
Course: Straight and unbranched.

2° veins:
There are just two prominent veins which diverge from the base at an acute angle (average 20°). It is possible that these are 2°s and that the venation is acrodromous, but it is not clear. If these are 2°s then they are opposite. Angle on LHS is 19° and on RHS is 21°. Since there is only one pair, there is no variation in divergence angle along the length of the lamina to be described, but the divergence angle is symmetrical. If these veins are 2°, then they are thick. Their course is uniformly curved and unbranched. There are no loop forming branches. There are no intersecondaries and there is no intramarginal vein.

3 veins:
Average angle of origin on admedial side of 2°s: 79°.
Average angle of origin on exmedial side of 2°s: 79°.
Combination: AA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 70°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.68a

Preservation: Good. The venation is clear in the part of the leaf preserved. The remaining organic material appears to be very uneven and patchy. The 1° appears very dark while the rest of the specimen appears to be of thin to medium thickness. The specimen is just a fragment from the base of the leaf so the overall shape of the leaf cannot be described. Removal of sediment cover on the RHS of the specimen and at the base may reveal more of the leaf. The margins are clear in the part of the leaf preserved. The apex is not present and so cannot be described. The base is nearly complete and can be described, only the very basal tip is missing. There is no petiole present.

Dimensions: Max. length 21.7mm min. Max. width 15.3mm min. Specimen is just a fragment from base of leaf so these are minimum estimates. RHS is more complete than LHS and max. width of RHS only is 7.7mm min. Assuming leaf is symmetrical, max. width is 15.4mm min. Area 167.7sq.mm min. Roughly sketching in a minimum outline for RHS of leaf, area of RHS only is 112.2sq.mm min. Assuming leaf is symmetrical, area is 224.4sq.mm, a minimum estimate for the leaf because the apical part is missing. Using this sketched outline gives an estimate of max. length of 23.7mm min. Max. length along 1° 20.6mm min. Using the sketched outline gives an estimate of max. length along 1° of 23.8mm min., slightly longer than estimated max. length because 1° is slightly curved. 'Leaf area' 244.3sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Parts of leaf preserved appear to be roughly symmetrical, but apical portion of leaf is missing and base is incomplete, so this is not a confident description for the whole lamina. Leaf base appears roughly symmetrical, but since base is incomplete this is not certain.

Form: It is not possible to estimate the leaf form of this fragmentary specimen. Using estimated max. length and width, length/width ratio is 1.55:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 51°, but since leaf is fragmentary, this is just an estimate. Base is described as acute and decurrent and although leaf is incomplete, this appears to be an accurate description.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is incomplete so it cannot be determined whether a petiole is present or not.

Venation type: Venation is pinnate and appears to be camptodromous eucamptodromous but the specimen is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 11.9mm min. from base. At this point, 1° vein width is 0.68mm and leaf width is 11mm. Size of 1° is therefore 6.2% and is termed massive, but specimen is too fragmentary for this to be a completely confident definition.
Course: Appears to be straight and unbranched.

2° veins:
Number: 7 min.
Pairs appear to be alternate.
Angle of divergence: Moderate acute (28-82°, average 53°).
Basal vein angle: Narrow acute (28°).
Variation: Lowest pair of 2°s appears to be more acute than those above. It appears that divergence angle is more acute on RHS than LHS.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: There appears to be composite 2°s present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 83°.
Average angle of origin on exmedial side of 2°s: 82°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 89°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.68b

Preservation: Fairly good. The venation is very clear. The remaining organic material appears to be of medium thickness and is very patchy, holey, uneven and split. The specimen is just a fragment so the overall shape of the leaf cannot be described. There may be a very small percentage of the margins present. The apex and base are not present and cannot be described.

Dimensions: Max. length 23mm min. Max. width 19.6mm min. This is just a scrappy fragment so these are minimum estimates. It appears that this is a fragment from the RHS of the leaf. Max. width of RHS only is 19.6mm min. Assuming leaf is symmetrical, max. width is 39.2mm min. Area 251.6sq.mm min. It is not possible to sketch in a minimum outline for this scrappy fragment, but assuming leaf is symmetrical, area is at least 503.2sq.mm min. 1° is not preserved. 'Leaf area' 601.1sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is just a fragment from RHS of leaf so it is not possible to describe lamina symmetry.

Form: It is not possible to estimate the leaf form of this fragmentary specimen. Using estimated max. width, length/width ratio is 0.59:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a very small percentage of margin is preserved, but there may be tiny projections along this part of the margin. Measured perpendicular to the midvein, the margin is indented 0.2-0.5mm, average 0.4mm, at least 2.2% of the distance to the midvein, which is a minimum estimate because 1° is not preserved. The projections appear to have quite rounded apices, so the margin is tentatively described as crenate. Sinuses between crenations appear to be rounded. Spacing of crenations is 0.7-1.3mm, average 1mm, standard deviation 0.3mm, and spacing is described as regular. However, the margin is not very clearly preserved, so this is not a confident description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Specimen is too fragmentary for venation pattern to be described.

1° vein: Not preserved.

2° veins:
Thickness appears to be moderate and course appears to be abruptly curved and branched, but specimen is too fragmentary to say anything further about the 2° veins.

3 veins:
Average angle of origin on admedial side of 2°s: 71°.
Average angle of origin on exmedial side of 2°s: 93°.
Combination: RA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.71b

Preservation: Fair. The venation is clear in the part of the leaf preserved. The venation is dark while the remainder of the lamina appears to be very pale and thin to no organic material. The specimen is just a very small fragment, so the overall shape of the

leaf cannot be described. There are no clear margins present. The apex and base are not present and cannot be described.

Dimensions: Max. length 6.8mm min. Max. width 4.9mm min. This is just a very small fragment of the leaf so these are minimum estimates. It is not possible to estimate the max. length and width of the leaf from this tiny fragment. Area 19.7sq.mm min. It is not possible to sketch in a minimum outline for the leaf from this tiny fragment and so estimates of leaf area cannot be made. 1° is not preserved. 'Leaf area' 22.2sq.mm min. This fragment appears to be a very small percentage of the leaf.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This is just a tiny fragment from a small part of the leaf so it is not possible to describe lamina symmetry.

Form: It is not possible to estimate the leaf form of this scrappy fragment. Length/width ratio is 1.39:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Specimen is too fragmentary for venation pattern to be described.

1° vein: Not preserved.

2° veins: Not preserved.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.71c

Preservation: Very poor. The venation is unclear. The remaining organic material appears to be of medium thickness. The specimen is just a fragment so the overall shape of the leaf cannot be described. There are no clear margins present. The apex and base are not present and cannot be described.

Dimensions: Max. length 12.9mm min. Max. width 16.5mm min. This is just a very small fragment of the leaf so these are minimum estimates. It is not possible to estimate the max. length and width of the leaf from this scrappy fragment. Area 127.4sq.mm min. It is not possible to sketch in a minimum outline for this tiny fragment and so estimates of leaf area cannot be made. 1° is not preserved. 'Leaf area' 141.9sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: This is just a scrappy fragment so it is not possible to describe lamina symmetry.

Form: It is not possible to estimate the leaf form of this scrappy fragment. Length/width ratio is 0.78:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Specimen is too fragmentary for venation pattern to be described.

1° vein: Not preserved.

2° veins:
Leaf is too fragmentary for 2° veins to be described.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.73b

Preservation: Fair. The venation is fairly clear in the part of the leaf preserved. The remaining organic material appears to be of medium thickness. The specimen is just a fragment so the overall shape of the leaf cannot be described. There appears to be margins present. The apex is not present so cannot be described. It appears that the LHS of the base is fairly complete, so the base can be described. There may be a petiole present.

Dimensions: Max. length 11.3mm min. Max. width 13.9mm min. This is just a fragment so these are minimum estimates. This appears to be a fragment from the basal LHS of the leaf and max. width of LHS only is 13.5mm min. Assuming leaf is symmetrical, max. width is 27mm min. Area 50.4sq.mm min. Roughly sketching in a minimum outline for LHS of leaf, area of LHS only is 82.2sq.mm min. Assuming leaf is symmetrical, area is 164.4sq.mm, a minimum estimate for the leaf because apical portion of specimen is missing. Max. length along 1° 5.6mm min. Max. length, 11.3mm, is a better estimate but is still a minimum. 'Leaf area' 203.4sq.mm min. There may be a petiole approximately 0.8mm in length, which would mean that length of lamina alone is 10.5mm min. This is not clearly a petiole, so this is not taken into account in estimates of leaf area and the estimated max. length includes this 'petiole'.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is just a fragment from LHS of leaf so it is not possible to describe lamina symmetry.

Form: It is not possible to estimate the leaf form of this fragmentary specimen. Using estimated max. width, length/width ratio is 0.42:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. RHS of leaf is missing, so angle is measured for LHS only. Assuming base is symmetrical, basal angle is 124°. Since leaf is incomplete, this is just an estimate. Base is described as obtuse and cuneate and although leaf is incomplete, this appears to be a fairly accurate description.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: It is not clear but there may be a petiole present. It is approximately 0.8mm wide and 0.8mm in length.

Venation type: Venation appears to be pinnate, but it is not possible to describe the venation pattern further. This specimen is too fragmentary for the venation pattern to be described confidently.

1° vein:
Size: Leaf is too fragmentary to estimate the leaf midpoint and at the midpoint of the specimen, 1° is not preserved. Measurements are made close to base, 4.2mm from base of lamina. At this point 1° vein is incomplete and its width is 0.31mm min. Leaf width is 8.6, but this is a minimum estimate because RHS of leaf is missing. Assuming leaf is symmetrical, leaf width is 17.2mm. Size of 1° is therefore 1.81% min. and is termed moderate, but leaf is too fragmentary to confidently describe 1° size.
Course: Appears to be straight and unbranched but leaf is too fragmentary for this to be certain.

2° veins:
Number: 3 min.
Only LHS of leaf is preserved, so no pairs can be studied.
Angle of divergence: Narrow acute (25-43°, average 33°).
Basal vein angle: Narrow acute (43°).
Variation: Leaf is too incomplete for variation in divergence angle along length of lamina to be described. Since veins can only be measured on LHS of leaf, divergence angle symmetry cannot be assessed.
Thickness: Moderate.

Course: It is not possible to describe 2° vein course for this fragmentary specimen.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 97°.
Average angle of origin on exmedial side of 2°s: 64°.
Combination: AR.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.76b

Preservation: Fairly good. The venation is fairly unclear. The remaining organic material is very uneven and patchy. In some parts (along 1°) it is dark, in others it appears thinner. The specimen is just a fragment so the overall shape cannot be described. The margins appear to be fairly clear in the basal RHS of the leaf. The apex is not present and so cannot be described. The fragment is the basal part of the leaf, so the base can be described; the RHS is more complete. There is a petiole present.

Dimensions: Max. length 33.4mm min. (including petiole). Petiole is approximately 8.3mm in length. Max. length of lamina alone 25mm min. Max. width 9.1mm min. RHS is more complete than LHS and max. width of RHS only is 6.1mm min. Assuming leaf is symmetrical, max. width is 12.2mm min. Area 124.3sq.mm min. (including petiole). Roughly sketching in a minimum outline for RHS, area of RHS only is 92.4sq.mm min. Assuming leaf is symmetrical, area is 184.8sq.mm, a minimum estimate for the leaf because apical portion of specimen is missing. This estimate does not include the petiole. Using this sketched outline gives an estimate of max. length of 25.5mm, a minimum estimate for length of lamina alone. Max. length along 1° 24.8mm min. (not including petiole). Using the sketched outline gives an estimate of max. length along 1° of 25.6mm min. (not including petiole). 'Leaf area' 208.2sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is just a fragment from base of leaf, but since leaf base appears to be slightly asymmetrical, whole lamina is described as asymmetrical. Apex is not present so its symmetry cannot be described.

Form: Point of max. width is 19.8mm from leaf base. Max. length of leaf is 25mm min., meaning that point of max. width from leaf base is at 79% of total leaf length. This would make the leaf form obovate. Using estimated max. width, length/width ratio is 2.05:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the narrow obovate subdivision, but this is a fragmentary specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 19.8mm from leaf base and max. length is 25.6mm min. Point of max. width from leaf base is therefore at 77% of total leaf length and the leaf form is still described as obovate. Using estimated max. length and width, length/width ratio is 2.10:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form is described as narrow obovate, but the specimen is fragmentary so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. RHS of leaf is more complete than LHS, so angle is measured for RHS only. Assuming base is symmetrical, basal angle is 37°. Since leaf is incomplete, this is just an estimate. Base is described as acute and decurrent and although leaf is incomplete, this appears to be a fairly accurate description.

Margin: Margin appears to be entire.

Petiole: A petiole is present and it appears to be normal. It is approximately 1.1mm wide and 8.3mm in length.

Venation type: Venation is pinnate and appears to be camptodromous eucamptodromous, but the specimen is too fragmentary for the venation pattern to be described confidently.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be 12.8mm min. from base. At this point, 1° vein width is 0.89mm and leaf width is 5.4mm, but this is a minimum estimate because here the LHS margin is not present. RHS only is 4.3mm wide at this point. Assuming leaf is symmetrical, leaf width is 8.5mm. Size of 1° is therefore 10.42% and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
Number: 5 min.
2°s are only preserved on RHS of leaf so pairs cannot be studied.
Angle of divergence: Narrow acute (12-49°, average 38°).
Basal vein angle: Narrow acute (12°)
Variation: Lowest 2° appears to be more acute than those above. Since 2°s are only preserved on RHS of leaf it is not possible to assess divergence angle symmetry.
Thickness: Fine.
Course: Appears to be uniformly curved and unbranched, but specimen is too fragmentary for this to be a confident description.
Behaviour of loop-forming branches: None.
Intersecondary veins: There are no clear intersecondaries preserved.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 101°.
Average angle of origin on exmedial side of 2°s: 38°.
Combination: AO.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 66°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.81b

Preservation: Poor. The venation is fairly unclear. The remaining organic material appears dark and thick, but very holey, patchy and uneven. The specimen is just a fragment so the overall shape of the leaf cannot be described. There are no clear margins present. The apex and base are not present and cannot be described.

Dimensions: Max. length 16.1mm min. Max. width 9.4mm min. This is just a scrappy fragment so these are minimum estimates. It is not possible to estimate the max. length and width of the leaf from this scrappy fragment. Area 76.9sq.mm min. It is not possible to sketch in a minimum outline for this fragment and so estimates of the leaf area cannot be made. 1° is not preserved. 'Leaf area' 100.9sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is just a scrappy fragment so lamina symmetry cannot be described.

Form: It is not possible to estimate the leaf form of this scrappy fragment. Length/width ratio is 1.71:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin not clearly preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Through comparison with D8754.8.67a, it appears that the highest vein order preserved in D8754.8.81b is the second. This specimen is therefore too fragmentary for venation type to be assessed.

1° vein: Not preserved.

2° veins:

Thickness appears to be moderate and course appears to be abruptly curved and branched, but specimen is too fragmentary to say anything further about the 2° veins.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.82b

Preservation: Fair. The venation is fairly clear in the part of the leaf preserved. The remaining organic material appears to be of medium thickness and is rather uneven and holey. The specimen is just a very small fragment so the overall shape of the leaf cannot be described. There is a very small portion of the margin preserved. The apex and base are not present and cannot be described.

Dimensions: Max. length 10.5mm min. Max. width 9.7mm min. This is just a scrappy fragment so these are minimum estimates. It is not possible to estimate the max. length and width of the leaf from this scrappy fragment. Area 61.7sq.mm min. It is not possible to sketch in a minimum outline for this fragment and so estimates of the leaf area cannot be made. 1° is not preserved. 'Leaf area' 67.9sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is just a tiny fragment from a small part of the leaf so it is not possible to describe lamina symmetry.

Form: It is not possible to estimate the leaf form of this scrappy fragment. Length/width ratio is 1.08:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Specimen is too fragmentary for venation pattern to be described.

1° vein: Not preserved.

2° veins:
Thickness appears to be moderate and course appears to be abruptly curved, but specimen is too fragmentary to say anything further about the 2° veins.

3 veins: Specimen is too fragmentary for 3° vein angles to be measured.

D8754.8.90b

Preservation: Poor. The venation is fairly unclear. The venation is dark while the remainder of the lamina appears to be very pale and thin to no organic material. The specimen is just a fragment so the overall shape of the leaf cannot be described. There are no margins preserved. The apex and base are not present and cannot be described.

Dimensions: Max. length 22mm min. Max. width 11.9mm min. This is a fragmentary specimen so these are minimum estimates. RHS is more complete than LHS and max. width of RHS only is 8.3mm min. Assuming leaf is symmetrical, max. width is 16.6mm min. Area 140sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 150.3sq.mm min. Assuming leaf is symmetrical, area is 300.6sq.mm, a minimum estimate for the leaf because this is a fragmentary specimen. Using this sketched outline gives an estimate of max. length of 25.3mm min. Max. length along 1° 18.3mm min. Using the sketched outline gives an estimate of max. length along 1° of 25.4mm min., slightly longer than estimated max. length because 1° is slightly curved. 'Leaf area' 281.1sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too incomplete for features of lamina symmetry to be described.

Form: Point of max. width is 5.8mm from leaf base. Max. length of leaf is 22mm min., meaning that point of max. width from leaf base is at 26% of total leaf length. This would make the leaf form ovate. Using estimated max. width, length/width ratio is 1.33:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the wide ovate subdivision, but this is a fragmentary specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 8.4mm from leaf base and max. length is 25.4mm min. Point of max. width from leaf base is therefore at 33% of total leaf length and the leaf form is still described as ovate. Using estimated max. length and width, length/width ratio is 1.53:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form fits in to the ovate subdivision, but the specimen is fragmentary so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate camptodromous brochidodromous, but the specimen is too fragmentary for venation pattern to be confidently described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 12.7mm from base. At this point, 1° vein width is 0.36mm and leaf width is 7.4mm, but this is a minimum estimate because margins are not present. Width of RHS only, which shows greater preservation than LHS, is estimated to be at least 7.3mm at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 14.5mm. Size of 1° is therefore estimated to be 2.48% max. and is termed stout, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched.

2° veins:
Number: 3 min.
2°s diverging from 1° are only preserved on LHS of leaf so pairs cannot be described confidently. Pairs appear to be alternate, but this is not certain.
Angle of divergence: Wide acute (56-75°, average 66°).
Basal vein angle: Not preserved.
Variation: Leaf is too fragmentary for variation in divergence angle along length of lamina to be described confidently. Since 2°s diverging from 1° are only preserved on LHS of leaf it is not possible to assess divergence angle symmetry.
Thickness: Moderate.
Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: None are clearly preserved.
Intersecondary veins: None preserved.
Intramarginal vein: None preserved.

3 veins:
Average angle of origin on admedial side of 2°s: 101°.
Average angle of origin on exmedial side of 2°s: 89°.
Combination: RO.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.98a

Preservation: Excellent. The venation is very clear. The remaining organic material is of medium thickness and appears fairly even. The specimen surface is very uneven, producing distortion in the drawing. The specimen is convex along the long axis of the leaf. The specimen is almost complete so the overall shape of the leaf

can be described. There is a small split in the lamina near the middle on the RHS and a small portion of the basal RHS of the leaf is missing. Most of the margins are present. The apex is present except for the very tip of the leaf and so this can be described. Removal of sediment cover here may reveal more of the apex. Although part of the basal RHS of the specimen is missing, the LHS of the leaf base is complete so the base can be described. There is no petiole present. There are a few holes in the leaf.

Dimensions: Max. length 41.9mm min. Max. width 15.5mm (point of max. width is slightly closer to base on RHS). Although leaf is almost complete, very tips of apex and base are missing, so estimate of max. length is a minimum. Area 430.6sq.mm min. Roughly sketching in a minimum outline for leaf, area is 451.1sq.mm min. Using this sketched outline gives an estimate of max. length of 42.1mm min. Max. length along 1° 40.5mm min. Estimated max. length, 42.1mm, is a better estimate but is still a minimum. 'Leaf area' 435sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Whole lamina appears to be slightly asymmetrical. Base appears to be slightly asymmetrical. Apex appears to be slightly asymmetrical, but since apical tip is not complete, this is not certain. However, this asymmetry may be a feature of the preservation of the leaf on a rather uneven rock surface.

Form: The point of max. width is 20mm from the leaf base and the max. length of the leaf is 41.9mm min. This means that the point of max. width from the leaf base is at 48% of the total leaf length, making the leaf form elliptic. Length/width ratio is 2.70:1. Since max. width appears to be an accurate measurement and max. length is a minimum, this is a minimum estimate for length/width ratio. This ratio means that the leaf form fits in to the elliptic subdivision, but this is an incomplete specimen, so this is just an estimate of leaf form. Using the sketched minimum outline, point of max. width is 20.2mm from leaf base and estimated max. length is 42.1mm min. Point of max. width from leaf base is therefore still at 48% of total leaf length and the leaf form is still described as elliptic. Using estimated max. length, length/width ratio is 2.72:1, which is again a minimum estimate. This means that the leaf form fits in to the elliptic subdivision and although the tips of the apex and base are incomplete, this appears to be an accurate description of leaf form.

Apex: Apical angle 55°. Apex is described as attenuate, but since the very tip of the apex is incomplete, this is not a completely confident description.

Base: Basal angle 69°. Since basal margins are incomplete, this is just an estimate. Base is described as acute and decurrent and although basal margins are incomplete, this appears to be an accurate description.

Margin: Margin is entire.

Petiole: Absent or not preserved.

Venation type: Venation is pinnate camptodromous and appears to be brochidodromous, but the venation may be eucamptodromous, so this is not a completely confident description.

1° vein:
Size: Midpoint is 21.1mm from leaf base. At this point, 1° vein width is 0.31mm and leaf width is 15.35mm. Size of 1° is therefore 2.02% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 16.
Pairs are alternate.
Angle of divergence: Moderate acute (42-78°, average 65°).
(Average on LHS 66°, average on RHS 64°).
Basal vein angle: Moderate acute (average 54°).
Variation: Divergence angle appears to vary irregularly.
Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 129°). They appear to be enclosed by 2°, 3°, or 4° arches. It also appears that they may form an intramarginal vein, but this is not clear.
Intersecondary veins: There may be intersecondaries present, but this is not certain.
Intramarginal vein: There is no clear intramarginal vein present, but this is not a completely confident description.

3 veins:
Average angle of origin on admedial side of 2°s: 88°.
Average angle of origin on exmedial side of 2°s: 76°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 87°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.98b

Preservation: Fair. The venation is clear. Most of the remaining organic material appears very pale and thin, while the main veins appear darker and thicker. The specimen is just a fragment so it is not possible to describe the overall shape of the leaf. There may be a small percentage of the margins present. The apex and base are not present and cannot be described.

Dimensions: Max. length 24.7mm min. Max. width 20mm min. Specimen is just a fragment from LHS of leaf, so these are minimum estimates. Max. width of LHS only is 19.2mm min. Assuming leaf is symmetrical, max. width is 38.4mm min. Area 285.8sq.mm min. Roughly sketching in a minimum outline for LHS, area of LHS only is 404.1sq.mm min. Assuming leaf is symmetrical, area is 808.2sq.mm, a minimum estimate for the leaf because this is a fragmentary specimen. Using this sketched outline gives an estimate of max. length of 28.3mm min. Max. length along 1° 24.7mm min. Estimated max. length, 28.3mm, is a better estimate but is still a minimum. 'Leaf area' 724.5sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is just a fragment from LHS of leaf so lamina symmetry cannot be described.

Form: Point of max. width is 11.1mm from leaf base. Max. length of leaf is 24.7mm min., meaning that point of max. width from leaf base is at 45% of total leaf length. This would make the leaf form elliptic. Using estimated max. width, length/width ratio is 0.64:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would fit in to the oblate subdivision, but this is a fragmentary specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 13mm from leaf base and max. length is 28.3mm min. Point of max. width from leaf base is therefore at 46% of total leaf length and the leaf form is still described as elliptic. Using estimated max. length and width, length/width ratio is 0.74:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form fits in to the oblate subdivision, but the specimen is fragmentary so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate camptodromous brochidodromous, but the specimen is too fragmentary for the venation pattern to be described confidently.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 14.2mm from base. At this point, 1° vein width is 0.7mm and leaf width is 19.4mm, but this is a minimum estimate because RHS is missing. Width of LHS only is at least 18.9mm at this point. Assuming leaf is symmetrical, leaf width is at least 37.7mm. Size of 1° is therefore 1.86% max. and is termed moderate, but the specimen is too fragmentary for the 1° size to be described completely confidently.
Course: Appears to be straight and unbranched.

2° veins:
Number: 1 min.

There is just one 2° preserved on LHS of leaf, so no pairs can be observed.
Angle of divergence: Moderate acute (49°).
Basal vein angle: Not preserved.
Variation: Since there is only one 2° vein preserved, the variation in divergence angle along the length of the leaf and divergence angle symmetry cannot be assessed.
Thickness: Moderate.
Course: Appears to be uniformly curved and unbranched, but this is not certain.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 76°.
Average angle of origin on exmedial side of 2°s: 89°.
Combination: RA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 90°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.98c

Preservation: Good. The venation is clear. The remaining organic material appears to be of medium thickness, but is rather patchy, uneven and holey. The specimen is just a fragment so it is not possible to describe the overall shape of the leaf. There may be a very small percentage of the margins present. It is incomplete, but it may be possible to describe the apex. The base is not clearly preserved, but it may be possible to describe it from the RHS of the leaf. There is no petiole.

Dimensions: Max. length 41.1mm. Max. width 15.5mm min. It is unclear, but it appears that estimate of max. length is quite good. This is a fragmentary specimen so max. width is a minimum estimate. RHS shows greater preservation than LHS and max. width of RHS only is 11.7mm min. Assuming leaf is symmetrical, max. width is 23.4mm min. Area 245.2sq.mm min. Roughly sketching in a minimum outline for RHS of leaf, area of RHS only is 245.6sq.mm min. Assuming leaf is symmetrical, area is 491.2sq.mm, a minimum estimate for the leaf because this is a fragmentary specimen. Max. length along 1° 41.1mm. 'Leaf area' 641.2sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Much of LHS of leaf is missing so it is not possible to confidently describe whole lamina symmetry. It appears that apical portion of lamina is roughly symmetrical, but it is not clear and it is not possible to be certain that whole lamina is symmetrical. LHS of base is missing so it is not possible to describe its symmetry.

Form: Point of max. width is 13.7mm from leaf base. Max. length of leaf is 41.1mm, meaning that point of max. width from leaf base is at 33% of total leaf length. The leaf form is therefore ovate. Using estimated max. width, length/width ratio is 1.76:1, but since max. length appears to be a fairly good estimate and max. width is a minimum, this is a maximum estimate for length/width ratio. This ratio means that the leaf form fits in to the ovate subdivision, but this is a fragmentary specimen so this is just an estimate of leaf form.

Apex: Leaf specimen is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle 31°. Apex appears to be attenuate, but apex is incomplete, so these are just estimates.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. LHS of leaf base is missing, so angle is measured for RHS only. Assuming base is symmetrical, basal angle is 103°. Since leaf is fragmentary and basal margins are incomplete, this is just an estimate. Base is described as obtuse and normal and although leaf is incomplete, this appears to be a fairly accurate description.

Margin: The margin is not clearly preserved, and although basal margin of leaf appears to be entire, there may be projections in the apical part of the leaf. Measured perpendicular to the midvein, the margin is indented 0.3-0.6mm, average 0.4mm, 31.3% of the distance to the midvein. Margin would therefore be described as lobed, but the margin is not very clear so this is not a confident description. Sinuses appear to be rounded. Spacing between projections is 2.7-2.8mm, average 2.8mm, but since the projections are not very clear, this is just an estimate of the spacing.

Petiole: Absent or not preserved.

Venation type: Venation appears to be pinnate camptodromous brochidodromous, but the specimen is incomplete so this is not a completely confident description.

1° vein:
Size: Midpoint is 20.6mm from base. At this point, 1° vein width is 0.53mm and leaf width is 7.8mm, but this is a minimum estimate because here the LHS is not present. RHS only is 7.5mm wide at this point. Assuming leaf is symmetrical, leaf width is 15.1mm. Size of 1° is therefore 3.51% and is termed stout.
Course: Straight and unbranched.

2° veins:
Number: 8 min.
Pairs cannot be studied in this fragmentary specimen.
Angle of divergence: Wide acute (71-90°, average 78°). (Average on LHS 79°, average on RHS 78°).
Basal vein angle: Wide acute (average 75°).
Variation: Divergence angle appears to be quite uniform. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 143°). They appear to form an intramarginal vein, but this is not completely clear.
Intersecondary veins: None preserved.
Intramarginal vein: There may be an intramarginal vein present, but this is not completely clear.

3 veins:
Average angle of origin on admedial side of 2°s: 85°.
Average angle of origin on exmedial side of 2°s: 86°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 88°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.98d

Preservation: Fairly poor. The venation is unclear. The remaining organic material appears dark, thick and holey. The specimen is just a fragment from the base of the leaf, so it is not possible to describe the overall shape of the leaf. A very small percentage of the margins are present at the base. The apex is not present and cannot be described. The base is incomplete, but may be described. There may be a petiole present.

Dimensions: Max. length 33.8mm min. (including petiole). Petiole is approximately 9.6mm in length, but it is difficult to define where lamina ends and petiole begins for this fragmentary specimen. Max. length of lamina alone 24.2mm min. Max. width 13.3mm min. RHS shows slightly greater preservation than LHS and max. width of RHS only is 8.7mm min. Assuming leaf is symmetrical, max. width is 17.4mm min. Area 167.3sq.mm min. (including petiole). Roughly sketching in a minimum outline for RHS of leaf, area of RHS only is 131.2sq.mm min. Assuming leaf is symmetrical, area is 262.4sq.mm, a minimum estimate for the leaf because this is just a fragment. This estimate does not include the petiole. Using this sketched outline gives an estimate of max. length of lamina alone of 25mm min. Max. length along 1° 24.3mm min. (not including petiole). Estimated max. length, 25mm, is better but still a minimum. 'Leaf area' 290sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is just a fragment from base of leaf so it is not possible to describe symmetry of whole lamina. Parts of base present appear to be roughly symmetrical, but this is just a small proportion of the leaf base so this is not a confident description. Apex is not present so its symmetry cannot be described.

Form: It is not possible to estimate the leaf form of this scrappy fragment. Using estimated max. length and width, length/width ratio is 1.44:1, but since both max. length and width are minimum

estimates, it is not really possible to estimate the length/width ratio of the leaf.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. RHS of leaf is more complete than LHS, so angle is measured for RHS only. Assuming base is symmetrical, basal angle is 53°. Since leaf is fragmentary and basal margins are incomplete, this is just an estimate. Base is described as acute and decurrent and although leaf is incomplete, this appears to be a fairly accurate description.

Margin: Only a very small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: A petiole is present and it appears to be normal, but it is difficult to define where lamina ends and petiole begins. Petiole is estimated to be approximately 9.6mm in length and 2.7mm wide.

Venation type: Specimen is too fragmentary for venation pattern to be described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 12.5mm min. from base. At this point, 1° vein width is 2.05mm and leaf width is 4.5mm, but this is a minimum estimate because margins are not present. Width of RHS only, which shows greater preservation than LHS, is estimated to be at least 6.3mm at this point. Assuming leaf is symmetrical, leaf width is estimated to be at least 12.5mm. Size of 1° is therefore estimated to be 16.4% max. and is termed massive, but the specimen is too fragmentary for the 1° size to be described confidently.
Course: Appears to be straight and unbranched, but specimen is too fragmentary for this to be certain.

2° veins:
Number: 5 min.
2°s diverging from 1° are only preserved on RHS of leaf so pairs cannot be described confidently. Pairs cannot be studied.
Angle of divergence: Narrow acute (28-49°, average 34°).
Basal vein angle: Moderate acute (49°).
Variation: Divergence angle appears to vary irregularly, but leaf is too fragmentary for this to be certain. Since LHS of leaf is not preserved it is not possible to assess divergence angle symmetry.
Thickness: Fine.
Course: Leaf is too fragmentary for 2° vein course to be described.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None preserved.

3 veins:
Average angle of origin on admedial side of 2°s: 59°.
Average angle of origin on exmedial side of 2°s: 107°.
Combination: OA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8754.8.100a

Preservation: Fairly good. The venation is fairly clear. The remaining organic material appears to be dark and thick and is rather patchy and uneven. There are several rounded purple objects obscuring the lamina; these are about 1mm in diameter. The specimen is incomplete so the overall shape of the leaf cannot be described. Much of the margins are preserved and appear fairly clear. The apex is not present and so cannot be described. The base of the leaf can be described from the basal LHS of the leaf. The basal RHS of the specimen is missing. There is no petiole preserved.

Dimensions: Max. length 53.2mm min. Max. width 42.5mm min. Leaf is incomplete so these are minimum estimates. LHS is more complete than RHS and max. width of LHS only is 24.9mm min. Assuming leaf is symmetrical, max. width is 49.8mm min. Area 1188.1sq.mm min. Roughly sketching in a minimum outline for LHS of leaf, area of LHS only is 937.7sq.mm min. Assuming leaf is symmetrical, area is 1875.4sq.mm, a minimum estimate for the leaf because the specimen is incomplete. Using this sketched outline gives an estimate of max. length of 55.4mm min. Max. length along 1° 47mm min. Estimated max. length, 55.4mm, is better but still a minimum. 'Leaf area' 1839.3sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Only a small portion of the leaf has margins present on both sides of the lamina and here the leaf appears to be slightly asymmetrical, but the specimen is too fragmentary for this to be a confident definition. RHS of base is missing and apex is not present so their symmetry cannot be described.

Form: Point of max. width is 16.8mm from leaf base. Max. length of leaf is 53.2mm min., meaning that point of max. width from leaf base is at 32% of total leaf length. This would make the leaf form ovate. Although the leaf is incomplete, this appears to be an accurate description of leaf form. Using estimated max. width, length/width ratio is 1.07:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form would be described as very wide ovate, but this is an incomplete specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 16.8mm from leaf base and max. length is 55.4mm min. Point of max. width from leaf base is therefore at 30% of total leaf length and the leaf form is still described as ovate. Using estimated max. length and width, length/width ratio is 1.11:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio falls within the bracket that is not given a clear definition in Hickey's scheme, so the nearest definition is used. This means that the leaf form is described as wide ovate, but the specimen is incomplete so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 168°, but since leaf is fragmentary and basal margins are incomplete, this is just an estimate. Base is described as cordate and although leaf is incomplete, this appears to be an accurate description.

Margin: There are projections clearly preserved along the LHS margin of the leaf. Measured perpendicular to the midvein, the margin is indented at least 1.5-1.7mm, average 1.6mm min., 7.9% of the distance to the midvein. These measurements are minimum estimates because the projections are incomplete. Projections appear to have rounded apices, so the margin is described as crenate. Sinuses between crenations are rounded. Crenations are incomplete so their spacing cannot be accurately measured. It is estimated to be at least 10.1mm, but it is not possible to determine whether the spacing is regular or irregular.

Petiole: Absent or not preserved.

Venation type: Venation is actinodromous. Only the LHS of the base is preserved, so assuming the leaf is roughly symmetrical, there are three 1° veins diverging from a single point. The position is basal. The development is imperfect, with the veins originating on the lateral actinodromous 1° veins covering a maximum of 50% of the blade area, and appears to be marginal, but since the basal margin is incomplete it is not possible to confidently describe the type of imperfect development. Lateral primary vein diverges from base at 71° to midvein.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be 27.7mm min. from base. At this point, 1° vein width is 0.47mm and leaf width is 34.3mm, but this is a minimum estimate because here the RHS margin is not present. RHS only is 20.7mm wide at this point. Assuming leaf is symmetrical, leaf width is 41.4mm. Size of 1° is therefore 1.13% and is termed moderate.
Course: Appears to be straight and branched.

2° veins:
Number: 6 min.
Pairs are alternate.
Angle of divergence: Moderate acute (45-69°, average 57°). (Average on LHS 52°, average on RHS 63°).
Basal vein angle: Moderate acute (average 45°).
Variation: Upper 2°s appear to be more obtuse than those below. It also appears that the lowest 2° is more acute than those above. Divergence angle is more acute on LHS than RHS, but basal part of RHS is missing. However, when angles measured from apical part of leaf only, where both sides of the leaf are preserved, are considered, divergence angle is still more acute on LHS than RHS.

Thickness: Moderate.
Course: Abruptly curved and appears to be unbranched, but this is not completely clear.
Behaviour of loop-forming branches: None present.
Intersecondary veins: There may be intersecondaries present, but this is not a confident description.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 83°.
Average angle of origin on exmedial side of 2°s: 74°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 92°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8754.8.101a

Preservation: Fairly good. The venation is very clear. The remaining organic material is rather patchy and uneven. It appears to be of medium thickness on the left, becoming very pale and thin on the right. The rock surface and therefore the specimen is quite broken up. The specimen is just a fragment so it is not possible to describe the overall shape of the leaf. The margin is very clearly preserved along the RHS of the specimen. The apex and base are not present and cannot be described.

Dimensions: Max. length 37.5mm min. Max. width 46.1mm min. This specimen is a fragment from what might be just the RHS of the leaf so these are minimum estimates. Max. width of RHS only is 46.1mm min. Assuming leaf is symmetrical, max. width is 92.2mm min. Area 679.8sq.mm min. It is not possible to sketch in a minimum outline for this fragmentary specimen, but assuming leaf is symmetrical, it appears that area of leaf is at least 1359.6sq.mm, a minimum estimate for the leaf because only a small part of the leaf is preserved. 1° is not clearly preserved. 'Leaf area' 2305sq.mm min.
However, this specimen is very fragmentary and appears to be composed of two separate pieces of the leaf. It is possible to rearrange these pieces and it appears that a small part of the 1° and LHS of the leaf may be preserved. In this case, max. length is 40.2mm min., max. width is 38.4mm min. RHS is more complete than LHS and max. width of RHS only is 25.1mm min. Assuming leaf is symmetrical, max. width is 50.2mm min. Area 662.9sq.mm min. Roughly sketching in a minimum outline for RHS, area of RHS only is 895.5sq.mm min. Assuming leaf is symmetrical, area is 1791sq.mm min. Using this sketched outline gives an estimated max. length of 45.1mm min. Max. length along 1° 8.2mm min. Estimated max. length, 45.1mm, is better but still a minimum. 'Leaf area' 1509.3sq.mm min.

Organisation: Specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be described.

Form: Point of max. width is 23.2mm from leaf base. Max. length of leaf is 37.5mm min., meaning that point of max. width from leaf base is at 62% of total leaf length. This would make the leaf form obovate. Using estimated max. width, length/width ratio is 0.41:1, but since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form would be described as very wide obovate, but this is a fragmentary specimen so this is not a good estimate of leaf form. Using the sketched minimum outline, point of max. width is 27.9mm from leaf base and max. length is 45.1mm min. Point of max. width from leaf base is therefore still at 62% of total leaf length and the leaf form is still described as obovate. Using estimated max. length and width, length/width ratio is 0.90:1, but again since both max. length and width are minimum estimates, it is not really possible to estimate the length/width ratio of the leaf. This ratio means that the leaf form is described as very wide obovate, but the specimen is fragmentary so this is just an estimate of leaf form.

Apex: Not preserved.

Base: Not preserved.

Margin: There are projections clearly preserved along the RHS margin of the leaf, in two distinct size classes. Measured perpendicular to the midvein, the margin is indented 0.4-1.7mm, average 0.8mm, 3.5% of the distance to the midvein. The distance to the midvein is just an estimate because 1° is not clearly preserved. The average indentation of the 1° projections is 1.6mm, 6.6% of the distance to the midvein, and the 2° projections 0.7mm, 2.8% of the distance to the midvein. Only two 1° projections are preserved. The projections have pointed apices, so the margin is described as toothed. Teeth are serrate. The serrations are compound, in two definite size groups. Apical angle of 1° serrations is acute (average 86°) and apical angle of 2° serrations is obtuse (average 94°). Overall, apical angle of serrations is obtuse (range 63-124°, average 92°). Dominant serration type is concave on basal side and convex on apical side. Most of the sinuses appear to be rounded. Including both 1° and 2° serrations, spacing is 1.3-3.5mm, average 2.2mm, standard deviation 0.7mm, and spacing is described as irregular. Spacing of 1° projections only is 10.8mm, but since there are only two preserved, it cannot be determined whether the 1° tooth spacing is regular or irregular.

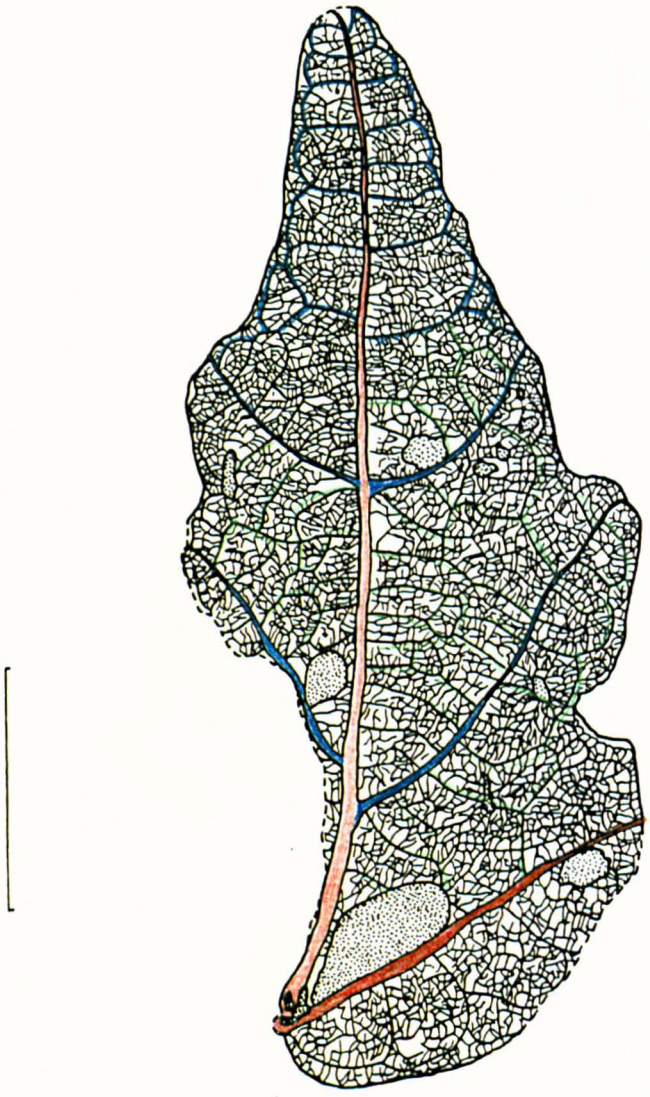
Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate simple craspedodromous, but the leaf is too fragmentary for the venation pattern to be described confidently.

1° vein:
Size: Leaf is too fragmentary to estimate the leaf midpoint and 1° is not clearly preserved at any point. Measurements are made 14.5mm from base of specimen. At this point 1° vein width is appears to be 0.94mm. At this point, leaf width is 39.1, but this is a minimum estimate because LHS of leaf is incomplete. Here width of RHS only is 23.1mm. Assuming leaf is symmetrical, leaf width is 46.1mm. Size of 1° is therefore estimated to be 2.04% and is termed stout, but leaf is too fragmentary to confidently describe 1° size.
Course: Leaf is too fragmentary for 1° course to be described.

2° veins:
Leaf is too fragmentary for 2° vein angles to be measured. Thickness is moderate and course appears to be uniformly curved and branched. It also appears that the 2°s are recurved and also may be provided with outer 2°s. There are no clear intersecondary veins preserved and there is no intramarginal vein.

3 veins:
Average angle of origin on admedial side of 2°s: 66°.
Average angle of origin on exmedial side of 2°s: 53°.
Combination: AA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.



D8754.8.1a
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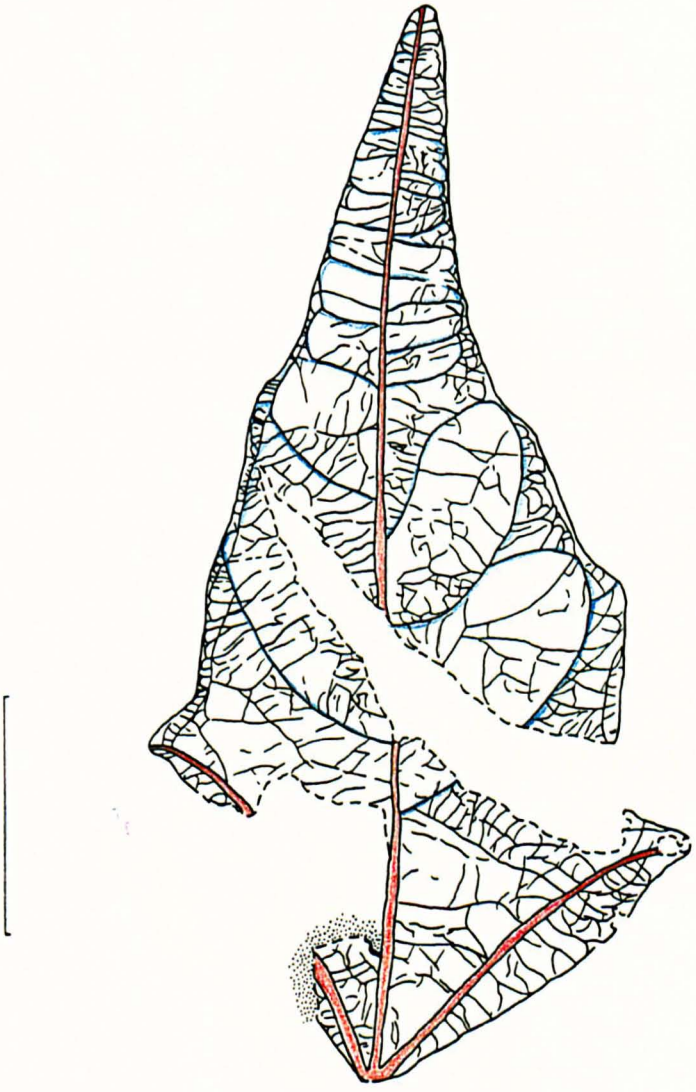

D8754.8.2a
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D8754.8.3a
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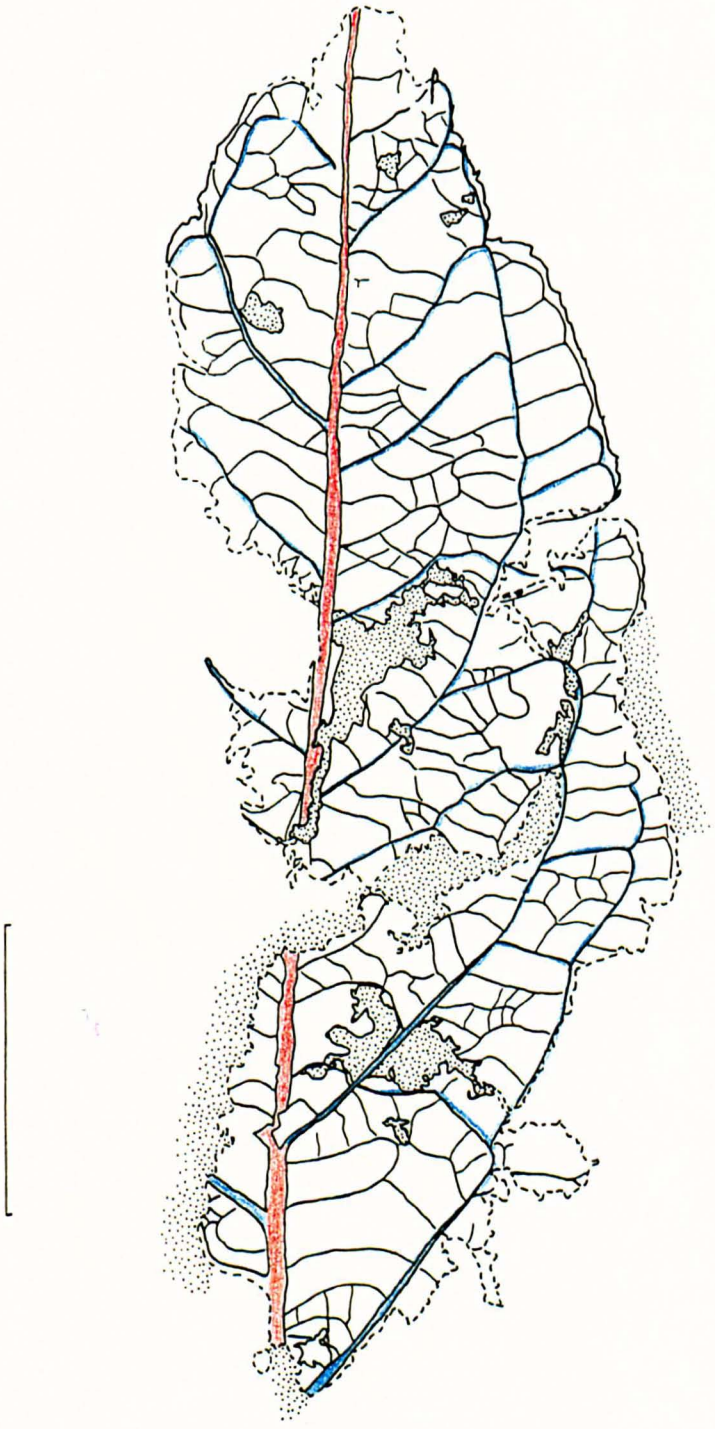

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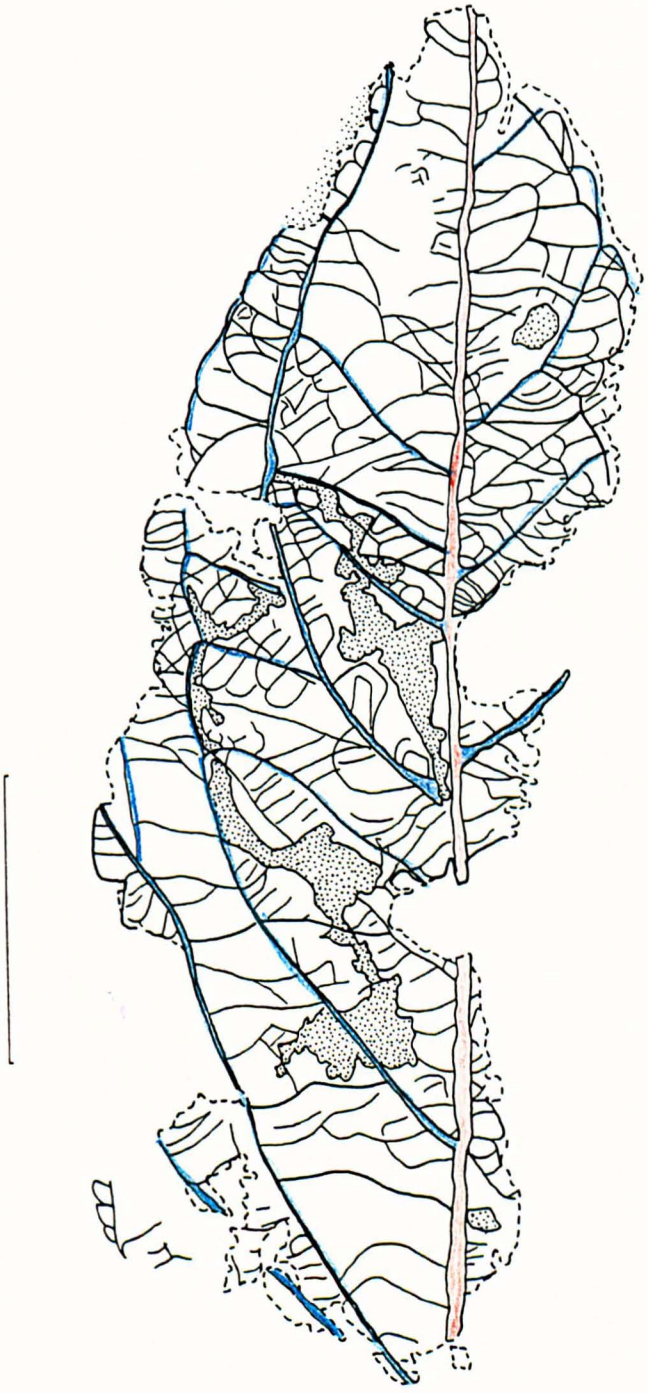

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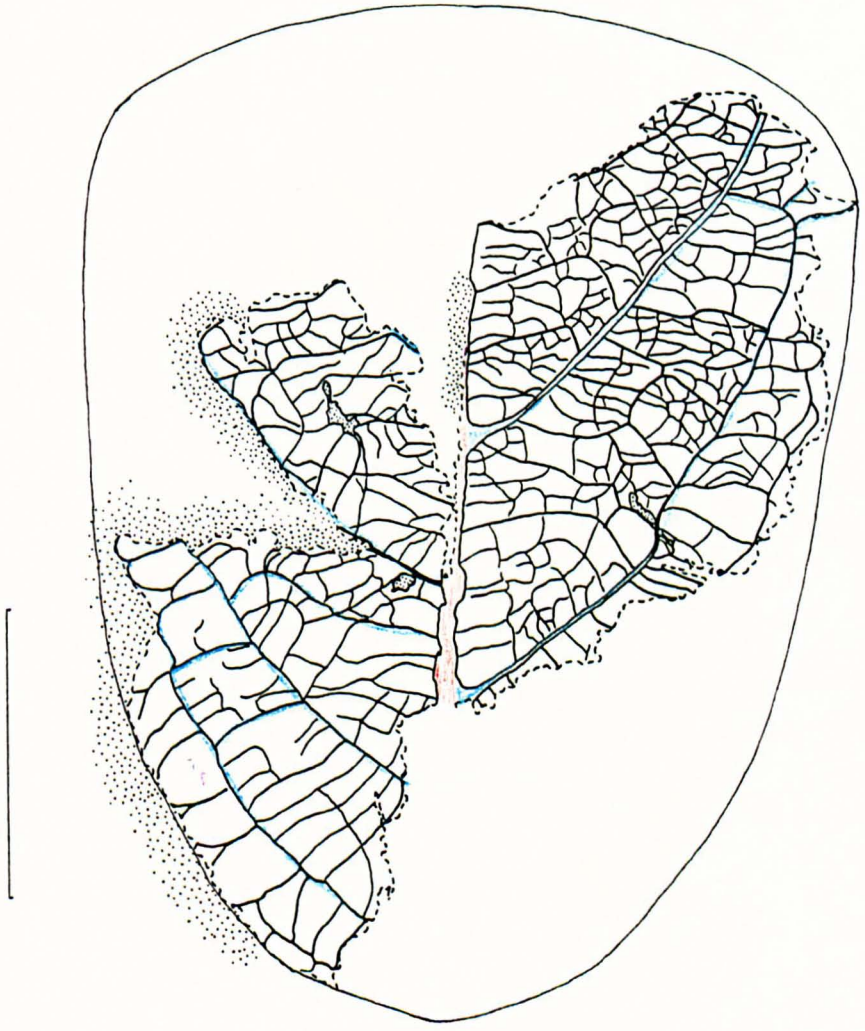

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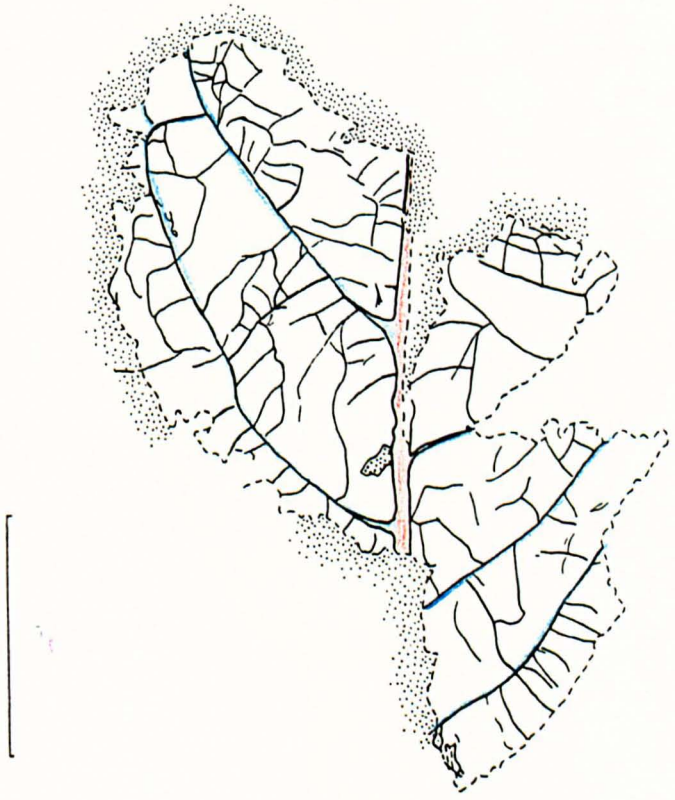

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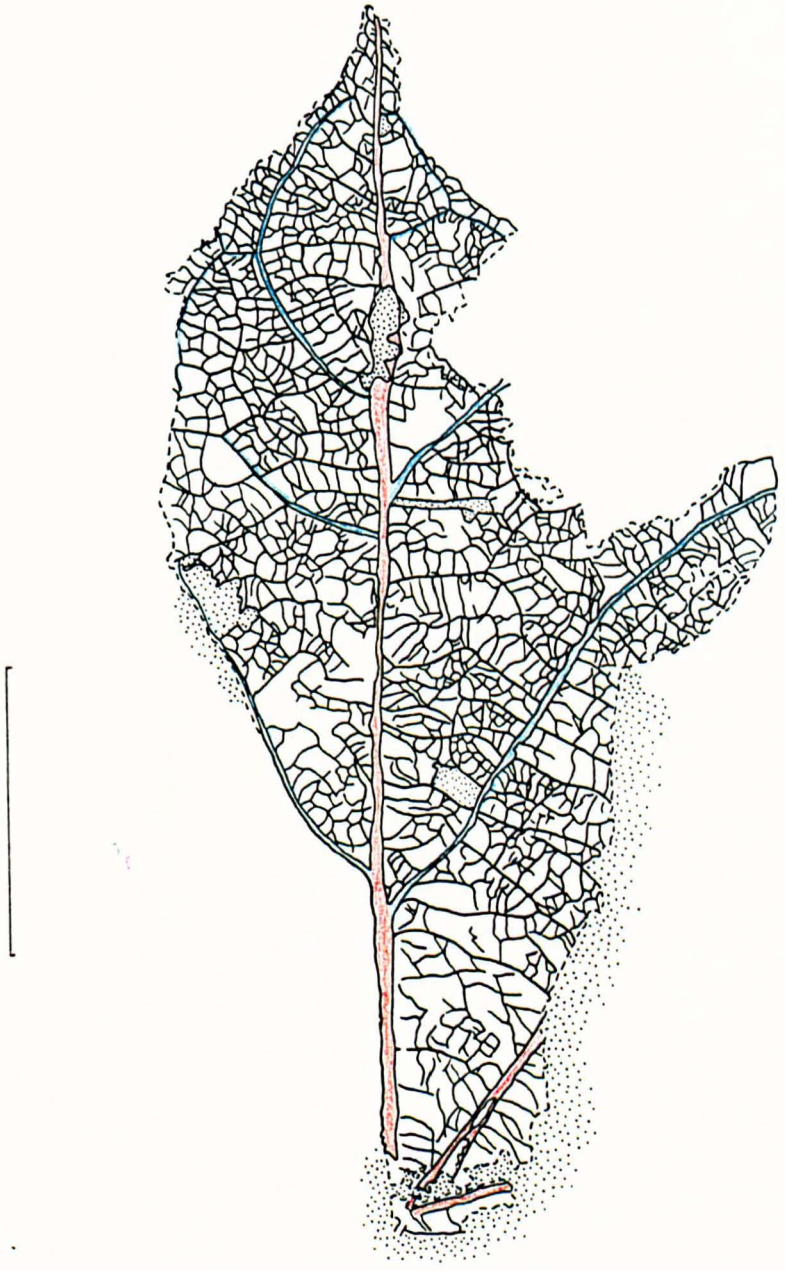

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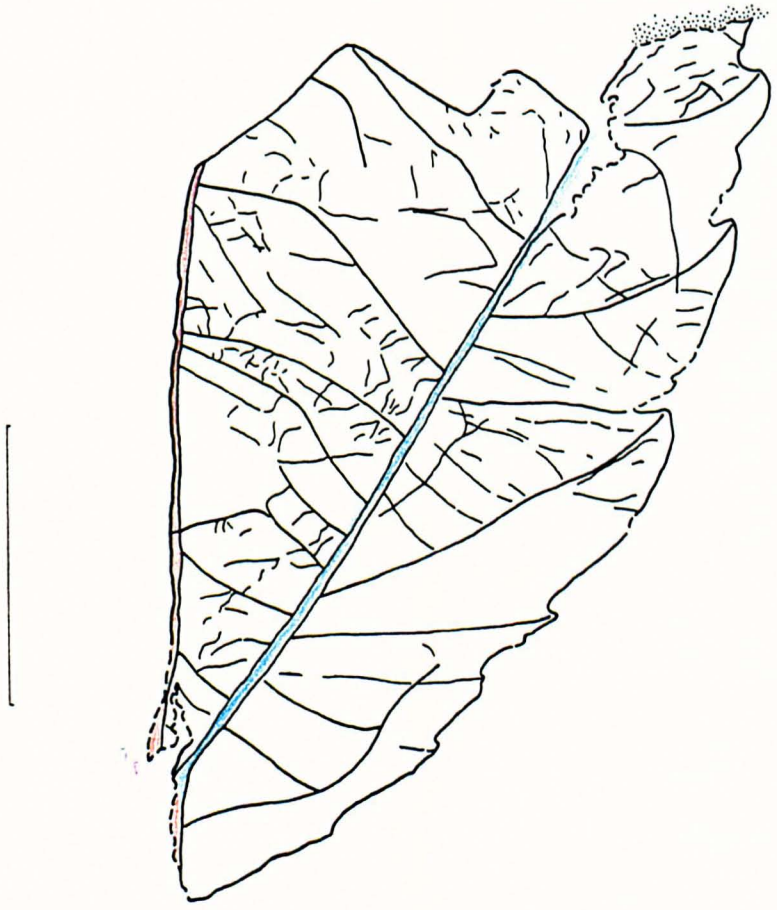

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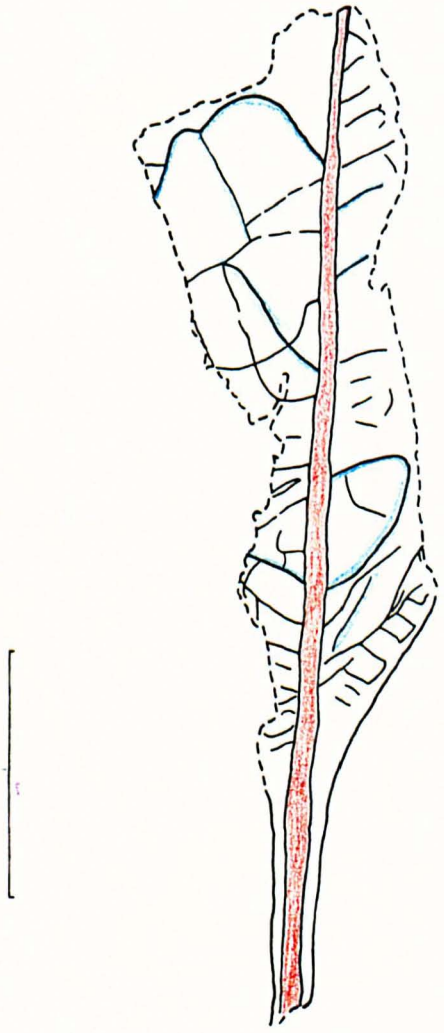

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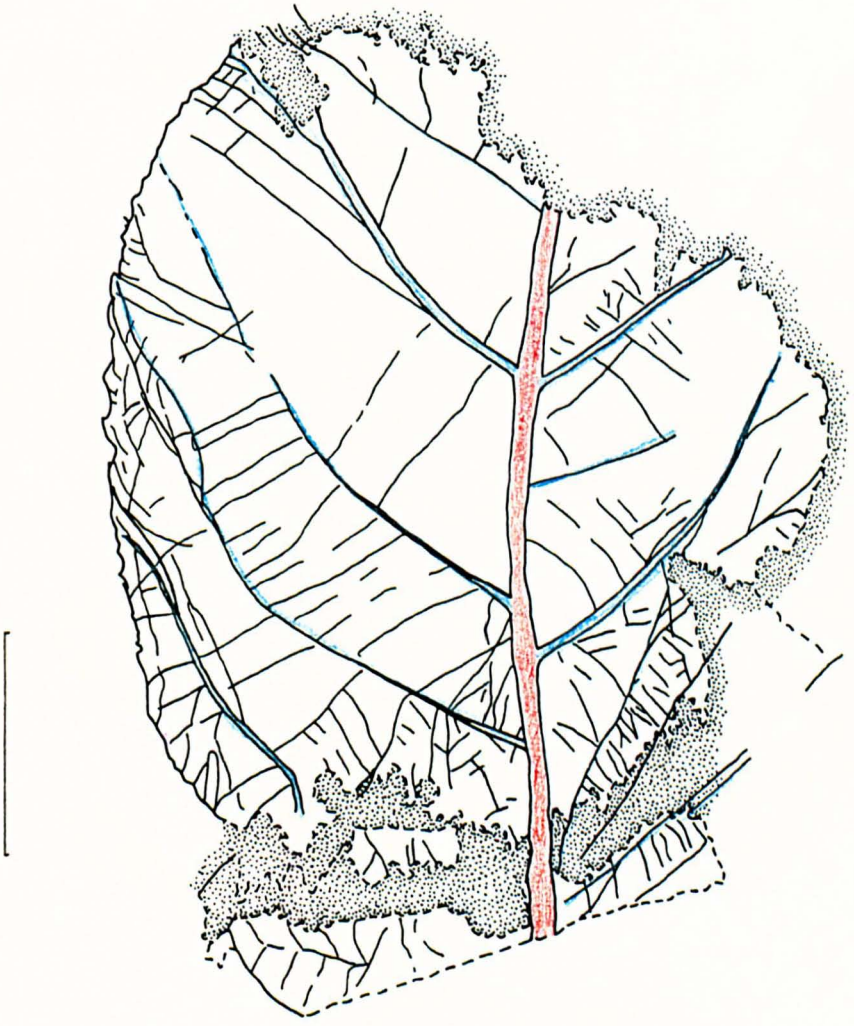

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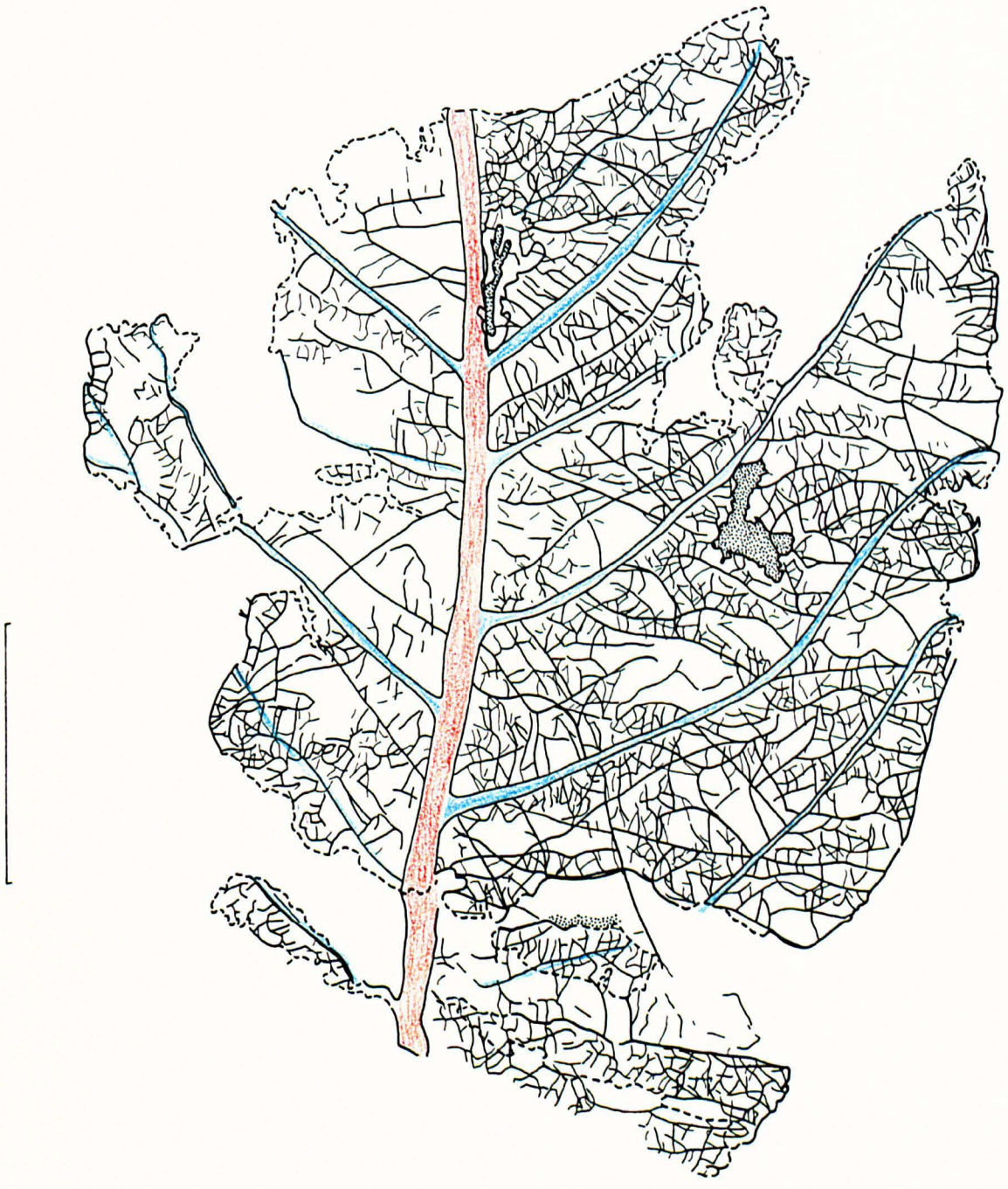
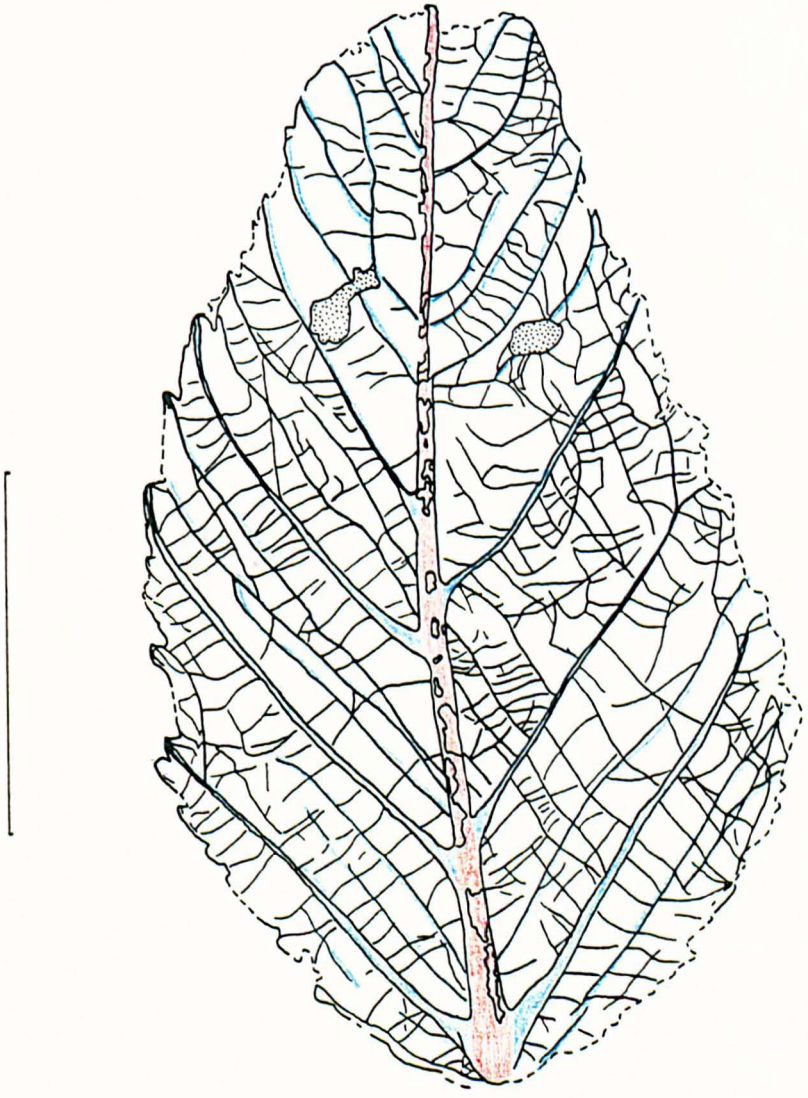


D8754.8.65a
Scale bar 10mm

D8754.8.7a
Scale bar 10mm



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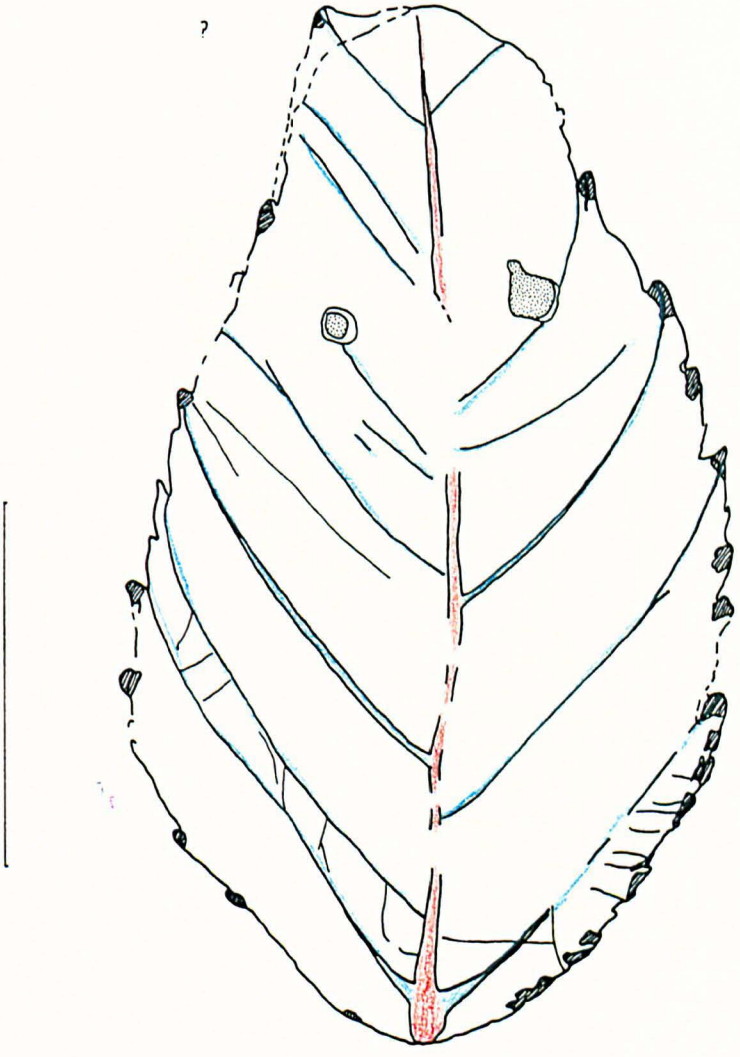

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D8754.8.8b
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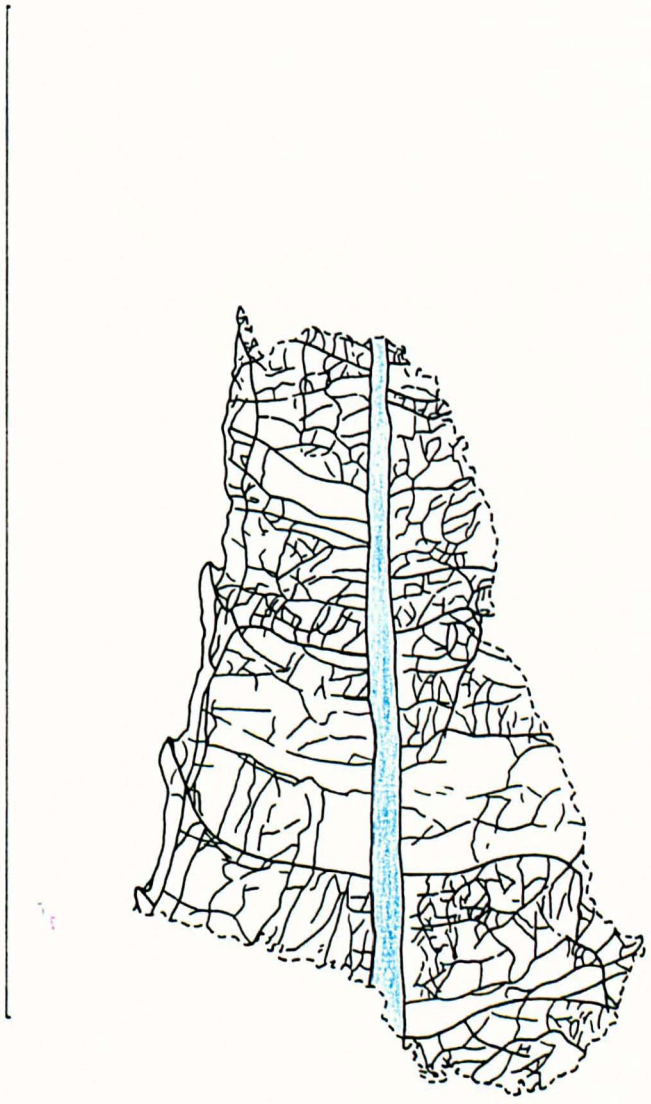

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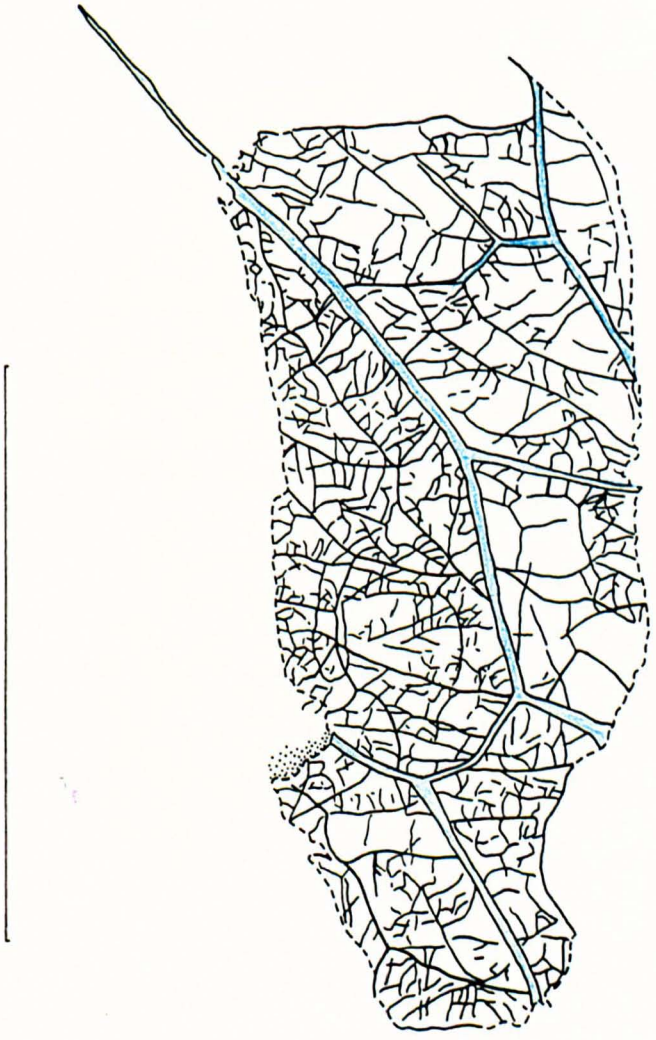

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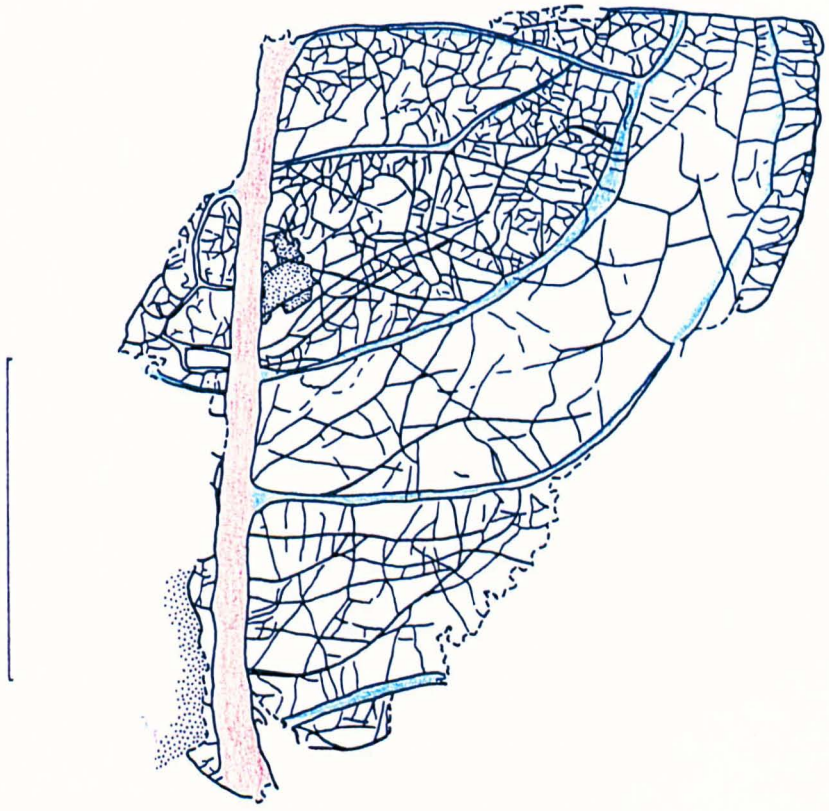


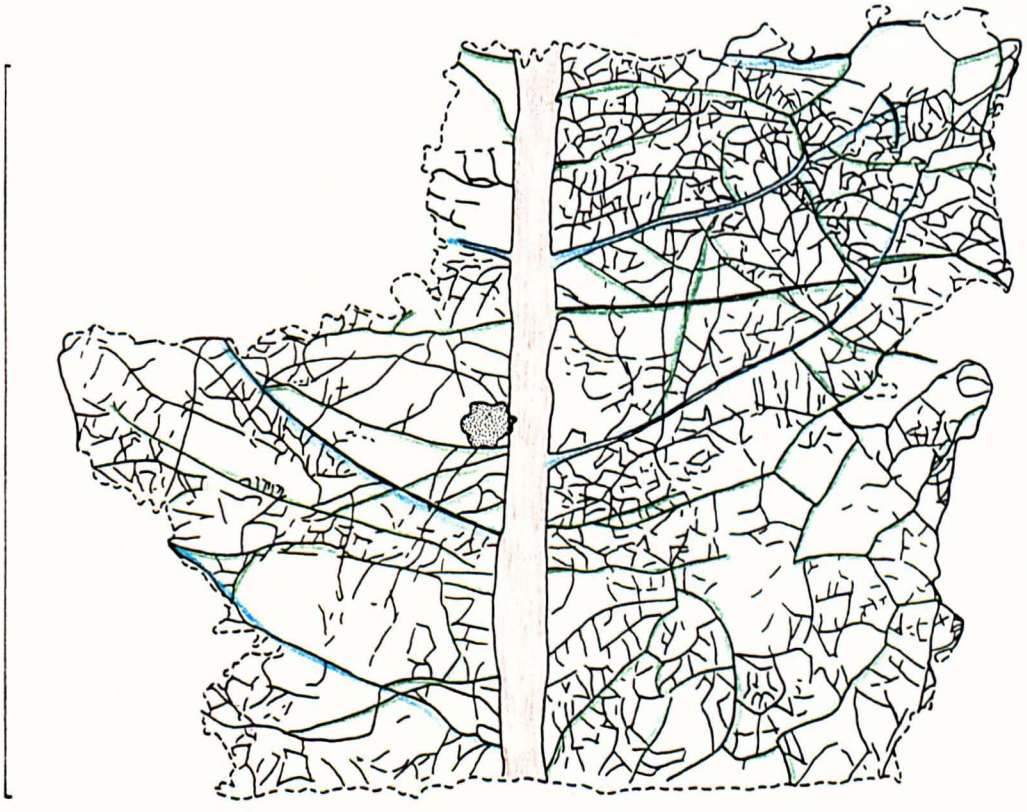
D8754.8.15a
Scale bar 10mm

D8754.8.16a
Scale bar 10mm

D8754.8.16b
Scale bar 10mm

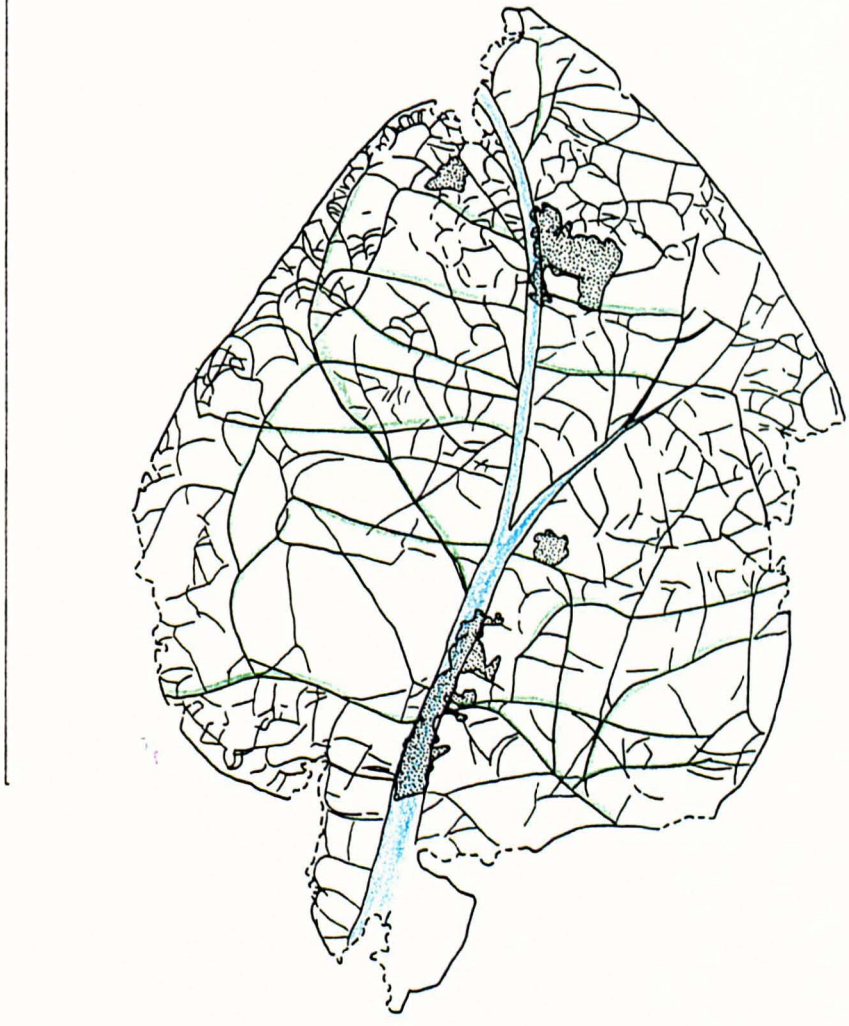
D8754.8.17b
Scale bar 10mm

D8754.8.21a
Scale bar 10mm



D8754.8.22b
Scale bar 10mm

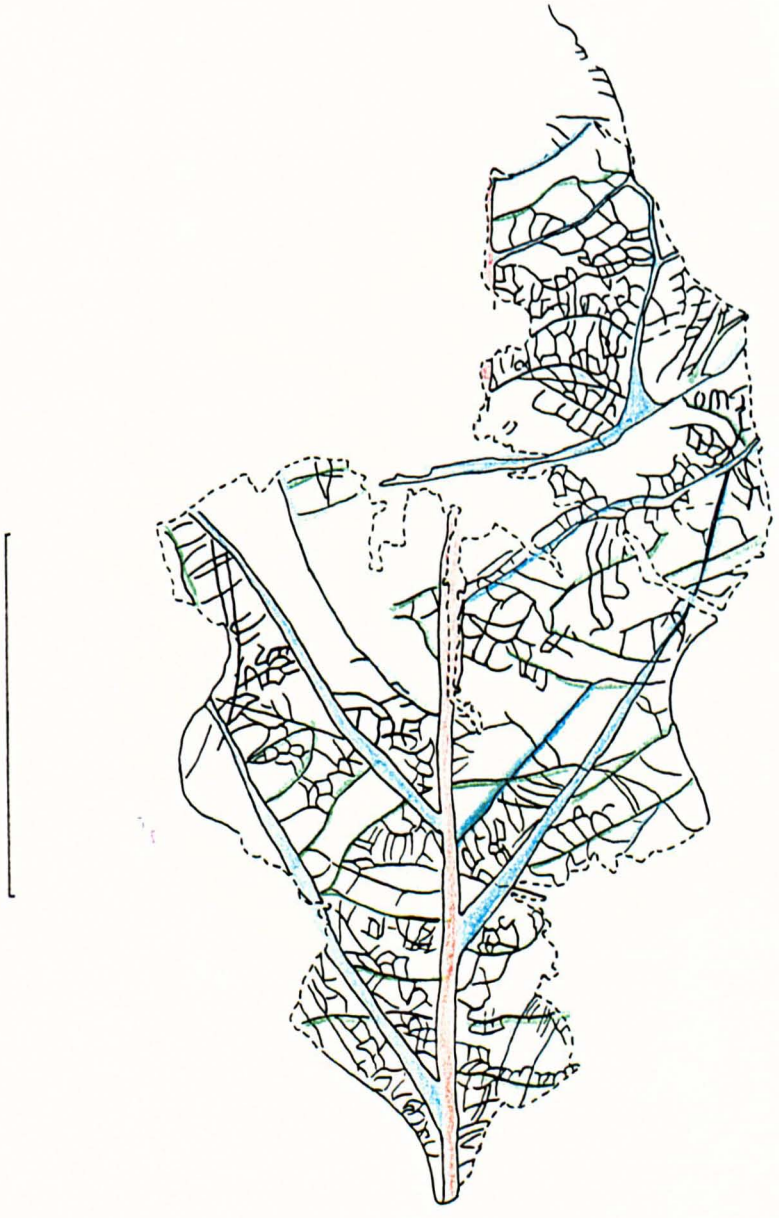
D8754.8.24b
Scale bar 10mm



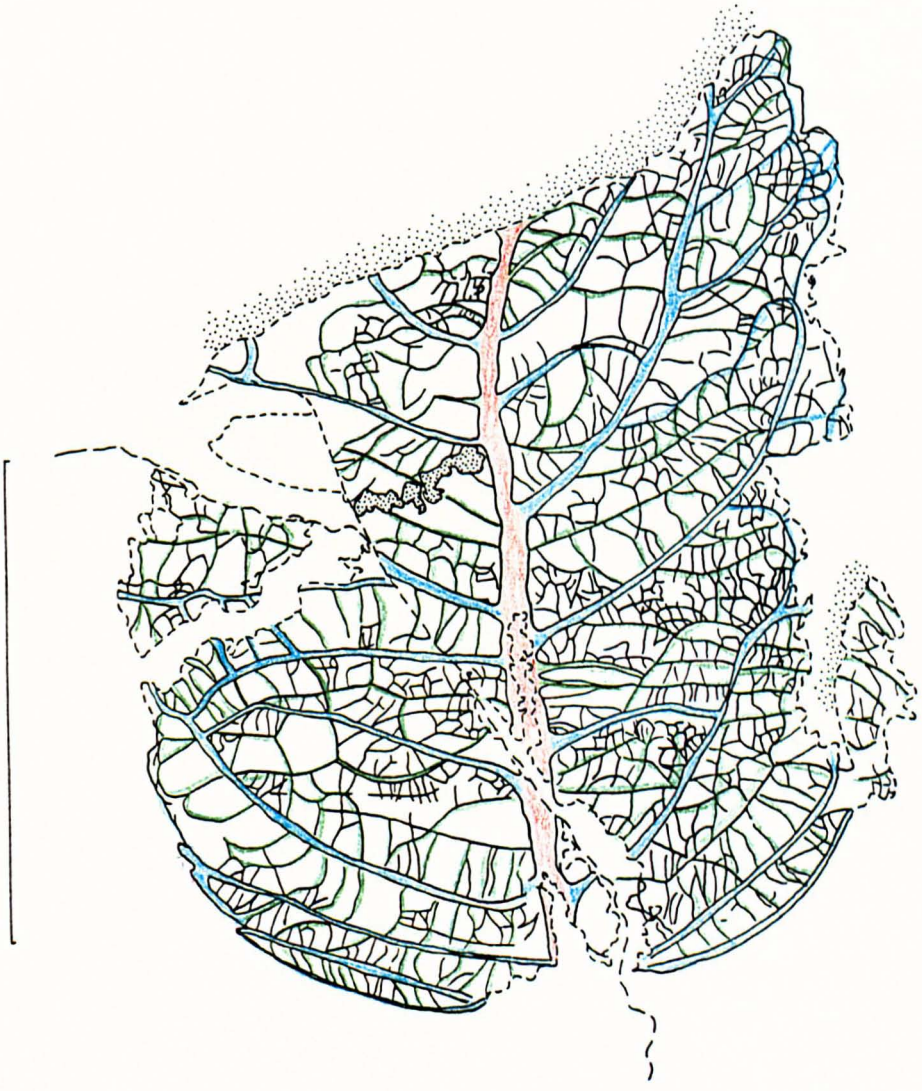
D8754.8.25a
Scale bar 10mm

D8754.8.26a
Scale bar 10mm

D8754.8.27a
Scale bar 10mm

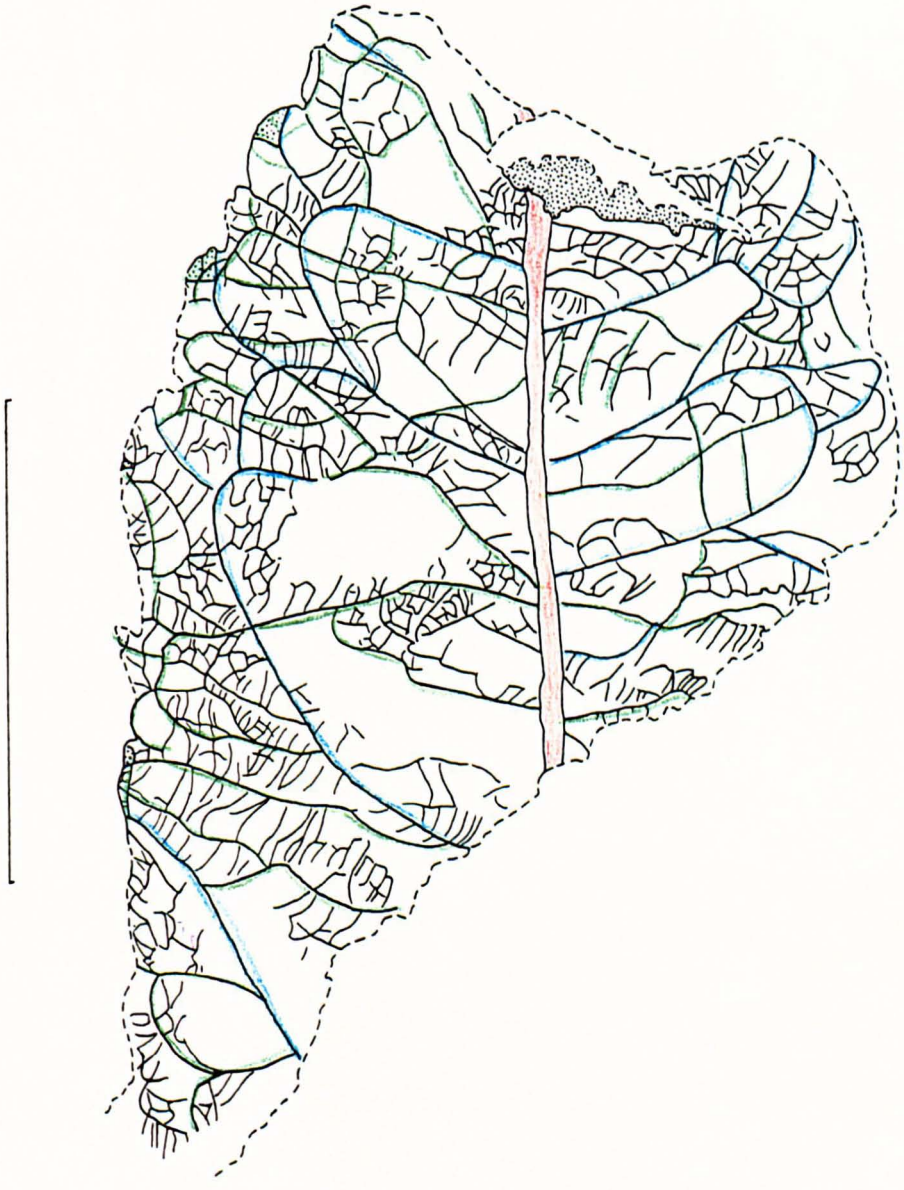


D8754.8.28a
Scale bar 10mm

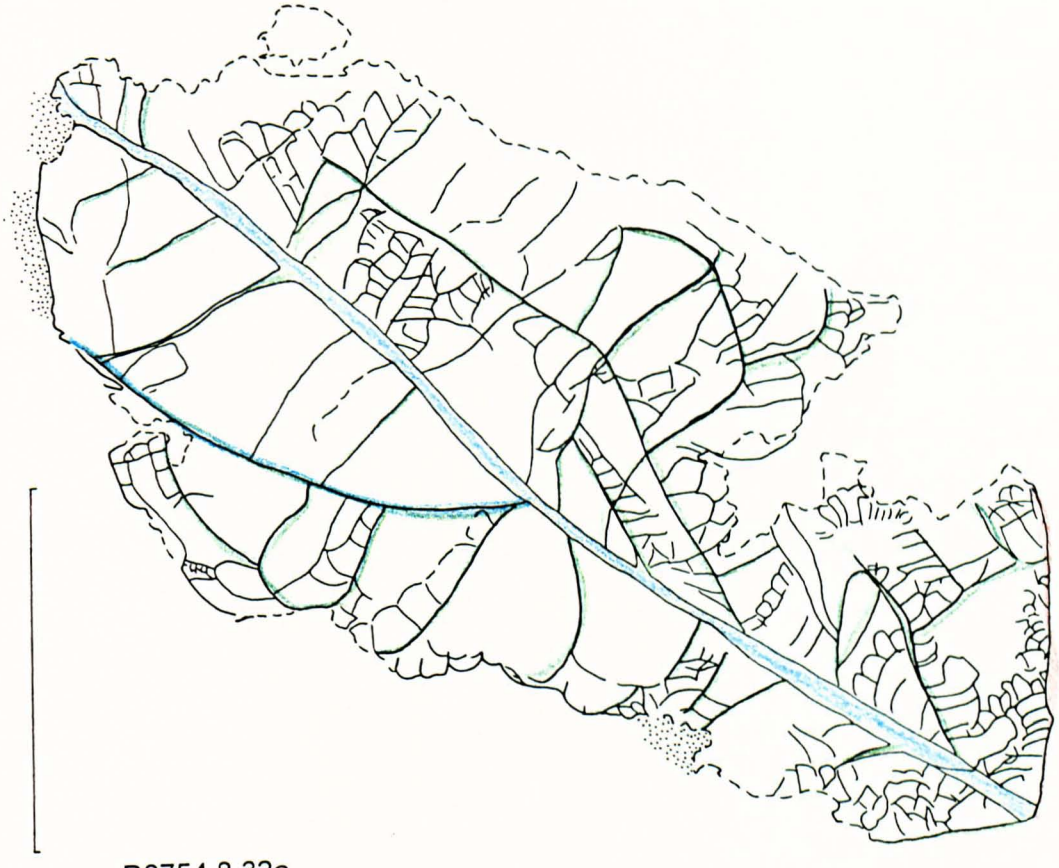


D8754.8.30a
Scale bar 10mm

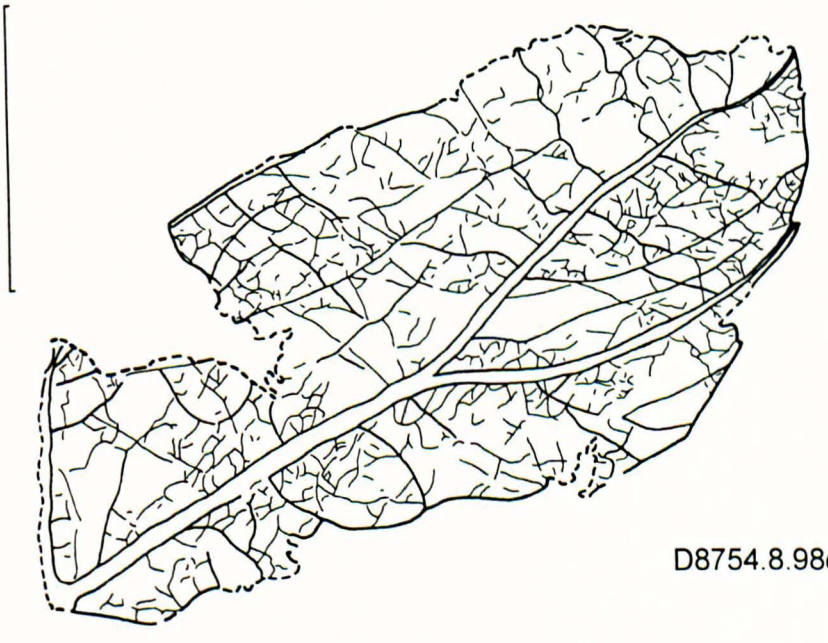
D8754.8.30a
Scale bar 10mm



D8754.8.31a
Scale bar 10mm

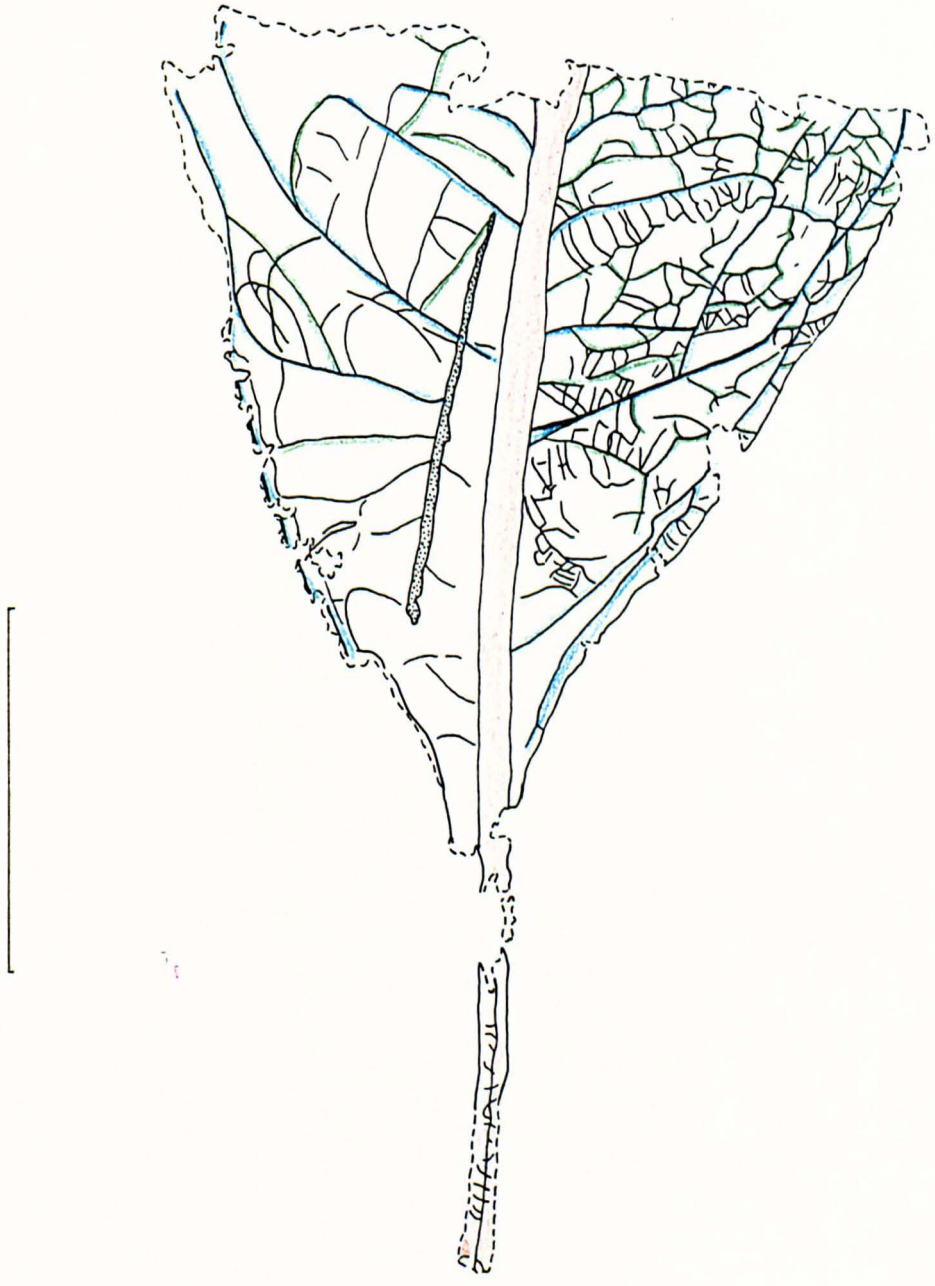


D8754.8.32a



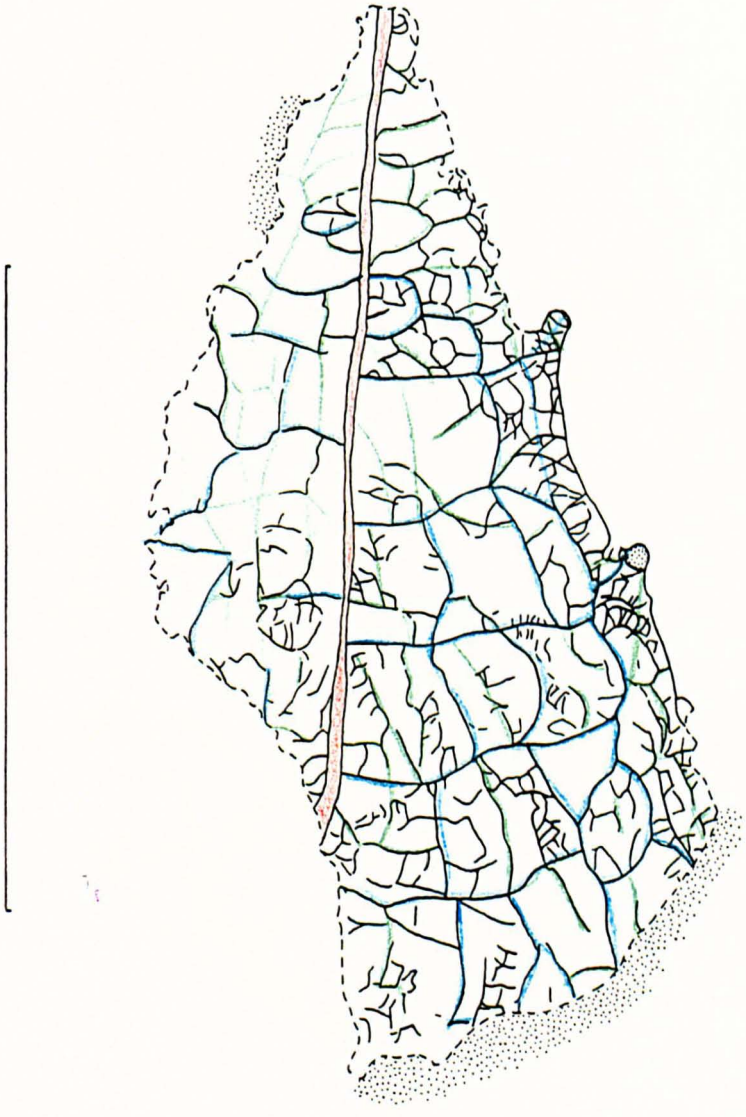
D8754.8.98e

D8754.8.32a and D8754.8.98e
Scale bar 10mm

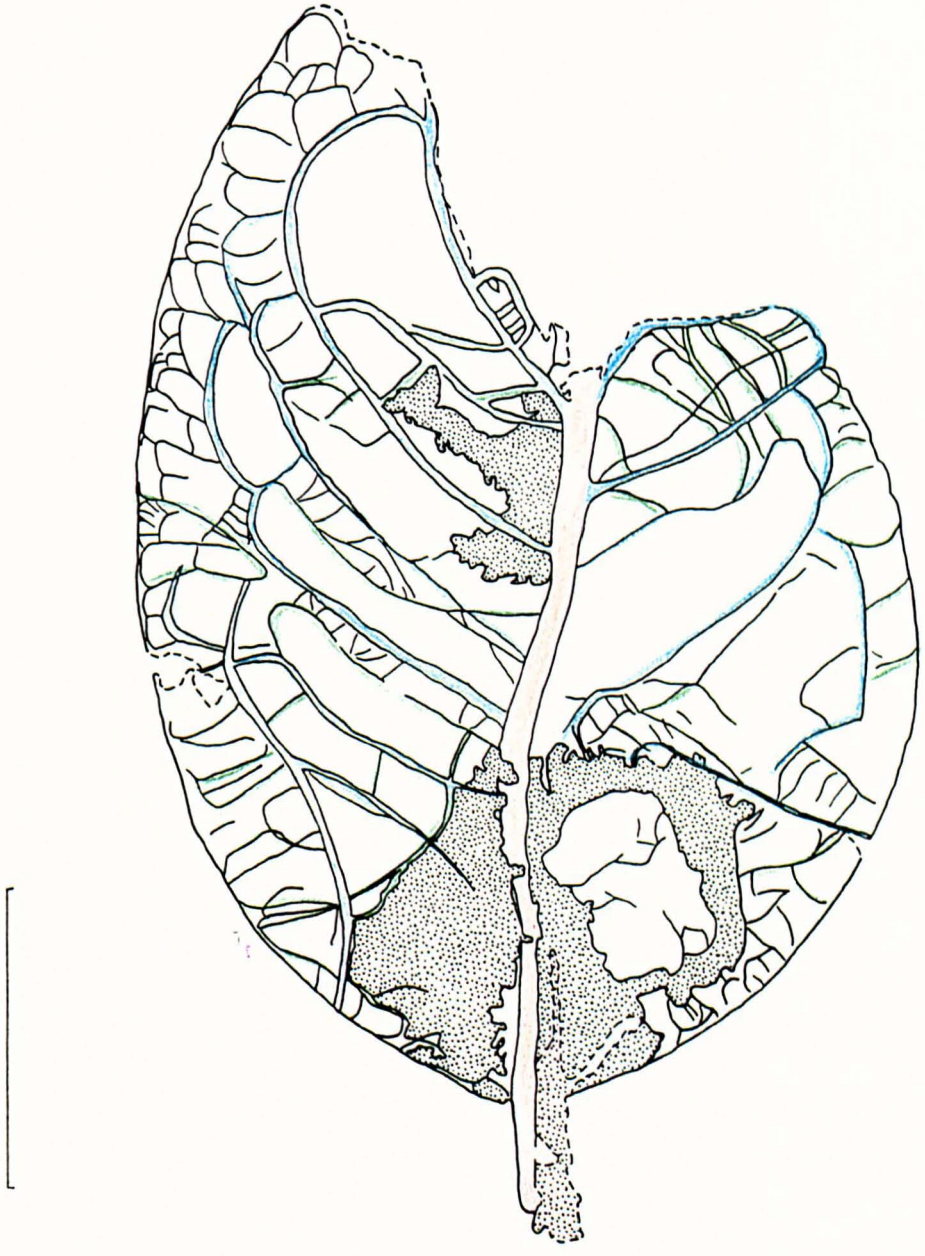


D8754.8.33a
Scale bar 10mm

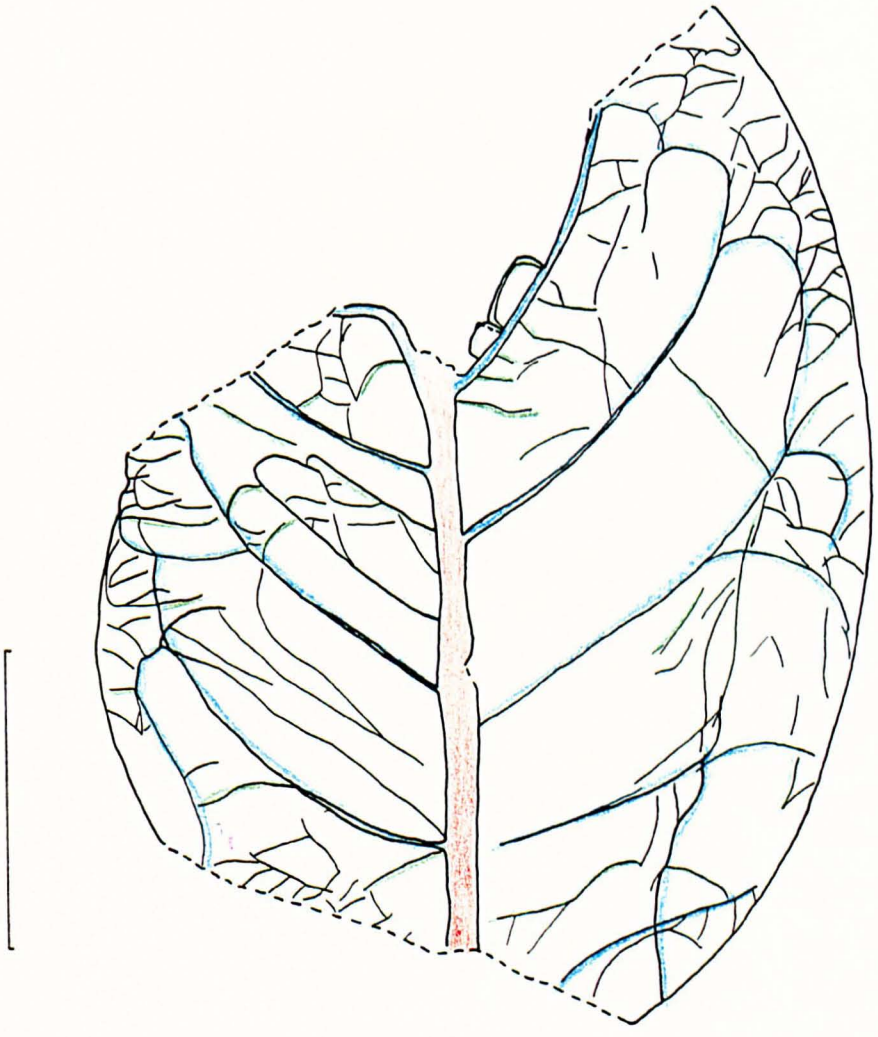
D8754.8.34a
Scale bar 10mm



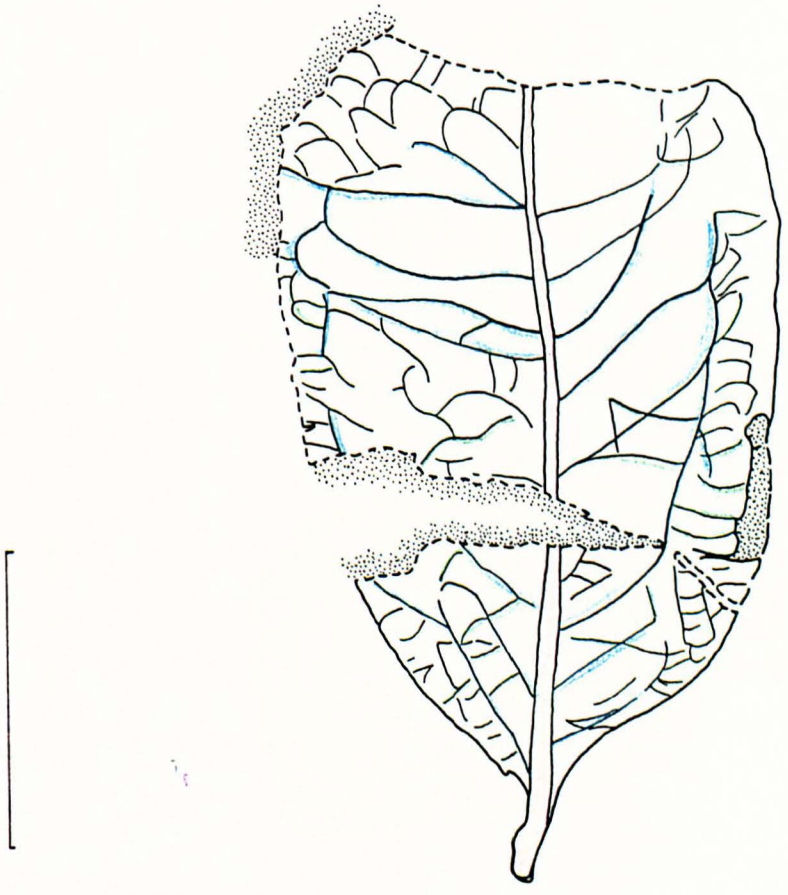
D8754.8.34b
Scale bar 10mm



D8754.8.35a
Scale bar 10mm

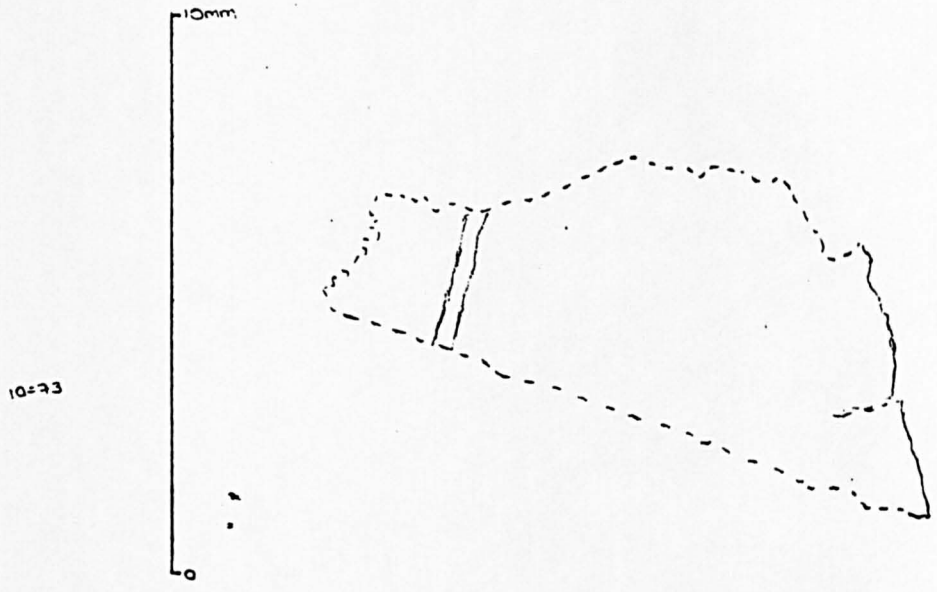


D8754.8.37a
Scale bar 10mm

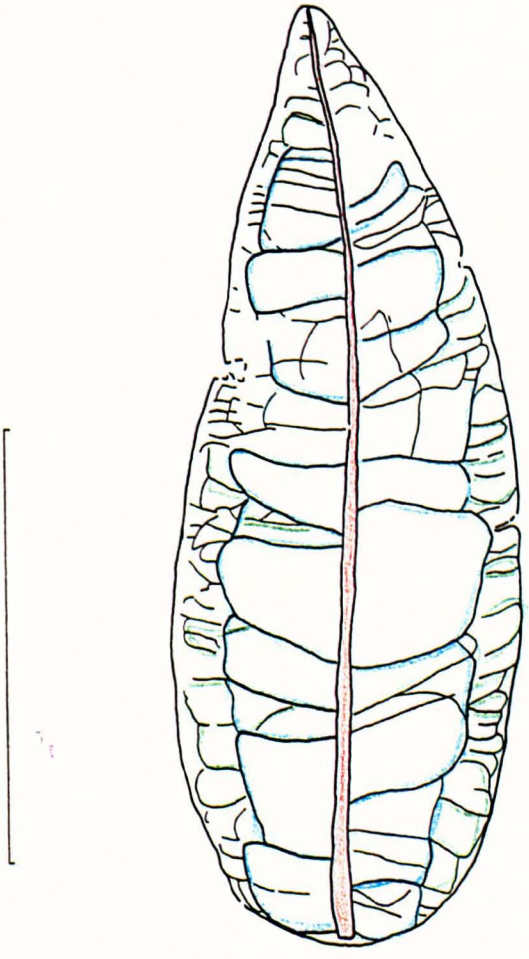


D8754.8.36a
Scale bar 10mm

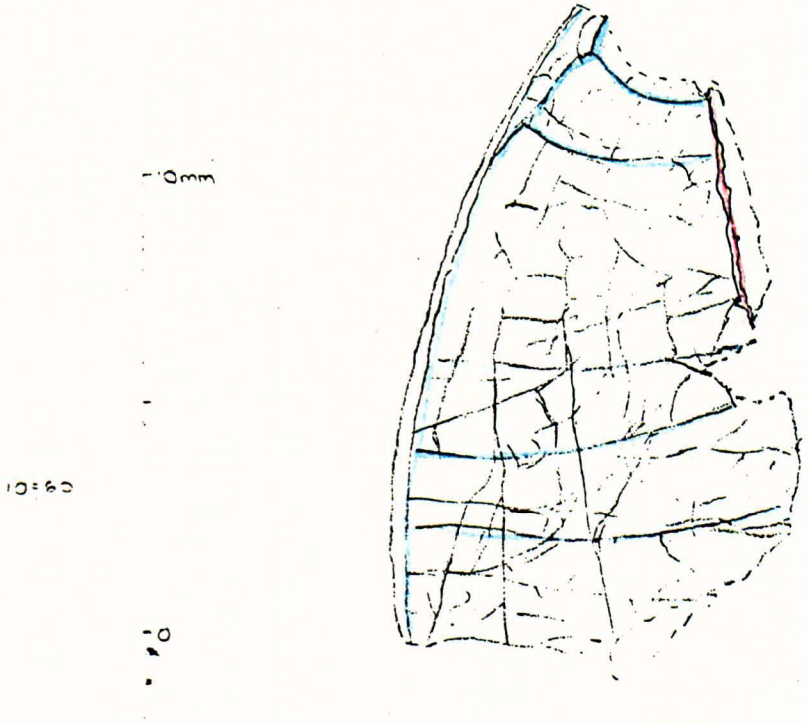
D8754.8.38a
Scale bar 10mm



D8754.8.38b
Scale bar 10mm

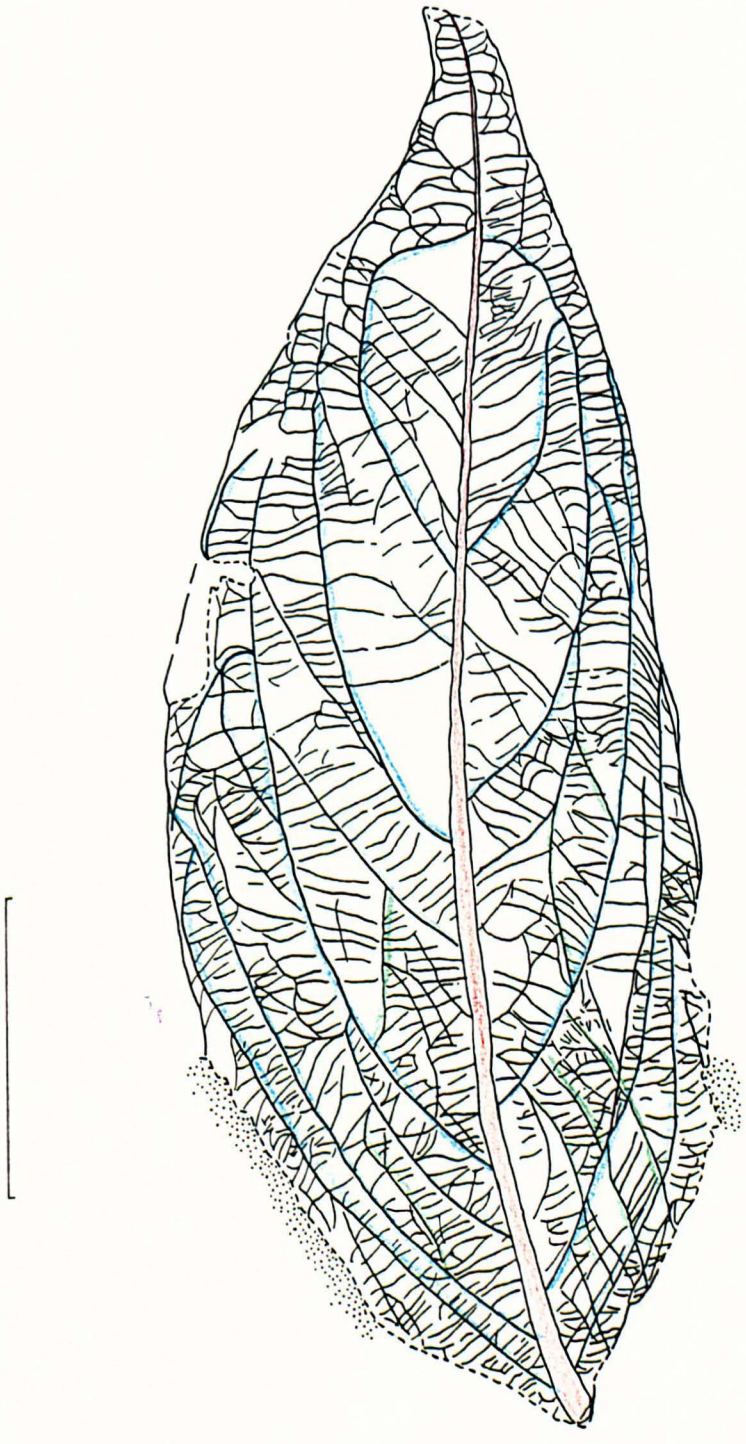


D8754.8.39a
Scale bar 10mm

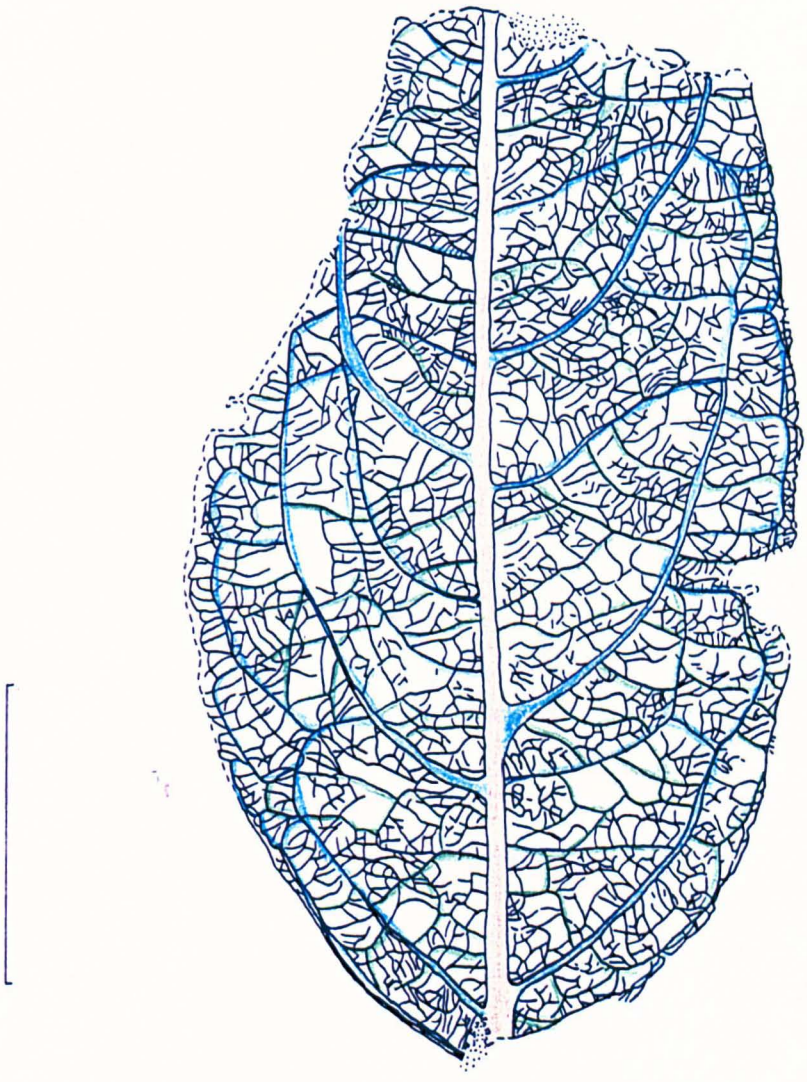


D8754.8.39b
Scale bar 10mm

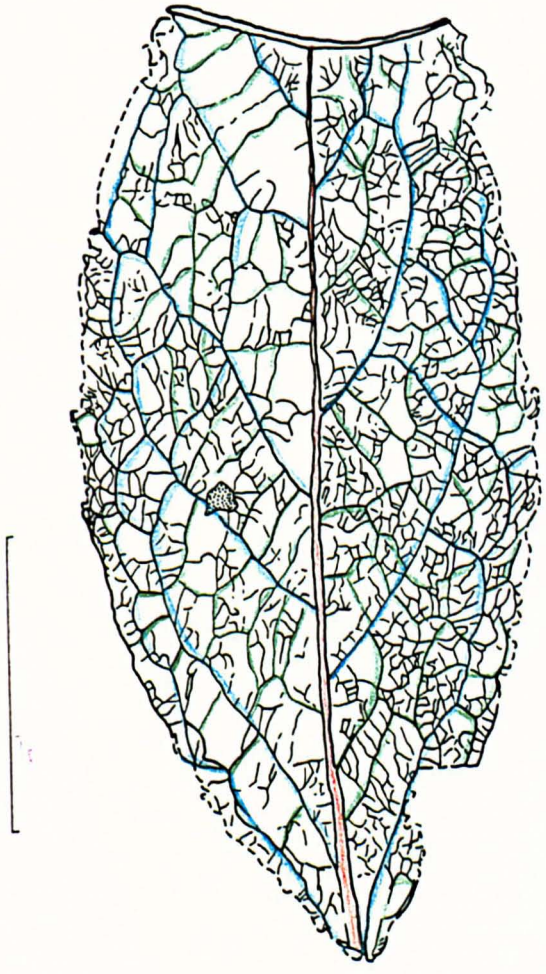
D8754.8.40a
Scale bar 10mm



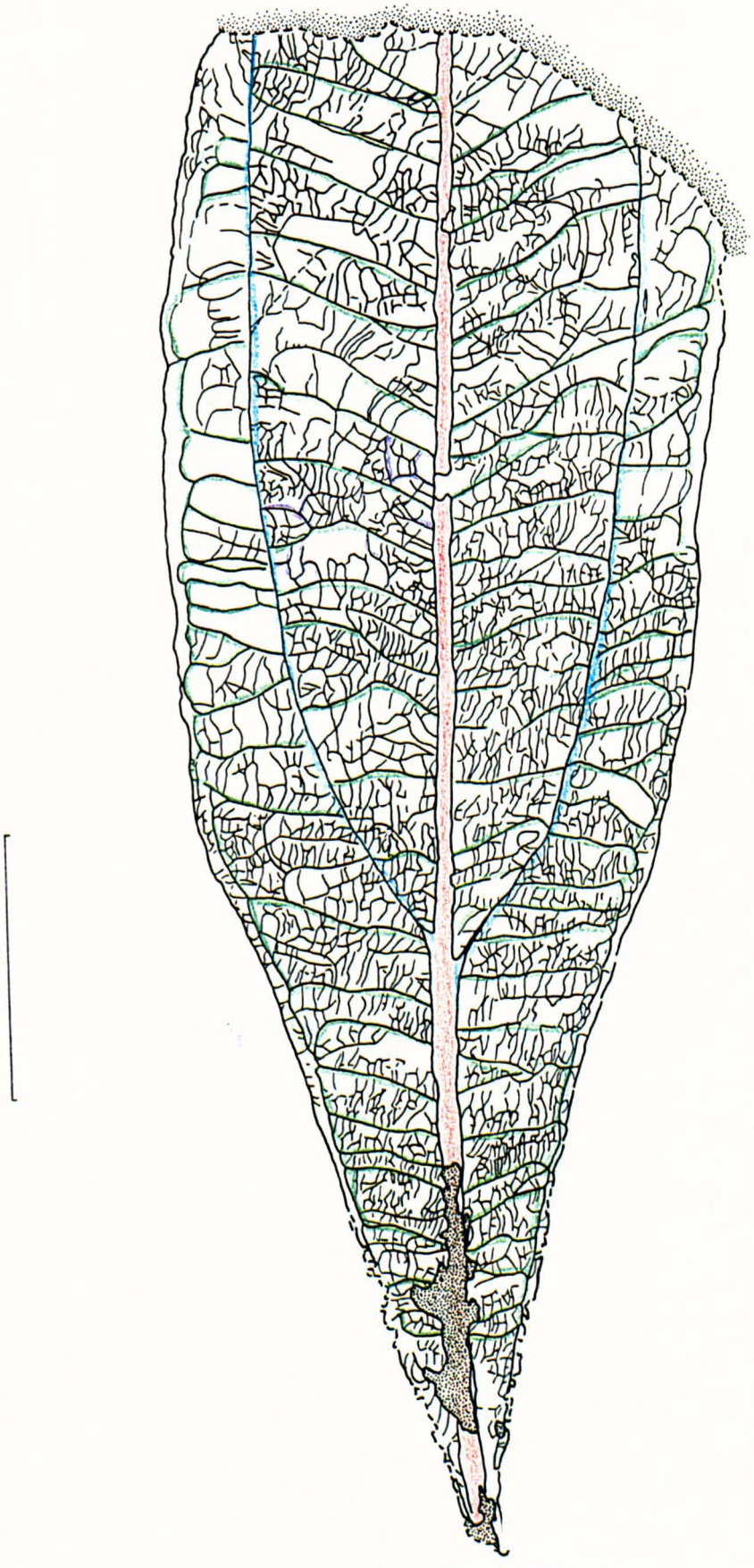
D8754.8.41a
Scale bar 10mm



D8754.8.42a
Scale bar 10mm

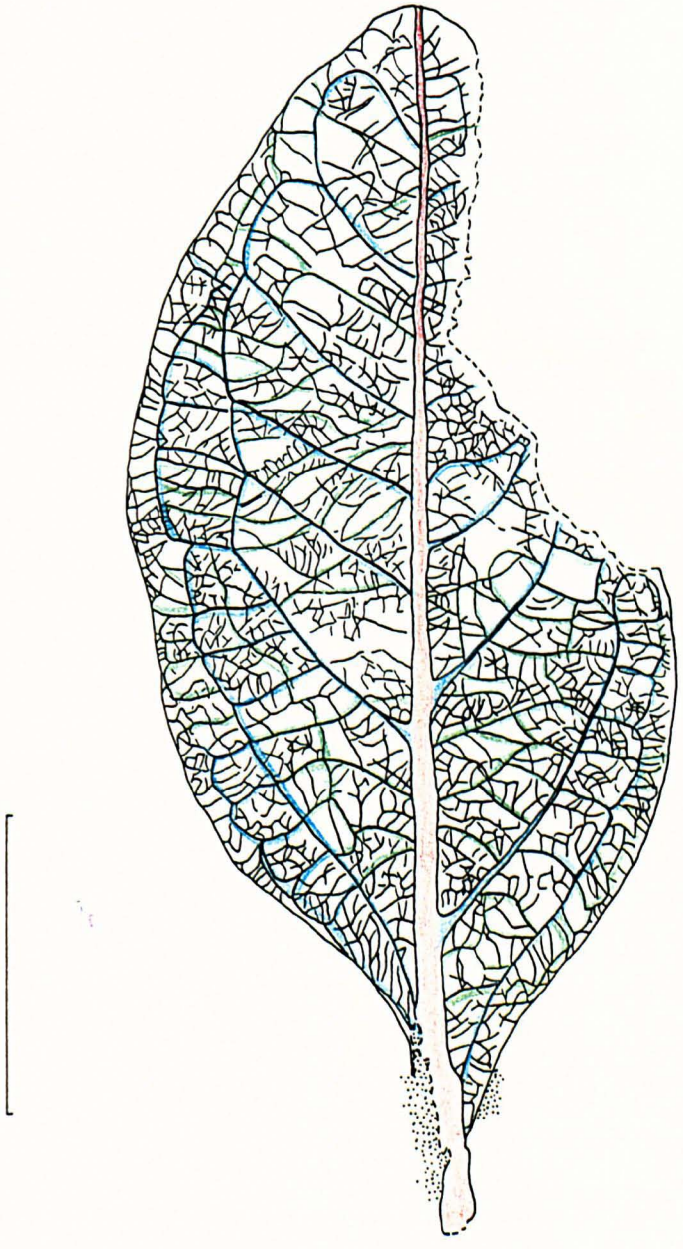


D8754.8.43a
Scale bar 10mm



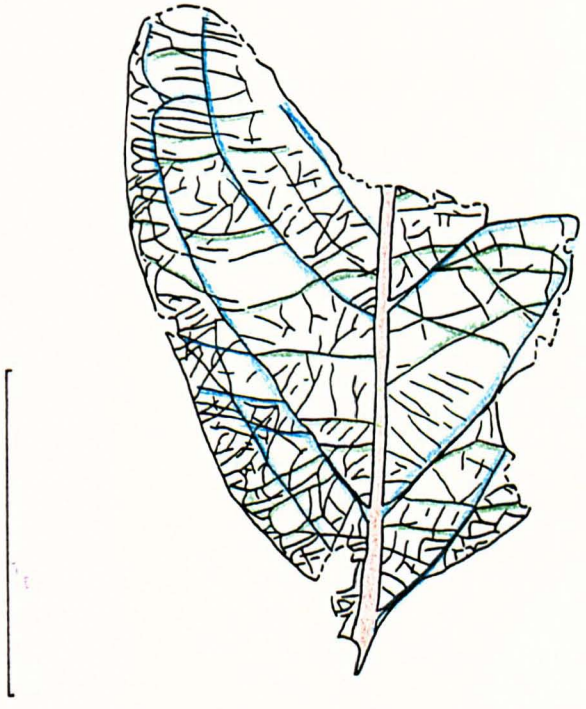
D8754.8.44a
Scale bar 10mm

D8754.8.44b
Scale bar 10mm

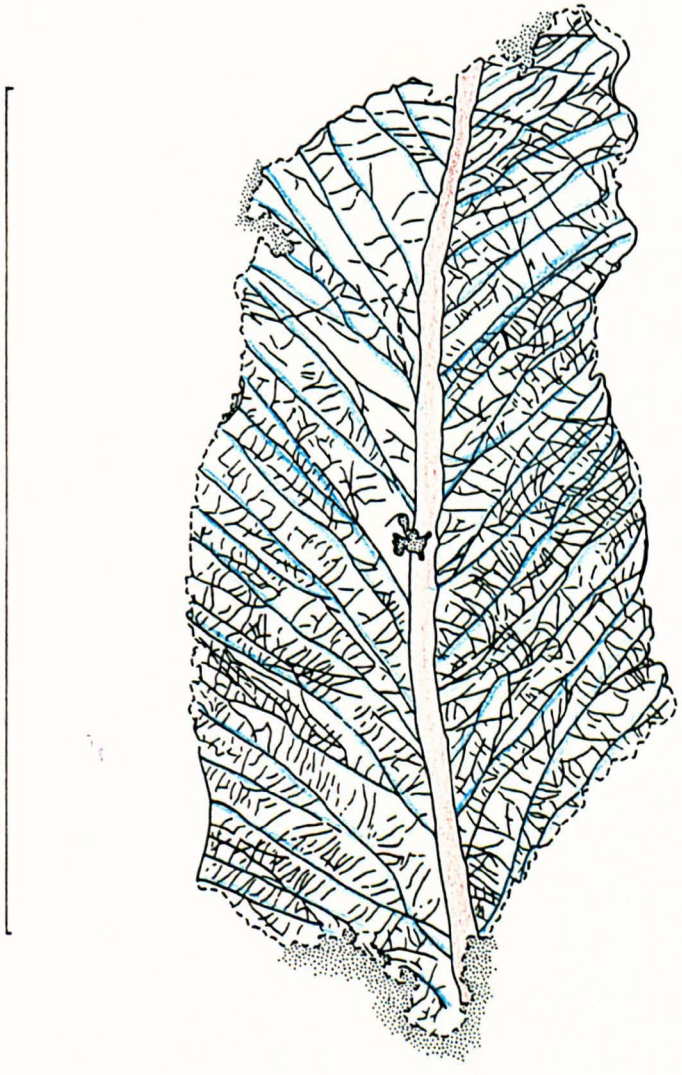


D8754.8.45a
Scale bar 10mm

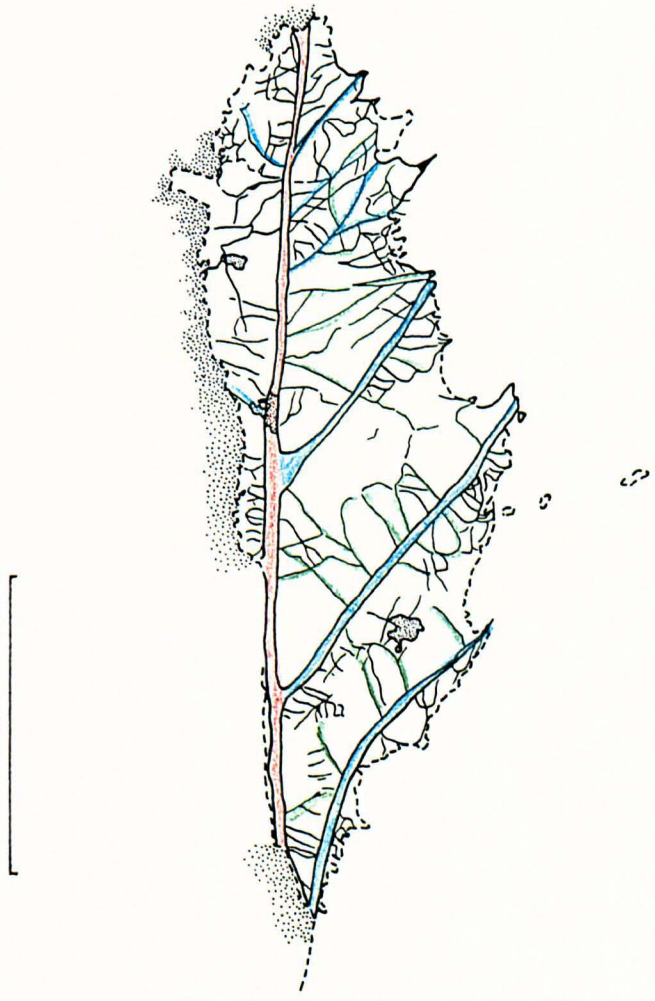
D8754.8.45b
Scale bar 10mm



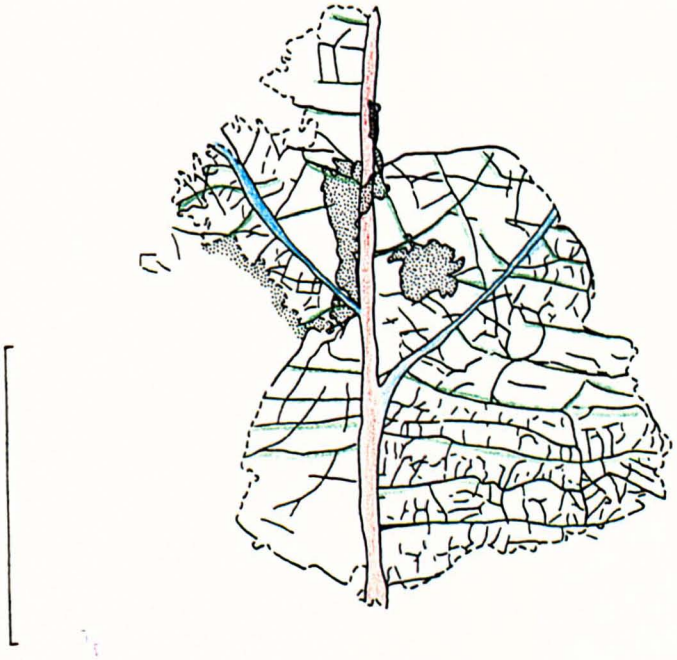
D8754.8.46a
Scale bar 10mm



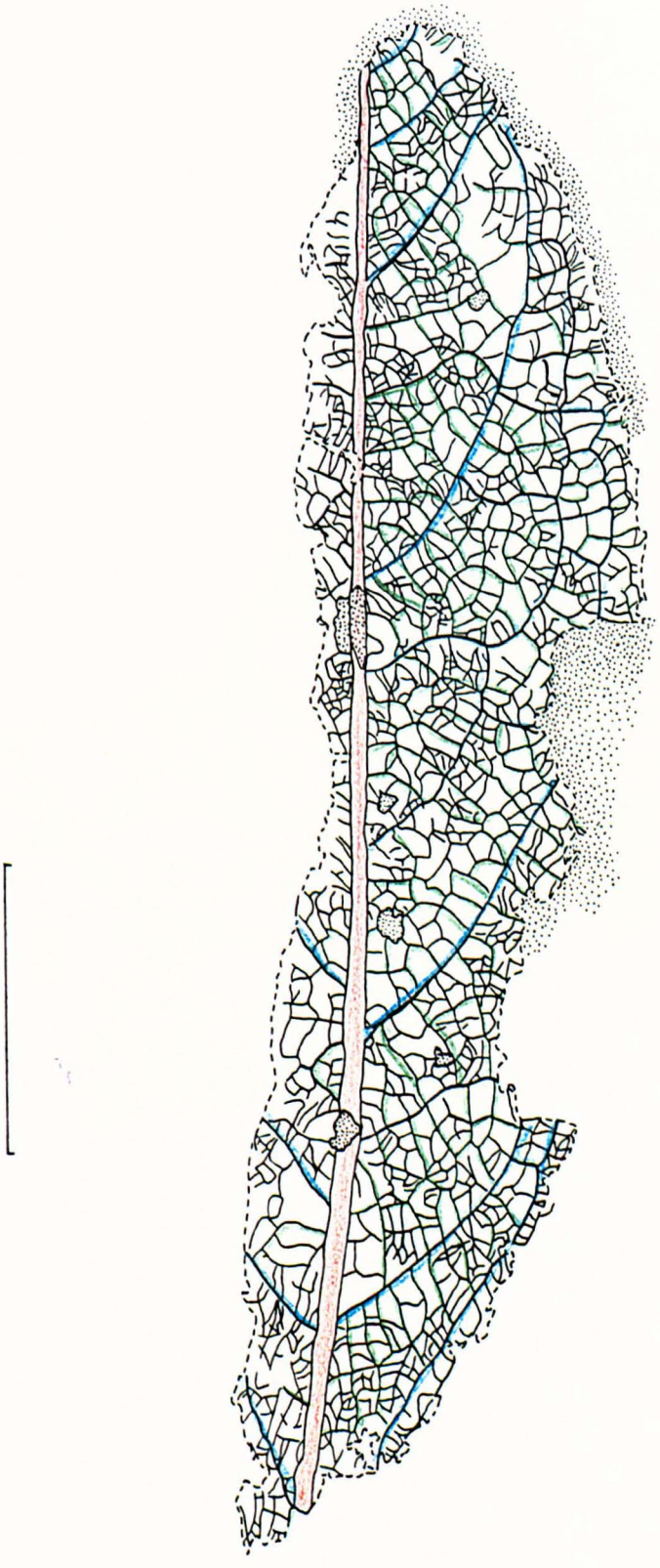
D8754.8.46d
Scale bar 10mm



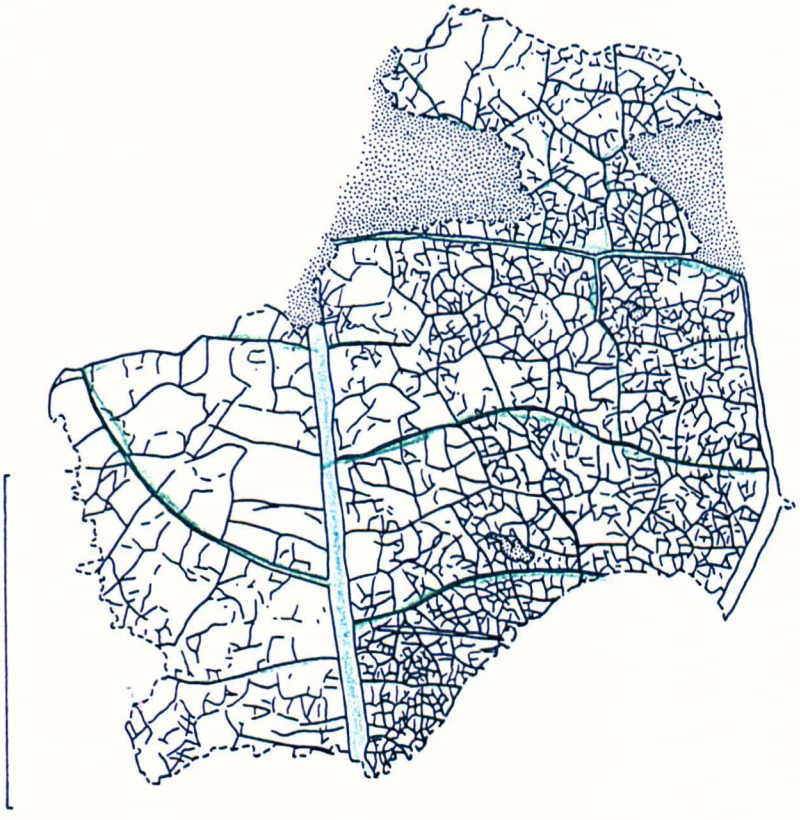
D8754.8.47a
Scale bar 10mm



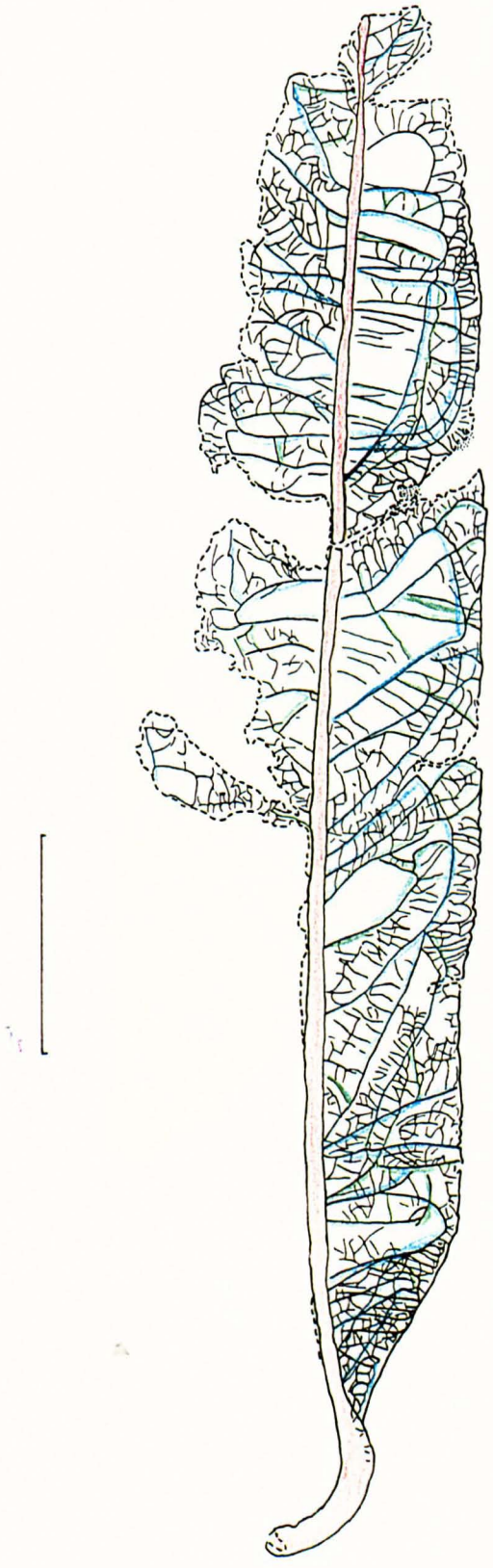
D8754.8.47b
Scale bar 10mm



D8754.8.48a
Scale bar 10mm

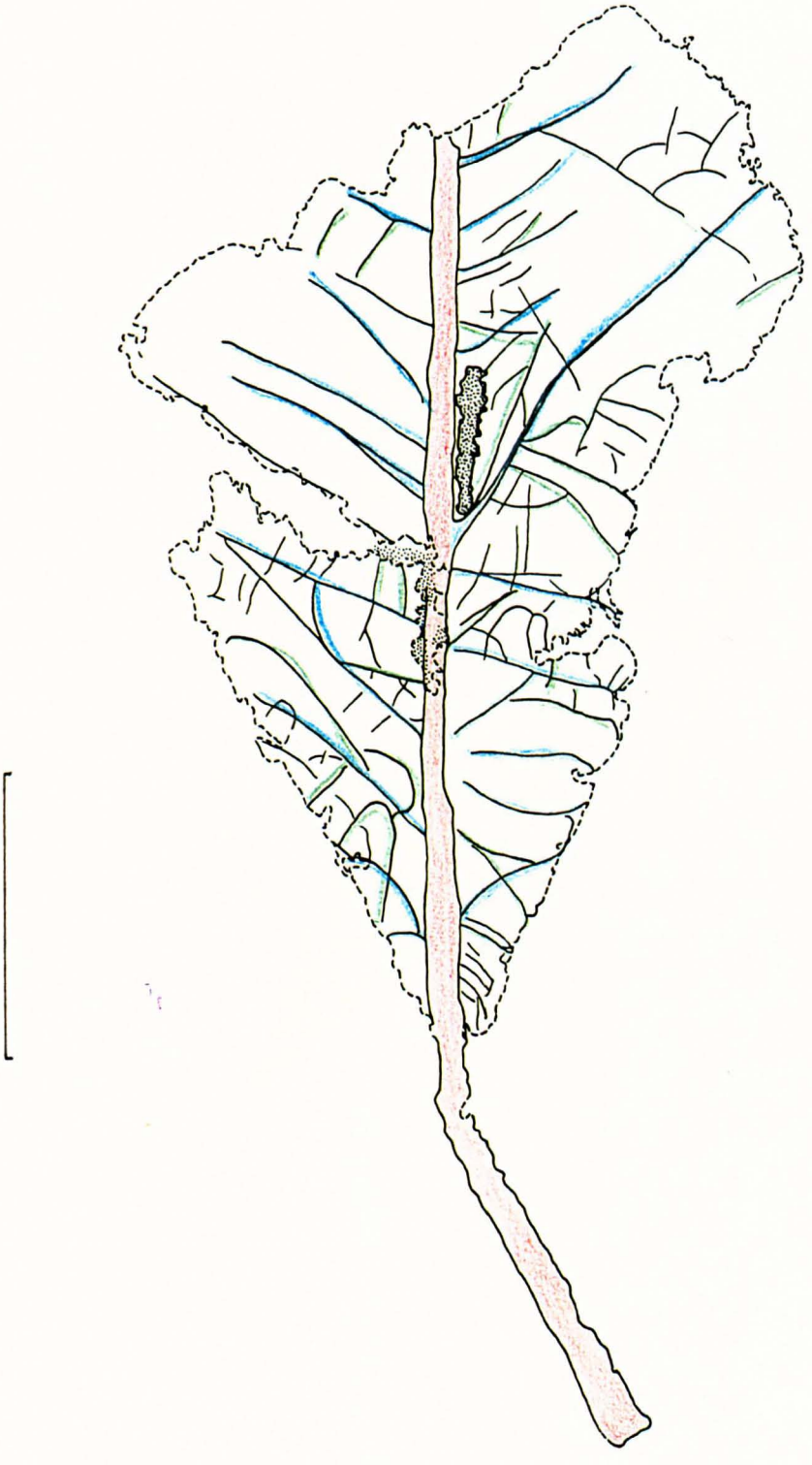


D8754.8.48b
Scale bar 10mm

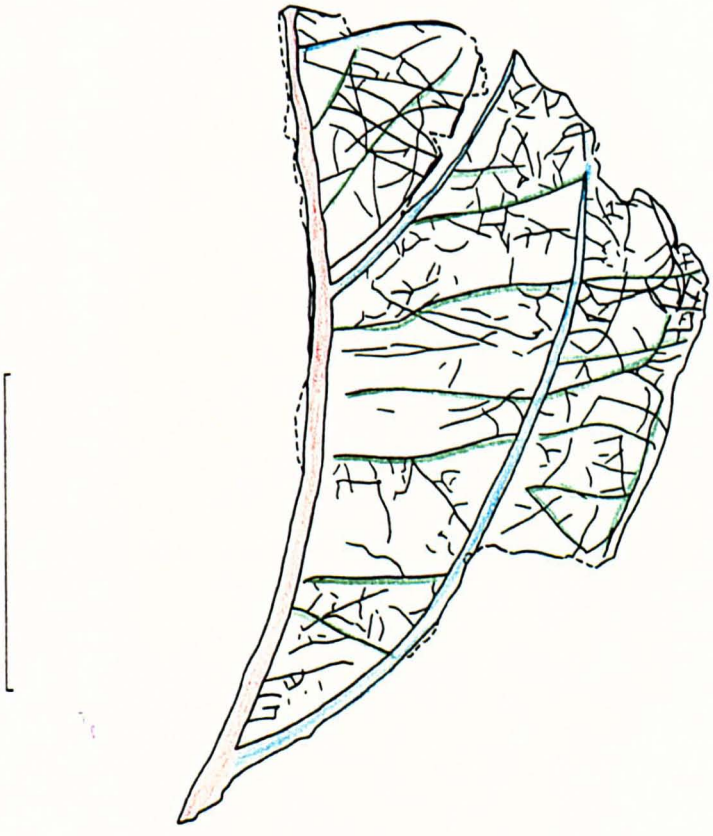


D8754.8.49a
Scale bar 10mm

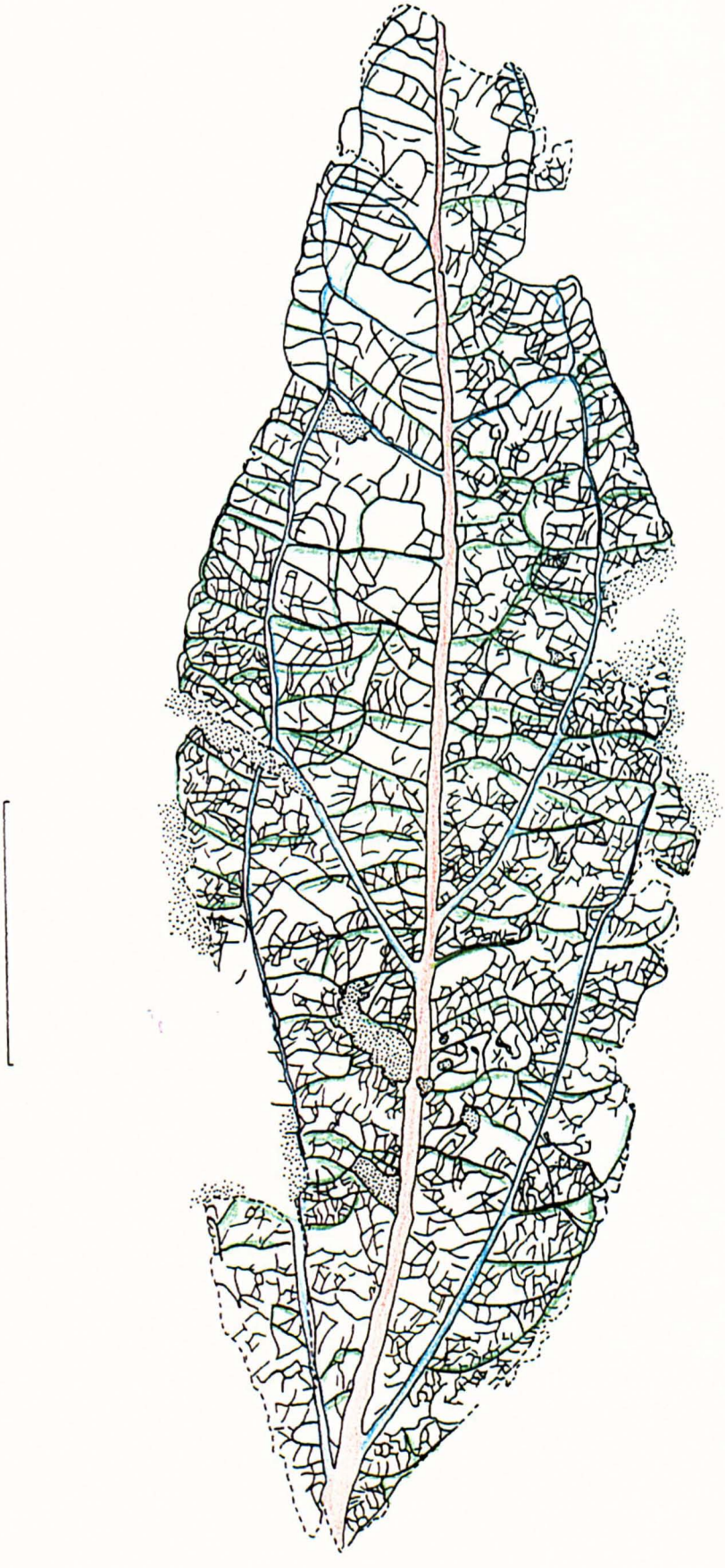
D8754.8.49b
Scale bar 10mm



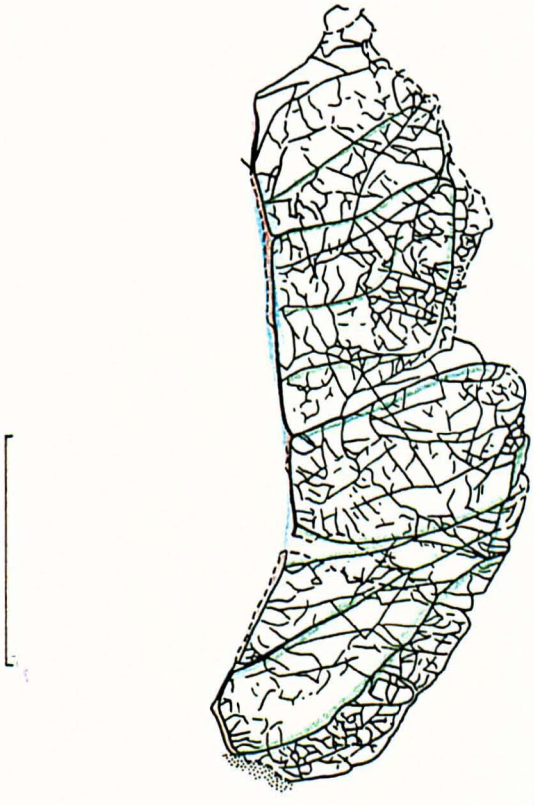
D8754.8.50a
Scale bar 10mm



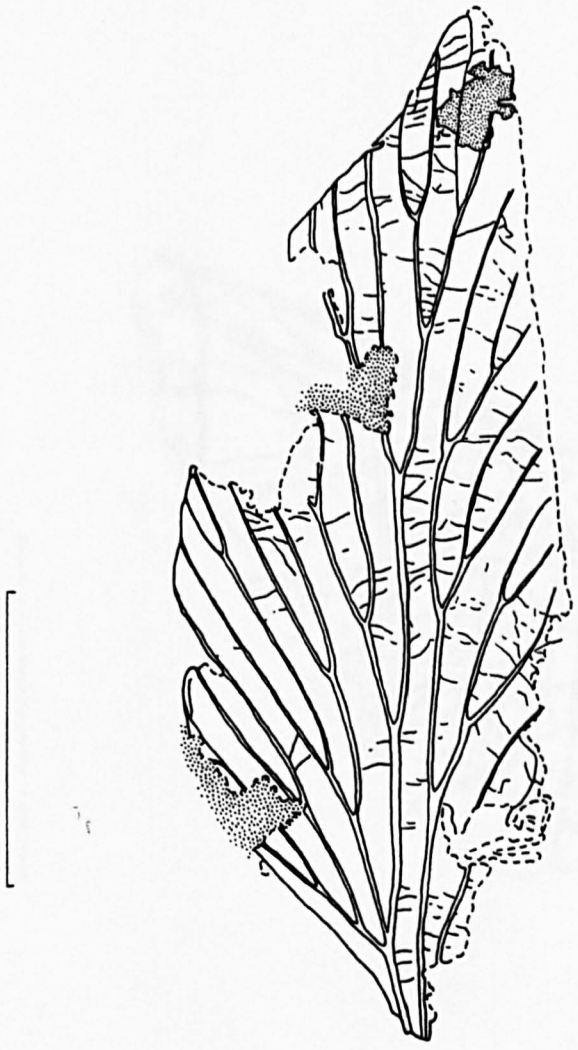
D8754.8.50b
Scale bar 10mm



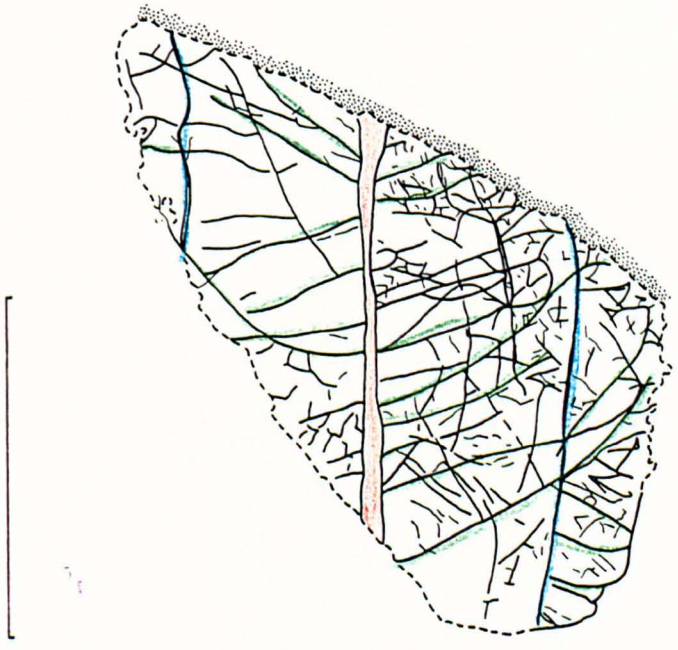
D8754.8.54a
Scale bar 10mm



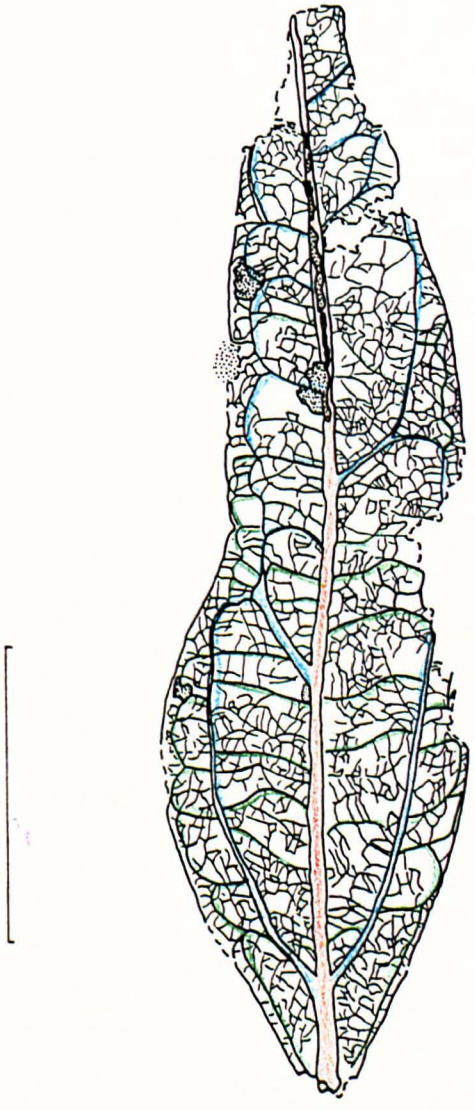
D8754.8.54b
Scale bar 10mm



D8754.8.56a
Scale bar 10mm

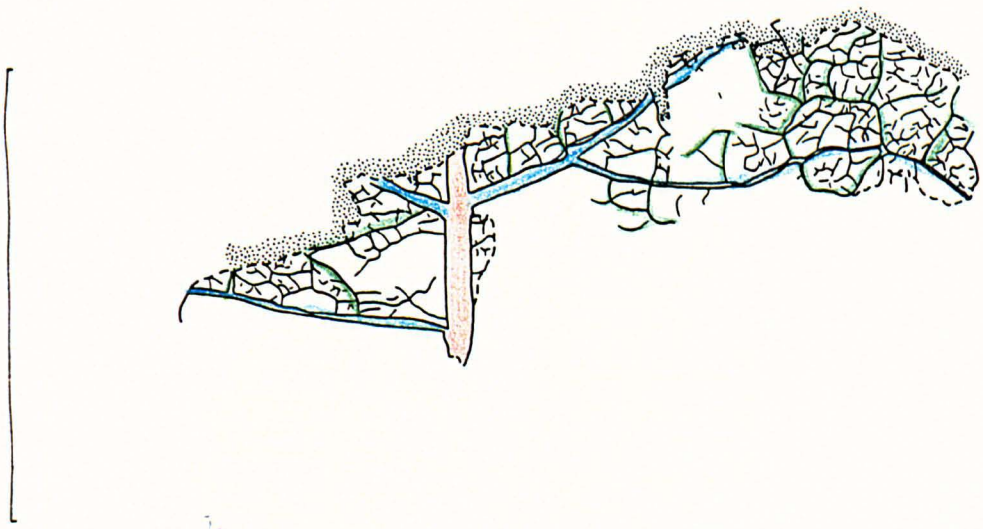


D8754.8.56b
Scale bar 10mm

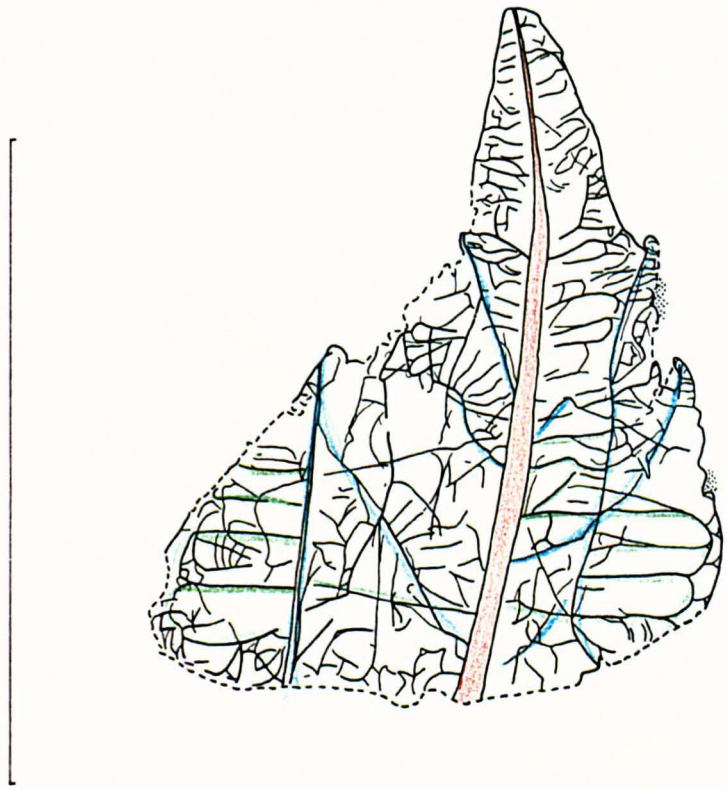


D8754.8.57a
Scale bar 10mm

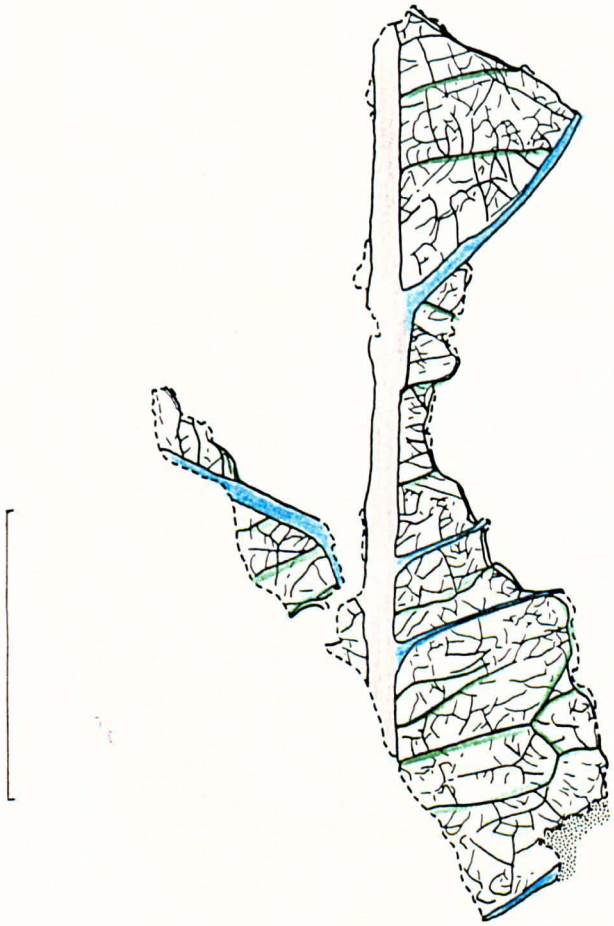
D8754.8.58a
Scale bar 10mm



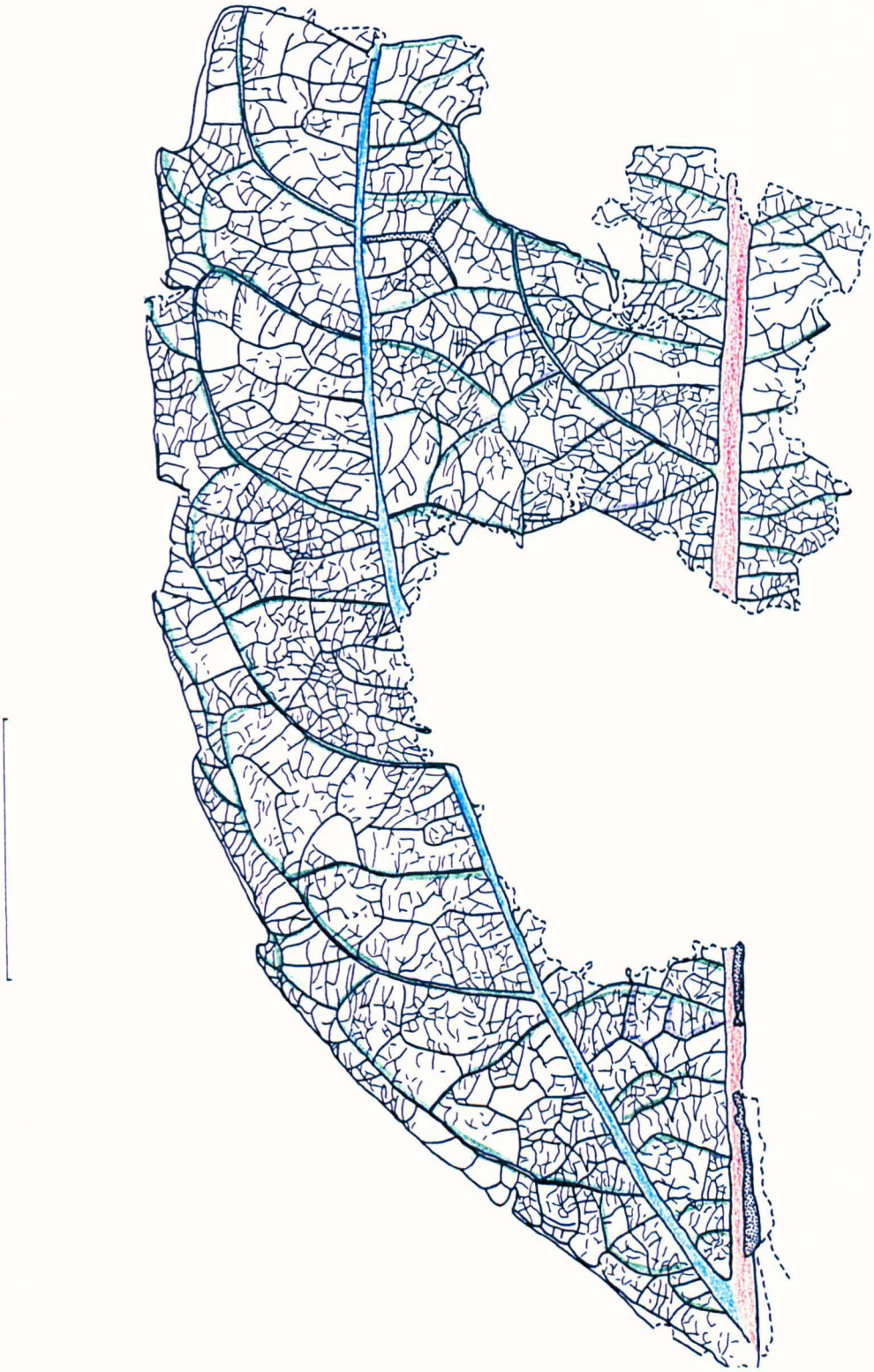
D8754.8.58b
Scale bar 10mm



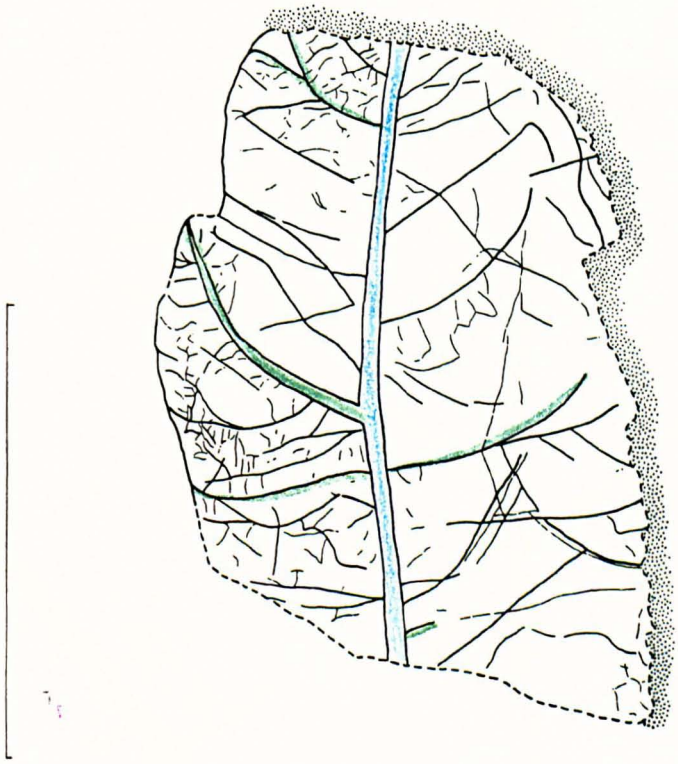
D8754.8.59a
Scale bar 10mm



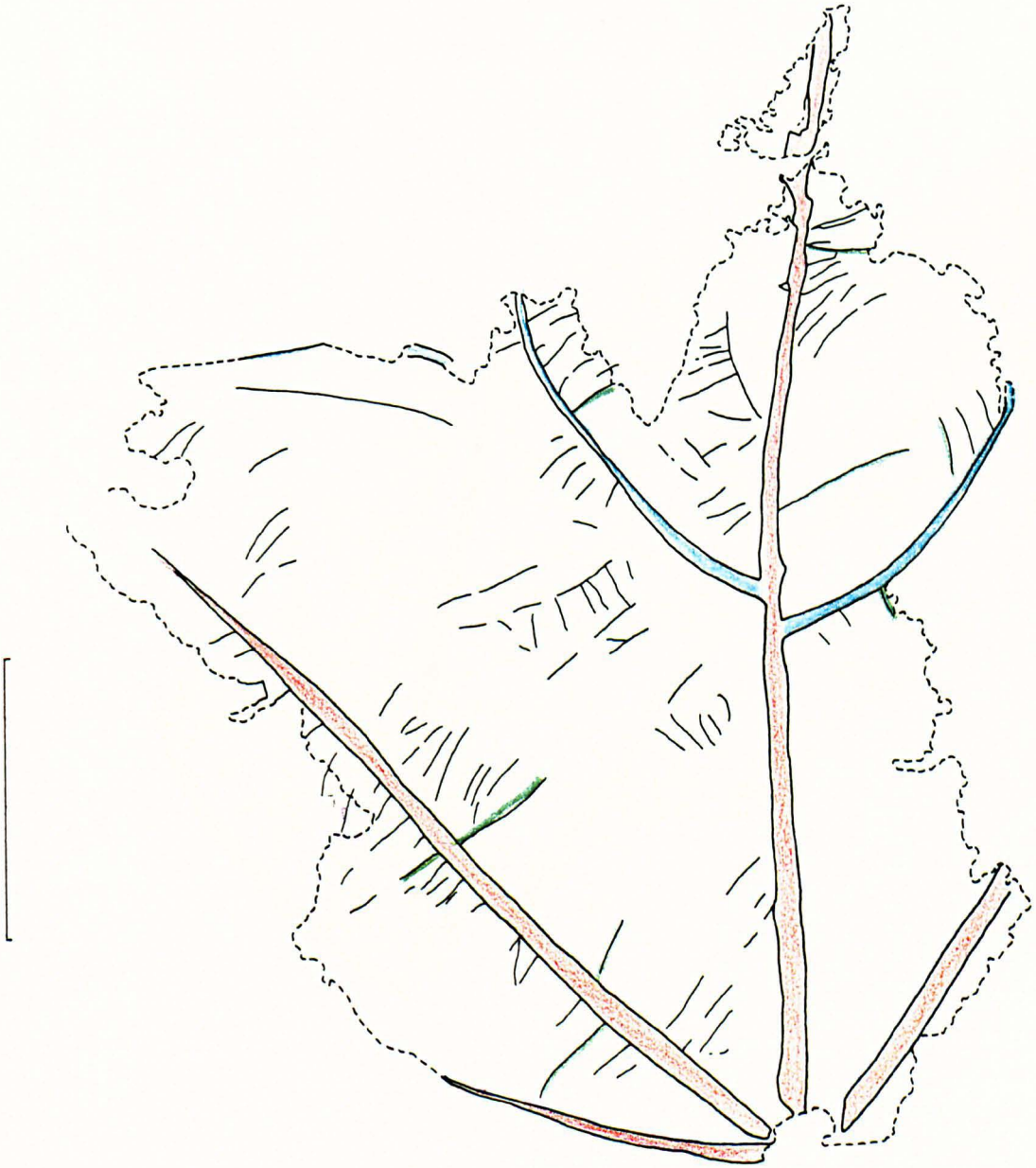
D8754.8.59c
Scale bar 10mm



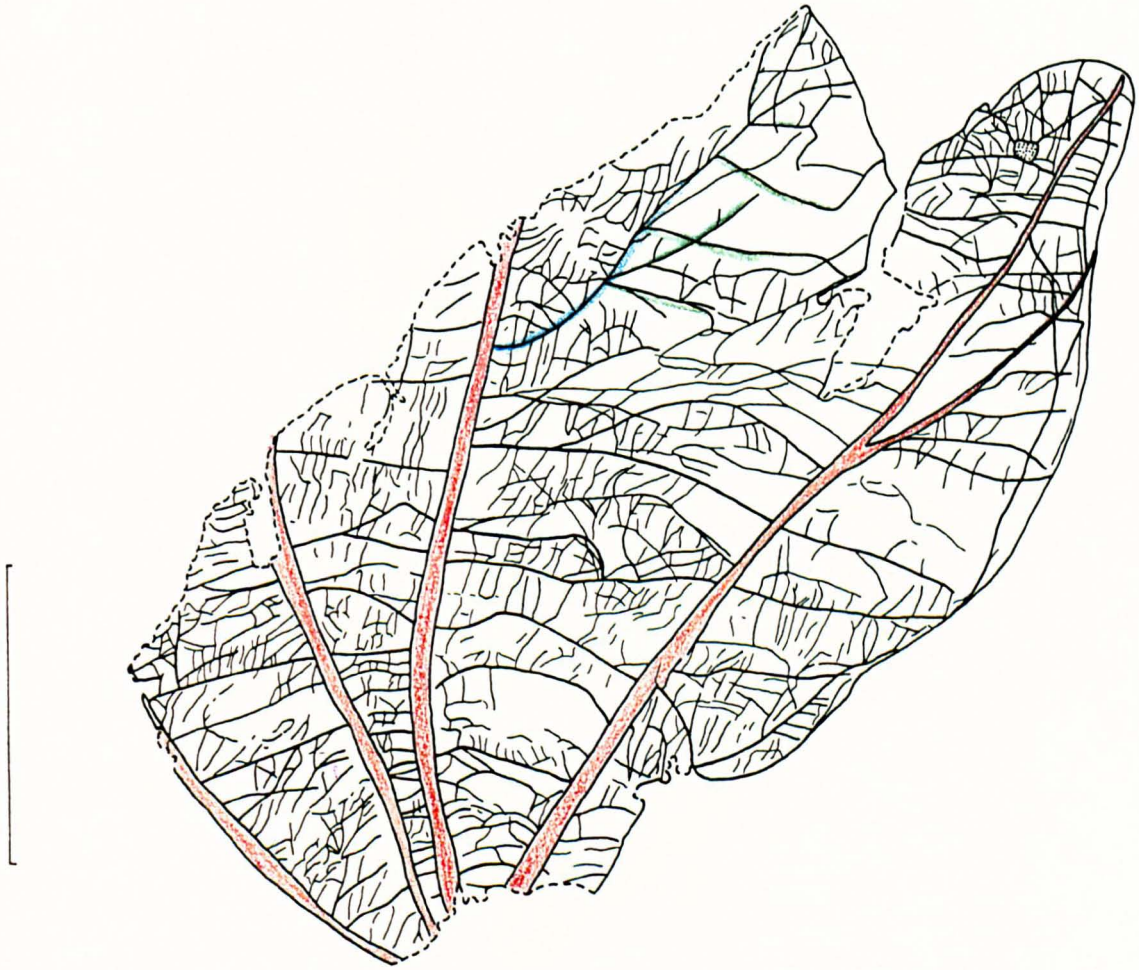
D8754.8.60a
Scale bar 10mm



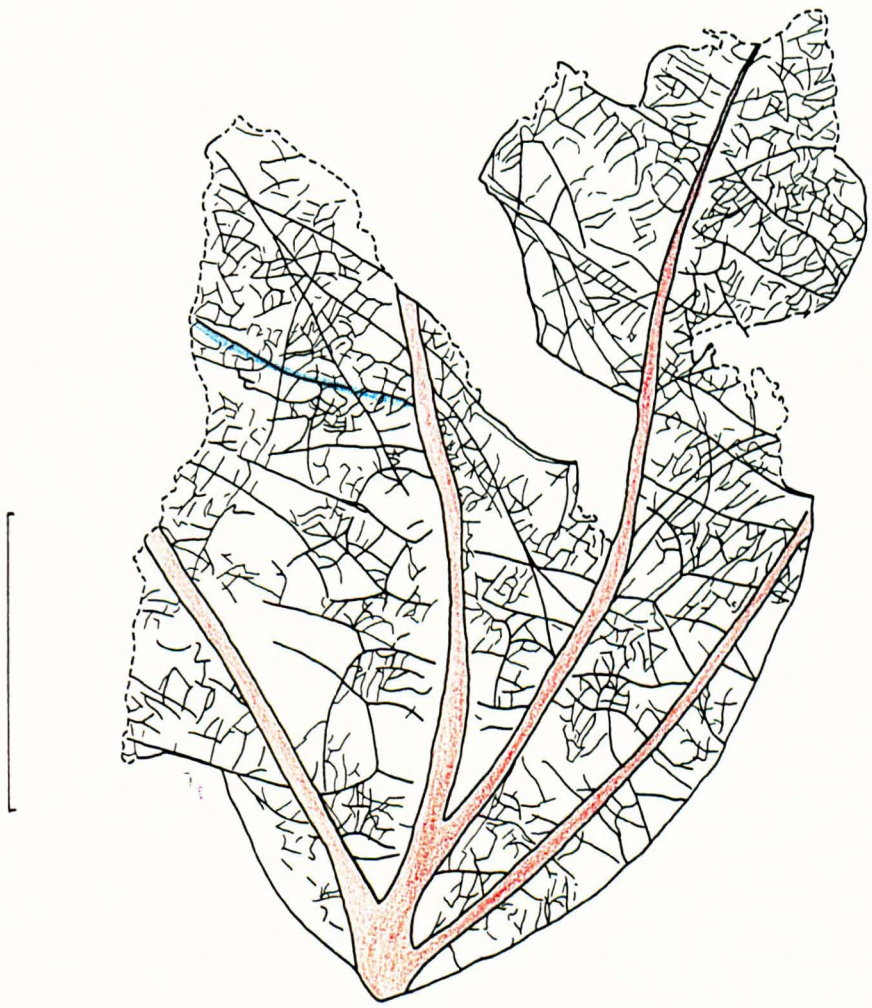
D8754.8.60b
Scale bar 10mm



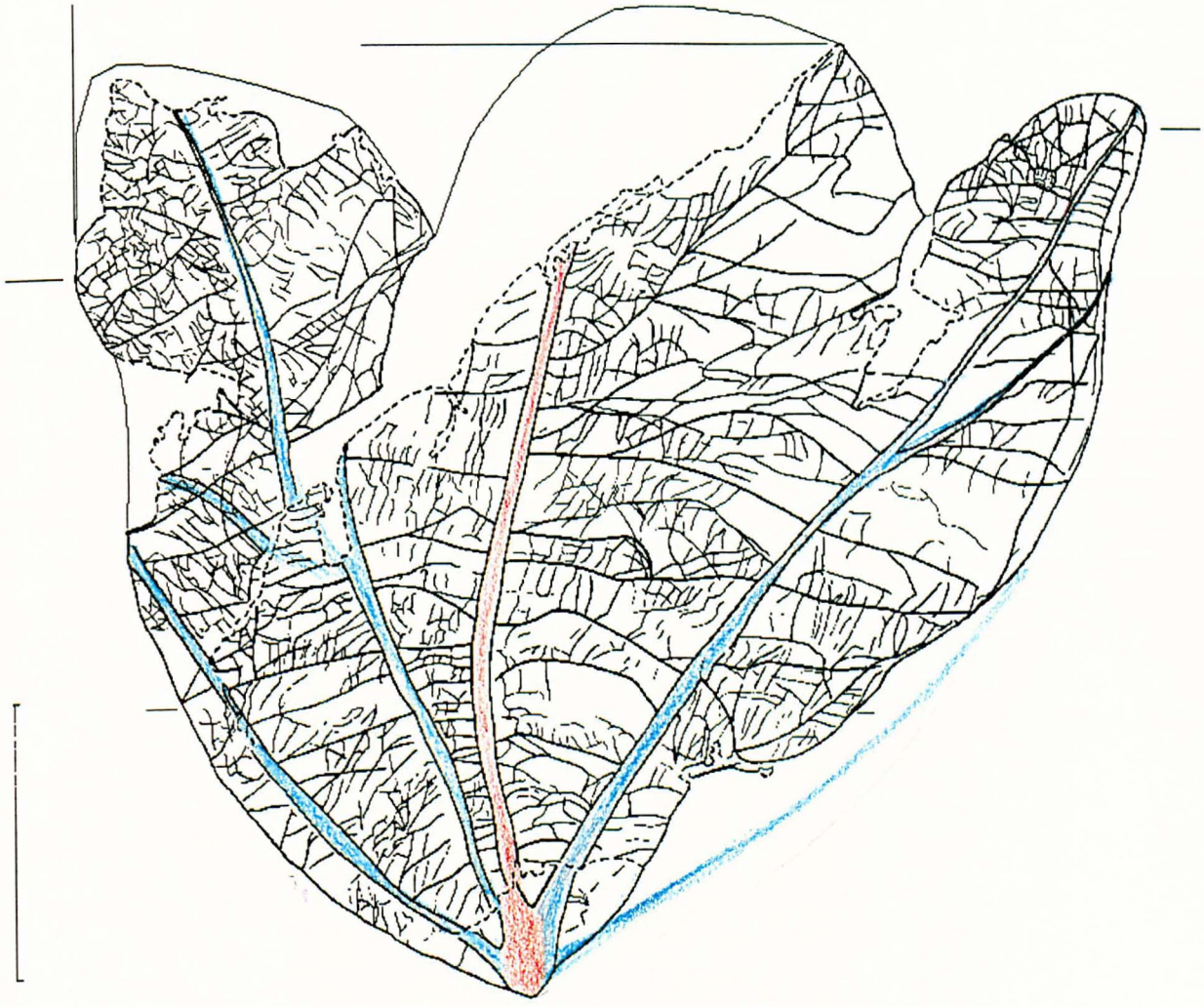
D8754.8.61a
Scale bar 10mm



D8754.8.62a
Scale bar 10mm



D8754.8.64a
Scale bar 10mm

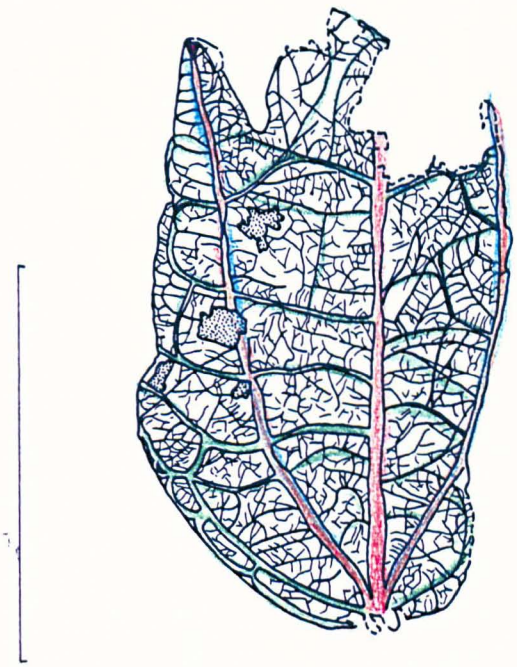


D8754.8.62a & 64a
Scale bar 10mm

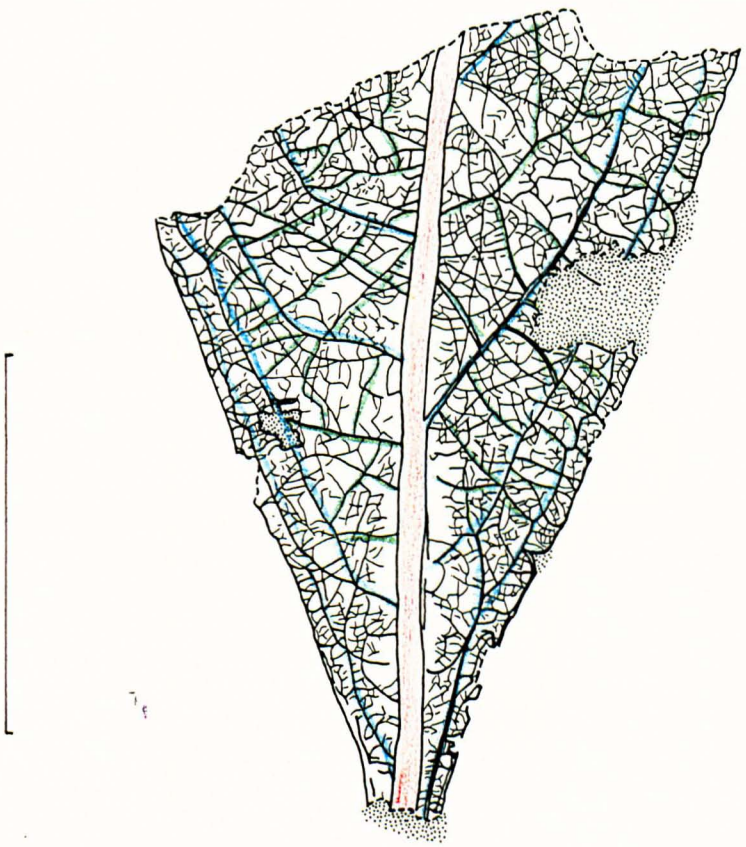
D8754.8.63a
Scale bar 10mm

D8754.8.66b
Scale bar 10mm

D8754.8.67a
Scale bar 10mm

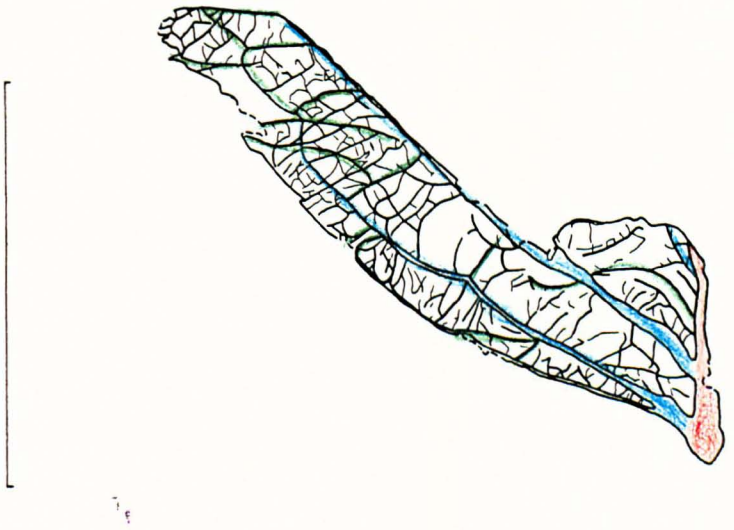


D8754.8.67b
Scale bar 10mm

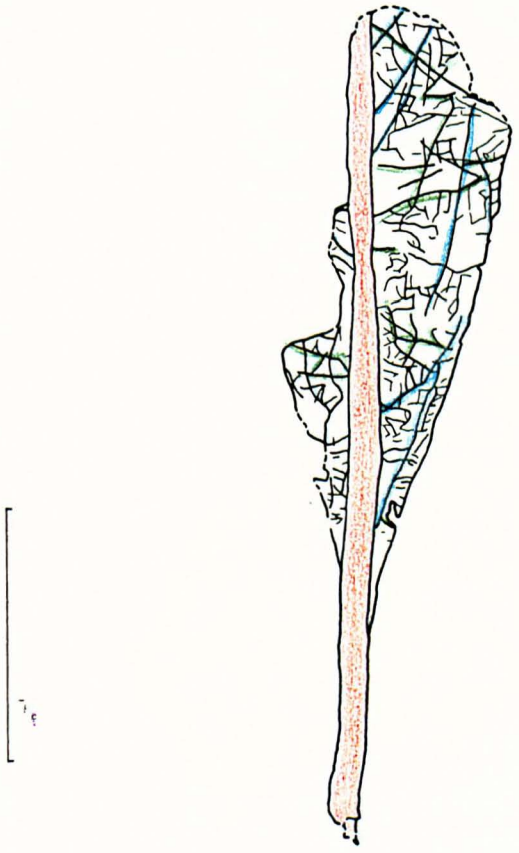


D8754.8.68a
Scale bar 10mm

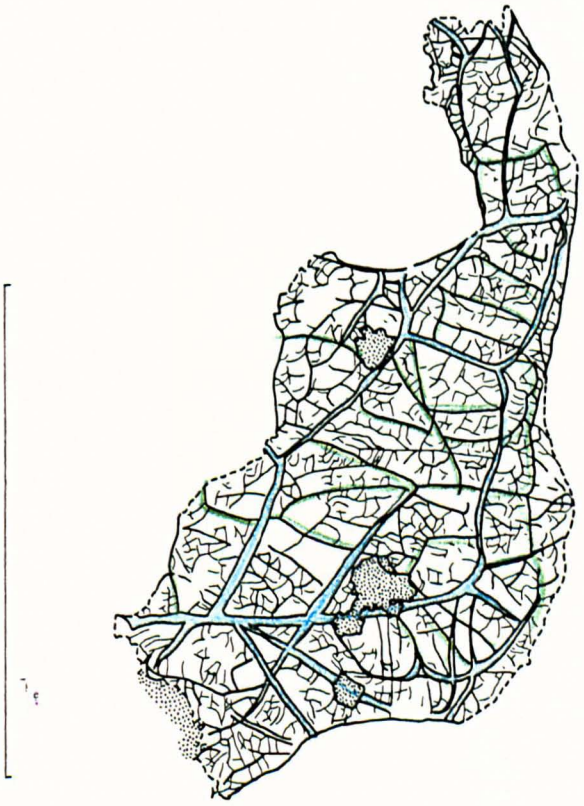
D8754.8.71b
Scale bar 10mm



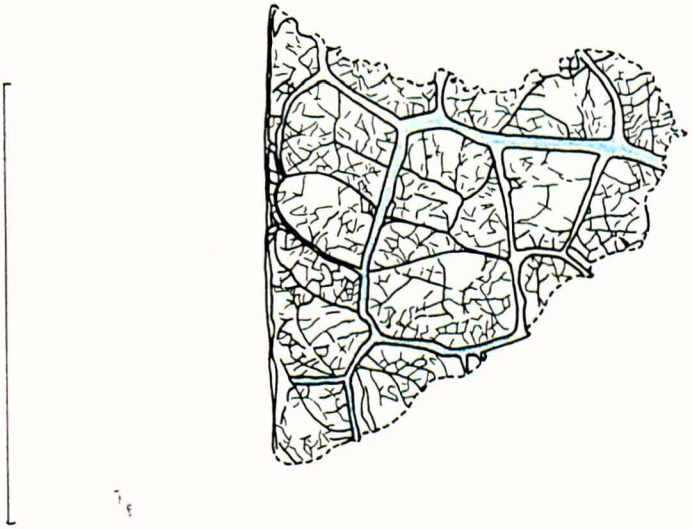
D8754.8.73b
Scale bar 10mm



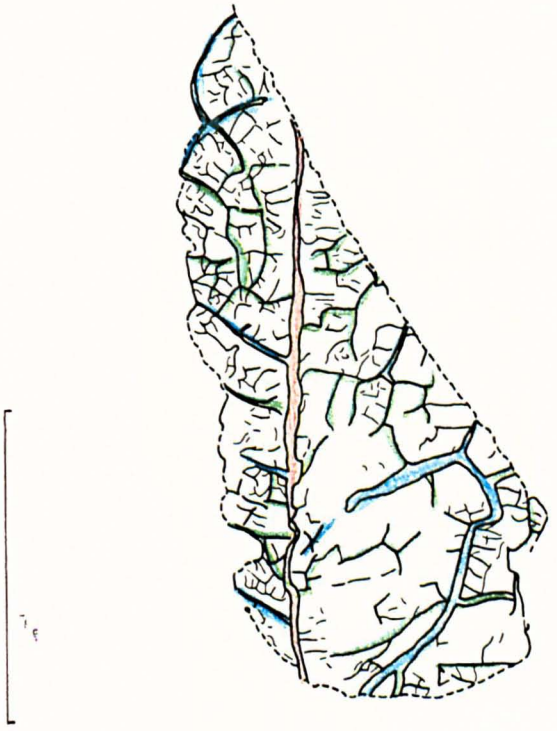
D8754.8.76b
Scale bar 10mm



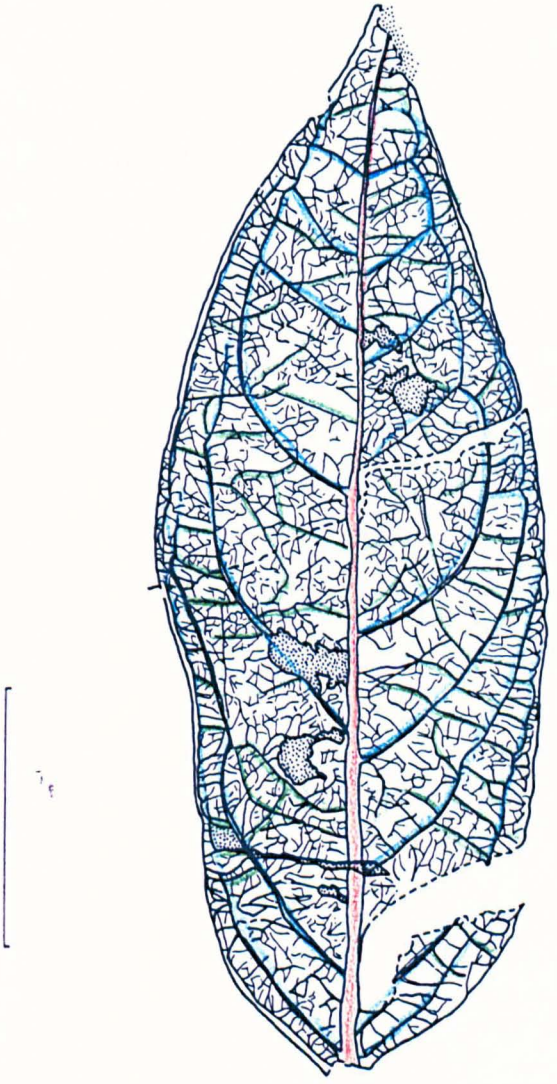
D8754.8.81b
Scale bar 10mm



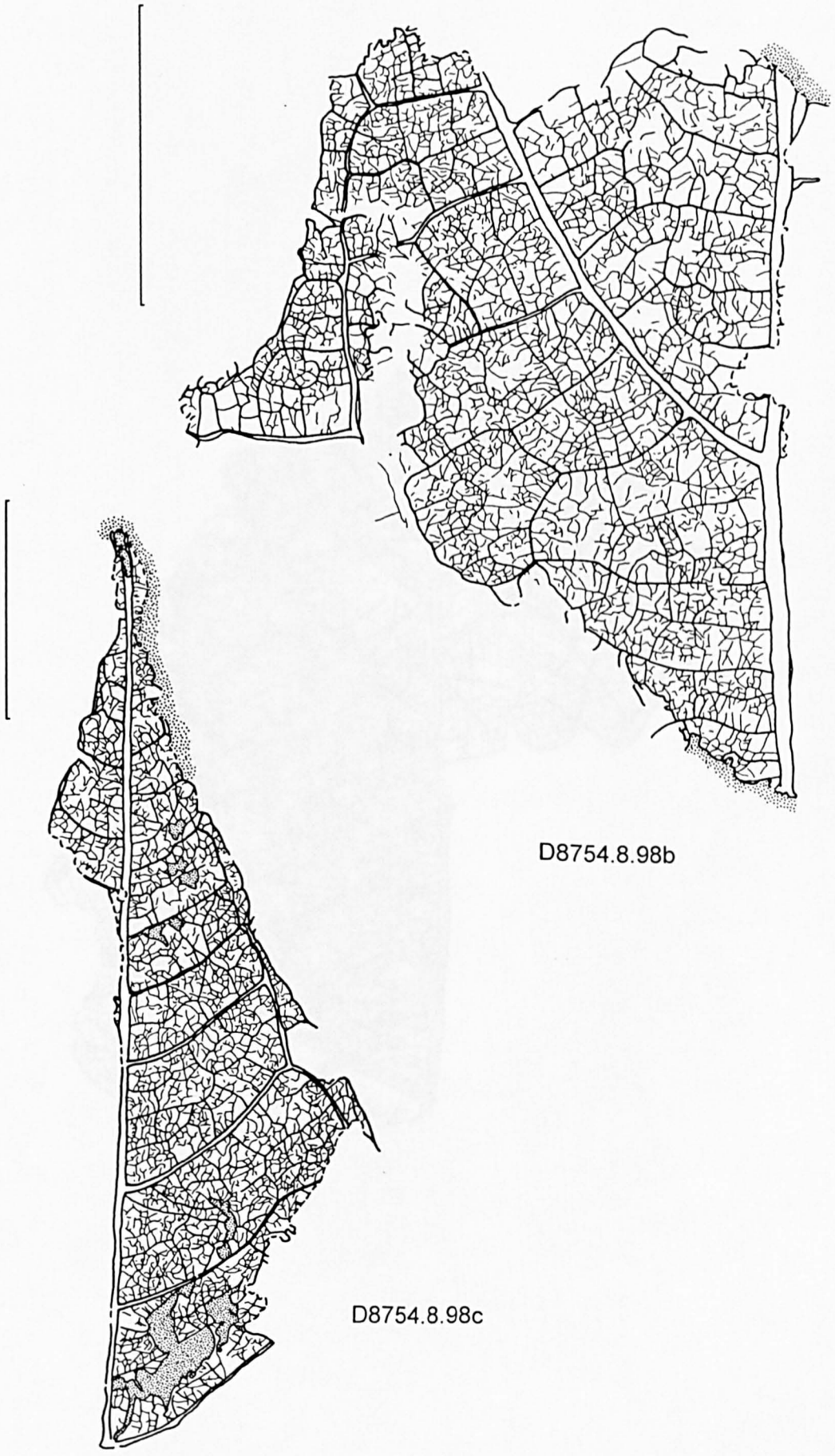
D8754.8.82b
Scale bar 10mm



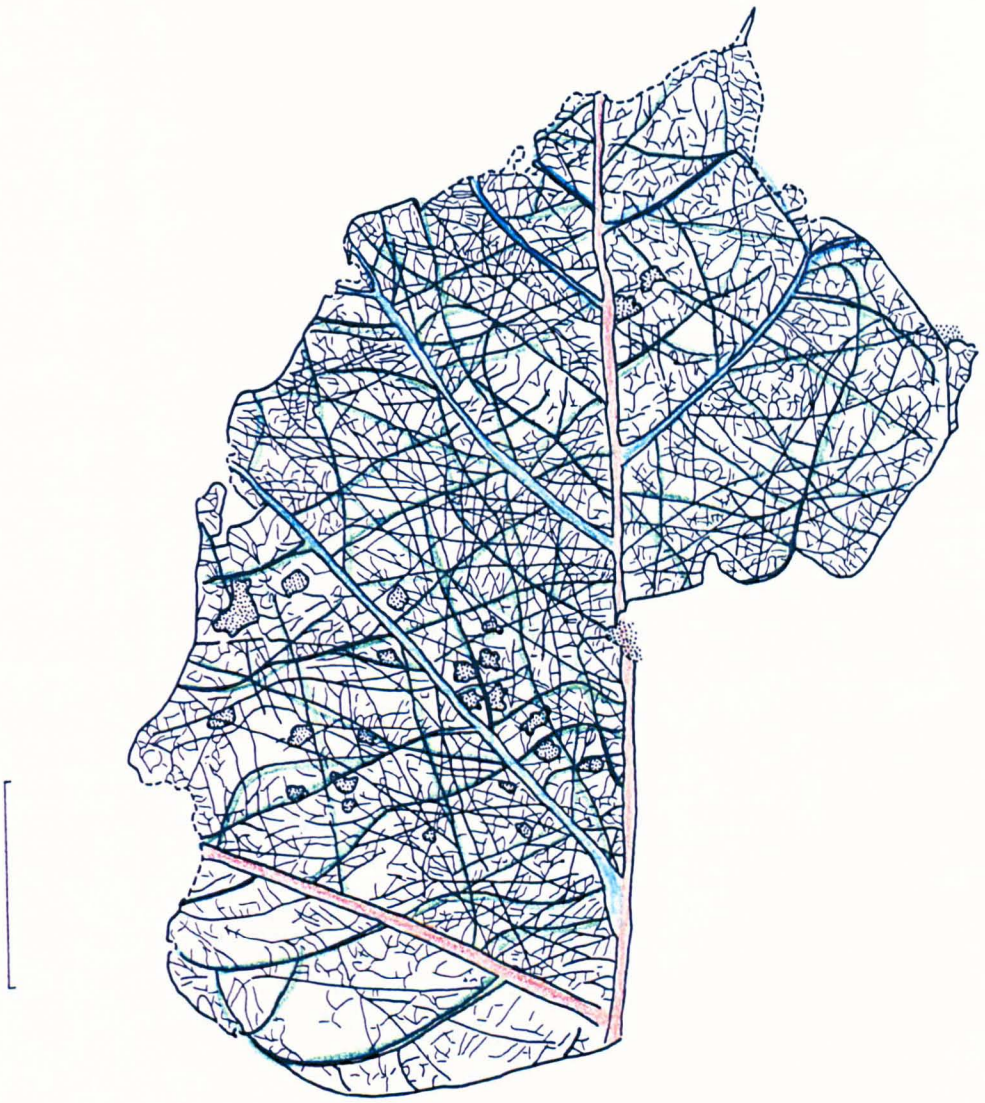
D8754.8.90b
Scale bar 10mm



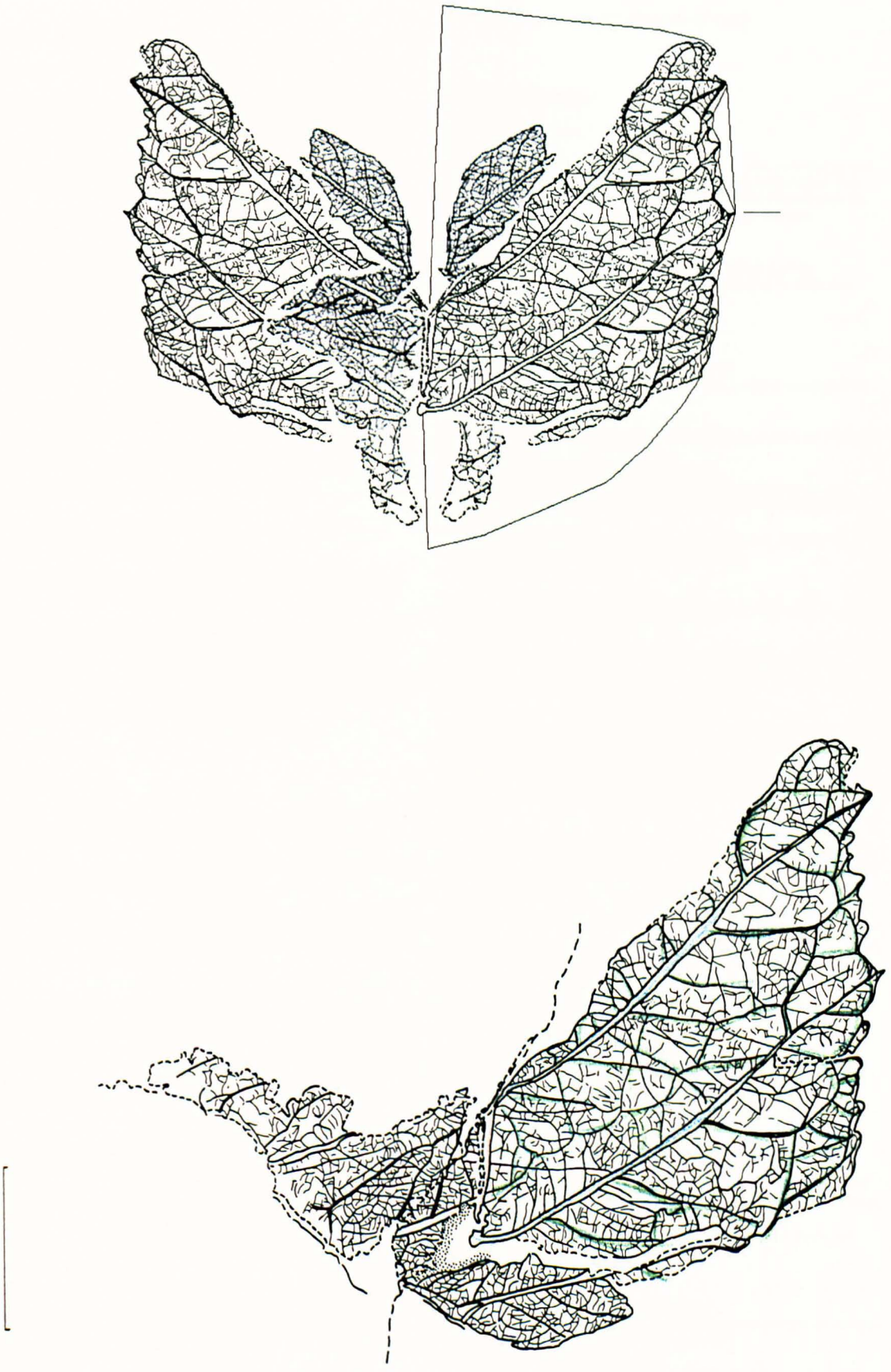
D8754.8.98a
Scale bar 10mm



D8754.8.98b and D8754.8.98c
Scale bar 10mm



D8754.8.100a
Scale bar 10mm



D8754.8.101a
Scale bar 10mm

D8604.37A/C&Ba

Part and counterpart.

Preservation: Good. Leaf is fragmentary. Pieces A and C were glued together. The venation is very clear. The leaf is preserved as a carbonaceous impression. The apex and base of the leaf is missing. There are clear margins preserved. It is possible that removing sediment cover in the apical and basal parts of the leaf may reveal more of the specimen.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 37.3mm min.
Max. length along 1°: 31.9mm min.
Maximum width: 18mm. From curvature of margins present, this appears to be a good estimate of maximum width.
Area: 360.8sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 40mm min.
Estimated area of one side of leaf only: 292.2sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 584.3sq.mm min.
Estimated maximum length along 1°: 40.2mm min. Slightly longer than max. length because 1° is slightly curved.
'Leaf area': 481.8sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Whole lamina appears to be asymmetrical. Apex and base are not present so their symmetry cannot be assessed.

Form: Position of max. width is estimated to be 22.7mm from the base of the leaf, 56.5% of the estimated leaf length. However it appears that the lamina form is oblong. Using estimated max. length, length/width ratio is estimated to be at least 2.24:1, making the leaf form subdivision oblong, but since the leaf is incomplete, this is not a confident description.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 20mm from base. At this point, 1° vein width is 0.68mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 16.8mm. Size of 1° is therefore 4.08% and is termed massive.
Course: Appears to be markedly curved.

2° veins:
At least 5 pairs, subopposite to alternate.
Angle of divergence: Narrow acute (25-81°, average 44°). (Average on one side 39°, average on other side 48°).
Basal vein angle: Not preserved.
Variation: It appears that the divergence angle varies irregularly. Divergence angle appears to be more acute on one side than the other.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right angle (average 88°). Also appear to be enclosed by 2° or 3° arches.
Intersecondary veins: None clearly preserved.
Intramarginal vein: No clear intramarginal vein present.

3 veins:
Average angle of origin on admedial side of 2°s: 80°.
Average angle of origin on exmedial side of 2°s: 87°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 73°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8604.38A&Ba

Part and counterpart.

Preservation: Very good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a carbonaceous impression. The apex is clearly preserved. The base of the leaf is missing and the central margins are not present. There are clear margins preserved in the apical portion of the leaf.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 24.2mm min.
Maximum length along 1°: 19.9mm min.
Maximum width: 13.9mm min.
Maximum width of one side only is 8mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 16mm min.
Area: 176.4sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 24.4mm min.
Estimated area of one side of leaf only: 124sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 248sq.mm min.
Estimated maximum length along 1°: 24.5mm min. Slightly longer than max. length because 1° is slightly curved.
'Leaf area': 238.3sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Apical part of leaf appears to be asymmetrical, so whole lamina is described as asymmetrical. Base of leaf is not preserved so its symmetry cannot be assessed.

Form: Specimen is too fragmentary for form to be described. Point of max. width is estimated to be 13mm from leaf base, 53.2% of leaf length. However, leaf is too incomplete for form to be described. Using estimated max. length and width, length/width ratio is 1.53:1, but since leaf is fragmentary this is just an estimate.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle is 92° and apex is described as obtuse.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, reticulodromous but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 12.2mm from base. At this point, 1° vein width is 0.51mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 13.3mm min. Size of 1° is therefore 3.86% max. and is termed stout.
Course: Straight and appears to be unbranched, but this is not certain.

2° veins:
At least 8 pairs, subopposite to alternate.
Angle of divergence: Wide acute (43-93°, average 73°). (Average on one side 75°, average on other side 72°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: None clearly preserved.
Intersecondary veins: Appears to be intersecondaries present but these are not clear.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 92°.

Average angle of origin on exmedial side of 2°s: 79°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 84°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8604.39a

Preservation: Good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a carbonaceous impression. The apex is missing. The RHS of the base is incomplete. There are clear margins preserved. It is possible that removing sediment cover in the basal part of the leaf may reveal more of the specimen.

Dimensions:
Maximum length: 30.9mm min.
Max. length along 1°: 19.4mm min.
Maximum width: 25.1mm min.
Maximum width of RHS only, which shows greater preservation than LHS: 16mm.
Assuming leaf is roughly symmetrical, maximum width: 32mm.
From curvature of margins present, this appears to be a good estimate of maximum width.
Area: 398.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 32.8mm min.
Estimated area of RHS of leaf only: 382.4sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 764.8sq.mm min.
Estimated maximum length along 1°: 32.8mm min.
'Leaf area': 699.7sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Base of leaf appears to be asymmetrical, so whole lamina is described as asymmetrical. Apex of leaf is not preserved so its symmetry cannot be described.

Form: Max. width is estimated to be 24.2mm from leaf base, 73.8% of the estimated leaf length. Leaf form may be obovate, but since apical part of leaf is missing, this is not certain. Using estimated length and width, length/width ratio is 1.03:1 min, which would make the leaf form very wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Base is incomplete, but basal angle is estimated to be 79° and base is described as acute decurrent.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Venation may be described as palinactinodromous, but this is not certain. There is one prominent midvein with a series of slightly narrower veins branching dichotomously from it. The position is basal and the development is described as flabellate.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 16.4mm from base. At this point, 1° vein width is 0.6mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 29.2mm. Size of 1° is therefore 2.05% and is termed stout.
Course: Straight and appears to be unbranched, but this is not certain.

2° veins:
At least 5 pairs.
Angle of divergence: Narrow acute (average 26°).
Basal vein angle: Not preserved.
Variation: 2° veins are too incompletely preserved for variation in divergence angle to be described.
Thickness: Moderate.
Course: Sinuous and branched. Secondaries also appear to be provided with outer 2° veins.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 24°). Also enclosed by 2° and 3° loops.
Intersecondary veins: None.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: None present.
Average angle of origin on exmedial side of 2°s: 47°.
Combination: A-.
There are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8604.54a

Preservation: Very good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a cream mineralisation. The apex is clearly preserved. The basal portion of the leaf is missing. There are clear margins preserved in the apical portion of the leaf.

Dimensions:
Maximum length: 38.1mm min.
Maximum length along 1°: 38.1mm min.
Maximum width: 15.4mm min.
Maximum width of LHS only, which shows slightly greater preservation than RHS, is 7.7mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 15.4mm min.
Area: 356.7sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 43.6mm min.
Estimated area of one side of leaf only: 213.5sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 427sq.mm min.
Estimated maximum length along 1°: 43.8mm min. Slightly longer than max. length because 1° is slightly curved.
'Leaf area': 449.7sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf is too fragmentary for whole lamina symmetry to be described. Apical part of leaf appears to be symmetrical, so the whole lamina may be symmetrical, but this cannot be certain. Base of leaf is not preserved so its symmetry cannot be assessed.

Form: Specimen is too fragmentary for form to be described. Point of max. width is estimated to be 13.9mm from leaf base, 31.7% of leaf length. However, leaf is too incomplete for form to be described. Using estimated max. length and width, length/width ratio is 2.84:1, but since leaf is fragmentary this is just an estimate.
Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle is 43° and apex is described as attenuate.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 21.8mm from base. At this point, 1° vein width is 0.6mm and leaf width is 13.7mm. Size of 1° is therefore 4.38% and is termed massive.
Course: Appears to be straight, but this is not certain.

2° veins:
Approximately 10 pairs min., alternate-subopposite.
Angle of divergence: Moderate acute (37-62°, average 50°).
(Average on LHS 52°, average on RHS 48°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears nearly uniform. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 136°). Also enclosed by 2° or 3° arches.

Intersecondary veins: Appears to be composite intersecondaries present.
Intramarginal vein: No clear intramarginal vein present.

3 veins:
Average angle of origin on admedial side of 2°s: 67°.
Average angle of origin on exmedial side of 2°s: 110°.
Combination: OA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 75°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.1A&Ba

Part and counterpart.

Preservation: Fairly good. Specimen is a fragment from one side of leaf only. Venation is fairly clear. Leaf is preserved as a dark carbonaceous impression. In D8605.1Aa there appears to be some charcoalification and pyritisation. Margins are clear in the part of the leaf preserved. Apex is not present and base is incomplete.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 94.1mm min.
Maximum length along 1°: 69.1mm min.
Maximum width: 23.5mm min.
Maximum width of one side only: 20.6mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 41.1mm. From curvature of margins present, this appears to be a good estimate of max. width.
Area: 1316sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 97.7mm min.
Estimated area of one side of leaf only: 1514.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 3029.7sq.mm min.
Estimated maximum length along 1°: 98mm min. Slightly longer than max. length because 1° is slightly curved.
'Leaf area': 2685.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Only one side of leaf is preserved so symmetry cannot be assessed.

Form: Position of max. width from base is estimated to be 79.9mm from the base of the leaf, 81.5% of the estimated leaf length. However it appears that the lamina form is oblong. Using estimated max. length and width, length/width ratio is estimated to be at least 2.38:1, making the leaf form subdivision oblong, but since the leaf is incomplete, this is not a confident description.

Apex: Not preserved.

Base: Leaf is fragmentary and base is too incomplete for basal angle to be measured. However, base appears to be acute cuneate.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 48.8mm from base. At this point, 1° vein width is 1.16mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 35mm. Size of 1° is therefore 3.32% and is termed stout.
Course: Markedly curved.

2° veins:
At least 6 pairs.
Since only one side of the leaf is preserved no pairs are observed.
Angle of divergence: Narrow acute (22-61°, average 35°).
Basal vein angle: Not preserved.
Variation: Upper 2°s appear more obtuse than lower. Since only one side of the leaf is preserved divergence angle symmetry cannot be assessed.
Thickness: Moderate.
Course: Appears to be recurved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 124°). Also appear to form an intramarginal vein.
Intersecondary veins: None.
Intramarginal vein: Appears to be an intramarginal vein present but this is not clear.

3 veins:
Average angle of origin on admedial side of 2°s: 92°.
Average angle of origin on exmedial side of 2°s: 64°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 94°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.2a

Preservation: Good. Specimen is a fragment from LHS of leaf only. Venation is very clear. Leaf is preserved as a carbonaceous impression. There are clear margins preserved. Apex is not present. Shape of base can be described from LHS of leaf. More of leaf may be revealed following removal of sediment cover.

Dimensions:
Maximum length: 46.7mm min.
Maximum length along 1°: 33.2mm min.
Maximum width: 11.7mm min.
Maximum width of LHS only: 10.4mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 20.8mm. From curvature of margins present, this appears to be a good estimate of max. width.
Area: 357.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 47.4mm min.
Estimated area of LHS of leaf only: 373sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 746sq.mm min.
Estimated maximum length along 1°: 47.4mm min.
'Leaf area': 657.3sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Only LHS of leaf is preserved so symmetry cannot be assessed.

Form: Position of max. width from base is estimated to be at least 25mm from the base of the leaf, 52.7% of the estimated leaf length. However it appears that the lamina form is oblong. Using estimated max. length and width, length/width ratio is estimated to be at least 2.28:1, making the leaf form subdivision oblong, but since the leaf is incomplete, this is not a confident description.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from LHS of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 58° and base is described as acute cuneate.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 23.7mm from base. At this point, 1° vein width is 1.09mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 19.8mm. Size of 1° is therefore 5.51% and is termed massive.
Course: Straight.

2° veins:
Number: 4 min.
Only LHS of leaf is preserved, so no pairs of 2°s can be observed.
Angle of divergence: Narrow acute (41-46°, average 44°).
Basal vein angle: Narrow acute (43°).
Variation: Divergence angle appears nearly uniform. Since only LHS of leaf is preserved, symmetry of divergence angle cannot be assessed.
Thickness: Moderate.
Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right-angle (100°). Also appear to be enclosed by 2° and 3° arches.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 94°.
Average angle of origin on exmedial side of 2°s: 90°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 88°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.5&15a

Part and counterpart.

Preservation: Fairly good. Leaf is fragmentary. Venation is very clear. Leaf is preserved as a carbonaceous impression. A small percentage of the margins are preserved. Neither apex nor base are present. More of D8605.15a may be revealed following removal of secondary calcite mineralisation. D8605.15a shows clearer preservation than the counterpart D8605.5a.

Dimensions: D8605.15a shows slightly greater preservation than D8605.5a, so measurements given are for D8605.15a.
Maximum length: 20mm min.
Maximum length along 1°: 14.9mm min.
Maximum width: 15.7mm min.
Area: 161.7sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 24mm min.
Estimated area of one side of leaf only: 160.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 321.2sq.mm min.
Estimated maximum length along 1°: 24mm min.
'Leaf area': 251.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length, length/width ratio is 1.53:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although only a small proportion of the margin is preserved, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 12mm from base. At this point, 1° vein width is 0.49mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 15.5mm min. Size of 1° is therefore 3.13% max. and is termed stout.
Course: Straight and appears to be unbranched but this is not certain.

2° veins:
Number: 3 pairs min.
Pairs are alternate.
Angle of divergence: Narrow acute (41-58°, average 43°).
(Average on LHS 47°, average on RHS 49°).
Basal vein angle: Not preserved.
Variation: Appears to be nearly uniform, but leaf is really too fragmentary for variation in divergence angle along the length of the lamina to be described. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: None clear enough preserved for angle to be measured.
Intersecondary veins: Appears to be intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 94°.
Average angle of origin on exmedial side of 2°s: 92°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 79°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.7a

Preservation: Fairly good. Specimen is a fragment from LHS of leaf only. Venation is very clear. Leaf is preserved as a carbonaceous impression. There are clear margins preserved. Neither apex nor base are present. 1° vein is not preserved.

Dimensions:
Maximum length: 11.5mm min.
Maximum width: 11mm min.
Maximum width of LHS only: 11mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 22mm min.
Area: 62.6sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 125.2sq.mm min.
'Leaf area': 168.7sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 0.52:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: There are clear projections preserved along LHS of leaf, but only a very small percentage of the margin is preserved. There are 5 clearly preserved projections. Measured perpendicular to the midvein, the margin is indented 0.3-0.8mm, average 0.6mm, 5.8% max. of the estimated distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 8-57°, average 41°). Dominant serration type is convex on basal side and concave on apical side. Sinuses appear quite rounded. Spacing between serrations is 1.3-2.6mm, average 2mm, standard deviation 0.5mm, and spacing is described as irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: This specimen is too fragmentary for venation type to be assessed.

1° vein: Not preserved.

2° veins:
Leaf is just a small fragment and only a small part of one 2° vein is preserved.

Angle of divergence: Not preserved.
Basal vein angle: Not preserved.
Variation: Cannot be assessed for this fragmentary specimen.
Thickness: Moderate.
Course: Appears to be recurved.
Behaviour of loop-forming branches: None.
Intersecondary veins: None present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 112°.
Average angle of origin on exmedial side of 2°s: 83°.
Combination: RO.
The 1° vein is not preserved so there are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8605.8A&8Ba

Part and counterpart.

Preservation: Fairly good. Specimen is a fragment from one side of leaf only. Venation is very clear. Leaf is preserved as a carbonaceous impression. There are clear margins preserved. Neither apex nor base are present. Removal of sediment cover in D8605.8Aa may reveal slightly more of the leaf.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 27.3mm min.
Maximum length along 1°: 21.3mm min.
Maximum width: 15mm min.
Maximum width of one side of leaf only: 14.7mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 29.4mm min.
Area: 257.7sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 29.5mm min.
Estimated area of one side of leaf only: 311.5sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 623sq.mm min.
Estimated maximum length along 1°: 29.5mm min.
'Leaf area': 577.2sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 1:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous, but specimen is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 14.7mm from base. At this point, 1° vein width is 0.38mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 29.3mm. Size of 1° is therefore 1.29% and is termed moderate.
Course: Appears to be straight and unbranched but this is not certain.

2° veins:
At least 3 pairs.
Angle of divergence: Wide acute (65-79°, average 74°). (Average on LHS 76°, average on RHS 72°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to be nearly uniform but leaf is too fragmentary for variation in divergence angle along length of lamina to be described. Only one side of leaf is preserved so divergence angle symmetry cannot be assessed.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right-angle (average 81°). Also appear to be enclosed by 3° arches.
Intersecondary veins: None.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 90°.
Average angle of origin on exmedial side of 2°s: 82°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 69°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.14a

Preservation: Fairly good. Specimen is a fragment from LHS of leaf only. Venation is very clear. Leaf is preserved as a carbonaceous impression. There may be a small percentage of the margins preserved, but this is not clear. Neither apex nor base are present. 1° vein is not preserved.

Dimensions:
Maximum length: 44.5mm min.
Maximum width: 18.9mm min.
Maximum width of LHS only: 18.9mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 37.8mm min.
Area: 404.2sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 808.4sq.mm min.
'Leaf area': 1121.4sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 1.18:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be entire, but since such a small proportion of the margin is preserved, this is not a completely confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, eucamptodromous, but specimen is too fragmentary for this to be certain.

1° vein: Not preserved.

2° veins:

3 veins:

D8605.16a

Preservation: Fair. Specimen is a fragment from LHS of leaf only. Venation is fairly clear. Leaf is preserved as a carbonaceous impression. There are clear margins preserved. Neither apex nor base are present.

Dimensions:
Maximum length: 36mm min.
Maximum length along 1°: 17.1mm min.
Maximum width: 27.9mm min.

Maximum width of LHS of leaf only: 27.5mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 55mm min.
Area: 607.8sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 42.4mm min.
Estimated area of LHS of leaf only: 851.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1703.2sq.mm min.
Estimated maximum length along 1°: 42.5mm min.
'Leaf area': 1558.3sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 0.77:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small proportion of the LHS margin is preserved, but it appears to be erose. Measured perpendicular to the midvein, the margin is indented 0.2-0.5mm, average 0.3mm, 1.2% of the distance to the midvein.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous, but specimen is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 21.2mm from base. At this point, 1° vein width is 0.52mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 53.2mm min. Size of 1° is therefore 0.98% max. and is termed weak.
Course: Appears to be straight and unbranched but this is not certain.

2° veins:
At least 4 pairs.
Since only part of one side of the leaf is preserved no pairs are observed.
Angle of divergence: Moderate acute (40-99°, average 63°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Since only one side of leaf is preserved divergence angle symmetry cannot be assessed.
Thickness: Moderate.
Course: Abruptly curved and branched. Appears to be outer secondaries present.
Behaviour of loop-forming branches: Appear to join superadjacent 2° at an approximate right angle (average 84°).
Intersecondary veins: None present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 87°.
Average angle of origin on exmedial side of 2°s: 78°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 101°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.19Aa

Preservation: Good. Leaf is fragmentary. The venation is clear. The leaf is preserved as a carbonaceous impression. The apex is missing, but the base of the leaf is present. There are clear margins preserved. It is possible that there is a petiole present, but this cannot be clearly distinguished from the lamina.

Dimensions:
Maximum length: 37mm min.
Max. length along 1°: 36.6mm min.
Maximum width: 8.9mm min.
Maximum width of LHS only, which shows greater preservation than RHS: 6.5mm min.
Assuming leaf is roughly symmetrical, maximum width: 13mm min.
Area: 159sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 37.3mm min.
Estimated area of LHS of leaf only: 136.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 273.8sq.mm min.
Estimated maximum length along 1°: 37.3mm min.
'Leaf area': 323.3sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf is too incomplete to describe the symmetry of the whole lamina. Base appears to be symmetrical, so whole lamina may be symmetrical, but this cannot be certain. Apex is incomplete so its symmetry cannot be assessed.

Form: Max. width is estimated to be at least 29.8mm from leaf base, 79.9% of the estimated leaf length. Leaf form may be obovate, but since apical part of leaf is missing, this is not certain. Using estimated length and width, length/width ratio is 2.87:1 min, which would make the leaf form narrow obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from LHS of leaf, which is more complete than RHS. Assuming base is roughly symmetrical, basal angle is estimated to be 24° and base is described as acute decurrent.

Margin: Although basal part of margin appears to be entire, margin is described as erose. There are projections preserved along the LHS margin in the central part of the leaf. Measured perpendicular to the midvein, the margin is indented 0.2-0.4mm, average 0.3mm, 5.3% of the distance to the midvein.

Petiole: There appears to be a winged petiole present, but it cannot be clearly distinguished from the lamina. It appears to be approximately 1.6mm wide and 6mm in length.

Venation type: Venation appears to be pinnate simple craspedodromous, but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 18.7mm from base. At this point, 1° vein width is 0.61mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 8.6mm. Size of 1° is therefore 7.09% and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
At least 6 pairs.
Pairs are subopposite to alternate.
Angle of divergence: Narrow acute (6-42°, average 24°). (Average on LHS 26°, average on RHS 22°).
Basal vein angle: Narrow acute (average 16°). (27° on LHS, 6° on RHS.)
Variation: Upper 2°s appear more obtuse than lower. Divergence angle symmetrical.
Thickness: Fine.
Course: Appears to be straight and branched.
Behaviour of loop-forming branches: None.
Intersecondary veins: Simple intersecondary veins present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 93°.
Average angle of origin on exmedial side of 2°s: 77°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 98°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.20a

Preservation: Fairly good. Specimen is a fragment from RHS of leaf only. Venation is very clear. Leaf is preserved as a carbonaceous impression. There are clear margins preserved. Neither apex nor base are present. 1° vein is not preserved. Slightly more of specimen may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 14.5mm min.
Maximum width: 8.2mm min.
Maximum width of RHS only: 8.2mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 16.4mm min.
Area: 84.9sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 169.8sq.mm min.
'Leaf area': 158.5sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 0.88:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although only a small proportion of the margin is preserved, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: This specimen is too fragmentary for venation type to be assessed.

1° vein: Not preserved.

2° veins:
Leaf is fragmentary and only a very small part of the 2° veins is preserved.

3 veins:

D8605.21A&Ba

Part and counterpart.

Preservation: Good. Leaf is fragmentary. The venation is clear. The leaf is preserved as a dark carbonaceous impression. The apex is missing and the base is incomplete. There are clear margins preserved. It is possible that removing sediment cover in the basal part of the leaf may reveal more of the specimen.

Dimensions: D8621.21Ba shows greater completeness than counterpart D8621.21Aa, so measurements given are for D8621.21Ba.
Maximum length: 49.7mm min.
Maximum length along 1°: 40.9mm min.
Maximum width: 32.9mm min.
Maximum width of LHS of leaf only: 16.7mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 33.4mm min.
Area: 788.4sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 51.1mm min.
Estimated area of one side of leaf only: 518.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1037.7sq.mm min.
Estimated maximum length along 1°: 51.2mm min.
'Leaf area': 1138.9sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf is too incomplete to describe the symmetry of the whole lamina. Base appears to be symmetrical, so whole lamina may be symmetrical, but this cannot be certain. Apex is incomplete so its symmetry cannot be assessed.

Form: Max. width is estimated to be at least 42.2mm from leaf base, 82.5% of the estimated leaf length. Leaf form may be obovate, but since apical part of leaf is missing, this is not certain. Using estimated length and width, length/width ratio is 1.53:1 min, which would make the leaf form wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 48° and base is described as acute decurrent.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Venation is pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 25.6mm from base. At this point, 1° vein width is 1.02mm and leaf width is 23.8mm. Size of 1° is therefore 4.3% and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
At least 12 pairs, appear subopposite to alternate, but 2° veins are difficult to distinguish confidently.
Angle of divergence: Narrow acute (18-68°, average 39°).
(Average on one side 38°, average on other side 40°).
Basal vein angle: Narrow acute (30°).
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.
Course: Recurved and branched. Secondaries also appear to be provided with outer 2° veins.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 121°). Appear to form an intramarginal vein.
Intersecondary veins: None.
Intramarginal vein: Appears to be an intramarginal vein but this is not clear.

3 veins:
Average angle of origin on admedial side of 2°s: 80°.
Average angle of origin on exmedial side of 2°s: 77°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 92°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.22Ba

Not clearly angiospermous.

Preservation: Fair. Leaf is fragmentary. Venation is clear. Leaf is preserved as a carbonaceous impression. Only a small percentage of the margin is preserved. Neither apex nor base are present. Removal of sediment cover may reveal slightly more of the leaf.

Dimensions:
Maximum length: 5.3mm min.
Maximum length along 1°: 5.1mm min.
Maximum width: 5.7mm min.
Maximum width of RHS only: 3mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 6mm min.
Area: 21sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 6.3mm min.
Estimated area of RHS of leaf only: 13.8sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 27.6sq.mm min.
Estimated maximum length along 1°: 6.3mm min.
'Leaf area': 25.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf

organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 2.6mm from leaf base, 41.3% of the estimated leaf length. Leaf form may be ovate, but leaf is too fragmentary for this to be certain. Using estimated length and width, length/width ratio is 1.05:1 min, which would make the leaf form very wide ovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin appears to be crenate, but it is too poorly preserved for this to be certain.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate simple craspedodromous but specimen is too fragmentary for venation type to be confidently described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 3.2mm from base. At this point, 1° vein width is 0.15mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 5.2mm min. Size of 1° is therefore 2.88% max. and is termed stout.
Course: Appears to be straight but this is not certain.

2° veins:
At least 3 pairs, alternate.
Angle of divergence: Narrow acute (33-49°, average 41°).
(Average on LHS 43°, average on RHS 39°).
Basal vein angle: Not preserved.
Variation: Divergence angle nearly uniform. Divergence angle symmetrical.
Thickness: Moderate.
Course: Sinuous and branched. Secondaries also appear to be provided with outer 2° veins.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 98°.
Average angle of origin on exmedial side of 2°s: 77°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 109°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.24a

Preservation: Fairly good. Specimen is a fragment from LHS of leaf only. Venation is very clear. Leaf is preserved as a carbonaceous impression. There are clear margins preserved. Neither apex nor base are present. 1° vein is not preserved. Removal of sediment cover may reveal a little more of the specimen.

Dimensions:
Maximum length: 12.4mm min.
Maximum width: 8.9mm min.
Maximum width of LHS only: 8.9mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 17.8mm min.
Area: 60.2sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 120.4sq.mm min.
'Leaf area': 147.1sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 0.7:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although only a very small proportion of the margin is preserved, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: This specimen is too fragmentary for venation type to be confidently described. It appears to be brochidodromous, but this is not clear.

1° vein: Not preserved.

2° veins:
Leaf is fragmentary and only a small part of the 2° veins is preserved.
Angle of divergence: Not preserved.
Basal vein angle: Not preserved.
Variation: Not preserved.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Not preserved.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 83°.
Average angle of origin on exmedial side of 2°s: 99°.
Combination: RR.

D8605.26a

Preservation: Fair. Leaf is fragmentary. Venation is very clear. Leaf is preserved as a carbonaceous impression and there also appears to be some pyritisation. There are no clear margins preserved. Neither apex nor base are present.
Dimensions:
Maximum length: 21.7mm min.
Maximum length along 1°: 19.3mm min.
Maximum width: 12.2mm min.
Maximum width of RHS only: 8mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 16mm min.
Area: 149.8sq.mm min.
A minimum outline for the leaf was estimated.
Estimated maximum length: 23.3mm min.
Estimated area of RHS of leaf only: 275.4sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 518.9sq.mm min.
Estimated maximum length along 1°: 23.3mm min.
'Leaf area': 248.5sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 14.2mm from leaf base, 60.9% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.46:1, which would make the leaf form wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: Not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, but specimen is too fragmentary for venation to be confidently described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 11.7mm from base. At this point, 1° vein width is 0.92mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 16mm min. Size of 1° is therefore 5.75% max. and is termed massive, but leaf is too incomplete for this to be a confident definition.
Course: Appears to be straight and unbranched but leaf is too incomplete for this to be certain.

2° veins:
Leaf is fragmentary, but there are at least 3 pairs of 2° veins and these appear to be alternate.
Angle of divergence: Narrow acute (32-57°, average 38°). (Average on LHS 32°, average on RHS 43°).
Basal vein angle: Not preserved.
Variation: Divergence appears nearly uniform but leaf is too fragmentary for variation in divergence angle along the length of the lamina to be described. Divergence angle more acute on LHS.
Thickness: Moderate.
Course: Appear to be curved but leaf is too fragmentary for 2° vein course to be confidently described.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: Appears to be intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 90°.
Average angle of origin on exmedial side of 2°s: 91°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 80°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.27A&Ba

Part and counterpart.

Preservation: Fairly good. Specimen is a fragment from one side of leaf only. Venation is very clear. Leaf is preserved as a carbonaceous impression. There are clear margins preserved. Neither apex nor base are present. 1° vein is not preserved.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 19.9mm min.
Maximum width: 15.2mm min.
Maximum width of one side of leaf only: 15.2mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 30.4mm min.
Area: 157.9sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 315.7sq.mm min.
'Leaf area': 402.3sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 1.31:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: There are clear projections preserved along one side of leaf, but only a very small percentage of the margin is preserved. There are 7 clearly preserved projections. Measured perpendicular to the midvein, the margin is indented 0.2-0.5mm, average 0.4mm, 2.4% max. of the estimated distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 23-128°, average 53°). Dominant serration type is straight on basal side and straight on apical side. Sinuses appear quite rounded. Spacing between serrations is 0.4-1.8mm, average 1.1mm, standard deviation 0.3mm, and spacing is described as irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Leaf is too fragmentary for venation type to be assessed.

1° vein: Not preserved.

2° veins:
Leaf is fragmentary and only part of one 2° vein is preserved.
Angle of divergence: Not preserved.
Basal vein angle: Not preserved.
Variation: Leaf is too fragmentary for the variation in divergence angle along the length of the leaf and divergence angle symmetry to be assessed.
Thickness: Moderate.
Course: Appears to be curved.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 86°.
Average angle of origin on exmedial side of 2°s: 72°.
Combination: AR.
The 1° vein is not preserved so there are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8605.28a

Preservation: Fair. Leaf is fragmentary. Venation is clear. Leaf is preserved as a carbonaceous impression. There may be a small percentage of the margin preserved, but this is not clear. Neither apex nor base are present.

Dimensions:
Maximum length: 12.6mm min.
Maximum length along 1°: 11.9mm min.
Maximum width: 9.1mm min.
Maximum width of RHS, which shows greater preservation than LHS, only: 5.9mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 11.8mm min.
Area: 50.6sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 13mm min.
Estimated area of RHS of leaf only: 43.2sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 86.4sq.mm min.
Estimated maximum length along 1°: 13mm min.
'Leaf area': 102.3sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 8mm from leaf base, 61.5% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.1:1, which would make the leaf form wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be toothed, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation is pinnate but specimen is too fragmentary for venation type to be further described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be

approximately 6.5mm from base. At this point, 1° vein width is 0.65mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 7.6mm min. Size of 1° is therefore 8.55% max. and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
Number: 4 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (32-69°, average 51°).
(Average on LHS 51°, average on RHS 51°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly.
Divergence angle symmetrical.
Thickness: Fine.
Course: Appears to be recurved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: Simple intersecondary veins present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 85°.
Average angle of origin on exmedial side of 2°s: 43°.
Combination: AR.
There are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8605.29a

Preservation: Fair. Specimen is fragmentary. Venation is very clear. Leaf is preserved as a carbonaceous impression. There are no clear margins preserved. Neither apex nor base are present. 1° vein is not preserved.

Dimensions:
Maximum length: 26.2mm min.
Maximum width: 27.1mm min.
Maximum width of one side of leaf only: 27.1mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 54.2mm min.
Area: 402.1sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 804.2sq.mm min.
'Leaf area': 946.7sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 0.48:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: This specimen is too fragmentary for venation type to be assessed.

1° vein: Not preserved.

2° veins:

3 veins:

D8605.30a

Preservation: Good. Leaf is fragmentary. The venation is clear. The leaf is preserved as a carbonaceous impression. The apex is incomplete and the base is missing. There are clear margins preserved.

Dimensions:
Maximum length: 61mm min.
Max. length along 1°: 57mm min.
Maximum width: 28.6mm. From curvature of margins present, this appears to be a good estimate of maximum width.
Area: 1155.8sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 64.8mm min.
Estimated area of one side of leaf only: 627.5sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1255sq.mm min.
Estimated maximum length along 1°: 64.9mm min.
'Leaf area': 1237.4sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Whole lamina is described as asymmetrical because middle part of leaf appears to be asymmetrical. Base of leaf is not preserved so its symmetry cannot be assessed. Apex appears to be roughly symmetrical, but it is incomplete so this is not a confident description.

Form: Position of max. width from base is estimated to be 21.6mm from the base of the leaf, 33.2% of the estimated leaf length. This would make the form ovate, but the leaf is too incomplete for this to be certain. Using estimated max. length, length/width ratio is estimated to be at least 2.27:1, making the leaf form subdivision narrow ovate, but since the leaf is incomplete, this is not a confident description.

Apex: Leaf is fragmentary so extent of apical portion is estimated using sketched minimum outline. Apex is incomplete and shape is described from LHS of leaf, which is more complete than RHS. Assuming apex is roughly symmetrical, apical angle is estimated to be 54° and apex is described as acute.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation is pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 32.4mm from base. At this point, 1° vein width is 0.76mm and leaf width is 27mm. Size of 1° is therefore 2.81% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 17 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (39-90°, average 53°).
(Average on LHS 54°, average on RHS 52°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent secondary at an obtuse angle (average 129°). Also form an intramarginal vein.
Intersecondary veins: None present.
Intramarginal vein: There is a clear intramarginal vein present.

3 veins:
Average angle of origin on admedial side of 2°s: 94°.
Average angle of origin on exmedial side of 2°s: 82°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 102°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.31a

Preservation: Fairly good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a carbonaceous impression. The apex and base are missing. A small percentage of the margin is preserved.

Dimensions:
Maximum length: 44mm min.
Maximum length along 1°: 32.8mm min.
Maximum width: 26.8mm min.
Maximum width of LHS, which shows greater preservation than RHS, only: 18.3mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 36.6mm min.
Area: 618.8sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 46.5mm min.
Estimated area of LHS of leaf only: 698.4sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1396.8sq.mm min.
Estimated maximum length along 1°: 46.6mm min.
'Leaf area': 1137sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: It is not really possible to described the leaf form of this fragmentary specimen. Position of max. width from base is estimated to be 24.9mm from the base of the leaf, 53.4% of the estimated leaf length. This would make the form elliptic, but the leaf is too incomplete for this to be certain. Using estimated max. length and width, length/width ratio is estimated to be at least 1.27:1, making the leaf form subdivision suborbiculate, but since the leaf is incomplete, this is not a confident description.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be toothed, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate camptodromous reticulodromous, but this is not a completely confident description.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 23.3mm from base. At this point, 1° vein width is 1.06mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 36.6mm. Size of 1° is therefore 2.9% and is termed stout.
Course: Straight and appears to be unbranched but this is not certain.

2° veins:
Number: 6 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (53-67°, average 61°). (Average on LHS 61°, average on RHS 62°).
Basal vein angle: Not preserved.
Variation: Divergence angle nearly uniform. Divergence angle symmetrical.
Thickness: Moderate.
Course: Appears to be recurved and branched. It also appears that 2°s are provided with outer secondaries.
Behaviour of loop-forming branches: None.
Intersecondary veins: None present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 106°.
Average angle of origin on exmedial side of 2°s: 57°.
Combination: AO.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 80°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8605.33a

Preservation: Very good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a carbonaceous impression. There is a clear margin present. The apex is missing. The base of the leaf is preserved. There is no petiole present.

Dimensions:
Maximum length: 38.5mm min.
Maximum length along 1°: 37.9mm min.
Maximum width: 12.6mm min.
Maximum width of LHS, which shows greater preservation than RHS, only: 7mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 14mm min.
Area: 322.6sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 39.1mm min.
Estimated area of LHS of leaf only: 198.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 397.8sq.mm min.
Estimated maximum length along 1°: 39.1mm min.
'Leaf area': 364.9sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Lamina appears to be symmetrical, but leaf is too incomplete for this to be certain. Leaf base appears to be symmetrical. Apex is not present so its symmetry cannot be assessed.

Form: Leaf is really too fragmentary for form to be described. Max. width is estimated to be at least 30.1mm from leaf base, 77% of the estimated leaf length. Leaf form may be obovate, but since apical part of leaf is missing, this is not certain. Using estimated length and width, length/width ratio is 2.79:1 min, which would make the leaf form narrow obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 43° and base is described as acute normal.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Venation appears to be acrodromous. The position is basal and although the apical part of the leaf is missing, the development appears to be imperfect.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 19.6mm from base. At this point, 1° vein width is 0.69mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 12.4mm. Size of 1° is therefore 5.56 % and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
Number: 6 pairs min.
Pairs are alternate.
Angle of divergence: Moderate acute (24-55°, average 47°). (Average on LHS 43°, average on RHS 51°).
Basal vein angle: Narrow acute (average 29°). (24° on LHS, 33° on RHS).
Variation: Lowest pair of 2°s appears to be more acute than those above. Divergence angle more acute on LHS.
Thickness: Moderate.
Course: Uniformly curved and unbranched.
Behaviour of loop-forming branches: None clearly preserved.
Intersecondary veins: Appears to be composite intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 91°.
Average angle of origin on exmedial side of 2°s: 69°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 70°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8606.4A&Ba

Part and counterpart.

Preservation: Fairly good. Leaf is fragmentary. Venation is clear. Leaf is preserved as a carbonaceous impression. Margin is preserved on one side of leaf only. Apex and base of leaf are missing. Slightly more of specimens may be revealed by removal of sediment cover. There may also be some insect damage in D8606.4Aa, but this is not at all clear. D8606.4Aa appears slightly more complete with clearer a margin than counterpart D8606.4Ba, but venation appears to be a little clearer in D8606.4Ba.

Dimensions: Most of the measurements given are averages for both D8606.4Aa and D8606.4Ba, but since the central parts of D8606.4AA are more complete, the area measurement given is from D8606.4Aa.
Maximum length: 21.2mm min.
Maximum length along 1°: 20.6mm min.
Maximum width: 14.6mm min.
Maximum width of one side of leaf only: 10.2mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 20.4mm min.
Area: 203.8sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 23.1mm min.
Estimated area of one side of leaf only: 168.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 337.7sq.mm min.
Estimated maximum length along 1°: 23.2mm min.
'Leaf area': 314.8sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 17.8mm from leaf base, 76.7% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.13:1, which would make the leaf form wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, but leaf is too fragmentary for venation to be confidently described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 11.6mm from base. At this point, 1° vein width is 0.55mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 17mm. Size of 1° is therefore 3.24% and is termed stout.
Course: Appears to be straight and unbranched, but leaf is too fragmentary for this to be certain.

2° veins:
Number: Only one pair preserved.
Pairs are subopposite.
Angle of divergence: Moderate acute (51-62°, average 57°).
(Average on one side 56°, average on other side 57°).
Basal vein angle: Not preserved.
Variation: Leaf is too fragmentary for variation in divergence angle along the length of the lamina to be described. Divergence angle symmetrical.
Thickness: Moderate.
Course: Curved and unbranched, but only a small part of the 2° veins is preserved.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 92°.
Average angle of origin on exmedial side of 2°s: 62°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 85°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8606.5a

Preservation: Good. Leaf is fragmentary. The venation is fairly clear. The leaf is preserved as a carbonaceous impression. There is a clear margin present. The apex is missing. The base of the leaf is preserved. There is a petiole present.

Dimensions:
Maximum length: 17.8mm min. (including petiole).
Maximum length: 14.4mm min. (not including petiole).
Maximum length along 1°: 14.3mm min.
Maximum width: 5.5mm. From curvature of margins present, this appears to be a good estimate of max. width.
Area: 51.8sq.mm min. (including petiole).
Area: 49.9sq.mm min. (not including petiole).
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 14.6mm min. (not including petiole).
Estimated area of LHS of leaf only: 25.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 51.8sq.mm min.
Estimated maximum length along 1°: 14.6mm min.
'Leaf area': 53.5sq.mm min.
Petiole length: 3.4mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf base appears to be asymmetrical, so whole lamina is described as asymmetrical. Apex is not preserved so its symmetry cannot be assessed.

Form: Position of max. width from base is 6.8mm from the base of the leaf, 46.2% max. of the estimated leaf length. This would make the form elliptic, but the leaf is too incomplete for this to be certain. Since the length is a minimum estimate it is more likely that the leaf form is ovate, but it is not possible to be certain. Using estimated max. length, length/width ratio is estimated to be at least 2.65:1, making the leaf form subdivision elliptic, but since the leaf is incomplete, this is not a confident description.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 51° and base is described as acute decurrent.

Margin: There are projections preserved along LHS of leaf, but these are not present along the RHS margin, which appears to be entire. There are only 3 projections. Measured perpendicular to the midvein, the margin is indented 0.5-1mm, average 0.8mm, 36.3% of the distance to the midvein. The margin is therefore described as lobed. Sinuses appear fairly angular.

Petiole: A petiole is present and appears to be normal. Petiole is curved and approximately 0.4mm wide and 3.4mm in length.

Venation type: Venation is described as pinnate simple craspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 7.3mm from base. At this point, 1° vein width is 0.29mm and leaf width is 4.8mm. Size of 1° is therefore 6.04% and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
Number: 6 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Narrow acute (26-57°, average 40°).
(Average on LHS 46°, average on RHS 33°).
Basal vein angle: Narrow acute (average 31°).
Variation: Divergence angle varies irregularly. Divergence angle more acute on RHS than LHS.
Thickness: Moderate.
Course: Appear to be sinuous and branched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 71°.
Average angle of origin on exmedial side of 2°s: 101°.
Combination: OA.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8606.6a

Preservation: Fair. Leaf is fragmentary. The venation is fairly clear. The leaf is preserved as a carbonaceous impression. The apex and base are missing. A very small percentage of the margin is preserved.

Dimensions:
Maximum length: 16.9mm min.
Maximum length along 1°: 13.5mm min.
Maximum width: 12.3mm min.
Maximum width of LHS of leaf only: 7.7mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 15.4mm min.
Area: 112.8sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 17.7mm min.
Estimated area of one side of leaf only: 96.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 193.2sq.mm min.
Estimated maximum length along 1°: 17.8mm min.
'Leaf area': 182.7sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 16.7mm from leaf base, 93.8% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.16:1, which would make the leaf form wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved. It appears to be toothed, but since such a small proportion of the margin is preserved, this is not a confident definition.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate simple craspedodromous, but leaf is fragmentary so this is not a completely confident description.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 8.9mm from base. At this point, 1° vein width is 0.75mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 12mm. Size of 1° is therefore 6.25% and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
Number: 8 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Wide acute (44-98°, average 74°). (Average on LHS 85°, average on RHS 63°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle more acute on RHS than LHS.
Thickness: Fine to moderate.
Course: Appear to be curved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 105°.
Average angle of origin on exmedial side of 2°s: 78°.
Combination: AO.
There are no clearly preserved 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8606.7A&Ba

Part and counterpart.

Preservation: Good. Leaf is almost whole. The venation is clear. The leaf is preserved as a carbonaceous impression. There is a clear margin preserved along one side of the leaf. The apex is incomplete and the base of the leaf is missing. It is possible that removal of sediment cover may reveal slightly more of the apical part of the leaf in D8606.7Aa.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 58.2mm min.
Max. length along 1°: 56.4mm min.
Maximum width: 16.1mm. From curvature of margins present, this appears to be a good estimate of maximum width.
Area: 716.3sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 60.9mm min.
Estimated area of one side of leaf only: 383.8sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 767.6sq.mm min.
Estimated maximum length along 1°: 60.9mm min.
'Leaf area': 653.7sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Lamina appears to be symmetrical, but apex and base are missing so symmetry cannot be confidently described.

Form: Position of max. width from base is estimated to be 28.4mm from the base of the leaf, 46.6% of the estimated leaf length. However it appears that the lamina form is oblong. Using estimated max. length, length/width ratio is estimated to be at least 3.78:1, making the leaf form subdivision narrow oblong, but since the leaf is incomplete, this is not a completely confident description. If the leaf length were at least 96.6mm, then the leaf form subdivision would be lorate.

Apex: Not preserved.

Base: Not preserved.

Margin: Described from D8606.7Aa in which margin is better preserved than in counterpart D8606.7Ba. There are clear projections preserved along one side of leaf. Measured perpendicular to the midvein, the margin is indented 0.2-0.7mm, average 0.4mm, 6.4% of the distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 31-157°, average 89°). Dominant serration type is convex on basal side and convex on apical side. Sinuses appear quite angular. Spacing between serrations is 0.5-5.7mm, average 2mm, standard deviation 1.1mm, and spacing is described as irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation is pinnate semicraspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 30.5mm from base. At this point, 1° vein width is 0.42mm and leaf width is 15.4mm. Size of 1° is therefore 2.74% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: At least 10 pairs.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (17-81°, average 53°). (Average on one side 51°, average on other side 55°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.

Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: Intervening between 2° veins which reach the margin there are 2° veins which form loops. These join superadjacent 2° at a right-angle (average 90°).
Intersecondary veins: There may be simple intersecondary veins present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 82°.
Average angle of origin on exmedial side of 2°s: 79°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 68°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8606.8a

Preservation: Fair. Leaf is fragmentary. The venation is fairly clear. The leaf is preserved as a true impression. None of the margin is preserved. The apex and base are missing. It is possible that removal of sediment cover may reveal slightly more of the specimen.

Dimensions:
Maximum length: 29.5mm min.
Maximum length along 1°: 25.9mm min.
Maximum width: 29.3mm min.
Maximum width of LHS of leaf only: 14.8mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 29.6mm min.
Area: 550.8sq.mm min.
A minimum outline for the leaf was estimated.
Estimated maximum length: 37.2mm min.
Estimated area of one side of leaf only: 477.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 955.2sq.mm min.
Estimated maximum length along 1°: 37.3mm min.
'Leaf area': 736.1sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 1.26:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate but specimen is too fragmentary for venation type to be confidently described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 18.6mm from base. At this point, 1° vein width is 0.73mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 31.4mm min. Size of 1° is therefore 2.32% max. and is termed stout, but the leaf is too fragmentary for this to be a confident definition.
Course: Appears to be markedly curved but this is not certain.

2° veins:
Number: 4 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (39-60°, average 49°). (Average on LHS 40°, average on RHS 57°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to be nearly uniform but leaf is too fragmentary for variation in divergence angle along the length of the lamina to be described confidently. Divergence angle more acute on LHS.
Thickness: Moderate.
Course: Appears to be recurved and unbranched but only a small part of the 2° is preserved.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 77°.
Average angle of origin on exmedial side of 2°s: 96°.
Combination: RA.
There are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

D8609.147a

Preservation: Fairly good. Leaf is fragmentary. The venation is clear. The leaf is preserved as a carbonaceous impression. There are clear margins preserved. The apex and base are missing. It is possible that slightly more of the base of the leaf may be revealed by removal of sediment cover. The rock surface is very uneven so it is very difficult to get the entire specimen in focus and this also results in distortion of the drawing.

Dimensions:
Maximum length: 22.7mm min.
Maximum length along 1°: 21.6mm min.
Maximum width: 9.6mm min.
Area: 142.6sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 23.8mm min.
Estimated area of one side of leaf only: 86.3sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 172.6sq.mm min.
Estimated maximum length along 1°: 24mm min. Slightly longer than estimated max. length because 1° is slightly curved.
'Leaf area': 153.6sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Lamina appears to be symmetrical, but apex and base are missing so symmetry cannot be confidently described.

Form: Position of max. width from base is estimated to be 14.5mm from the base of the leaf, 60.2% of the estimated leaf length. However it appears that the lamina form is oblong. Using estimated max. length, length/width ratio is estimated to be 2.5:1, making the leaf form subdivision oblong, but since the leaf is incomplete, this is not a completely confident description.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, brochidodromous but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 11.9mm from base. At this point, 1° vein width is 0.35mm and leaf width is 9.3mm. Size of 1° is therefore 3.76% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 5 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (30-93°, average 53°). (Average on LHS 63°, average on RHS 44°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly but leaf is too poorly preserved for this to be certain. Divergence angle more acute on RHS than LHS.
Thickness: Moderate.
Course: Sinuous and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at a right-angle (90°).
Intersecondary veins: There appears to be composite

intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 78°.
Average angle of origin on exmedial side of 2°s: 95°.
Combination: RA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 76°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8610.1A&Ba

Part and counterpart.

Preservation: Good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a carbonaceous impression. There are clear margins preserved. The apex and base are missing. It is possible that slightly more of the leaf may be revealed by removal of sediment cover. The rock surface of D8610.1Ba is very uneven so it is very difficult to draw the specimen.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 47.5mm min.
Maximum length along 1°: 34.2mm min.
Maximum width: 36mm min.
Maximum width of one side of leaf only: 18.6mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 37.1mm min.
Area: 899.2sq.mm min.
From the curvature of the margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 51.8mm min.
Estimated area of one side of leaf only: 739.7sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1479.4sq.mm min.
Estimated maximum length along 1°: 51.8mm min.
'Leaf area': 1281.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 42.3mm from leaf base, 81.6% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.4:1, which would make the leaf form wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate, camptodromous, eucamptodromous, but since this is a fragmentary specimen, this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 25.9mm from base. At this point, 1° vein width is 1.03mm and leaf width is 32.2mm. Size of 1° is therefore 3.18% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 8 pairs min.
Pairs are alternate.
Angle of divergence: Moderate acute (32-65°, average 47°). (Average on one side 44°, average on other side 50°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle more acute on one side than the other.
Thickness: Moderate.
Course: Appear to be uniformly curved and unbranched.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: Appears to be simple intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 84°.
Average angle of origin on exmedial side of 2°s: 94°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 82°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8616.74a

Preservation: Good. Leaf is almost whole. The venation is fairly clear. The leaf is preserved as a true impression. There appears to be pale coloured secondary mineralisation on the specimen surface. There may be a small percentage of the margin preserved, the rest of the margin is not very clear. The apical and basal margins are incomplete.

Dimensions: Measurements given are averages taken from two drawings created using low angle lighting from different directions. The measurements appear to be fairly good estimates for the leaf.
Maximum length: 24mm.
Max. length along 1°: 23.5mm.
Maximum width: 16.1mm.
Area: 203.7sq.mm.
'Leaf area': 256.3sq.mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Apex, base and whole lamina appears to be roughly symmetrical, but since the margins are not very clear this is not a completely confident description.

Form: Position of max. width is on average 10.9mm from the base of the leaf, 45.5% of the estimated leaf length. This means that the leaf form is described as elliptic. Length/width ratio is 1.49:1, making the leaf form subdivision suborbiculate, but since the leaf margin is not clear, this is not a completely confident description.

Apex: Apical margin is incomplete but apical angle appears to be 73° and apex is described as acute.

Base: Basal margin is incomplete but basal angle appears to be 81° and base is described as acute normal.

Margin: Margin appears to be toothed. Although leaf margin is too poorly preserved for teeth to be described in detail, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Venation is pinnate simple craspedodromous.

1° vein:
Size: Midpoint is approximately 12mm from base. At this point, 1° vein width is 0.62mm and leaf width is 15.8mm. Size of 1° is therefore 3.89% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 5 pairs min.
Pairs are alternate.
Angle of divergence: Moderate acute (36-60°, average 51°). (Average on LHS 55°, average on RHS 46°).
Basal vein angle: Narrow acute (average 37°). (38° on LHS, 36° on RHS).
Variation: Lowest pair of 2°s more acute than all those above. Divergence angle more acute on RHS.
Thickness: Moderate.
Course: Appears to be recurved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 62°.

Average angle of origin on exmedial side of 2°s: 80°.
Combination: RA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 76°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8616.128a

Preservation: Fairly good. Leaf is fragmentary. The venation is clear. The leaf is preserved as a true impression, but there also appears to be some cream coloured mineralisation. There may be a small percentage of the margin preserved, the rest of the margin is not very clear. The apical margin is incomplete and the base is missing. The rock surface is very uneven.

Dimensions:
Maximum length: 46.5mm min.
Maximum length along 1°: 26.4mm min.
Maximum width: 38.5mm min.
Maximum width of RHS of leaf only: 20mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 40mm min.
Area: 864.4sq.mm min.
A minimum outline for the leaf was estimated.
Estimated maximum length: 50.3mm min.
Estimated area of one side of leaf only: 755.5sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1511sq.mm min.
Estimated maximum length along 1°: 50.3mm min.
'Leaf area': 1341.3sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 17.4mm from leaf base, 34.6% of the estimated leaf length. Leaf form may be ovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.26:1, which would make the leaf form wide ovate, but leaf is too fragmentary for form to be described confidently.

Apex: Leaf is fragmentary so extent of apical portion is estimated using sketched minimum outline. Apex is incomplete and shape is described from LHS of leaf, which is more complete than RHS. Assuming apex is roughly symmetrical, apical angle is estimated to be 111° and apex is described as obtuse. However, apical margin is incomplete so this is not a confident description.

Base: Not preserved.

Margin: Margin appears to be toothed. Although leaf margin is too poorly preserved for teeth to be described in detail, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate simple craspedodromous, but specimen is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 25.2mm from base. At this point, 1° vein width is 0.79mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 38.2mm min. Size of 1° is therefore 2.07% max. and is termed stout, but the leaf is too incomplete for this to be a confident definition.
Course: Appears to be straight and unbranched but this is not certain.

2° veins:
Number: 7 pairs min.
Pairs are subopposite.
Angle of divergence: Narrow acute (31-40°, average 36°).
(Average on LHS 38°, average on RHS 33°).
Basal vein angle: Not preserved.
Variation: Divergence angle nearly uniform. Divergence angle symmetrical.
Thickness: Moderate.
Course: Many of the 2° are uniformly curved, but course is described as recurved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: Appears to be simple intersecondary veins present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 80°.
Average angle of origin on exmedial side of 2°s: 93°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 117°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8618.106a

Preservation: Very good. Leaf is almost whole. The venation is very clear. The leaf is preserved as a true impression, but there also appears to be some cream coloured mineralisation in some of the veins. There is a clearly preserved margin. The apex is missing. The base is present and is petiolate. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. It is possible that slightly more of the LHS of the leaf may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 65.9mm min. (including petiole).
Maximum length: 63mm min. (not including petiole).
Maximum length along 1°: 59.6mm min.
Maximum width: 34.2mm min.
Maximum width of RHS of leaf only: 18.3mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 36.6mm. From curvature of margins present, this appears to be a good estimate of max. width.
Area: 1515.7sq.mm min. (including petiole).
Area: 1512.9sq.mm min. (not including petiole).
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 63.4mm min. (not including petiole).
Estimated area of RHS of leaf only: 899.3sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1798.6sq.mm min.
Estimated maximum length along 1°: 63.8mm min. Slightly longer than estimated max. length because 1° is slightly curved.
'Leaf area': 1556.7sq.mm min.
Petiole length: 2.8mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf base appears to be symmetrical. Although apex is incomplete, it appears to be asymmetrical, so whole lamina is described as asymmetrical.

Form: Position of max. width is 29.7mm from the base of the leaf, 46.6% max. of the estimated leaf length. This would make the form elliptic, but the leaf is too incomplete for this to be certain. If the complete lamina length was at least 66mm, which cannot be ruled out, then the leaf form would be ovate. Using estimated max. length and width, length/width ratio is estimated to be at least 1.74:1, making the leaf form subdivision wide elliptic, but since the leaf is incomplete, this is not a confident description.

Apex: Not preserved.

Base: Leaf is fragmentary so extent of basal portion is estimated using sketched minimum outline. Base is described from RHS of leaf, which is more complete than LHS. Assuming base is roughly symmetrical, basal angle is estimated to be 82° and base is described as acute normal.

Margin: Margin is entire. Leaf is almost whole so this appears to be a good description. However, in the basal RHS of the leaf there may be spines along the margin. The preservation of the leaf margin does not allow these projections to be confidently described as spines.

Petiole: A petiole is present and appears to be normal. It is approximately 0.9mm wide and 2.8mm in length.

Venation type: Pinnate camptodromous brochidodromous.

1° vein: At approx. midpoint, estimated to be 31.7mm from leaf

base, vein width is 0.87mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 36.8mm min. Size of 1° is therefore 2.36% max. and is termed stout.
Course: Curved.

2° veins:
At least 5 pairs, alternate.
Angle of divergence: Moderate acute (30-52°, average 46°). (Average on LHS 46°, average on RHS 46°).
Basal vein angle: Narrow acute (average 40°). (30° on LHS, 49° on RHS).
Variation: Divergence angle varies irregularly. Symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right-angle (average 93°).
Intersecondary veins: None.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 97°.
Average angle of origin on exmedial side of 2°s: 76°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 83°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8619.6a

Preservation: Good. Leaf is almost whole. The venation is clear. The leaf is preserved as a true impression. A small percentage of the margin is preserved, but the margin is unclear. The apex is missing and the base is incomplete. There is no petiole present. The rock surface is very uneven, leading to distortion in the drawing.

Dimensions:
Maximum length: 47.7mm min.
Maximum length along 1°: 45.7mm min.
Maximum width: 38.5mm. From curvature of margins present, this appears to be a good estimate of max. width.
Area: 1088sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 47.8mm min.
Estimated area of RHS of leaf only: 628.1sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1256.2sq.mm min.
Estimated maximum length along 1°: 48mm min. Slightly longer than estimated max. length because 1° is slightly curved.
'Leaf area': 1232sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf base appears to be asymmetrical, so whole lamina is described as asymmetrical. Apex is incomplete so its symmetry cannot be assessed.

Form: Position of max. width from base is 23.6mm from the base of the leaf, 49.1% max. of the estimated leaf length. This would make the form elliptic, but the leaf is too incomplete for this to be certain. If the complete lamina length was at least 52.5mm, which cannot be ruled out, then the leaf form would be ovate. Using estimated max. length, length/width ratio is estimated to be at least 1.25:1, making the leaf form subdivision suborbiculate, but since the leaf is incomplete, this is not a confident description.

Apex: Apex appears to be obtuse, but apical margin is too incomplete for this to be certain.

Base: Leaf is fragmentary so extent of basal portion is estimated using sketched minimum outline. Base of leaf appears to be distorted by the uneven rock surface, but basal angle is approximately 68° and base is described as acute normal.

Margin: There are clear projections preserved along LHS of leaf, but only a very small percentage of the margin is preserved. There are only three clearly preserved projections. Measured perpendicular to the midvein, the margin is indented 0.6-1.2mm, average 0.9mm, 4.6% of the distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 43-61°, average 51°). Dominant serration type is convex on basal side and straight on apical side. Sinuses appear quite angular. Spacing between serrations is 2.9-7.2mm, average 4.6mm, standard deviation 1.9mm, and spacing is described as irregular.

Petiole: Absent or not preserved.

Venation type: Venation appears to be pinnate simple craspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 23.9mm from base. At this point, 1° vein width is 0.9mm and leaf width is 38.4mm. Size of 1° is therefore 2.34% and is termed stout.
Course: Appears to be curved but this is not clear.

2° veins:
Number: 9 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Narrow acute (21-90°, average 44°). (Average on LHS 35°, average on RHS 52°).
Basal vein angle: Narrow acute (average 30°). (21° on LHS, 39° on RHS).
Variation: Upper 2°s more obtuse than lower. Divergence angle more acute on LHS.
Thickness: Moderate.
Course: Specimen surface is very uneven producing distortion in the drawing, but course of 2°s appears to be recurved and unbranched. Some 2° veins appear to be sinuous.
Behaviour of loop-forming branches: None.
Intersecondary veins: None preserved.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 79°.
Average angle of origin on exmedial side of 2°s: 92°.
Combination: RA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 77°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8619.7a

Preservation: Good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a carbonaceous impression. There is a clearly preserved margin. The apex and base are missing. The rock surface is very uneven, making it difficult to get all of the specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 42.4mm min.
Maximum length along 1°: 38mm min.
Maximum width: 28.4mm min.
Maximum width of LHS of leaf only: 15.1mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 30.2mm min.
Area: 837.5sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 54.2mm min.
Estimated area of LHS of leaf only: 617.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1235.2sq.mm min.
Estimated maximum length along 1°: 54.2mm min.
'Leaf area': 1091.2sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Lamina appears to be slightly asymmetrical. Apex and base are not present so their symmetry cannot be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 1.79:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate camptodromous brochidodromous, but the leaf is incomplete so this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 27.1mm from base. At this point, 1° vein width is 0.97mm and leaf width is 25.8mm. Size of 1° is therefore 3.76% and is termed stout.
Course: Appears to be straight and unbranched but this is not certain.

2° veins:
Number: 5 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Wide acute (54-84°, average 69°). (Average on LHS 73°, average on RHS 66°).
Basal vein angle: Not preserved.
Variation: Upper 2° appear to be more acute than those below. Divergence angle more acute on RHS.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right-angle (average 92°). Also appear to be enclosed by 2° or 3° arches.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 92°.
Average angle of origin on exmedial side of 2°s: 95°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 77°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8619.12a

Preservation: Very good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a true impression, but there also appears to be some orange-brown coloured mineralisation. There is a clearly preserved margin. The apex is missing. The base is present. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 50.1mm min.
Maximum length along 1°: 45.8mm min.
Maximum width: 70mm min.
Maximum width of RHS of leaf only: 36.9mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 73.8mm min.
Area: 1691.3sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 52mm min.
Estimated area of LHS of leaf only: 1162sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 2324sq.mm min.
Estimated maximum length along 1°: 52.2mm min.
'Leaf area': 2568.2sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Base appears to be roughly symmetrical. Whole lamina may be roughly symmetrical but leaf is too incomplete for this to be certain. Apex is not present so its symmetry cannot be assessed.

Form: Position of max. width from base is at least 23.5mm from the base of the leaf, 45% of the estimated leaf length. This would make the form elliptic, but the leaf is too incomplete for this to be certain. Using estimated max. length and width, length/width ratio is estimated to be 0.71:1, making the leaf form subdivision oblate, but since the leaf is incomplete, this is not a confident description.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 117° and base is described as obtuse cuneate.

Margin: Margin appears to be entire, but since margin is only present in basal part of leaf, this is not a confident description.

Petiole: Absent or not preserved.

Venation type: Palinactinodromous. The position appears to be basal or possibly suprabasal, palinactinodromous veins arising approximately 8.8mm above the base of the leaf. The development cannot be assessed for this fragmentary specimen. Lateral primary veins diverge from the midvein at 27-31°.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 26mm from base. At this point, 1° vein width is 0.81mm and leaf width is 56.3mm min. Assuming the leaf is symmetrical the leaf width is estimated to be 70.4mm min. at this point. Size of 1° is therefore 1.15% max. and is termed weak.
Course: Appears to be curved, but this is not clear.

2° veins:
2° veins are very difficult to distinguish.
Angle of divergence: Narrow acute (41-48°, average 44°).
Basal vein angle: Narrow acute (41-48°, average 44°).
Variation: The variation in divergence angle along the length of the leaf cannot be assessed, but the divergence appears to be asymmetrical.
Thickness: Appears to be thick.
Course: Appears to be curved but this cannot be confidently assessed.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 85°.
Average angle of origin on exmedial side of 2°s: 82°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° vein forming the midvein, the average angle of origin on the midvein is 98°.
It may be significant that this is different to the average angle of origin on exmedial side of 2°s.

D8619.18a

Preservation: Excellent. Leaf is almost whole. The venation is very clear. Part of the leaf is preserved as a carbonaceous impression, but most is preserved as a cream coloured mineralisation. There is a clearly preserved margin. The apex is present and the base is incomplete. There is no petiole present.

Dimensions:
Maximum length: 69mm min.
Maximum length along 1°: 62.8mm min.
Maximum width: 33.3mm. From curvature of margins present, this appears to be a good estimate of max. width.
Area: 1471.7sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 69.8mm min.
Estimated area of LHS of leaf only: 786.4sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1572.8sq.mm min.
Estimated maximum length along 1°: 69.8mm min.
'Leaf area': 1549.6sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Apex and whole lamina appears to be asymmetrical. Base is incomplete but it also appears to be asymmetrical.

Form: Position of max. width from base is estimated to be 23.9mm from the base of the leaf, 34.2% of the estimated leaf length. This would make the form ovate, but the leaf is too incomplete for this to be completely certain. If the complete lamina length was at least 83.5mm then the leaf form would be elliptic, but this does not appear likely. Using estimated max. length, length/width ratio is at least 2.1:1, making the leaf form subdivision narrow ovate. Although the leaf is incomplete, from the curvature of the margin present this appears to be a good description of the leaf form.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle is 56° and apex is described as acute.

Base: Not preserved.

Margin: Margin is entire.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 34.9mm from base. At this point, 1° vein width is 0.57mm and leaf width is 30.3mm. Size of 1° is therefore 1.88% and is termed moderate.
Course: Straight and unbranched.

2° veins:
Number: 5 pairs min.
Pairs appear to be alternate.
Angle of divergence: Narrow acute (22-83, average 41°).
(Average on LHS 43°, average on RHS 39°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right-angle (average 84°).
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 97°.
Average angle of origin on exmedial side of 2°s: 74°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 95°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8621.27a

Preservation: Good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a true impression. There is a clearly preserved margin. The apex and base are missing.

Dimensions:
Maximum length: 51.4mm min.
Maximum length along 1°: 40.4mm min.
Maximum width: 38.7mm.
Area: 1218.5sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 58.7mm min.
Estimated area of LHS of leaf only: 846sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1692sq.mm min.
Estimated maximum length along 1°: 58.7mm min.
'Leaf area': 1514.5sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Position of max. width from base is estimated to be 27mm from the base of the leaf, 46% of the estimated leaf length. This would make the form elliptic, but the leaf is too incomplete for this to be certain. Using estimated max. length and width, length/width ratio is 1.52:1, making the leaf form subdivision wide elliptic, but since the leaf is incomplete, this is not a confident description.

Apex: Not preserved.

Base: Not preserved.

Margin: There are clear projections preserved along both sides of leaf. Measured perpendicular to the midvein, the margin is indented 0.2-2.4mm, average 0.7mm, 5.3% of the distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There appears to be two size classes of teeth, so tooth series is described as compound. Teeth are serrate. Apical angle of serrations is acute (range 24-138°, average 73°). Dominant serration type is convex on basal side and convex on apical side. Sinuses appear quite angular. Spacing between serrations is 0.5-2.5mm, average 1.2mm, standard deviation 0.5mm, and spacing is described as irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Pinnate simple craspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 29.4mm from base. At this point, 1° vein width is 0.36mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 35.8mm. Size of 1° is therefore 1.01% and is termed weak.
Course: Straight and appears to be unbranched but this is not certain.

2° veins:
Number: 6 pairs min.
Pairs are alternate.
Angle of divergence: Narrow acute (27-43°, average 35°).
(Average on LHS 36°, average on RHS 34°).
Basal vein angle: Not preserved.
Variation: Divergence angle nearly uniform. Divergence angle symmetrical.
Thickness: Fine to moderate.
Course: Many of the 2° are uniformly curved, but course is described as recurved and branched. 2°s are provided with clear outer secondaries.
Behaviour of loop-forming branches: None.
Intersecondary veins: Appears to be simple intersecondary veins present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 79°.
Average angle of origin on exmedial side of 2°s: 94°.
Combination: RA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 127°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8625.119a

Preservation: Good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a true impression. There is a clearly preserved margin. The apex is missing. The base is incomplete. There is no petiole present.

Dimensions:
Maximum length: 55.9mm min.
Maximum length along 1°: 40.5mm min.
Maximum width: 35.3mm min.
Maximum width of LHS of leaf only: 23.2mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 46.4mm min.
Area: 1076.8sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 58.6mm min.
Estimated area of LHS of leaf only: 968.7sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1937.4sq.mm min.
Estimated maximum length along 1°: 58.4mm min.
'Leaf area': 1379.1sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Base appears to be asymmetrical, so whole lamina is described as asymmetrical. Apex is not present so its symmetry cannot be assessed.

Form: Position of max. width from base is estimated to be 20.8mm from the base of the leaf, 35.5% of the estimated leaf length. This would make the form ovate, and from the curvature of the margin present, this appears to be a good description of lamina form. Using estimated max. length and width, length/width ratio is at

least 1.26:1. This would make the leaf form subdivision wide ovate, but the specimen is too incomplete for this to be certain.

Apex: Not preserved.

Base: Leaf is fragmentary so extent of basal portion is estimated using sketched minimum outline. Base is incomplete and shape is described from LHS of leaf, which is more complete than RHS. Assuming base is roughly symmetrical, basal angle is estimated to be 95° and base is described as obtuse normal. However, basal margin is incomplete so this is not a confident description.

Margin: There is only one clear projection preserved along LHS of leaf. Measured perpendicular to the midvein, the margin is indented 2.1mm, 11.3% of the distance to the midvein. Projection has a rather rounded apex, so the margin is described as crenate. Sinus appears quite rounded. Since there is only one preserved, spacing between crenations cannot be estimated.

Petiole: Absent or not preserved.

Venation type: Appears to be pinnate simple craspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 29.3mm from base. At this point, 1° vein width is 0.65mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 43.4mm. Size of 1° is therefore 1.5% and is termed moderate.
Course: Appears to be straight and unbranched.

2° veins:
Number: 2 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (47-58°, average 50°). (Average on LHS 47°, average on RHS 54°).
Basal vein angle: Moderate acute (average 56°).
Variation: Upper secondaries more acute than lower. Divergence angle more acute on LHS.
Thickness: Moderate.
Course: Appears to be uniformly curved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 77°.
Average angle of origin on exmedial side of 2°s: 63°.
Combination: AA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 108°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ134.2A&Ba

Part and counterpart.

Preservation: Good. Leaf is fragmentary. The venation is clear, best preserved in DJ134.2Aa. The leaf is preserved as a carbonaceous impression. There is a clearly preserved margin. The apex is present. The base is missing. It is possible that slightly more of the apex of DJ134.2Aa may be revealed by removal of sediment cover.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 17.8mm min.
Maximum length along 1°: 17mm min.
Maximum width: 13.7mm min.
Maximum width of one side of leaf only: 7.2mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 14.3mm min.
Area: 127.1sq.mm min.
From the curvature of the margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 20.5mm min.
Estimated area of one side of leaf only: 83.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 167.7sq.mm min.
Estimated maximum length along 1°: 20.5mm min.
'Leaf area': 195.4sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf apex appears to be symmetrical. Whole lamina may be symmetrical but specimen is too fragmentary for this to be certain. Base is not present so its symmetry cannot be assessed.

Form: Leaf is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 1.43:1, but since leaf is fragmentary this is just an estimate.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle is 52° and apex is described as attenuate.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved but there are clear projections preserved along both sides of leaf. There are 5 clearly preserved projections. Measured perpendicular to the midvein, the margin is indented 0.3-1.4mm, average 0.7mm, 16.7% of the distance to the midvein. The best-preserved projections have rather pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is obtuse (range 73-134°, average 110°). Dominant serration type is convex on basal side and convex on apical side. Sinuses appear quite rounded. Spacing between serrations is 3.8-4.5mm, average 4.3mm, standard deviation 0.19mm, and spacing is described as regular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate semicraspedodromous, but leaf is fragmentary so this is not a completely confident description.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 10.3mm from base. At this point, 1° vein width is 0.25mm and leaf width is 8.5mm. Size of 1° is therefore 3.02% and is termed stout.
Course: Appears to be straight and unbranched but leaf is too fragmentary for this to be certain.

2° veins:
Number: At least 4 pairs.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (40-90°, average 57°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Leaf is too incomplete for divergence angle symmetry to be assessed.
Thickness: Moderate.
Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: Appears to be loop-forming branches and these join superadjacent 2° at an obtuse angle (average 128°).
Intersecondary veins: None present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 84°.
Average angle of origin on exmedial side of 2°s: 73°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 67°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ134.6a

Preservation: Fair. Leaf is fragmentary. The venation is fairly clear. The leaf is preserved as a carbonaceous impression. There is a clearly preserved margin. The apex is missing. The base is present. There is no petiole present. The rock surface is curved, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. It is possible that slightly more of the leaf may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 14mm min.
Maximum length along 1°: 14mm min.
Maximum width: 10.6mm min.
Maximum width of RHS of leaf only: 6.6mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 13.2mm min.

Area: 76.2sq.mm min.
From the curvature of the margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 14.1mm min.
Estimated area of one side of leaf only: 54.2sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 108.4sq.mm min.
Estimated maximum length along 1°: 14.2mm min.
'Leaf area': 125sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Base appears to be roughly symmetrical. Whole lamina may be roughly symmetrical but leaf is too incomplete for this to be certain. Apex is not present so its symmetry cannot be assessed.

Form: Leaf is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 1.08:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 68° and base is described as acute cuneate.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Venation appears to be acrodromous but leaf is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 7.1mm from base. At this point, 1° vein width is 0.38mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 10mm. Size of 1° is therefore 3.8% and is termed stout.
Course: Appears to be straight and unbranched but leaf is too fragmentary for this to be certain.

2° veins:
Number: 2 min.
Pairs are subopposite.
Angle of divergence: Only the basal part of the leaf is preserved. Here the divergence angle is 31-45°. (Average on LHS 40°, average on RHS 33°).
Basal vein angle: Narrow acute (average 35°). (36° on LHS, 34° on RHS).
Variation: Divergence angle nearly uniform in the part of the leaf preserved. Divergence angle appears asymmetrical, but 2°s are only preserved in base of leaf.
Thickness: Moderate.
Course: Appears to be straight and unbranched but only a small part of the 2° veins is preserved.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: Appears to be simple intersecondaries present but these are not clear.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 89°.
Average angle of origin on exmedial side of 2°s: 86°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 124°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ134.11a

Preservation: Fairly poor. Leaf is fragmentary. The venation is fairly clear. The leaf is preserved as a carbonaceous impression. There is no margin preserved. Neither the apex nor base is present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 17.7mm min.
Maximum length along 1°: 17.7mm min.
Maximum width: 10.6mm min.
Maximum width of LHS of leaf only: 7.4mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 14.8mm min.
Area: 65.1sq.mm min.
From the curvature of the margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 18.2mm min.
Estimated area of LHS of leaf only: 87.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 175.8sq.mm min.
Estimated maximum length along 1°: 18.2mm min.
'Leaf area': 179.6sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 1.23:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be pinnate but the leaf is really too fragmentary for the venation to be described confidently.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 9.1mm from base. At this point, 1° vein width is 0.36mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 12.8mm min. Size of 1° is therefore 2.81% max. and is termed stout, but it is not really possible to define 1° vein size for this fragmentary specimen.
Course: Appears to be straight and unbranched but specimen is too fragmentary for this to be certain.

2° veins:
Number: 2 pairs min.
Pairs are alternate.
Angle of divergence: Narrow acute (32-47°, average 41°). (Average on LHS 39°, average on RHS 43°).
Basal vein angle: Not preserved.
Variation: Divergence angle nearly uniform. Divergence angle appears symmetrical.
Thickness: Moderate.
Course: Appears to be uniformly curved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 94°.
Average angle of origin on exmedial side of 2°s: 87°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 111°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ134.12A&Ba

Part and counterpart.

Preservation: Fair. Leaf is fragmentary. The venation is clear. The leaf is preserved as a carbonaceous impression. There is no margin preserved. Neither the apex nor base is present.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 15.2mm min.
Maximum width: 11.4mm min.
Area: 114.6sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.

'Leaf area': 115.1sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Length/width ratio is 1.33:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Leaf is too poorly preserved for the venation to be described.

1° vein: Not preserved.

2° veins:

3 veins:

DJ134.13a

Preservation: Fairly good. Leaf is almost whole. The venation is fairly clear. The leaf is preserved as a true impression. There is a small percentage of the margin preserved. The apex is incomplete. The base is missing.

Dimensions:
Maximum length: 31.7mm min.
Maximum length along 1°: 28.3mm min.
Maximum width: 24.6mm min.
Maximum width of RHS of leaf only: 12.7mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 25.4mm min.
Area: 557.8sq.mm min.
From the curvature of the margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 32mm min.
Estimated area of RHS of leaf only: 317sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 634sq.mm min.
Estimated maximum length along 1°: 31.2mm min.
'Leaf area': 541.9sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Whole lamina appears to be asymmetrical. Apex is asymmetrical. Base is too incomplete for its symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 6.5mm from leaf base, 20.3% of the estimated leaf length. Leaf form may be ovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.26:1, which would make the leaf form wide ovate, but leaf is too fragmentary for form to be described confidently.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle is 114° and apex is described as emarginate.

Base: Not preserved.

Margin: The margin is not very clearly preserved but there are clear projections preserved along a small percentage of the margin on both sides of leaf. Measured perpendicular to the midvein, the margin is indented 0.1-0.6mm, average 0.3mm, 3.1% of the distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 12-107°, average 73°). Dominant serration type is convex on basal side and straight on apical side. Sinuses appear to be angular. Spacing between serrations is 0.3-1.2mm, average 0.7mm, standard deviation 0.25mm, and spacing is described as irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Pinnate simple craspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 16mm from base. At this point, 1° vein width is 0.73mm and leaf width is 22.9mm. Size of 1° is therefore 3.19% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 7 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (47-60°, average 55°). (Average on LHS 57°, average on RHS 54°).
Basal vein angle: Not preserved.
Variation: Divergence angle nearly uniform. Symmetrical.
Thickness: Moderate.
Course: Appears to be recurved and unbranched. It is also possible that 2°s are provided with outer secondaries but these are not clear.
Behaviour of loop-forming branches: None.
Intersecondary veins: Appears to be simple intersecondary veins present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 113°.
Average angle of origin on exmedial side of 2°s: 48°.
Combination: AO.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 70°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ134.15A&Ba

Part and counterpart.

Preservation: Excellent. Leaf is almost whole. The venation is fairly clear. The leaf is preserved as a carbonaceous impression. Part of the leaf appears to be disrupted by possible reduction spots. There is a clearly preserved margin. The apex and base are present. There is no petiole present.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Leaf is almost whole, so measurements of max. length and width are accurate.
Maximum length: 69.8mm.
Max. length along 1°: 69.4mm.
Maximum width: 18.2mm.
Area: 754.1sq.mm min.
Part of one side of leaf is missing, but the other side is complete.
Area of complete side of leaf only: 395.6sq.mm.
Assuming leaf is roughly symmetrical, area: 791.2sq.mm. This appears to be a good estimate.
'Leaf area': 846.3sq.mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Base, apex and whole lamina appears to be symmetrical.

Form: Position of max. width is on average 33.9mm from the base of the leaf, 48.6% of the leaf length. This means that the leaf form is described as elliptic. Length/width ratio is 3.83:1, making the leaf form subdivision narrow elliptic. Since the leaf is almost whole, this is a good description of lamina form.

Apex: Apical angle is 35° and apex is described as attenuate.

Base: Basal margin is incomplete so base is described from one side of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 45° and base is described as acute normal.

Margin: There are clear projections preserved along both sides of leaf. Measured perpendicular to the midvein, the margin is indented 0.1-0.9mm, average 0.4mm, 4.8% of the distance to the

midvein. Projections have pointed apices, so the margin is described as toothed. There appears to be only one size class of teeth, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is obtuse (range 28-167°, average 95°). Dominant serration type is concave on basal side and straight on apical side. Sinuses appear quite rounded. Spacing between serrations is 0.4-6.1mm, average 2.3mm, standard deviation 1.18mm, and spacing is described as irregular.

Petiole: Absent or not preserved.

Venation type: Pinnate semicraspedodromous.

1° vein:
Size: Midpoint is approximately 34.9mm from leaf base. At this point, 1° vein width is 0.37mm and leaf width is 16.6mm. Size of 1° is therefore 2.23% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: Approximately 15 pairs.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (14-107°, average 61°). (Average on one side 59°, average on other side 63°).
Basal vein angle: Narrow acute (average 41°). (36° on one side, 41° on other side).
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Appear quite fine.
Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: 2° veins are difficult to distinguish, but loop-forming branches appear to join superadjacent 2° at an obtuse angle (average 103°).
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 71°.
Average angle of origin on exmedial side of 2°s: 58°.
Combination: AA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 92°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ134.16a

Preservation: Good. Leaf is fragmentary. The venation is clear. The leaf is preserved as a true impression, but in parts there is cream coloured mineralisation. There is a clearly preserved margin. The apex is missing. The base is present and is petiolate. In the apical part of the leaf the rock surface slopes away abruptly and another part of the same leaf may be preserved on this surface. This part needs to be redrawn separately and is excluded from description. It is possible that slightly more of the LHS of the leaf may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 53.5mm min. (including petiole).
Maximum length: 39mm min. (not including petiole).
Maximum length along 1°: 34.8mm min.
Maximum width: 24.8mm min.
Maximum width of RHS of leaf only: 16.8mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 33.6mm min.
Area: 583.5sq.mm min. (including petiole).
Area: 553.2sq.mm min. (not including petiole).
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 40.7mm min. (not including petiole).
Estimated area of RHS of leaf only: 429.3sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 858.6sq.mm min.
Estimated maximum length along 1°: 40.8mm min.
'Leaf area': 913.9sq.mm min.
Petiole length: 14.2mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf is too incomplete to describe the symmetry of the whole lamina. Base appears to be symmetrical, so whole lamina may be symmetrical, but this cannot be certain. Apex is not preserved so its symmetry cannot be assessed.

Form: Leaf is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 1.21:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Leaf is fragmentary so extent of basal portion is estimated using sketched minimum outline. Base is described from RHS of leaf, which is more complete than LHS. Assuming base is roughly symmetrical, basal angle is estimated to be 64° and base is described as acute cuneate.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: There is a petiole present and it appears to be winged. It is approximately 1.6mm wide and 6mm in length.

Venation type: Venation appears to be pinnate camptodromous eucamptodromous, but the leaf is too incomplete for this to be a completely confident description.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 20.4mm from base. At this point, 1° vein width is 0.85mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 23.4mm. Size of 1° is therefore 3.63% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 7 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Narrow acute (11-53°, average 40°). (Average on LHS 40°, average on RHS 40°).
Basal vein angle: Narrow acute (12°).
Variation: Upper 2°s appear more obtuse than lower. Divergence angle symmetrical.
Thickness: Moderate.
Course: Appears to be straight and unbranched.
Behaviour of loop-forming branches: None present.
Intersecondary veins: Appears to be simple intersecondaries present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 95°.
Average angle of origin on exmedial side of 2°s: 83°.
Combination: RR.
There are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

DJ134.21A/Ba

Preservation: Fairly good. Leaf is fragmentary. The venation is clear. The leaf is preserved as a true impression, but in parts there is some cream coloured mineralisation. There is a small percentage of the margin preserved. The apex is missing. The base is incomplete and appears to be petiolate.

Dimensions:
Maximum length: 34.7mm min. (including petiole).
Maximum length: 33.7mm min. (not including petiole).
Maximum length along 1°: 28.9mm min.
Maximum width: 32.8mm min.
Maximum width of LHS of leaf only: 23.6mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 47.2mm min.
Area: 514.2sq.mm min. (including petiole).
Area: 513.7sq.mm min. (not including petiole).
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 35mm min. (not including petiole).
Estimated area of LHS of leaf only: 602.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1205.8sq.mm min.
Estimated maximum length along 1°: 35.2mm min.
'Leaf area': 1107.6sq.mm min.
Petiole length: 1mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf base appears to be slightly asymmetrical, so whole lamina is described as asymmetrical. Apex is too incomplete for its symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 12.4mm from leaf base, 35.2% of the estimated leaf length. Leaf form may be ovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 0.75:1, which would make the leaf form subdivision very wide ovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Basal margin is incomplete but basal angle is estimated to be approximately 114° and base is described as obtuse cuneate.

Margin: Only a very small percentage of the margin is preserved near the base of the leaf, so it is too incomplete to be described confidently.

Petiole: A petiole is present and appears to be normal. It is approximately 0.6mm wide and 1mm in length.

Venation type: The venation appears to be palinactinodromous. The position appears to be possibly suprabasal, palinactinodromous veins arising approximately 2.1mm above the base of the leaf. The development may be perfect but this is not certain.
The primary veins appear to diverge from the midvein at approximately 39°.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 17.5mm from base. At this point, 1° vein width is 0.45mm and leaf width is 28.8mm min. Assuming the leaf is symmetrical the leaf width is estimated to be 47.4mm min. at this point. Size of 1° is therefore 0.95% max. and is termed weak.
Course: Straight and branched.

2° veins:
2° veins are very difficult to distinguish.
Angle of divergence: Narrow acute (30-50°, average 43°).
Basal vein angle: Cannot be confidently assessed.
Variation: The variation in divergence angle along the length of the leaf cannot be assessed, but the divergence appears to be asymmetrical.
Thickness: Appears to be fine.
Course: Appears to be curved but this cannot be confidently assessed.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 102°.
Average angle of origin on exmedial side of 2°s: 62°.
Combination: AO.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° vein forming the midvein, the average angle of origin on the midvein is 112°.
It may be significant that this is different to the average angle of origin on exmedial side of 2°s.

DJ134.22A/Ba

Preservation: Fairly good. Leaf is almost whole. The venation is fairly clear. The leaf is preserved as a true impression. There is a small percentage of the margin preserved. The apex is missing. The base is incomplete. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. The rock is rather coarse grained and detail is not clearly preserved.

Dimensions:
Maximum length: 66.6mm min.
Maximum length along 1°: 40.6mm min.
Maximum width: 59.5mm min.
Area: 2029.7sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 66.6mm min.
Estimated area of RHS of leaf only: 1221.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 2443.2sq.mm min.
Estimated maximum length along 1°: 64.6mm min.
'Leaf area': 2641.8sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Whole lamina appears to be asymmetrical, but leaf margins are too poorly preserved for this to be certain. Apex and base are incomplete so their symmetry cannot be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 39.9mm from leaf base, 59.9% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Length/width ratio is 1.12:1, which would make the leaf form wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin may be crenate but leaf is too poorly preserved for this to be certain.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: The venation appears to be pinnate simple craspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 33.3mm from base. At this point, 1° vein width is 1.02mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 53.2mm. Size of 1° is therefore 1.92% and is termed moderate.
Course: Appears to be straight and unbranched.

2° veins:
Number: 4 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Narrow acute (21-32°, average 27°).
(Average on LHS 29°, average on RHS 26°).
Basal vein angle: Narrow acute (31°).
Variation: Divergence angle nearly uniform. Divergence angle symmetrical.
Thickness: Thick.
Course: Appears to be recurved and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 92°.
Average angle of origin on exmedial side of 2°s: 69°.
Combination: AR.
There are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

DJ134.27Ba

Preservation: Fairly good. Leaf is fragmentary. The venation is fairly clear. The leaf is preserved as a true impression. It is not possible to see any fine detail because the rock is rather coarse grained and weathered. There is a small percentage of the margin preserved. The apex is missing. The base is incomplete. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 64.7mm min.
Maximum length along 1°: 55.4mm min.
Maximum width: 46.6mm min.
Maximum width of RHS of leaf only: 24.5mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 49mm min.
Area: 2023.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 65.4mm min.
Estimated area of RHS of leaf only: 1319.3sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 2638.6sq.mm min.
Estimated maximum length along 1°: 65.5mm min.
'Leaf area': 2139.7sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The apex and whole lamina appears to be asymmetrical, but leaf margins are too poorly preserved for this to

be certain. Base is too incomplete for its symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 33mm from leaf base, 50.4% of the estimated leaf length. Leaf form may be elliptic, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.34:1, which would make the leaf form subdivision suborbiculate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Basal margin is not clearly preserved. Base appears to be obtuse but this is not a completely confident description.

Margin: Margin appears to be crenate but leaf is too poorly preserved for margin to be described in detail.

Petiole: Absent or not preserved.

Venation type: Appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 32.7mm from base. At this point, 1° vein width is 1.24mm and leaf width is 45.5mm min. Size of 1° is therefore 2.73% max. and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 7 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (35-63°, average 45°). (Average on LHS 41°, average on RHS 49°).
Basal vein angle: Moderate acute (46°).
Variation: Divergence angle varies irregularly. Divergence angle more acute on LHS than RHS.
Thickness: Moderate.
Course: Abruptly curved and branched. Appears to be outer secondaries present.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 65°).
Intersecondary veins: None present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 94°.
Average angle of origin on exmedial side of 2°s: 68°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 92°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ134.28a

Preservation: Fairly good. Specimen is a fragment from LHS of leaf. The venation is fairly clear. The leaf is preserved as a carbonaceous impression. There is a small percentage of the margin preserved. The apex and base are incomplete. There is no petiole present. Primary vein is not clearly preserved. The rock surface is very uneven and the specimen is in an awkward position, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 35.6mm min.
Maximum width: 15mm min.
Maximum width of LHS of leaf only: 15mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 30mm min.
Area: 317.4sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 634.8sq.mm min.
'Leaf area': 712sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is a fragment from LHS of leaf only so lamina symmetry cannot be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 17.8mm from leaf base, 50% of the estimated leaf length. Leaf form may be elliptic, but since leaf is fragmentary, this is not certain. Using estimated width, length/width ratio is 1.19:1, which would make the leaf form subdivision orbiculate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Basal margin is incomplete but assuming base is roughly symmetrical, basal angle is estimated to be approximately 84° and base is described as acute cuneate.

Margin: Leaf is too poorly preserved for margin to be confidently described in detail, but there appears to be projections along the LHS of the leaf. Measured perpendicular to the midvein, the margin is indented 0.6mm, 7.3% of the distance to the midvein. Projection has a rather rounded apex, so the margin is described as crenate. Sinus appears quite angular. Margin is too poorly preserved for spacing between crenations to be estimated.

Petiole: Absent or not preserved.

Venation type: Appears to be pinnate semicraspedodromous.

1° vein:
Size: Cannot be measured for this fragmentary specimen.
Course: Appears to be curved but this is not clear.

2° veins:
Number: At least 3.
Since only LHS of leaf is preserved no pairs can be described.
Angle of divergence: Approximately 55°, but cannot be clearly measured in central part of leaf.
Basal vein angle: Not clearly preserved.
Variation: Leaf is too poorly preserved for variation in divergence angle along the length of the lamina to be described. Since only one side of leaf is preserved, divergence angle symmetry cannot be assessed.
Thickness: Moderate.
Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 70°).
Intersecondary veins: None present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 72°.
Average angle of origin on exmedial side of 2°s: 90°.
Combination: RA.
There are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

DJ147.1a

Preservation: Fairly good. Specimen is just a fragment from apical part of leaf. The venation is fairly unclear. The leaf is preserved as a white and orange tinged mineralisation. There is a clearly preserved margin. The specimen is a fragment from the apex of the leaf. The base is not present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. It is possible that slightly more of the leaf may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 10.9mm min.
Maximum length along 1°: 10.1mm min.
Maximum width: 6.5mm min.
Maximum width of LHS of leaf only: 3.6mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 7.2mm min.
Area: 40.1sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 13.2mm min.
Estimated area of LHS of leaf only: 25.4sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 50.8sq.mm min.
Estimated maximum length along 1°: 13.1mm min.
'Leaf area': 63.4sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf is too incomplete to describe the symmetry of the

whole lamina. Apex appears to be roughly symmetrical, so whole lamina may be symmetrical, but this cannot be certain. Base is not preserved so its symmetry cannot be assessed.

Form: Leaf is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 1.51:1, but since leaf is fragmentary this is just an estimate.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle is 53° and apex is described as attenuate.

Base: Not preserved.

Margin: There is one projection preserved along LHS of leaf. Measured perpendicular to the midvein, the margin is indented 1mm, 27.8% of the distance to the midvein. The margin is therefore described as lobed. Sinus is rounded.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Leaf is too fragmentary for venation to be confidently described.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 6.6mm from base. At this point, 1° vein width is 0.14mm and leaf width is 4.2mm. Size of 1° is therefore 3.33% and is termed stout.
Course: Appears to be straight and unbranched but leaf is too fragmentary for this to be certain.

2° veins:
Number: 4 pairs min.
Pairs subopposite to alternate.
Angle of divergence: Narrow acute (23-54°, average 33°).
(Average on LHS 23°, average on RHS 43°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly but leaf is too fragmentary for variation in divergence angle along the length of the lamina to be described. Divergence angle appears to be more acute on LHS.
Thickness: Moderate.
Course: Appears to be sinuous but leaf is too fragmentary for 2° veins to be described confidently.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: None preserved.
Intramarginal vein: None preserved.

3 veins: Not preserved.

DJ147.3a

Preservation: Fair. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a carbonaceous impression. There is no clearly preserved margin. The apex and base are missing. It is possible that slightly more of the leaf may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 13.9mm min.
Maximum width: 10mm min.
Area: 71.8sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
'Leaf area': 92.7sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Length/width ratio is 1.39:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Leaf is too poorly preserved for venation to be confidently described.

1° vein: Not preserved.

2° veins:

3 veins:

DJ147.4a

Preservation: Fairly good. Specimen is a fragment from LHS of leaf. The venation is very clear. The leaf is preserved as a true impression, but there also appears to be some white-cream coloured mineralisation in some of the veins. There is a clearly preserved margin. The apex is missing. The base is incomplete. There is no petiole present.

Dimensions:
Maximum length: 30.8mm min.
Maximum length along 1°: 4.3mm min.
Maximum width: 15.8mm min.
Maximum width of LHS of leaf only: 15.6mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 31.2mm min.
Area: 144.2sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 32mm min.
Estimated area of LHS of leaf only: 336.7sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 673.4sq.mm min.
Estimated maximum length along 1°: 32mm min.
'Leaf area': 665.6sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is just a fragment from LHS of leaf, so its symmetry cannot be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 28mm from leaf base, 87.5% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.03:1, which would make the leaf form subdivision very wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from LHS of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 86° and base is described as acute decurrent.

Margin: There are only 3 clear projections preserved along LHS of leaf. Measured perpendicular to the midvein, the margin is indented 0.2-0.8mm, average 0.4mm, 3.1% of the estimated distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 63-68°, average 65°). Sinuses appear quite angular. Spacing between serrations is 3-3.7mm, average 3.4mm, standard deviation 0.35mm, and spacing is described as regular.

Petiole: Absent or not preserved.

Venation type: Appears to be suprabasal acrodromous. The development appears to be perfect but this cannot be confidently assessed from this fragmentary specimen.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 16mm from base. At this point, however, 1° vein is not preserved. Near leaf base 1° vein width is 0.37mm. Assuming lamina is roughly symmetrical, leaf width is estimated to be 25.4mm min. at approximate midpoint. Size of 1° is therefore estimated to be 1.46% max. and is termed moderate, but leaf is too fragmentary for this to be a confident definition.
Course: Appears to be straight and unbranched but it is not really possible to describe 1° vein characters for this fragmentary specimen.

2° veins:

There is just one prominent 2° preserved on LHS, no pairs can be observed.
Angle of divergence: Not preserved.
Basal vein angle: Not preserved.
Variation: Leaf is too fragmentary for the variation in divergence angle along the length of the leaf and divergence angle symmetry to be assessed.
Thickness: Thick.
Course: Appears to be uniformly curved and unbranched.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: None preserved.
Average angle of origin on exmedial side of 2°s: 81°.
Combination: R-.
There are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

DJ147.6a

Preservation: Very good. Leaf is almost whole. The venation is very clear. The leaf is preserved as a carbonaceous impression. There is a clearly preserved margin. The apex is missing. The base is incomplete. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. It is possible that slightly more of the leaf may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 23.9mm min.
Maximum length along 1°: 23.6mm min.
Maximum width: 13.8mm min.
Maximum width of RHS of leaf only: 7.3mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 14.6mm. From curvature of margin present it appears that this is a good estimate of max. width.
Area: 229.8sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 24.1mm min.
Estimated area of RHS of leaf only: 135.5sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 271sq.mm min.
Estimated maximum length along 1°: 24.2mm min.
'Leaf area': 235.5sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: It appears that the whole lamina may be roughly symmetrical, but leaf margins are too incomplete for this to be certain. Apex and base are incomplete so their symmetry cannot be assessed.

Form: Position of max. width is 11.5mm from the base of the leaf, 47.5% max. of the estimated leaf length. This would make the form elliptic, but the leaf is too incomplete for this to be certain. If the complete lamina length was at least 32.5mm, which cannot be ruled out, then the leaf form would be ovate. Using estimated max. length and width, length/width ratio is estimated to be at least 1.66:1, making the leaf form subdivision wide elliptic, but since the leaf is incomplete, this is not a confident description.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from RHS of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 91° and base is described as obtuse normal.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Pinnate camptodromous reticulodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 12.1mm from base. At this point, 1° vein width is 0.59mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 14.2mm. Size of 1° is therefore 4.15% and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
Number: 7 pairs min.
Pairs are opposite to subopposite.
Angle of divergence: Wide acute (51-99°, average 69°). (Average on LHS 70°, average on RHS 68°).
Basal vein angle: Approximately right-angled (average 94°).
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right angle (average 91°). Also appear to be enclosed by 3° or 4° arches.
Intersecondary veins: Appears to be composite intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 87°.
Average angle of origin on exmedial side of 2°s: 72°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 75°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.7a

Preservation: Fair. Specimen is a fragment from RHS of leaf. The venation is clear. The leaf is preserved as a true impression, with some mineralisation along 1° and 2° veins. There also appears to be some secondary beige-cream mineralisation covering much of the specimen and it may be possible to chip off this layer. There is no clearly preserved margin preserved. Neither the apex nor base are preserved.

Dimensions:
Maximum length: 40.2mm min.
Maximum length along 1°: 32.2mm min.
Maximum width: 12.7mm min.
Maximum width of RHS of leaf only: 11.7mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 23.4mm min.
Area: 367.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 41.4mm min.
Estimated area of RHS of leaf only: 429.1sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 858.2sq.mm min.
Estimated maximum length along 1°: 41.4mm min.
'Leaf area': 645.8sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is just a fragment from RHS of leaf, so its symmetry cannot be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 14.9mm from leaf base, 36% of the estimated leaf length. Leaf form may be ovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.77:1, which would make the leaf form subdivision ovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Basal margin is not clearly preserved. Base appears to be obtuse but this is not a confident description.

Margin: Not preserved.

Petiole: Base of leaf is not clearly preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate camptodromous brochidodromous, but the leaf is too incomplete for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 20.7mm from base. At this point, 1° vein width is

0.26mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 22.4mm min. Size of 1° is therefore estimated to be 1.16% and is termed weak, but leaf is too poorly preserved for this to be a confident definition.
Course: Straight and appears to be unbranched but this is not certain.

2° veins:
Number: 4 min.
Only RHS of leaf is preserved, so no pairs of 2°s can be observed.
Angle of divergence: Wide acute (34-90°, average 71°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears nearly uniform. Since only RHS of leaf is preserved, symmetry of divergence angle cannot be assessed.
Thickness: Moderate.
Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: Joins superadjacent 2° at an obtuse angle (103°). Also appear to be enclosed by 2° and 3° arches.
Intersecondary veins: Appears to be intersecondary veins present but this is not certain.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 96°.
Average angle of origin on exmedial side of 2°s: 77°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 90°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.8a

Preservation: Fairly good. Specimen is a fragment from LHS of leaf. The venation is clear. The leaf venation is preserved by cream coloured mineralisation. The most prominent also appears to have charcoalified organic material in places. There is a clearly preserved margin. Neither the apex nor base are present.

Dimensions:
Maximum length: 24.1mm min.
Maximum width: 8.4mm min.
Maximum width of LHS of leaf only: 8.4mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 16.8mm min.
Area: 118.6sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 237.2sq.mm min.
'Leaf area': 269.9sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is just a fragment from LHS of leaf, so its symmetry cannot be assessed.

Form: Specimen is too fragmentary for form to be described. Length/width ratio is 1.43:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a small percentage of the margin is preserved but there is one clear projection preserved along LHS of leaf. Measured perpendicular to the midvein, the margin is indented 0.2mm, 2.4% max. of the estimated distance to the midvein. Projection has a pointed apex, so the margin is described as toothed. There is obviously only one size class of teeth in this small part of the margin, but tooth series is described as simple. Tooth is serrate. Apical angle of serrations is acute (37°). Serration type is convex on basal side and concave on apical side. Sinus appears quite angular. Since there is only one tooth preserved, spacing between serrations cannot be estimated.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Leaf is too fragmentary for venation to be described.

1° vein: Not preserved.

2° veins:

3 veins:

DJ147.9&15a

Part and counterpart.

Preservation: Fairly good. Leaf is fragmentary. The venation is clear. DJ147.9a is preserved as a true impression. DJ147.15a is preserved as a cream-white coloured mineralisation, with the venation pattern distinguished by a lack of mineralisation. There is a clearly preserved margin. The leaf is a fragment from the apex of the leaf. The base is not present.

Dimensions: DJ147.9a shows slightly greater completeness than counterpart DJ147.15a, so measurements given are for DJ147.9a.
Maximum length: 25.7mm min.
Maximum length along 1°: 25.8mm min.
Maximum width: 19mm min.
Area: 218.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 25.9mm min.
Estimated area of one side of leaf only: 151.7sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 303.4sq.mm min.
Estimated maximum length along 1°: 26mm min.
'Leaf area': 329.3sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf is too incomplete to describe the symmetry of the whole lamina. Apex appears to be roughly symmetrical, so whole lamina may be symmetrical, but this cannot be certain. Base is not preserved so its symmetry cannot be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated maximum length, length/width ratio is 1.37:1, but since leaf is fragmentary this is just an estimate.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Apical angle is 83° and apex is described as acute.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation is described as pinnate camptodromous brochidodromous, but the specimens are fragments from the apical part of the leaf only so this is not a completely confident definition.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 13mm from base. At this point, 1° vein width is 0.49mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 17.6mm. Size of 1° is therefore 2.77% and is termed stout.
Course: Markedly curved.

2° veins:
At least 5 pairs, subopposite to alternate.
Angle of divergence: Moderately acute (42-83°, average 59°).
(Average on one side 57°, average on other side 61°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent secondary at an obtuse angle (average 110°) and enclosed by 3° arches.
Intersecondary veins: None.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 83°.
Average angle of origin on exmedial side of 2°s: 82°.
Combination: RR.

In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 76°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.10a

Preservation: Excellent. Leaf is almost whole. The venation is clear. Venation pattern is picked out as white-cream coloured mineralisation on a brown fossil. There is a clearly preserved margin. The apex is incomplete. The base is present. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. It is possible that slightly more of the LHS of the leaf may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 32.2mm min.
Maximum length along 1°: 31.3mm min.
Maximum width: 12mm min.
Area: 219sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 32.4mm min.
Estimated area: 262.3sq.mm min.
Estimated maximum length along 1°: 32.5mm min.
'Leaf area': 260sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf base and whole lamina is asymmetrical. Apex is too incomplete for its symmetry to be assessed.

Form: Position of max. width is approximately 11.2mm from the base of the leaf, 34.5% max. of the estimated leaf length. However it appears that the lamina form is oblong. Using estimated max. length, length/width ratio is estimated to be 2.71:1, making the leaf form subdivision oblong, but since the leaf is incomplete, this is not a confident description.

Apex: Leaf is fragmentary and apex is too incomplete for apical angle to be measured. However, apex appears to be attenuate.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is 51° and base is described as acute cuneate.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 16.2mm from base. At this point, 1° vein width is 0.26mm and leaf width is 12mm min. Size of 1° is therefore 2.17% max. and is termed stout.
Course: Markedly curved.

2° veins:
Number: 12 pairs min.
Pairs are alternate, but appear opposite in apical part of leaf.
Angle of divergence: Wide acute (20-97°, average 77°). (Average on LHS 81°, average on RHS 72°).
Basal vein angle: Moderate acute (average 50°). (80° on LHS, 20° on RHS).
Variation: Divergence angle varies irregularly. Divergence angle more acute on RHS.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right-angle (average 84°). Also appear to be enclosed by 3° arches.
Intersecondary veins: Appears to be intersecondaries present and these may be composite but it is not clear.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 92°.
Average angle of origin on exmedial side of 2°s: 81°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 97°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.11a

Preservation: Excellent. Leaf is almost whole. The venation is very clear. The leaf is preserved as cream coloured mineralisation of veins only. There is a clearly preserved margin. The apex and base are incomplete. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 38.3mm min.
Maximum length along 1°: 37.5mm min.
Maximum width: 11.1mm min.
Maximum width of RHS of leaf only: 7.6mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 15.2mm min.
Area: 245.7sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 38.5mm min.
Estimated area of RHS of leaf only: 182.8sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 365.6sq.mm min.
Estimated maximum length along 1°: 38.5mm min.
'Leaf area': 390.1sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The part of the specimen where both sides of the leaf are preserved appears to be roughly symmetrical, but leaf is too incomplete for whole lamina to be confidently described as symmetrical. Apex and base are incomplete so their symmetry cannot be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 15mm from leaf base, 39% of the estimated leaf length. Leaf form may be ovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 2.53:1, which would make the leaf form subdivision narrow ovate, but leaf is too fragmentary for form to be described confidently.

Apex: Leaf is fragmentary and apex is too incomplete for apical angle to be measured. However, apex appears to be attenuate.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from RHS of leaf, which is more complete than LHS. Assuming base is roughly symmetrical, basal angle is estimated to be 70° and base is described as acute normal.

Margin: There are clear projections preserved along both sides of leaf. In basal part of leaf margin is too poorly preserved to be described, but there is one projection on apical RHS and two on apical LHS. Measured perpendicular to the midvein, the margin is indented 0.5-0.8mm, average 0.6mm, 14.1% of the distance to the midvein. Projections have rounded apices, so the margin is described as crenate. Sinuses are rounded. Spacing between crenations is 4.4mm, but margin is too incomplete for regularity of spacing to be assessed.

Petiole: Absent or not preserved.

Venation type: Actinodromous. The position appears to be basal and the development imperfect. Lateral primary vein diverges from midvein at approximately 46°.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 19.3mm from base. At this point, 1° vein width is 0.34mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 12.8mm min. Size of 1° is therefore 2.66% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 9 pairs min.
Pairs are opposite or alternate.
Angle of divergence: Wide acute (67-124°, average 72°).

(Average on LHS 74°, average on RHS 69°).
Basal vein angle: Appears to be wide acute (68°), but since base is not preserved this is not completely certain.
Variation: Upper 2°s appear to be more obtuse than those below. It also appears that the lowest 2° is more acute than those above.
Divergence angle is symmetrical.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: In middle and basal parts of leaf, 2° veins reach margin, but in apical part they form loops. Looping 2°s join superadjacent 2° at an obtuse angle (average 118°). Also appear to be enclosed by 3° and 4° arches.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 80°.
Average angle of origin on exmedial side of 2°s: 99°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 83°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.12A&Ba

Part and counterpart.

Preservation: Excellent. Leaf is almost whole. The venation is clear. The leaf is preserved as an impression with cream-beige coloured mineralisation. There is a clearly preserved margin. The apex is present and one side of the base is incomplete. There is no petiole present.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Leaf is almost whole, so measurements of max. length and width are accurate.
Maximum length: 23.6mm.
Max. length along 1°: 23.6mm.
Maximum width: 7.9mm.
Area: 114.9sq.mm min.
Part of one side of leaf is missing, but the other side is complete.
Area of complete side of leaf only: 58.3sq.mm.
Assuming leaf is roughly symmetrical, area: 116.5sq.mm. This appears to be a good estimate.
'Leaf area': 123.5sq.mm.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf apex and whole lamina appears to be symmetrical, but since base is incomplete, whole lamina cannot confidently be described as symmetrical.

Form: Position of max. width is on average 6.9mm from the base of the leaf, 29.3% of the leaf length. This means that the leaf form is described as ovate. Length/width ratio is 3.01:1, making the leaf form subdivision lanceolate. Since the leaf is almost whole, this is a good description of lamina form.

Apex: Apical angle is 38° and apex is described as attenuate.

Base: Basal angle is 69° and base is described as acute decurrent.

Margin: Margin is entire.

Petiole: Absent or not preserved.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf midpoint is 11.8mm from base. At this point, 1° vein width is 0.22mm and leaf width is 6.9mm. Size of 1° is therefore 3.2% and is termed stout.
Course: Straight and unbranched.

2° veins:
Approximately 8 pairs min., alternate-subopposite.
Angle of divergence: Wide acute (34-113°, average 65°).
(Average on one side 57°, average on other side 73°).
Basal vein angle: Narrow acute (average 36°).
Variation: It appears that the lowest pair of 2°s is more acute than those above. Divergence angle more acute on one side than the other.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 112°). Also appear to be enclosed by 3° or 4° arches.
Intersecondary veins: Present. Appear to be simple.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 97°.
Average angle of origin on exmedial side of 2°s: 67°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 89°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.13a

Preservation: Fair. Leaf is fragmentary. The venation is very clear. The leaf is preserved as an impression with cream coloured mineralisation. There is no margin preserved. Neither the apex nor base are present.

Dimensions:
Maximum length: 27mm min.
Maximum width: 18.9mm min.
Area: 288.7sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
'Leaf area': 340.2sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Length/width ratio is 1.43:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Not preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Leaf is too fragmentary for venation to be described.

1° vein: Not preserved.

2° veins:

3 veins:

DJ147.14a

Preservation: Good. Leaf is almost whole. The venation is clear. The leaf is preserved as a carbonaceous impression. There is a clearly preserved margin. The apex is incomplete. The base is not present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 33.3mm min.
Maximum length along 1°: 32.1mm min.
Maximum width: 17.2mm min.
Area: 305.2sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 34.4mm min.
Estimated area: 337.2sq.mm min.
Estimated maximum length along 1°: 34.3mm min.

'Leaf area': 394.5sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Apex and whole lamina appear to be asymmetrical. Base is too incomplete for its symmetry to be assessed.

Form: Position of max. width is estimated to be 10.3mm from the base of the leaf, 29.9% of the estimated leaf length. However it appears that the lamina form is oblong. Using estimated max. length, length/width ratio is estimated to be 2:1, making the leaf form subdivision oblong, but since the leaf is incomplete, this is not a confident description.

Apex: Leaf is incomplete so extent of apical portion is estimated using sketched minimum outline. Tip of apex is missing, but apical angle appears to be 55° and apex is described as acute.

Base: Not preserved.

Margin: Margin appears to be entire.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 17.2 mm from base. At this point, 1° vein width is 0.38mm and leaf width is 13.6mm min. Size of 1° is therefore 2.79% max. and is termed stout.
Course: Markedly curved.

2° veins:
Number: 12 pairs min.
Pairs are alternate.
Angle of divergence: Approximately right-angled (50-100°, average 85°). (Average on LHS 87°, average on RHS 83°).
Basal vein angle: Not preserved.
Variation: Divergence angle nearly uniform and symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right angle (average 88°). Also appear to be enclosed by 2°, 3° or 4° arches.
Intersecondary veins: Appear to be simple intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 89°.
Average angle of origin on exmedial side of 2°s: 79°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 89°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.17a

Preservation: Fairly good. Leaf is fragmentary. The venation is clear. The leaf is preserved as an impression with cream coloured mineralisation. There is a small percentage of the margin preserved. Neither the apex nor base are present.

Dimensions:
Maximum length: 38.9mm min.
Maximum length along 1°: 34.7mm min.
Maximum width: 17mm min.
Maximum width of LHS of leaf only: 9.7mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 19.4mm min.
Area: 290.4sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 39mm min.
Estimated area of LHS of leaf only: 297.7sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 595.4sq.mm min.
Estimated maximum length along 1°: 35.2mm min.
'Leaf area': 504.4sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf is too fragmentary for its symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 2.01:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Only a very small percentage of the margin is preserved. It appears to be entire, but this is not certain.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate camptodromous brochidodromous but the specimen is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 19.5mm from base. At this point, 1° vein width is 0.24mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 17.4mm min. Size of 1° is therefore 1.38% max. and is termed moderate, but leaf is too fragmentary for this to be a confident definition.
Course: Appears to be curved, but this is not clearly the 1° vein.

2° veins:
Number: 6 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Approximately right-angled (61-97°, average 82°). (Average on LHS 79°, average on RHS 85°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly but leaf is too fragmentary for variation in divergence angle along the length of the lamina to be described. Divergence angle more acute on LHS than RHS.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 108°). Also appear to be enclosed by 3° or 4° arches.
Intersecondary veins: Appear to be simple intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 95°.
Average angle of origin on exmedial side of 2°s: 68°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 88°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.18a

Preservation: Fair. Leaf is just a fragment from the RHS of the leaf. The venation is clear. The leaf is preserved as an impression with cream coloured mineralisation. A small percentage of the margin is preserved. Neither the apex nor base are preserved. The 1° is not preserved. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 18.4mm min.
Maximum width: 9mm min.
Maximum width of RHS of leaf only: 9mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 18mm min.
Area: 84.4sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 168.8sq.mm min.
'Leaf area': 220.8sq. mm min.

Organisation: The specimen is too fragmentary for the leaf

organisation to be described.

Symmetry: Specimen is just a fragment from RHS of leaf, so its symmetry cannot be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 1.02:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: There are clear projections preserved along RHS of leaf, but only a very small percentage of the margin is preserved. There are only 2 clearly preserved projections. Measured perpendicular to the midvein, the margin is indented 0.4-0.7mm, average 0.6mm, 6.4% max. of the estimated distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 55-69°, average 62°). Dominant serration type is acuminate on basal side and concave on apical side. Sinuses appear quite rounded. Spacing between serrations is 5.9mm, but since there are only two preserved it is not possible to assess the regularity of the spacing.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Specimen is too fragmentary for venation to be described.

1° vein: Not preserved.

2° veins:

3 veins:

DJ147.19&54a

Part and counterpart.

DJ147.19a

Preservation: Good. Specimen is a fragment from RHS of leaf. The venation is very clear. The leaf is preserved as an impression with cream coloured mineralisation picking out the venation. There is a clearly preserved margin. The apex is missing. The base is incomplete. There is no petiole present.

DJ147.54a

Preservation: Good. Specimen is a fragment from LHS of leaf. The venation is very clear. The leaf is preserved as a true impression with some cream coloured mineralisation in the main veins. There is a clearly preserved margin. The apex is missing. The LHS of the base is present. There is no petiole. It is possible that slightly more of the LHS margin may be revealed by removal of sediment cover.

Dimensions: Measurements given are for DJ147.19a, which shows slightly greater completeness than counterpart DJ147.54a.
Maximum length: 49.1mm min.
Maximum length along 1°: 49.9mm min.
Maximum width: 11.1mm min.
Maximum width of RHS of leaf only: 8.7mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 17.4mm. From curvature of margin present, this appears to be a good estimate of max. width.
Area: 302.6sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 49.9mm min.
Estimated area of RHS of leaf only: 316.8sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 633.6sq.mm min.
Estimated maximum length along 1°: 50.8mm min.
'Leaf area': 589.3sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is just a fragment from one side of leaf, so its symmetry cannot be assessed.

Form: Position of max. width is approximately 28.1mm from the base of the leaf, 55.3% max. of the estimated leaf length. However it appears that the lamina form is oblong. Using estimated max. length and width, length/width ratio is estimated to be 2.92:1, making the leaf form subdivision oblong, but since the leaf is incomplete, this is not a confident description. If the maximum length of the leaf was at least 52.2mm, which appears likely, then the leaf form subdivision would be narrow oblong.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from one side of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 43° and base is described as acute normal.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 25mm from base. At this point, 1° vein width is 0.49mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 16.1mm. Size of 1° is therefore 3.02% and is termed stout.
Course: Markedly curved.

2° veins:
Approximately 12 pairs min.
Since only one side of the leaf is preserved it is not possible to describe pairs.
Angle of divergence: Wide acute (54-108°, average 80°).
Basal vein angle: Wide acute (average 98°).
Variation: Divergence angle varies irregularly. Since only one side of leaf is preserved divergence angle symmetry cannot be assessed.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 123°). Also appear to be enclosed by 2°, 3°, or 4° arches. In the basal part of the leaf the looping 2°s appear to fuse forming an intramarginal vein.
Intersecondary veins: Composite intersecondaries present.
Intramarginal vein: Even though the basal looping 2°s appear to fuse, there is no intramarginal vein present.

3 veins:
Average angle of origin on admedial side of 2°s: 92°.
Average angle of origin on exmedial side of 2°s: 88°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 81°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.20a

Preservation: Good. Leaf is fragmentary. The venation is clear. The leaf is preserved as an impression with the venation picked out by cream coloured mineralisation. There is a clearly preserved margin. The apex is missing. The base is incomplete. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 21.8mm min.
Maximum length along 1°: 19.6mm min.
Maximum width: 17.2mm min.
Maximum width of RHS of leaf only: 11mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 22mm min.
Area: 234.4sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 22.3mm min.
Estimated area of RHS of leaf only: 174.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 349.8sq.mm min.
Estimated maximum length along 1°: 21.4mm min.

'Leaf area': 327.1sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf is too incomplete for its symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 13.2mm from leaf base, 59.2% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.01:1, which would make the leaf form subdivision very wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from RHS of leaf, which is more complete than LHS. Assuming base is roughly symmetrical, basal angle is estimated to be 153° and base is described as cordate.

Margin: There appears to be a projection preserved in the basal RHS of the leaf, the remainder of the margin is not preserved. Measured perpendicular to the midvein, the margin is indented 1.9mm, 18.6% of the distance to the midvein. Projection has a rounded apex, so the margin is described as crenate. Sinus is rounded. Spacing between crenations cannot be assessed because margin is too incomplete.

Petiole: Absent or not preserved.

Venation type: Appears to be actinodromous. The position is basal and the development appears that it may be perfect but the leaf is too fragmentary for this to be clear. Lateral primary veins diverge from base at 49° to midvein on LHS and 42° on RHS.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 11.2mm from base. At this point, 1° vein width is 0.45mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 17.6mm. Size of 1° is therefore 2.56% and is termed stout.
Course: Appears to be straight and branched.

2° veins: None preserved.

3 veins:
Although there are clearly preserved 3° veins, their divergence angles cannot be measured because leaf is just a small fragment and there are no 2° veins preserved.

DJ147.23a

Preservation: Fairly good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a carbonaceous impression. There is a small percentage of the margin preserved. Neither the apex nor base are present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 17.8mm min.
Maximum length along 1°: 13.6mm min.
Maximum width: 12.1mm min.
Area: 118.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 19.1mm min.
Estimated area of LHS of leaf only: 88.4sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 176.8sq.mm min.
Estimated maximum length along 1°: 19.1mm min.
'Leaf area': 154.1sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 1.58:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin may be crenate but leaf is too incomplete for this to be certain.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate camptodromous brochidodromous but the leaf is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 9.6mm from base. At this point, 1° vein width is 0.29mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 12mm min. Size of 1° is therefore 2.42% max. and is termed stout.
Course: Straight and appears to be unbranched but this is not certain.

2° veins:
Number: 2 pairs min.
Pairs are alternate.
Angle of divergence: Approximately right-angled (76-87°, average 81°). (Average on LHS 82°, average on RHS 80°).
Basal vein angle: Not preserved.
Variation: Appears to be nearly uniform but leaf is too fragmentary for variation in divergence angle along the length of the lamina to be described confidently. Divergence angle appears to be symmetrical.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 135°). Also appear to be enclosed by 3° or 4° arches.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 96°.
Average angle of origin on exmedial side of 2°s: 93°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 90°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.24a

Preservation: Fairly good. Leaf is fragmentary. The venation is clear. The leaf is preserved as an impression with cream coloured mineralisation. There is a clearly preserved margin. Neither the apex nor base of the leaf is present.

Dimensions:
Maximum length: 15.4mm min.
Maximum length along 1°: 14.6mm min.
Maximum width: 9mm min.
Maximum width of LHS of leaf only: 4.6mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 9.2mm min.
Area: 96.4sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 17.9mm min.
Estimated area of LHS of leaf only: 63.1sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 126.2sq.mm min.
Estimated maximum length along 1°: 17.9mm min.
'Leaf area': 109.8sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: The part of the leaf preserved appears to be roughly symmetrical, but since the apex and base are missing, the symmetry of the leaf cannot be confidently described.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 1.95:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: There are clear projections preserved along both sides of leaf. There are 3 clearly preserved projections. Measured perpendicular to the midvein, the margin is indented 0.4-0.5mm, average 0.5mm, 11.8% of the distance to the midvein. Projections have rather pointed apices, so the margin is described as toothed. There is only one size class of teeth, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 44-98°, average 67°). Dominant serration type is acuminate on basal side and convex on apical side. Sinuses appear quite rounded. Spacing between serrations is 4.4mm, but margin is too incomplete for regularity of spacing to be assessed.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate semicraspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 9mm from base. At this point, 1° vein width is 0.33mm and leaf width is 8mm. Size of 1° is therefore 4.13% and is termed massive.
Course: Straight and appears to be unbranched but this is not certain.

2° veins:
Number: At least 7 pairs.
Pairs are alternate.
Angle of divergence: Wide acute (43-86°, average 66°). (Average on LHS 65°, average on RHS 67°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.
Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: Intervening between 2° veins reaching margin, some form loops. These join superadjacent 2° at an obtuse angle (average 107°).
Intersecondary veins: Appears to be simple intersecondary veins present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 92°.
Average angle of origin on exmedial side of 2°s: 82°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 79°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.25a

Preservation: Good. Leaf is fragmentary. The venation is clear. The leaf is preserved as an impression with the venation picked out by cream coloured mineralisation. There is a clearly preserved margin. The apex is missing. The base is incomplete. There is no petiole present. There may be wound reaction tissue in the apical part of the leaf, possibly indicating insect damage. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. Different parts of the leaf were drawn separately.

Dimensions:
Maximum length: 28.1mm min.
Maximum length along 1°: 21.2mm min.
Maximum width: 21mm min.
Maximum width of LHS of leaf only: 11.8mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 23.6mm. From curvature of margin present, this appears to be a good estimate of max. width.
Area: 393.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 28.8mm min.
Estimated area of LHS of leaf only: 289.3sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 578.6sq.mm min.
Estimated maximum length along 1°: 29mm min.
'Leaf area': 456.3sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 16.1mm from leaf base, 55.5% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.23:1, which would make the leaf form subdivision wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from LHS of leaf, which is more complete than RHS. Assuming base is roughly symmetrical, basal angle is estimated to be 105° and base appears to be obtuse normal. However, basal margin is incomplete so this is not a completely confident description.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 14.4mm from base. At this point, 1° vein width is 0.59mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 23.4mm. Size of 1° is therefore 2.52% and is termed stout.
Course: Markedly curved.

2° veins:
Number: 7 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Wide acute (61-101°, average 75°).
(Average on LHS 74°, average on RHS 76°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right-angle (average 86°). Also enclosed by 2° arches.
Intersecondary veins: Appears to be intersecondaries present, but it is not clear if these are simple or composite.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 84°.
Average angle of origin on exmedial side of 2°s: 78°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 80°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.26a

Preservation: Fair. Leaf is just a fragment from LHS of the leaf. The venation is clear. The leaf is preserved as an impression with the venation picked out by cream coloured mineralisation. There is a small percentage of the margin preserved. Neither the apex nor base of the leaf is present. The 1° vein is not preserved. It is possible that slightly more of the leaf may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 17.5mm min.
Maximum width: 14.3mm min.
Maximum width of LHS of leaf only: 14.3mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 28.6mm min.
Area: 143sq.mm min.

Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 286sq.mm min.
'Leaf area': 333.7sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 0.61:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Only a very small percentage of the margin is preserved so this is not a completely confident description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Leaf is too poorly preserved for venation to be described.

1° vein: Not preserved.

2° veins:
At least 3 pairs, but leaf is only fragmentary.
Angle of divergence: Not preserved.
Basal vein angle: Not preserved.
Variation: Not preserved.
Thickness: Moderate.
Course: Abruptly curved.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 67°). Also appear to be enclosed by 3° arches.
Intersecondary veins: None.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 96°.
Average angle of origin on exmedial side of 2°s: 76°.
Combination: AR.
There are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

DJ147.28a

Preservation: Fair. Specimen is a rather scrappy fragment. The venation is fairly clear. The leaf is preserved as an impression with cream coloured mineralisation. There may be a small percentage of the margin preserved. Neither the apex nor base of the leaf are present. The 1° vein does not appear to be preserved.

Dimensions:
Maximum length: 17.2mm min.
Maximum width: 14.2mm min.
Area: 136.6sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
'Leaf area': 162.8sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Length/width ratio is 1.21:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin may be entire, but margin is not clearly preserved.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Leaf is too poorly preserved for venation to be described.

1° vein: Not preserved.

2° veins:

3 veins:

DJ147.29a

Preservation: Fair. Leaf is just a fragment from one side of the leaf. The venation is clear. The leaf is preserved as a carbonaceous impression. There is a small percentage of the margin preserved. Neither the apex nor base of the leaf are present. The 1° vein is not preserved.

Dimensions:
Maximum length: 15.3mm min.
Maximum width: 7.8mm min.
Maximum width of LHS of leaf only: 7.8mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 15.6mm min.
Area: 76.1sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 152.2sq.mm min.
'Leaf area': 159.1sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too fragmentary for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 0.98:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Only a very small percentage of the margin is preserved so this is not a completely confident description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Leaf is too poorly preserved for venation to be described.

1° vein: Not preserved.

2° veins:

3 veins:

DJ147.30a

Preservation: Fairly good. Leaf is a fragment from LHS of leaf. The venation is clear. The leaf is preserved as a carbonaceous impression. There is a clearly preserved margin. Neither the apex nor base of the leaf are preserved. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 21.3mm min.
Maximum length along 1°: 17.5mm min.
Maximum width: 12.5mm min.
Maximum width of LHS of leaf only: 12.5mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 25mm min.
Area: 163.8sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 25.2mm min.
Estimated area of LHS of leaf only: 221.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 443.2sq.mm min.
Estimated maximum length along 1°: 25.3mm min.

'Leaf area': 421.7sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is a fragment from LHS of leaf only so it is not possible to assess lamina symmetry.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 1.01:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: There are clear projections preserved along LHS of leaf, but only a small percentage of the margin is preserved. There are 5 clearly preserved projections. Measured perpendicular to the midvein, the margin is indented 0.3-0.5mm, average 0.4mm, 5.9% of the distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 40-118°, average 63°). Dominant serration type is concave on basal side and convex on apical side. Sinuses appear quite rounded. Spacing between serrations is 1.6-5.1mm, average 3.5mm, standard deviation 1.13mm, and spacing is described as irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Venation appears to be acrodromous but the leaf is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 12.6mm from base. At this point, 1° vein width is 0.22mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 21mm. Size of 1° is therefore 1.05% and is termed weak.
Course: Appears to be curved but this is not certain.

2° veins:
Leaf is fragmentary and only part of one 2° vein is preserved.
Angle of divergence: Not preserved.
Basal vein angle: Not preserved.
Variation: Leaf is too fragmentary for the variation in divergence angle along the length of the leaf and divergence angle symmetry to be assessed.
Thickness: Moderate.
Course: Appears to be uniformly curved and branched.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 80°.
Average angle of origin on exmedial side of 2°s: 82°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 80°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.31a

Preservation: Fairly good. Leaf is a fragment from RHS of leaf. The venation is clear. The leaf is preserved as an impression with cream coloured mineralisation. There is a clearly preserved margin. Neither the apex nor base of the leaf are present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 20mm min.
Maximum length along 1°: 12.3mm min.
Maximum width: 12.7mm min.
Maximum width of RHS of leaf only: 12.1mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 24.2mm min.
Area: 188.5sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 22.9mm min.
Estimated area of LHS of leaf only: 229.8sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 459.6sq.mm min.
Estimated maximum length along 1°: 22.9mm min.
'Leaf area': 369.5sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is a fragment from RHS of leaf only so it is not possible to assess lamina symmetry.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 17.5mm from leaf base, 76.4% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 0.95:1, which would make the leaf form subdivision very wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Basal margin is not clearly preserved. Base appears to be obtuse but this is not a confident description.

Margin: Margin may be entire but leaf is too incomplete for this to be certain.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 11.5mm from base. At this point, 1° vein width is 0.63mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 22mm. Size of 1° is therefore 2.86% and is termed stout.
Course: Appears to be straight and unbranched but leaf is too fragmentary for this to be certain.

2° veins:
At least 3 pairs.
Angle of divergence: Moderate acute (52-71°, average 61°).
Basal vein angle: Not preserved.
Variation: divergence angle appears to vary irregularly but leaf is too fragmentary for divergence angle along the length of the lamina to be confidently described. Only one side of leaf is preserved so divergence angle symmetry cannot be assessed.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right-angle (average 87°).
Intersecondary veins: None.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 85°.
Average angle of origin on exmedial side of 2°s: 82°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 61°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.32a

Preservation: Excellent. Leaf is almost whole. The venation is very clear. The leaf is preserved as an impression with orange-cream coloured mineralisation. There is a clearly preserved margin. The apex and base are incomplete. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. Different parts of the leaf were drawn separately.

Dimensions:
Maximum length: 51.5mm min.
Maximum length along 1°: 50.6mm min.
Maximum width: 22.2mm min.
Maximum width of LHS of leaf only: 12.5mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 24.9mm min.
Area: 611.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf

was estimated.
Estimated maximum length: 51.6mm min.
Estimated area of LHS of leaf only: 420.5sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 841sq.mm min.
Estimated maximum length along 1°: 51.7mm min.
'Leaf area': 857.4sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The base of the leaf and therefore the whole lamina is described as asymmetrical. Since the rock surface is so uneven it is difficult to assess the symmetry of the whole lamina. The apex is too incomplete for its symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 25.4mm from leaf base, 49% of the estimated leaf length. Leaf form may be elliptic, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 2.08:1, which would make the leaf form subdivision elliptic, but leaf is too fragmentary for form to be described confidently.

Apex: Leaf is fragmentary so extent of apical portion is estimated using sketched minimum outline. Apex is incomplete and shape is described from RHS of leaf. Assuming apex is roughly symmetrical, apical angle is estimated to be 44° and apex is described as attenuate.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from LHS of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 110° and base is described as obtuse cuneate.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 25.8mm from base. At this point, 1° vein width is 0.57mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 24.7mm. Size of 1° is therefore 2.31% max. and is termed stout.
Course: Markedly curved.

2° veins:
Number: 12 pairs min.
Pairs are alternate.
Angle of divergence: Moderate acute (40-66°, average 52°). (Average on LHS 51°, average on RHS 53°).
Basal vein angle: Moderate acute (average 56°). (56° on LHS, 57° on RHS).
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 117°). Also enclosed by 2° arches.
Intersecondary veins: Appears to be simple intersecondaries present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 89°.
Average angle of origin on exmedial side of 2°s: 87°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 90°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.33a

Preservation: Fairly good. Specimen is a fragment from basal RHS of leaf. The venation is fairly clear. The leaf is preserved as an impression with orange-yellow coloured mineralisation. There is a clearly preserved margin. The apex is missing. The base is incomplete. There is no petiole present.

Dimensions:
Maximum length: 21mm min.
Maximum length along 1°: 20.4mm min.
Maximum width: 9mm min.
Maximum width of RHS of leaf only: 8.4mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 16.8mm min.
Area: 113.1sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 21.8mm min.
Estimated area of RHS of leaf only: 114.3sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 228.6sq.mm min.
Estimated maximum length along 1°: 21.8mm min.
'Leaf area': 244.2sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is a fragment from RHS of leaf only so it is not possible to assess lamina symmetry.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 17.3mm from leaf base, 79.4% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.3:1, which would make the leaf form subdivision wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from RHS of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 63° and base is described as acute cuneate.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 10.9mm from base. At this point, 1° vein width is 0.71mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 12.2mm. Size of 1° is therefore 5.82% and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
Number: 4 min.
Only RHS of leaf is preserved, so no pairs of 2°s can be observed.
Angle of divergence: Wide acute (66-76°, average 78°).
Basal vein angle: Narrow acute (34°).
Variation: It appears that lowest 2° may be more acute than those above. Since only RHS of leaf is preserved, symmetry of divergence angle cannot be assessed.
Thickness: Moderate.
Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: Joins superadjacent 2° at an approximate right-angle (80°).
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 94°.
Average angle of origin on exmedial side of 2°s: 79°.
Combination: AR.
There are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

DJ147.34a

Preservation: Fairly good. Leaf is just a fragment from one side of the leaf. The venation is clear. The leaf is preserved as a true impression, possibly with some cream coloured mineralisation in some of the veins. There is a clearly preserved margin. Neither the apex nor base of the leaf are present. The 1° vein is not preserved. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the

drawing.

Dimensions:
Maximum length: 31.8mm min.
Maximum width: 12.5mm min.
Maximum width of LHS of leaf only: 12.5mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 25mm min.
Area: 152.4sq.mm min.
Specimen is too fragmentary for a minimum outline for the leaf to be estimated.
Assuming leaf is roughly symmetrical, estimated area: 304.8sq.mm min.
'Leaf area': 530sq. mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is a fragment from one side of leaf only so it is not possible to assess lamina symmetry.

Form: Specimen is too fragmentary for form to be described. Using estimated max. width, length/width ratio is 1.27:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: There are clear projections preserved along LHS of leaf, but only a small percentage of the margin is preserved. There are 4 clearly preserved projections. Measured perpendicular to the midvein, the margin is indented 0.7-1.8mm, average 1mm, 8.1% max. of the estimated distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 21-73°, average 42°). Dominant serration type is convex on basal side and straight on apical side. Sinuses appear quite angular. Spacing between serrations is 2.7-3.7mm, average 3.2mm, standard deviation 0.38mm, and spacing is described as regular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Specimen is too fragmentary for venation to be described.

1° vein: Not preserved.

2° veins:
Leaf is fragmentary and only a small part of two 2° veins is preserved.
Angle of divergence: Not preserved.
Basal vein angle Not preserved.
Variation: Leaf is too fragmentary for the variation in divergence angle along the length of the leaf and divergence angle symmetry to be assessed.
Thickness: Moderate.
Course: Appears to be curved.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 90°.
Average angle of origin on exmedial side of 2°s: 73°.
Combination: AR.
The 1° vein is not preserved so there are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

DJ147.35a

Preservation: Fairly good. Leaf is fragmentary. The venation is fairly clear. The leaf is preserved as an impression with orange-cream coloured mineralisation. There is a clearly preserved margin. Neither the apex nor base of the leaf are present.

Dimensions:
Maximum length: 23.3mm min.
Maximum length along 1°: 13.6mm min.
Maximum width: 17.5mm min.
Maximum width of RHS of leaf only: 9.9mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 19.8mm min.
Area: 244.1sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 24.8mm min.
Estimated area of RHS of leaf only: 194sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 388sq.mm min.
Estimated maximum length along 1°: 24.8mm min.
'Leaf area': 327.4sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is too incomplete for lamina symmetry to be described. In the part of the leaf where both sides of the lamina are preserved, it appears to be roughly symmetrical, but this is not a confident description.

Form: Position of max. width is estimated to be 6.2mm from the base of the leaf, 25% of the estimated leaf length. This means that the leaf form is described as ovate. Although the leaf is incomplete, this appears to be a good description of lamina form. Using estimated max. length and width, length/width ratio is 1.25:1, making the leaf form subdivision wide ovate, but specimen is too fragmentary for this to be certain.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin appears to be erose. Measured perpendicular to the midvein, the margin is indented 0.1-0.9mm, average 0.3mm, 4.1% of the distance to the midvein.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Pinnate simple craspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 12.4mm from base. At this point, 1° vein width is 0.59mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 16.4mm. Size of 1° is therefore 3.6% and is termed stout.
Course: Appears to be straight and unbranched.

2° veins:
Number: 8 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (35-100°, average 62°). (Average on LHS 61°, average on RHS 63°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.
Course: Appears to be sinuous to recurved and branched. It is also possible that 2°s are provided with outer secondaries but these are not clear.
Behaviour of loop-forming branches: None.
Intersecondary veins: Appears to be simple intersecondary veins present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 93°.
Average angle of origin on exmedial side of 2°s: 64°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 79°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.37A&B/Ca

Part and counterpart.

Preservation: Very good. Leaf is almost whole. The venation is clear. The leaf is preserved as a true impression. There is a clearly preserved margin, which in DJ134.37B/Ca appears to be curled slightly upwards. The apex is present and the base is incomplete. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. Two drawings of each specimen were necessary. Part of DJ147.37Aa is covered by

secondary calcareous mineralisation and picking this off may reveal slightly more of the RHS of the specimen.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 32.3mm min.
Maximum length along 1°: 32.2mm min.
Maximum width: 24.9mm min.
Maximum width of one side of leaf only: 12.9mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 25.7mm. From curvature of margin present, this appears to be a good estimate of max. width.
Area: 577.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 32.9mm min.
Estimated area of one side of leaf only: 304.2sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 608.3sq.mm min.
Estimated maximum length along 1°: 33.2mm min.
'Leaf area': 568.8sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Rock surface is very uneven, making lamina symmetry difficult to assess. However, apex and whole lamina appear to be asymmetrical. Base also appears to be asymmetrical, but it is too incomplete for this to be certain.

Form: Lamina form is described from DJ147.37B/Ca which shows slightly better preservation. Position of max. width is estimated to be 15.6mm from the base of the leaf, 46% of the estimated leaf length. This means that the leaf form is described as elliptic. Using estimated max. length and width, length/width ratio is 1.37:1, making the leaf form subdivision suborbiculate. Since the leaf is almost whole, this appears to be a good description of lamina form.

Apex: Apical angle is 109° and apex is described as obtuse.

Base: Basal margin is not clearly preserved. Base appears to be obtuse normal, but this is not a confident description.

Margin: Measured from DJ137.37Aa in which margin is better preserved than in Counterpart DJ147.37B/Ca. There are clear projections preserved along both sides of the leaf. Measured perpendicular to the midvein, the margin is indented 0.3-1mm, average 0.5mm, 6.4% of the distance to the midvein. Projections have rounded apices, so the margin is described as crenate. Sinuses appear rather angular. Spacing between crenations is 0.9-6.8mm, average 2.9mm, standard deviation 1.88mm, and spacing is described as irregular. Margin also appears to be enrolled.

Petiole: Absent or not preserved.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 16.4mm from base. At this point, 1° vein width is 0.45mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 25.3mm. Size of 1° is therefore 1.76% and is termed moderate.
Course: Markedly curved.

2° veins:
Number: 6 pairs min.
Pairs are subopposite.
Angle of divergence: Moderate acute (29-81°, average 48°).
(Average on one side 53°, average on other side 43°).
Basal vein angle: Not clearly preserved.
Variation: Divergence angle varies irregularly. Divergence angle more acute on one side than the other.
Thickness: Moderate.
Course: Abruptly curved and branched. Appears to be outer secondaries present.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right-angle (average 90°). Also appear to be enclosed by 3° or 4° arches.
Intersecondary veins: Appears to be simple intersecondaries present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 83°.
Average angle of origin on exmedial side of 2°s: 78°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 86°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.38Aa

Preservation: Good. Specimen is a fragment from RHS of leaf. The venation is very clear. The leaf is preserved as an impression with the venation picked out by cream coloured mineralisation. There is a clearly preserved margin. The apex is missing. The base is incomplete. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. Removal of sediment cover on the RHS margin did not reveal any more of the leaf.

Dimensions:
Maximum length: 46.1mm min.
Maximum length along 1°: 46.1mm min.
Maximum width: 11.8mm min.
Maximum width of RHS of leaf only: 10.5mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 21mm. From curvature of margin present, this appears to be a good estimate of max. width.
Area: 327.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 49.2mm min.
Estimated area of RHS of leaf only: 362.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 725.2sq.mm min.
Estimated maximum length along 1°: 49.3mm min.
'Leaf area': 690.2sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is a fragment from RHS of leaf only so lamina symmetry cannot be assessed.

Form: Position of max. width is estimated to be 13.3mm from the base of the leaf, 27% of the estimated leaf length. This means that the leaf form is described as ovate. Using estimated max. length and width, length/width ratio is 2.35:1, making the leaf form subdivision narrow ovate. Although the leaf is incomplete this appears to be a good description of lamina form.

Apex: Leaf is fragmentary and apex is too incomplete for apical angle to be measured. However, apex appears to be attenuate.

Base: Not preserved.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 24.6mm from base. At this point, 1° vein width is 0.58mm and leaf width is 7.9mm, but this is a minimum estimate because the LHS of the leaf is not present. RHS only is estimated to be 9.2mm wide at this point. Assuming leaf is symmetrical, leaf width is 18.4mm. Size of 1° is therefore 3.15% and is termed stout.
Course: Straight.

2° veins:
At least 8. Since only one side of the leaf is preserved it is not possible to describe pairs.
Angle of divergence: Wide acute (60-89°, average 76°).
Basal vein angle: Not preserved.
Variation: Upper 2°s appear more obtuse than lower. Since only one side of leaf is preserved divergence angle symmetry cannot be assessed.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 103°). Also appear to be enclosed by 2°, 3°, or 4° arches.

Intersecondary veins: Composite intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 90°.
Average angle of origin on exmedial side of 2°s: 92°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 85°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.39a

Preservation: Excellent. Leaf is almost whole. The venation is very clear. The leaf is preserved as an impression, with the venation picked out by cream coloured mineralisation. There is a clearly preserved margin. The apex is present and it appears that the base can be described from the LHS of the specimen. The basal RHS is missing. There appears to be a petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. The apex of the leaf appears to be slightly twisted along the 1° vein.

Dimensions:
Maximum length: 34.1mm (including petiole).
Maximum length: 30.4mm (not including petiole).
Maximum length along 1°: 30.4mm.
Maximum width: 12.8mm min.
Maximum width of LHS of leaf only: 8.5mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 17mm. From curvature of margins present, this appears to be a good estimate of max. width.
Area: 163.8sq.mm min. (including petiole).
Area: 161.6sq.mm min. (not including petiole).
Area of LHS of leaf (which shows greater preservation than RHS) only: 123.5sq.mm.
Assuming leaf is roughly symmetrical, estimated area: 247sq.mm.
'Leaf area': 344.5sq.mm min.
Petiole length: 3.8mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: The apex appears to be asymmetrical, so the whole lamina is described as asymmetrical. The base of the leaf is too incomplete for its symmetry to be assessed.

Form: Position of max. width is 9.6mm from the base of the lamina, 31.6% of the leaf length. This means that the leaf form is described as ovate. Using estimated max. width, length/width ratio is 1.79:1, making the leaf form subdivision ovate. Although the leaf is incomplete this appears to be a good description of lamina form.

Apex: Apical angle is 27° and apex is described as attenuate.

Base: Shape of base is described from LHS of leaf, which is more complete than RHS. Assuming base is roughly symmetrical, basal angle is estimated to be 80° and base is described as acute normal.

Margin: There is one projection preserved along LHS of leaf. Measured perpendicular to the midvein, the margin is indented 2.6mm, 39.4% of the distance to the midvein. The margin is therefore described as lobed. Sinus is too incomplete to be described. Since there is only one lobe it is not possible to estimate spacing.

Petiole: A petiole is present and appears to be normal. It is approximately 0.8mm wide and 3.8mm in length.

Venation type: Appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 15.2mm from base. At this point, 1° vein width is 0.33mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 7.6mm. Size of 1° is therefore 4.34% and is termed massive.
Course: Markedly curved.

2° veins:
Number: 4 pairs min.
Pairs are alternate.
Angle of divergence: Moderate acute (36-63°, average 48°).
(Average on LHS 47°, average on RHS 49°).
Basal vein angle: Moderate acute (47°).
Variation: It appears that the divergence angle varies irregularly.
Divergence angle appears to be symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 116°). Also appear to be enclosed by 2° arches. May possibly form an intramarginal vein but this is not clear.
Intersecondary veins: Appears to be composite intersecondaries present.
Intramarginal vein: No clear intramarginal vein present.

3 veins:
Average angle of origin on admedial side of 2°s: 87°.
Average angle of origin on exmedial side of 2°s: 83°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 60°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.40a

Preservation: Fairly good. Specimen is a fragment from RHS of leaf. The venation is clear. The leaf is preserved as an impression with the venation picked out by orange-cream coloured mineralisation. There is a clearly preserved margin. Neither the apex nor base of the leaf are present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 36mm min.
Maximum length along 1°: 29.1mm min.
Maximum width: 16.2mm min.
Maximum width of RHS of leaf only: 13mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 26mm min.
Area: 323.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 36.9mm min.
Estimated area of RHS of leaf only: 360.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 721.2sq.mm min.
Estimated maximum length along 1°: 37mm min.
'Leaf area': 641.3sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is a fragment from RHS of leaf only so lamina symmetry cannot be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 28.6mm from leaf base, 77.3% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.42:1, which would make the leaf form subdivision wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although only a small proportion of the margin is preserved, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 18.5mm from base. At this point, 1° vein width is

0.57mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 21.2mm min. Size of 1° is therefore 2.69% max. and is termed stout.
Course: Markedly curved.

2° veins:
Number: 5 pairs min.
Pairs appear to be alternate but leaf is too fragmentary for this to be certain.
Angle of divergence: Wide acute (58-104°, average 72°).
(Average on LHS 72°, average on RHS 72°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle appears to be symmetrical, but only one 2° is preserved on LHS of leaf.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 70°). Also appear to be enclosed by 2° or 3° arches.
Intersecondary veins: Appears to be intersecondaries present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 77°.
Average angle of origin on exmedial side of 2°s: 71°.
Combination: AA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 90°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.41Aa

Preservation: Fairly good. Specimen is a fragment from LHS of leaf. The venation is clear. The leaf is preserved as an impression with the venation picked out by cream coloured mineralisation. There is a clearly preserved margin. Neither the apex nor base of the leaf are present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. The specimen is also in a very awkward position on the slab.

Dimensions:
Maximum length: 19.6mm min.
Maximum length along 1°: 7.6mm min.
Maximum width: 7mm min.
Maximum width of LHS of leaf only: 6.7mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 13.4mm min.
Area: 87.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 20.6mm min.
Estimated area of LHS of leaf only: 103sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 206sq.mm min.
Estimated maximum length along 1°: 20.6mm min.
'Leaf area': 184sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is a fragment from LHS of leaf only so lamina symmetry cannot be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 13.6mm from leaf base, 66% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.54:1, which would make the leaf form subdivision wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Apex appears to be obtuse but apical margin is too incomplete for this to be certain.

Base: Not preserved.

Margin: There are 7 clear projections preserved along LHS of leaf. Measured perpendicular to the midvein, the margin is indented 0.2-0.3mm, average 0.3mm, 4.9% of the distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 34-141°, average 82°). Dominant serration type is acuminate on basal side and straight on apical side. Sinuses appear quite angular. Spacing between serrations is 1.5-2.1mm, average 1.8mm, standard deviation 0.22mm, and spacing is described as regular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate semicraspedodromous.

1° vein:
Size: Leaf is incomplete and 1° vein is not preserved at approximate midpoint of leaf, so measurements are made closer to base. At this point, 1° vein width is 0.56mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 13.2mm. Size of 1° is therefore 4.24% and is termed massive.
Course: Unbranched and appears to be straight but leaf is too fragmentary for this to be certain.

2° veins:
Number: At least 3.
Only one side of leaf is preserved so there are no pairs of 2°s.
Angle of divergence: Moderate acute (average 50°).
Basal vein angle: Not clearly preserved.
Variation: Leaf is too fragmentary for variation in divergence angle along the length of the lamina to be described and since only one side of the leaf is present it is not possible to assess divergence angle symmetry.
Thickness: Moderate.
Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an acute angle (average 71°).
Intersecondary veins: None present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 91°.
Average angle of origin on exmedial side of 2°s: 69°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 85°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.43a

Preservation: Fairly good. Leaf is fragmentary. The venation is clear. The leaf is preserved as an impression with cream coloured mineralisation. There appears to be a small percentage of the margin preserved. Neither the apex nor base of the leaf are present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. It is possible that slightly more of the RHS of the leaf may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 14.9mm min.
Maximum length along 1°: 14.3mm min.
Maximum width: 17.2mm min.
Maximum width of RHS of leaf only: 10.5mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 21mm min.
Area: 137.1sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 15.5mm min.
Estimated area of RHS of leaf only: 117.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 235.2sq.mm min.
Estimated maximum length along 1°: 15.6mm min.
'Leaf area': 218.4sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf is too incomplete for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 11.3mm from leaf base, 72.4% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 0.74:1, which would make

the leaf form subdivision very wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is fragmentary so extent of basal portion is estimated using sketched minimum outline. Base is incomplete and shape is described from LHS of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 59° and base is described as acute normal. However, basal margin is incomplete so this is not a confident description.

Margin: Margin is too poorly preserved to be described.

Petiole: Absent or not preserved.

Venation type: Appears to be acrodromous but leaf is too poorly preserved for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 7.8mm from base. At this point, 1° vein width is 0.27mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 17.8mm min. Size of 1° is therefore 1.52% max. and is termed moderate, but leaf is too fragmentary for this to be a confident definition.
Course: Markedly curved.

2° veins:

3 veins:

DJ147.44a

Preservation: Very good. Leaf is fragmentary. The venation is fairly clear. The leaf is preserved as a true impression, with the 1° vein picked out by cream coloured mineralisation. The rock appears to be rather coarse grained and it is difficult to see fine detail. There is a clearly preserved margin. The apex is present and the base is incomplete. Much of the RHS of the leaf is not clearly preserved. There appears to be a petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions: Measurements of maximum length and width appear fairly accurate.
Maximum length: 35.7mm (including petiole).
Maximum length: 35.2mm (not including petiole).
Maximum length along 1°: 35.8mm. Slightly longer than estimated max. length because 1° is slightly curved.
Maximum width: 11.1mm min.
Maximum width of LHS of leaf only: 6.6mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 13.2mm. From curvature of margins present, this appears to be a good estimate of max. width.
Area: 139.8sq.mm min. (including petiole).
Area: 139.7sq.mm min. (not including petiole).
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated area of LHS of leaf only: 107.3sq.mm.
Assuming leaf is roughly symmetrical, estimated area: 214.6sq.mm.
'Leaf area': 315sq.mm.
Petiole length: 0.5mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Apex appears to be roughly symmetrical. LHS of specimen is too incomplete in remainder of leaf for symmetry of base and whole lamina to be described.

Form: Position of max. width is 6.3mm from the base of the lamina, 17.6% of the leaf length. This means that the leaf form is described as ovate. Using estimated max. width, length/width ratio is 2.71:1, making the leaf form subdivision narrow ovate. Although the leaf is incomplete this appears to be a good description of lamina form.

Apex: Leaf is fragmentary so extent of apical portion is estimated using sketched minimum outline. Apical margin is incomplete but apical angle is estimated to be 15° and apex is described as attenuate.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from LHS of leaf, which is more complete than RHS. Assuming base is roughly symmetrical, basal angle is estimated to be 87° and base is described as rounded.

Margin: There are 12 projections preserved along LHS of leaf. Measured perpendicular to the midvein, the margin is indented 0.2-0.4mm, average 0.3mm, 6% of the distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth are serrate. Apical angle of serrations is acute (range 15-140°, average 78°). Dominant serration type is acuminate on basal side and straight on apical side. Sinuses appear quite angular. Spacing between serrations is 0.2-2.1mm, average 0.9mm, standard deviation 0.54mm, and spacing is described as irregular.

Petiole: A petiole is present and appears to be normal. It is approximately 0.4mm wide and 0.5mm in length.

Venation type: Appears to be pinnate semicraspedodromous.

1° vein:
Size: Leaf is incomplete and at approximate midpoint 1° vein is not preserved. Measurements are therefore made closer to leaf base. At this point, 1° vein width is 0.31mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 7.8mm. Size of 1° is therefore 3.97% and is termed stout.
Course: Markedly curved.

2° veins:
Number: Appears to be at least 12 pairs.
Pairs are subopposite to alternate.
Angle of divergence: Moderate acute (32-93°, average 62°).
(Average on LHS 70°, average on RHS 54°).
Basal vein angle: Wide acute (73°).
Variation: Divergence angle varies irregularly. Divergence angle appears to be more acute on RHS, but RHS of leaf is not well preserved.
Thickness: Moderate.
Course: Appears to be abruptly curved and branched.
Behaviour of loop-forming branches: There appears to be some loop-forming branches alternating between 2° veins which reach the margin. These join superadjacent 2° at an obtuse angle (average 152°).
Intersecondary veins: None present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 89°.
Average angle of origin on exmedial side of 2°s: 67°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 94°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.45a

Preservation: Fairly good. Leaf is fragmentary. The venation is clear. The leaf is preserved as an impression with cream coloured mineralisation. There is a clearly preserved margin. Neither the apex nor base of the leaf are preserved. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 26.3mm min.
Maximum length along 1°: 21.3mm min.
Maximum width: 24.4mm min.
Maximum width of RHS of leaf only: 14.5mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 29mm min.
Area: 341.2sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 27.3mm min.
Estimated area of RHS of leaf only: 264sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 528sq.mm min.
Estimated maximum length along 1°: 26.2mm min.
'Leaf area': 527.8sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf is too incomplete for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 24.6mm from leaf base, 90.1% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 0.94:1, which would make the leaf form subdivision very wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from RHS of leaf, which is more complete than LHS. Assuming base is roughly symmetrical, basal angle is estimated to be 129° and base is described as lobate.

Margin: There appears to be projections along RHS of leaf, but only a small percentage of the margin is present. There are only three projections preserved. Measured perpendicular to the midvein, the margin is indented 0.4-1mm, average 0.7mm, 8.4% of the distance to the midvein. Projections have rounded apices, so the margin is described as crenate. Sinuses are rounded. Spacing between crenations is 6.5mm, but margin is too incomplete for regularity of spacing to be assessed.

Petiole: Absent or not preserved.

Venation type: Appears to be pinnate but specimen is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 13.7mm from base. At this point, 1° vein width is 0.9mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 18mm. Size of 1° is therefore 5% and is termed massive.
Course: Appears to be straight and unbranched but leaf is too fragmentary for this to be certain.

2° veins:
Number: 2 pairs min.
Pairs appear to be alternate.
Angle of divergence: Not clearly preserved. Basal vein angle is the only one which can be measured.
Basal vein angle: Moderate acute (46°).
Variation: Cannot be described for this fragmentary specimen.
Thickness: Moderate.
Course: Appears to be straight and unbranched, but only part of the 2° veins is preserved.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 85°.
Average angle of origin on exmedial side of 2°s: 98°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 86°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.46a

Preservation: Very good. Leaf is almost whole. Leaf is preserved as a pale brown carbonaceous impression. Secondary calcareous mineralisation has been picked off where possible using a scalpel and dissection kit, but some remains, obscuring the leaf. The specimen surface is very uneven. There is 3D preservation in the basal part of the primary vein. The venation is clear. There is a clearly preserved margin. Only the very tip of the apex is missing and one side of the base is incomplete. There is no petiole present.

Dimensions:
Maximum length: 48.3mm min.
Maximum length along 1°: 47.6mm min.
Maximum width: 18mm min.
Maximum width of LHS only, which shows slightly greater preservation than RHS, is 9.1mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 18.2mm min.
Area: 479.5sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 48.6mm min.
Estimated area of one side of leaf only: 250.1sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 500.2sq.mm min.
Estimated maximum length along 1°: 48.7mm min.
'Leaf area': 590.9sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Apex is symmetrical. Base and whole lamina appear symmetrical, but leaf is too fragmentary for this to be certain.

Form: Point of max. width is at 15.8mm max. from leaf base, 32.4% max. of the leaf length. The lamina form is therefore ovate. Using the estimated max. length and width, the length width ratio is 2.68:1 and the leaf form subdivision is narrow ovate. Although the leaf is incomplete, this appears to be a good description of lamina form.

Apex: Apical angle is 30° and apex is described as attenuate.

Base: Basal angle is 75° and base is described as acute normal.

Margin: Margin is entire.

Petiole: Absent or not preserved.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be at least 24.3mm from base. At this point, 1° vein width is 0.48mm and leaf width is 13.6mm. Size of 1° is therefore 3.53% and is termed stout.
Course: Markedly curved.

2° veins:
Approximately 6 pairs min., alternate-subopposite.
Angle of divergence: Moderate acute (49-77°, average 61°).
(Average on LHS 63°, average on RHS 60°).
Basal vein angle: Wide acute (average 68°).
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 116°). Also appear to be enclosed by 2°, 3°, or 4° arches.
Intersecondary veins: Appears to be composite intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 89°.
Average angle of origin on exmedial side of 2°s: 88°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 79°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.48a

Preservation: Fairly good. Specimen is a fragment from basal part of leaf. The venation is fairly clear. The leaf is preserved as a true impression, but the 1° vein is preserved by cream-beige coloured mineralisation. There is a clearly preserved margin. The apex is missing. The RHS of the base is present and appears to be petiolate. There are spherical objects on the lamina which may be galls, but this is not at all clear.

Dimensions:
Maximum length: 18.5mm min. (including petiole).
Maximum length: 16.6mm min. (not including petiole).
Maximum length along 1°: 11.1mm min.
Maximum width: 17.2mm min.
Maximum width of RHS of leaf only: 13.6mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 27.2mm min.
Area: 143.3sq.mm min. (including petiole).
Area: 141.5sq.mm min. (not including petiole).
From curvature of margins present, a minimum outline for the leaf was estimated.

Estimated maximum length: 17.4mm min. (not including petiole).
Estimated area of RHS of leaf only: 167.7sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 335.4sq.mm min.
Estimated maximum length along 1°: 17.4mm min.
'Leaf area': 315.5sq.mm min.
Petiole length: 1.9mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf is too incomplete for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 12.5mm from leaf base, 71.8% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 0.64:1, which would make the leaf form subdivision very wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from RHS of leaf, which is more complete than LHS. Assuming base is roughly symmetrical, basal angle is estimated to be 123° and base is described as obtuse normal.

Margin: Margin appears to be entire, but since margin is only present in basal part of leaf, this is not a confident description.

Petiole: A petiole is present and appears to be normal. It is approximately 1.5mm wide and 1.9mm in length.

Venation type: Appears to be pinnate camptodromous brochidodromous but specimen is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 8.7mm from base. At this point, 1° vein width is 0.73mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 23.4mm. Size of 1° is therefore 3.12% and is termed stout.
Course: Straight and appears to be unbranched but leaf is too fragmentary for this to be certain.

2° veins:
At least 3 pairs, alternate.
Angle of divergence: Wide acute (60-67°, average 66°). (Average on LHS 67°, average on RHS 66°).
Basal vein angle: Moderate acute (63°).
Variation: Divergence angle nearly uniform. Symmetrical.
Thickness: Moderate.
Course: Uniformly curved and unbranched.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: Appears to be intersecondary veins present.
Intramarginal vein: None preserved.

3 veins:
Average angle of origin on admedial side of 2°s: 77°.
Average angle of origin on exmedial side of 2°s: 64°.
Combination: AA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 84°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.49A&Ba

Part and counterpart.

Preservation: Good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a true impression with some cream coloured mineralisation in the main veins. Part of DJ147.49Ba shows the remains of carbonaceous material. There is a clearly preserved margin. The apex is missing. The base is incomplete. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. It is possible that slightly more of the LHS of DJ147.49Ba may be revealed by removal of sediment cover. There are spherical objects on the lamina which may be galls, but this is not at all clear. Part and counterpart preserve different parts of the leaf so description is based on a composite of the two fragments.

Dimensions:
Maximum length: 26.2mm min. (including petiole).
Maximum length: 24.9mm min. (not including petiole).
Maximum length along 1°: 14.2mm min.
Maximum width: 35.1mm min.
Maximum width of RHS of leaf only: 24.4mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 48.8mm min.
Area: 471.6sq.mm min. (including petiole).
Area: 469.6sq.mm min. (not including petiole).
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 25.8mm min. (not including petiole).
Estimated area of RHS of leaf only: 486.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 973.2sq.mm min.
Estimated maximum length along 1°: 25.3mm min.
'Leaf area': 839.4sq.mm min.
Petiole length: 1.7mm.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Leaf is too incomplete for lamina symmetry to be assessed.

Form: Position of max. width is estimated to be 10.1mm from the base of the leaf, 39.1% max. of the estimated leaf length. This means that the leaf form is described as ovate. Although the leaf is incomplete, this appears to be a good description of lamina form. Using estimated max. length and width, length/width ratio is 0.53:1, making the leaf form subdivision very wide ovate, but specimen is too fragmentary for this to be certain.

Apex: Not preserved.

Base: Leaf is fragmentary so extent of basal portion is estimated using sketched minimum outline. Basal margin is incomplete, but angle is measured from one side of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 167° and base is described as hastate.

Margin: The margin appears to be lobed, with the margin indented at least 7.5mm, 37.9% of the estimated distance to the midvein. Sinus appears to be quite angular. Spacing between lobes appears to be approximately 17.3mm, but this is not an accurate measurement because the lobes are incomplete. The margin of the lobes is not entire. It appears to be crenate.

Petiole: A petiole is present and appears to be normal. It is approximately 1.7mm wide and 1.7mm in length.

Venation type: Basal actinodromous. The development appears to be imperfect but the leaf is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 12.9mm from base. At this point, 1° vein width is 0.52mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 47mm min. Size of 1° is therefore 1.11% max. and is termed weak.
Course: Appears to be straight and branched.

2° veins:
Number: 1 pair min.
Pair is opposite.
Angle of divergence: Moderate acute (42-52°, average 48°). (Average on one side 51°, average on other side 44°).
Basal vein angle: Moderate acute (48°). (Average on one side 51°, average on other side 44°).
Variation: Since only one pair of secondary veins is preserved variation in divergence angle along the length of the lamina cannot be assessed. Divergence angle more acute on one side of the leaf than the other.
Thickness: Moderate to thick.
Course: Appear to be straight and unbranched.
Behaviour of loop-forming branches: None present.
Intersecondary veins: None.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 85°.
Average angle of origin on exmedial side of 2°s: 67°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 79°.

It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.51a

Preservation: Fairly good. Leaf is fragmentary. The venation is clear. The leaf is preserved as a true impression, but there also appears to be some cream coloured mineralisation in some of the veins. It appears that a small percentage of the margin is preserved. Neither the apex nor base of the leaf are present.

Dimensions:
Maximum length: 21.3mm min.
Maximum length along 1°: 20.3mm min.
Maximum width: 14.4mm min.
Maximum width of LHS of leaf only: 11mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 22mm min.
Area: 161.2sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 21.3mm min.
Estimated area of LHS of leaf only: 158.2sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 316.4sq.mm min.
Estimated maximum length along 1°: 21.3mm min.
'Leaf area': 312.4sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf is too incomplete for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 12.9mm from leaf base, 60.6% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 0.97:1, which would make the leaf form subdivision very wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: There are only two clear projections preserved along RHS of leaf, but only a very small percentage of the margin is preserved. Measured perpendicular to the midvein, the margin is indented 0.5-1.9mm, average 1.2mm, 22.3% of the distance to the midvein. Projections have pointed apices, so the margin is described as toothed. There is only one size class of teeth in this small part of the margin, so tooth series is described as simple. Teeth appear to be dentate. Apices of teeth are acuminate (range 52-76°, average 64°). Sinus preserved appears quite angular. Margin is too incomplete for spacing between teeth to be measured.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate simple craspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 10.7mm from base. At this point, 1° vein width is 0.87mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 19.4mm. Size of 1° is therefore 4.48% and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
Number: 5 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Narrow acute (12-49°, average 26°).
(Average on LHS 35°, average on RHS 17°).
Basal vein angle: Narrow acute (average 42°).
Variation: Divergence angle varies irregularly. Divergence angle more acute on RHS than LHS.
Thickness: Moderate.
Course: Appear to be sinuous and branched.
Behaviour of loop-forming branches: None.
Intersecondary veins: There appears to be composite intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 84°.
Average angle of origin on exmedial side of 2°s: 68°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 56°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.52a

Preservation: Good. Specimen is a fragment from LHS of leaf. The venation is clear. The leaf is preserved as an impression with the venation picked out by cream coloured mineralisation. There is a clearly preserved margin. The apex is missing. The base can be described from the LHS of the leaf. There is no petiole.

Dimensions:
Maximum length: 24.5mm min.
Maximum length along 1°: 22.7mm min.
Maximum width: 10.3mm min.
Maximum width of LHS of leaf only: 9.8mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 19.6mm min.
Area: 152.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 25.2mm min.
Estimated area of LHS of leaf only: 163sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 326sq.mm min.
Estimated maximum length along 1°: 25.2mm min.
'Leaf area': 329.3sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is a fragment from LHS of leaf only so lamina symmetry cannot be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 21.5mm from leaf base, 85.3% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.29:1, which would make the leaf form subdivision wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from LHS of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 68° and base is described as acute cuneate.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Appears to be pinnate camptodromous brochidodromous, but specimen is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 12.6mm from base. At this point, 1° vein width is 0.59mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 14mm. Size of 1° is therefore 4.21% and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
Number: 4 min.
Specimen is a fragment from one side of leaf only so no pairs can be described.
Angle of divergence: Moderate acute (50-71°, average 63°).
Basal vein angle: Moderate acute (average 50°).
Variation: Lowest pair of 2°s appears to be more acute than those above. Divergence angle symmetry cannot be assessed because only one side of leaf is preserved.
Thickness: Moderate.
Course: Abruptly curved and unbranched.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: Appears to be composite intersecondaries present.

Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 87°.
Average angle of origin on exmedial side of 2°s: 75°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 78°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.53a

Preservation: Good. Leaf is fragmentary. The venation is clear. The leaf is preserved as a true impression, but it is orange and appears to be weathered. The main veins are picked out by cream coloured mineralisation. There is a clearly preserved margin. The apex is missing. The base is incomplete. There is no petiole present. The rock surface is very uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing. It is possible that slightly more of the leaf may be revealed by removal of secondary calcareous mineralisation.

Dimensions:
Maximum length: 30.4mm min.
Maximum length along 1°: 29mm min.
Maximum width: 27.6mm min.
Maximum width of LHS of leaf only: 17mm.
Assuming leaf is roughly symmetrical, max. width is estimated to be 34mm. From curvature of margin present, this appears to be a good estimate of max. width.
Area: 456.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 32mm min.
Estimated area of LHS of leaf only: 296sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 592sq.mm min.
Estimated maximum length along 1°: 31.8mm min.
'Leaf area': 725.3sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Whole lamina appears to be asymmetrical. Apex and base are too incomplete for their symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 24.1mm from leaf base, 75.3% max. of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 0.94:1, which would make the leaf form subdivision very wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is fragmentary so extent of basal portion is estimated using sketched minimum outline. Basal margin is incomplete but shape of base is described from LHS of leaf, which is more complete than RHS. Assuming base is roughly symmetrical, basal angle is estimated to be 94° and base is described as obtuse normal.

Margin: There is one projection preserved along LHS of leaf. Measured perpendicular to the midvein, the margin is indented 8.1mm, 49.1% of the distance to the midvein. The margin is therefore described as lobed. Sinus is rounded. Since there is only one lobe it is not possible to estimate spacing.

Petiole: Absent or not preserved.

Venation type: Basal actinodromous. The development appears to be perfect but the specimen is too incomplete for this to be certain. Primary veins diverge from midvein at angles of 40° (LHS) and 52° (RHS) to the midvein.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 16mm from base. At this point, 1° vein width is 0.7mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 25mm min. Size of 1° is therefore 2.8% max. and is termed stout.
Course: Appears to be straight and branched.

2° veins:
Number: 4 pairs min.
Pairs are alternate.
Angle of divergence: Moderate acute (35-90°, average 63°).
(Average on LHS 55°, average on RHS 72°).
Basal vein angle: Narrow acute (average 39°).
Variation: Upper secondary veins more obtuse than lower.
Divergence angle more acute on LHS.
Thickness: Moderate.
Course: Appears to be uniformly curved and unbranched, but 2° veins are not completely preserved.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: Appears to be intersecondary veins present, but they are not very clear.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 97°.
Average angle of origin on exmedial side of 2°s: 73°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 104°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.55A&Ba

Part and counterpart.

Preservation: Good. Leaf is fragmentary. The venation is very clear. The leaf is preserved as a carbonaceous impression. There is a clearly preserved margin. Neither the apex nor base of the leaf are present. It is possible that slightly more of the RHS of DJ147.55Aa may be revealed by removal of sediment cover.

Dimensions: Part and counterpart show almost the same completeness, measurements given are averages for both part and counterpart.
Maximum length: 39.4mm min.
Maximum length along 1°: 27.6mm min.
Maximum width: 17.8mm min.
Maximum width of one side of leaf only: 10.7mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 21.3mm min.
Area: 312.7sq.mm min., measured for DJ147.55Ba in which apex is more complete.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 39.5mm min.
Estimated area of one side of leaf only: 288sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 575.9sq.mm min.
Estimated maximum length along 1°: 39.5mm min.
'Leaf area': 560.9sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: The part of the leaf preserved appears to be roughly symmetrical, but the specimen is too incomplete for this to be a confident description. The base is not present and the apex is incomplete, so their symmetry cannot be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 17mm from leaf base, 42.9% of the estimated leaf length. Leaf form may be ovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.85:1, which would make the leaf form subdivision ovate, but leaf is too fragmentary for form to be described confidently.

Apex: Leaf is fragmentary so extent of apical portion is estimated using sketched minimum outline. Apex is incomplete and shape is described from one side of leaf. Assuming apex is roughly symmetrical, apical angle is estimated to be 77° and apex is described as acute.

Base: Not preserved.

Margin: Margin is described from DJ147.55Aa in which it is better preserved than in counterpart DJ147.55Ba. There are projections preserved along both sides of leaf. There are only four projections preserved. Measured perpendicular to the midvein, the margin is indented 0.3-1.1mm, average 0.7mm, 10.5% of the distance to the midvein. Projections have rounded apices, so the margin is described as crenate. Sinuses are rounded. Spacing between

crenations is 4.6-10.6mm, average 7.3mm, standard deviation 2.49mm, and is described as irregular.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Pinnate semicraspedodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 19.8mm from base. At this point, 1° vein width is 0.56mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 20.4mm. Size of 1° is therefore 2.72% and is termed stout.
Course: Straight and appears to be unbranched but leaf is too fragmentary for this to be certain.

2° veins:
Number: 6 pairs min.
Pairs are alternate.
Angle of divergence: Wide acute (52-97°, average 68°). (Average one side 72°, average on other side 64°).
Basal vein angle: Not preserved.
Variation: Divergence angle appears to vary irregularly.
Divergence angle more acute one side than the other.
Thickness: Moderate.
Course: Abruptly curved and branched. It also appears that 2°s are provided with outer 2° veins.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 101°).
Intersecondary veins: Appears to be simple intersecondaries present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 83°.
Average angle of origin on exmedial side of 2°s: 84°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 75°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.56a

Preservation: Good. Specimen is a fragment from RHS of leaf. The venation is very clear. The leaf is preserved as a carbonaceous impression. There is a clearly preserved margin. The apex is missing. The RHS of the base is present. There is no petiole. The rock surface is quite uneven, making it difficult to get the entire specimen in focus and leading to distortion in the drawing.

Dimensions:
Maximum length: 32.7mm min.
Maximum length along 1°: 29.9mm min.
Maximum width: 10.6mm min.
Maximum width of RHS of leaf only: 9.8mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 19.6mm min.
Area: 188.7sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 33mm min.
Estimated area of RHS of leaf only: 197sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 394sq.mm min.
Estimated maximum length along 1°: 33.1mm min.
'Leaf area': 432.5sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Specimen is a fragment from RHS of leaf only so lamina symmetry cannot be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 19.5mm from leaf base, 58.9% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.69:1, which would make the leaf form subdivision wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Shape of base is described from RHS of leaf. Assuming base is roughly symmetrical, basal angle is estimated to be 49° and base is described as acute normal.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: Absent or not preserved.

Venation type: Pinnate camptodromous brochidodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 16.5mm from base. At this point, 1° vein width is 0.23mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 15.2mm min. Size of 1° is therefore 1.51% max. and is termed moderate.
Course: Markedly curved.

2° veins:
Number: 12 min.
Since only RHS of leaf is preserved no pairs are observed.
Angle of divergence: Wide acute (74-106°, average 86°).
Basal vein angle: Wide acute (average 74°).
Variation: Lowest pair of 2°s appears to be more acute than those above. Divergence angle symmetry cannot be assessed because only one side of the leaf is present.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an obtuse angle (average 119°). Also appear to be enclosed by 2° or 3° arches.
Intersecondary veins: Appears to be composite intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 88°.
Average angle of origin on exmedial side of 2°s: 96°.
Combination: RR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 85°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.59a

Preservation: Fairly good. Leaf is fragmentary. The venation is fairly clear. The leaf is preserved as an impression with cream coloured mineralisation. There appears to be a small percentage of the margin preserved. The apex is missing. The base is incomplete. There is no petiole present. It is possible that slightly more of the leaf may be revealed by removal of sediment cover.

Dimensions:
Maximum length: 19.8mm min.
Maximum length along 1°: 19.6mm min.
Maximum width: 15mm min.
Maximum width of RHS of leaf only: 8.3mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 16.6mm min.
Area: 157.5sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 20.4mm min.
Estimated area of LHS of leaf only: 121.5sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 243sq.mm min.
Estimated maximum length along 1°: 20.5mm min.
'Leaf area': 226.9sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf is too incomplete for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 16.9mm from leaf base, 82.4% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.23:1, which would make the leaf form subdivision wide obovate, but leaf is too fragmentary

for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is too poorly preserved to be confidently described.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate but leaf is too fragmentary for venation type to be described further.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 10.2mm from base. At this point, 1° vein width is 0.88mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 13.2mm min. Size of 1° is therefore 6.67% max. and is termed massive.
Course: Appears to be straight.

2° veins:
Number: 7 pairs min.
Pairs are alternate.
Angle of divergence: Moderate acute (30-73°, average 56°).
(Average on LHS 59°, average on RHS 54°).
Basal vein angle: Wide acute (average 66°).
Variation: Divergence angle varies irregularly. Divergence angle symmetrical.
Thickness: Moderate.
Course: Appear to be sinuous and unbranched.
Behaviour of loop-forming branches: None.
Intersecondary veins: There appears to be simple intersecondaries present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 70°.
Average angle of origin on exmedial side of 2°s: 51°.
Combination: AA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 83°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ147.60a

Preservation: Fairly good. Specimen is a fragment from the apical LHS of the leaf. The venation is fairly clear. The leaf is preserved as an impression with orange-cream coloured mineralisation. There is a clearly preserved margin. The apex is incomplete. The base is missing.

Dimensions:
Maximum length: 20.2mm min.
Maximum length along 1°: 8.6mm min.
Maximum width: 9.1mm min.
Maximum width of LHS of leaf only: 9mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 18mm min.
Area: 60.6sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 23.2mm min.
Estimated area of LHS of leaf only: 142.6sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 285.2sq.mm min.
Estimated maximum length along 1°: 23.2mm min.
'Leaf area': 278.4sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Specimen is just a fragment from apical LHS of leaf so lamina symmetry cannot be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 1.29:1, but since leaf is fragmentary this is just an estimate.

Apex: Leaf is fragmentary so extent of apical portion is estimated using sketched minimum outline. Apex is incomplete and shape is described from LHS of leaf. Assuming apex is roughly symmetrical, apical angle is estimated to be 76° and apex is described as acute.

Base: Not preserved.

Margin: Margin is entire. Although only a small percentage of the leaf margin is preserved, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate camptodromous brochidodromous, but leaf is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete and at approximate midpoint 1° vein is not preserved. Measurements are therefore made closer to apex. At this point, 1° vein width is 0.28mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 14.4mm. Size of 1° is therefore 1.94% and is termed moderate, but leaf is too fragmentary for this to be a confident definition.
Course: Appears to be straight and unbranched but leaf is too fragmentary for this to be certain.

2° veins:
At least 3 pairs.
Angle of divergence: Wide acute (64-85°, average 67°).
Basal vein angle: Not preserved.
Variation: Upper secondaries appear to be more obtuse than lower, but leaf is too fragmentary for divergence angle along the length of the lamina to be described. Only one side of the leaf is preserved, so divergence angle symmetry cannot be assessed.
Thickness: Moderate.
Course: Abruptly curved and branched.
Behaviour of loop-forming branches: Join superadjacent 2° at an approximate right-angle (average 91°) and enclosed by 3° arches.
Intersecondary veins: None.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 105°.
Average angle of origin on exmedial side of 2°s: 73°.
Combination: AO.
There are no 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein.

DJ147.60b

Preservation: Fairly good. Leaf is fragmentary. The venation is fairly clear. The leaf is preserved as an impression with some cream coloured mineralisation along the main veins. There is a small percentage of the margin preserved. Neither the apex nor base of the leaf are present.

Dimensions:
Maximum length: 15.4mm min.
Maximum length along 1°: 14mm min.
Maximum width: 13.3mm min.
Maximum width of RHS of leaf only: 10.1mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 20.2mm min.
Area: 150.4sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 21.8mm min.
Estimated area of RHS of leaf only: 172.4sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 344.8sq.mm min.
Estimated maximum length along 1°: 21.8mm min.
'Leaf area': 293.6sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf is too incomplete for lamina symmetry to be assessed.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 1.08:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin is entire. Although only a small percentage of the

leaf margin is preserved, this appears to be a good description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate camptodromous brochidodromous, but leaf is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 10.9mm from base. At this point, 1° vein width is 0.62mm and, assuming lamina is roughly symmetrical, leaf width is estimated to be 19.8mm min. Size of 1° is therefore 3.13% and is termed stout.
Course: Straight and appears to be unbranched but leaf is too fragmentary for this to be certain.

2° veins:
At least 3 pairs, subopposite to alternate.
Angle of divergence: Moderate acute (39-71°, average 49°).
(Average on LHS 57°, average on RHS 41°).
Basal vein angle: Not preserved.
Variation: Divergence angle varies irregularly. Divergence angle more acute on RHS of leaf. .
Thickness: Moderate.
Course: Uniformly curved and unbranched.
Behaviour of loop-forming branches: None preserved.
Intersecondary veins: Appears to be intersecondary veins present.
Intramarginal vein: None preserved.

3 veins:
Average angle of origin on admedial side of 2°s: 93°.
Average angle of origin on exmedial side of 2°s: 67°.
Combination: AR.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 72°.
It may be significant that this is similar to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ451.7a

Preservation: Fairly good. Leaf is fragmentary. The venation is clear. The leaf is preserved as an impression with cream-white coloured mineralisation. There is a small percentage of the margin preserved. Neither the apex nor base of the leaf are present.

Dimensions:
Maximum length: 50.8mm min.
Maximum length along 1°: 45.7mm min.
Maximum width: 33.7mm min.
Maximum width of RHS of leaf only: 17mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 34mm min.
Area: 999.8sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 67mm min.
Estimated area of RHS of leaf only: 856.4sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 1712.8sq.mm min.
Estimated maximum length along 1°: 67.1mm min.
'Leaf area': 1520.9sq.mm min.

Organisation: The specimen is too fragmentary for the leaf organisation to be described.

Symmetry: Leaf is too incomplete for lamina symmetry to be assessed.

Form: Specimen is really too fragmentary for lamina form to be estimated. Max. width is estimated to be 40.8mm from leaf base, 60.7% of the estimated leaf length. Leaf form may be obovate, but since leaf is fragmentary, this is not certain. Using estimated length and width, length/width ratio is 1.97:1, which would make the leaf form subdivision wide obovate, but leaf is too fragmentary for form to be described confidently.

Apex: Not preserved.

Base: Not preserved.

Margin: Margin appears to be entire, but it is too incomplete for this to be a confident description.

Petiole: Base of leaf is not preserved so it cannot be determined whether a petiole is present or not.

Venation type: Appears to be pinnate camptodromous eucamptodromous.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 33.5mm from base. At this point, 1° vein width is 0.6mm and leaf width is 33.1mm min. Size of 1° is therefore 1.81% and is termed moderate.
Course: Appears to be straight and unbranched.

2° veins:
Number: 10 pairs min.
Pairs are subopposite to alternate.
Angle of divergence: Narrow acute (26-49°, average 35°).
(Average on LHS 37°, average on RHS 32°).
Basal vein angle: Not preserved.
Variation: Upper 2°s more obtuse than lower 2°s. Divergence angle symmetrical.
Thickness: Moderate.
Course: Uniformly curved and branched.
Behaviour of loop-forming branches: None present.
Intersecondary veins: Appears to be simple intersecondaries present.
Intramarginal vein: None.

3 veins:
Average angle of origin on admedial side of 2°s: 76°.
Average angle of origin on exmedial side of 2°s: 94°.
Combination: RA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 100°.
It may be significant that this is unequal to the average angle of 3° vein origin on the exmedial side of the 2° veins.

DJ452.2a

Preservation: Good. Specimen is a fragment from base of leaf. The venation is clear. The leaf is preserved as an impression with the venation picked out by cream-white coloured mineralisation. There is also some brown material along the leaf axis. There is a clearly preserved raised margin. The apex is missing. The base is present and is petiolate. It is possible that slightly more of the base of the leaf may be revealed by removal of sediment cover.

Dimensions: It is not possible to clearly distinguish the petiole from the lamina, so measurements include petiole.
Maximum length: 21mm min.
Maximum length along 1°: 18.2mm min.
Maximum width: 9.5mm min.
Maximum width of RHS of leaf only: 4.9mm min.
Assuming leaf is roughly symmetrical, max. width is estimated to be 9.8mm min.
Area: 89.9sq.mm min.
From curvature of margins present, a minimum outline for the leaf was estimated.
Estimated maximum length: 21.4mm min.
Estimated area of LHS of leaf only: 51.9sq.mm min.
Assuming leaf is roughly symmetrical, estimated area: 103.8sq.mm min.
Estimated maximum length along 1°: 21.4mm min.
'Leaf area': 139.8sq.mm min.

Organisation: Appears simple but it is not possible to be certain about this.

Symmetry: Base of leaf appears to be symmetrical. Apex is missing and whole lamina is too incomplete for its symmetry to be confidently described.

Form: Specimen is too fragmentary for form to be described. Using estimated max. length and width, length/width ratio is 2.18:1, but since leaf is fragmentary this is just an estimate.

Apex: Not preserved.

Base: Leaf is incomplete so extent of basal portion is estimated using sketched minimum outline. Basal angle is estimated to be 20° and base is described as acute decurrent.

Margin: Margin is entire. Although leaf margin is incomplete, this appears to be a good description.

Petiole: There appears to be a petiole present but it cannot be clearly distinguished from the lamina. It is approximately 2.4mm

wide and 8.7mm in length. It appears that it may be winged but this is not clear.

Venation type: Appears to be pinnate camptodromous eucamptodromous, but leaf is too fragmentary for this to be certain.

1° vein:
Size: Leaf is incomplete but midpoint is estimated to be approximately 10.7mm from base. At this point, 1° vein width is 0.94mm and leaf width is 4.1mm. Size of 1° is therefore 22.93% and is termed massive.
Course: Appears to be straight and unbranched.

2° veins:
Number: 3 pairs min.
Pairs are alternate.
Angle of divergence: Narrow acute (6-16°, average 11°). (Average on LHS 9°, average on RHS 12°).
Basal vein angle: Narrow acute (average 8°).
Variation: Divergence angle nearly uniform. Divergence angle symmetrical.
Thickness: Moderate.
Course: Appear to be recurved and branched.
Behaviour of loop-forming branches: None.
Intersecondary veins: None present.
Intramarginal vein: None present.

3 veins:
Average angle of origin on admedial side of 2°s: 70°.
Average angle of origin on exmedial side of 2°s: 111°.
Combination: OA.
In those 3° veins which originate on the admedial side of 2° veins and curve to join the 1° forming the midvein, average angle of 3° vein origin on midvein is 141°.
It may be significant that this differs from the average angle of 3° vein origin on the exmedial side of the 2° veins.

D8604.37A/Ca
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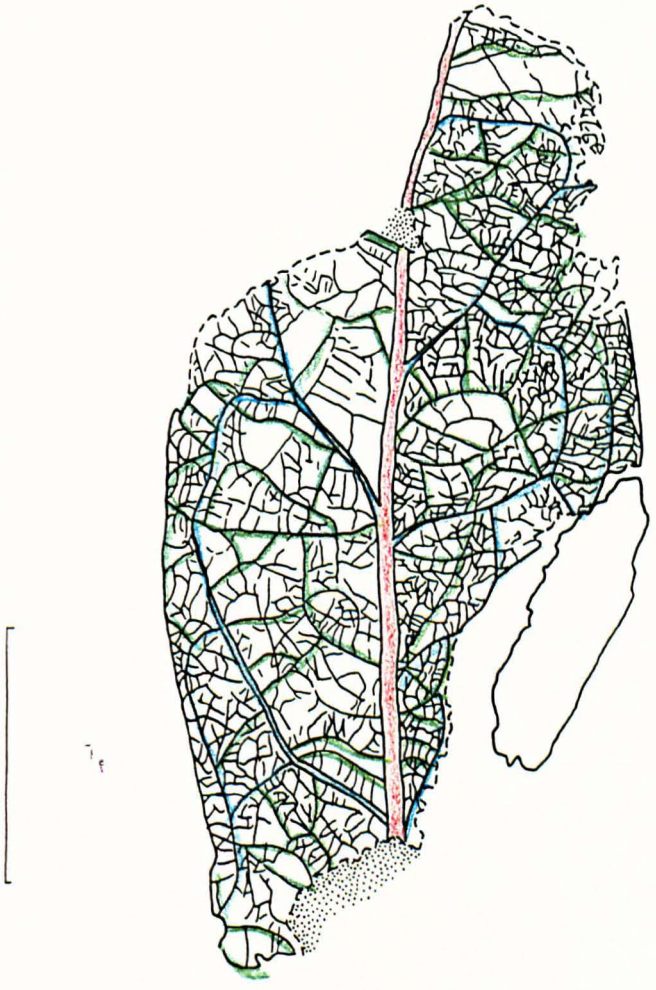

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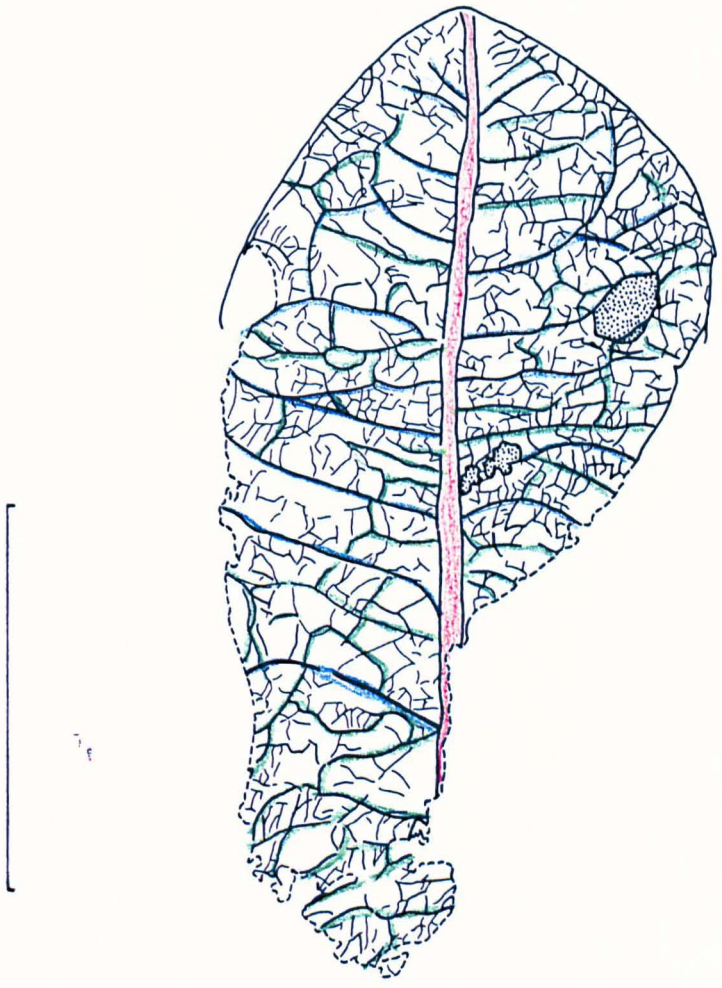

D8604.38Aa
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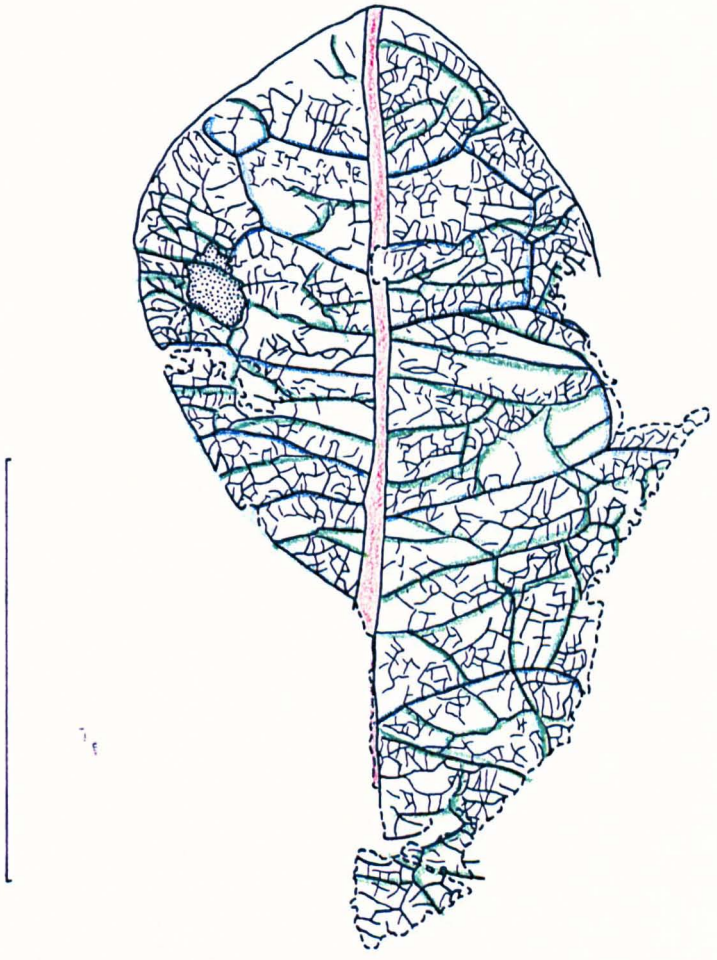

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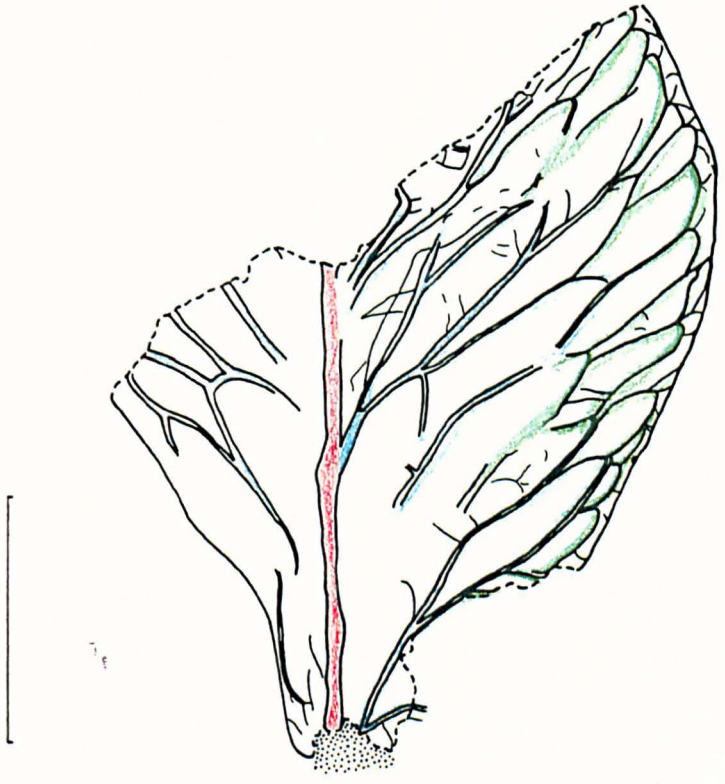

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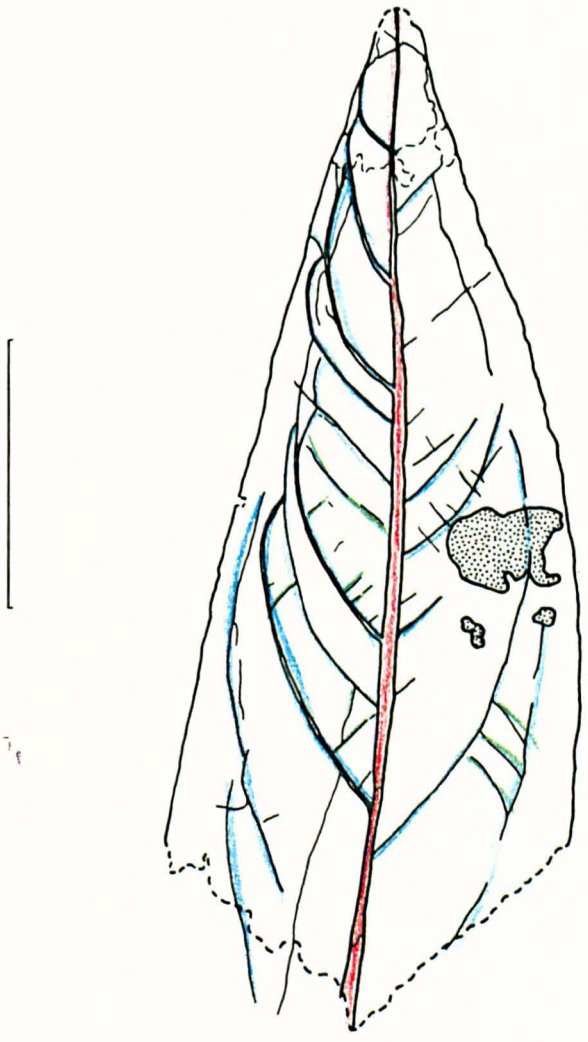

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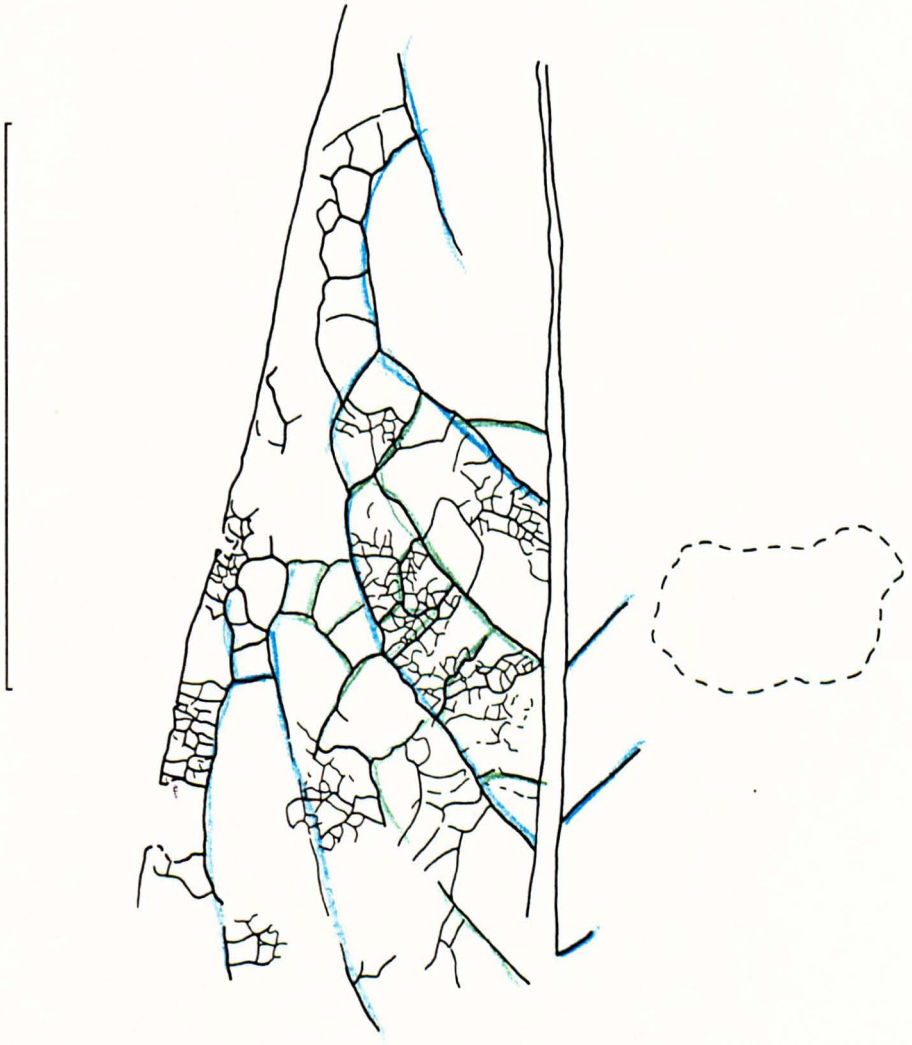
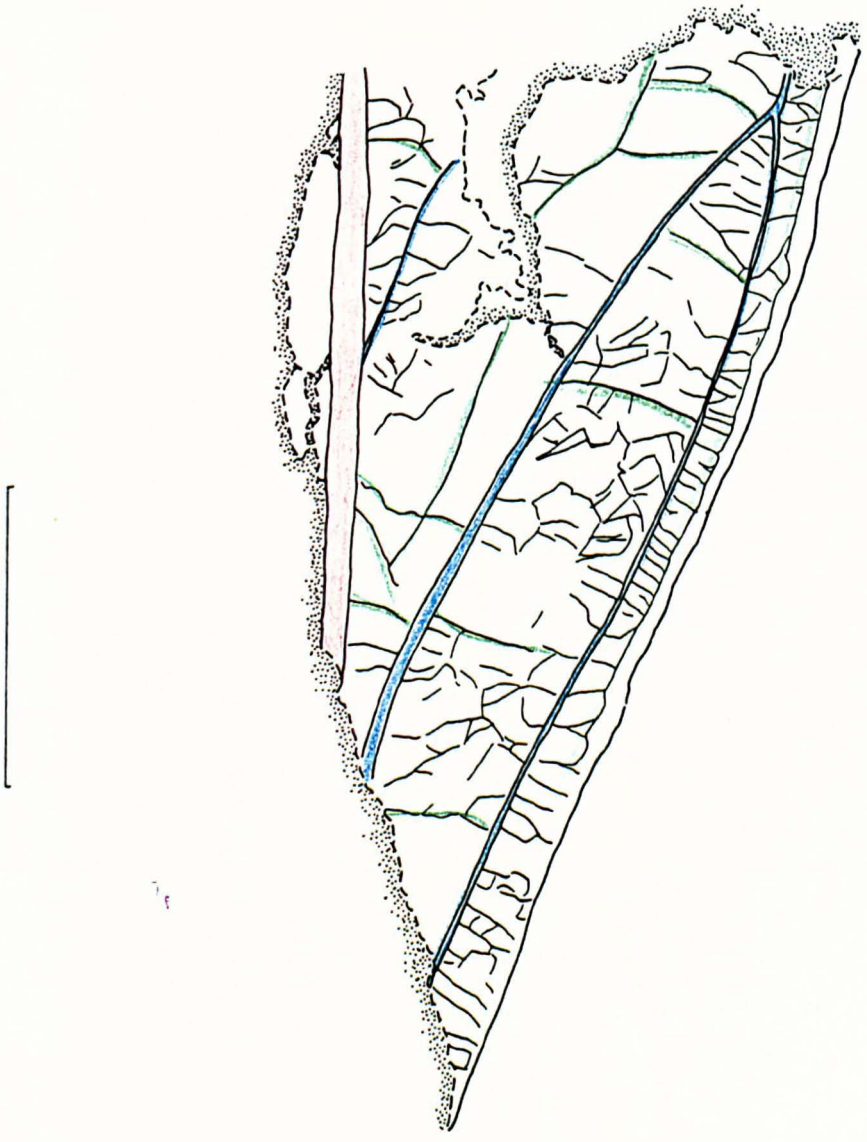


D8604.54a
Scale bar 10mm

D8605.1Aa
Scale bar 10mm



D8605.1Aa
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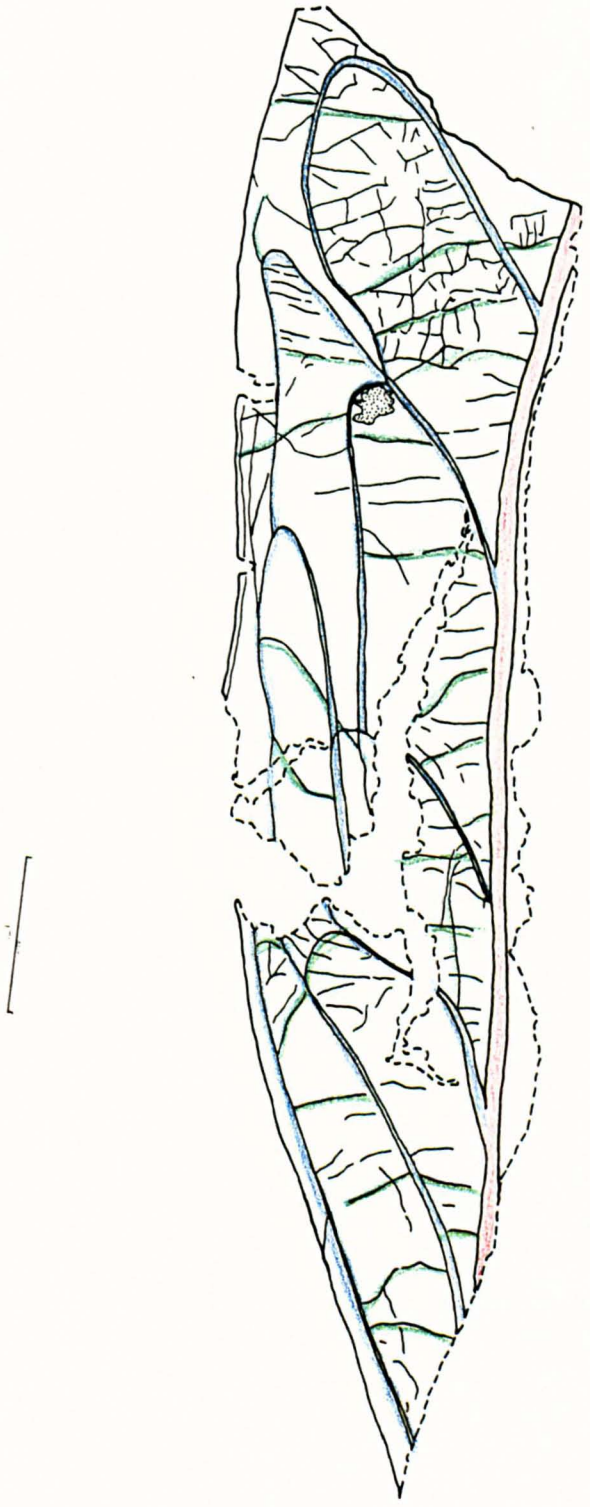

D8605.1Ba
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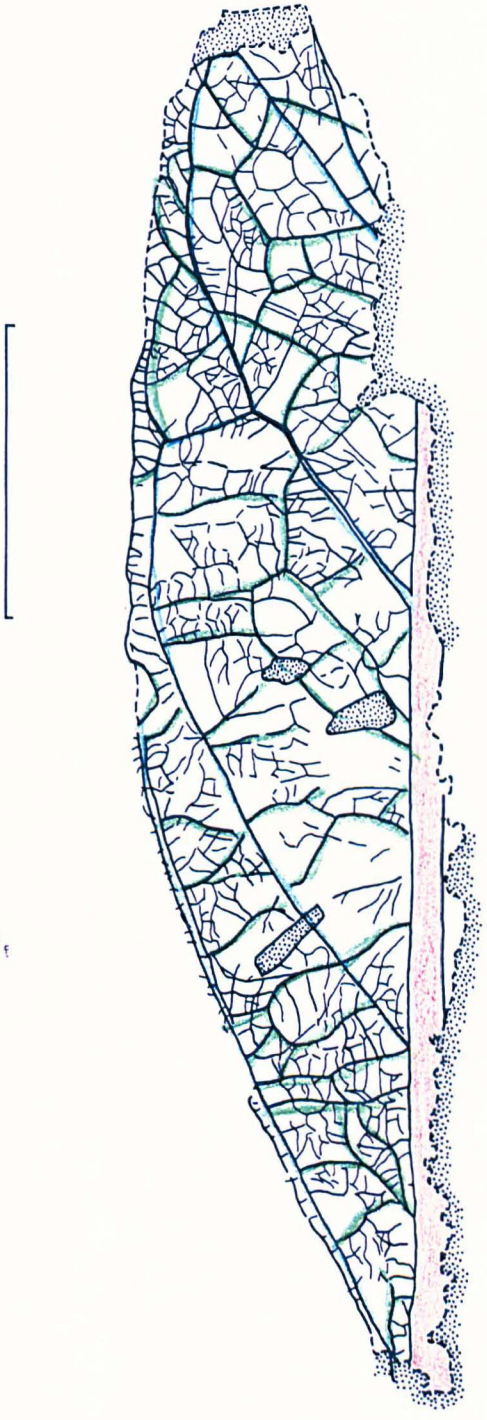
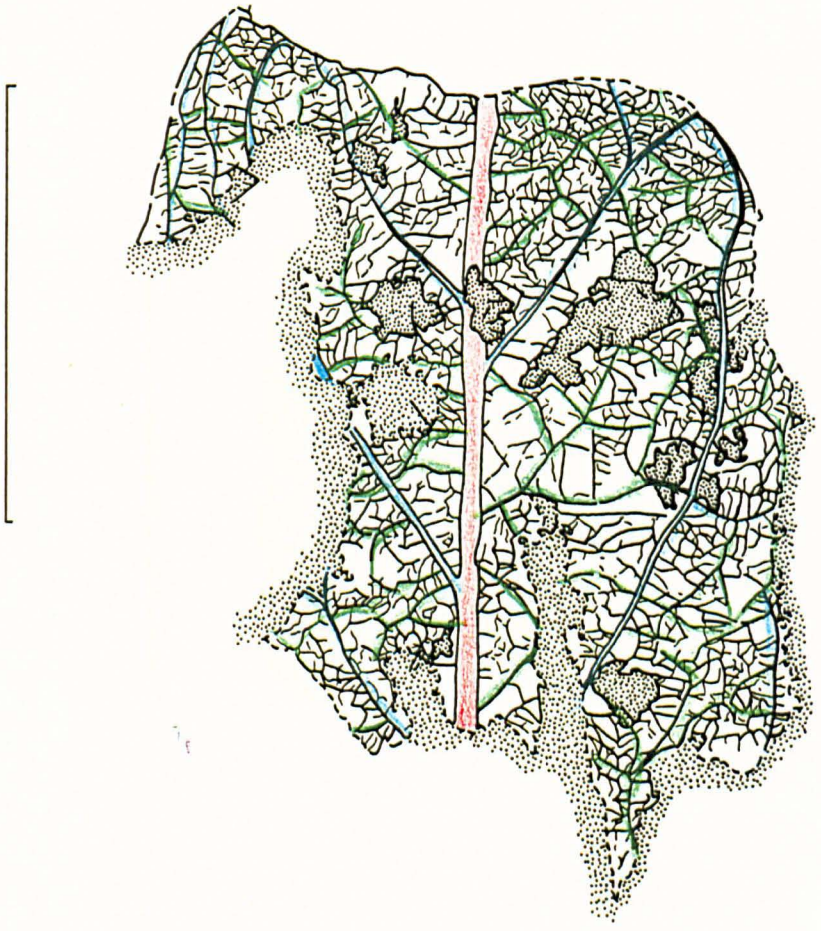
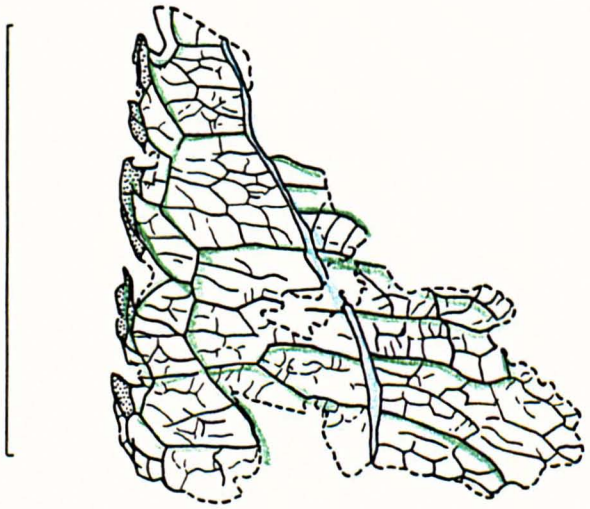


D8605.2a.
Scale bar 10mm

D8605.5a
Scale bar 10mm

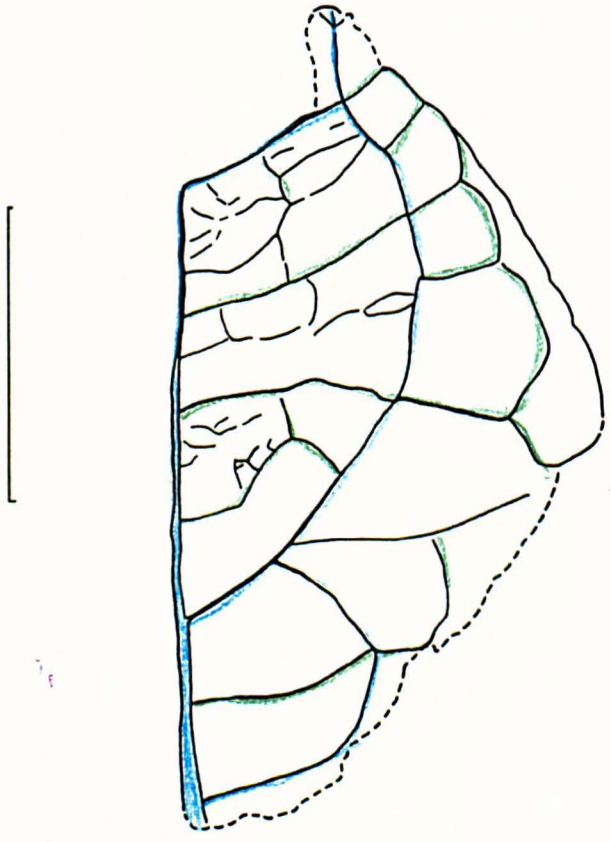


D8605.15a
Scale bar 10mm

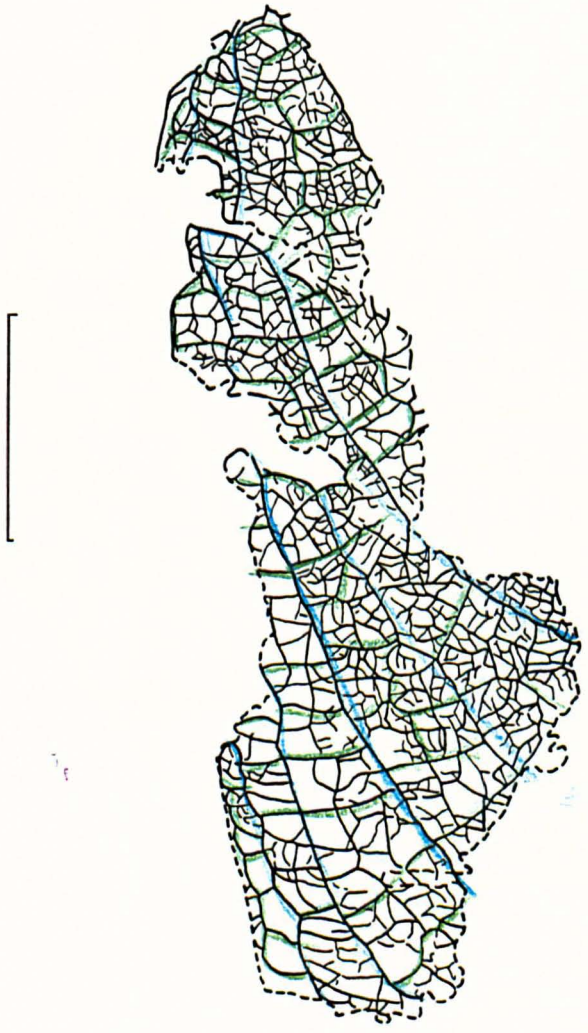


D8605.7a
Scale bar 10mm

D8605.8Aa
Scale bar 10mm



D8605.8Ba
Scale bar 10mm



D8605.14a
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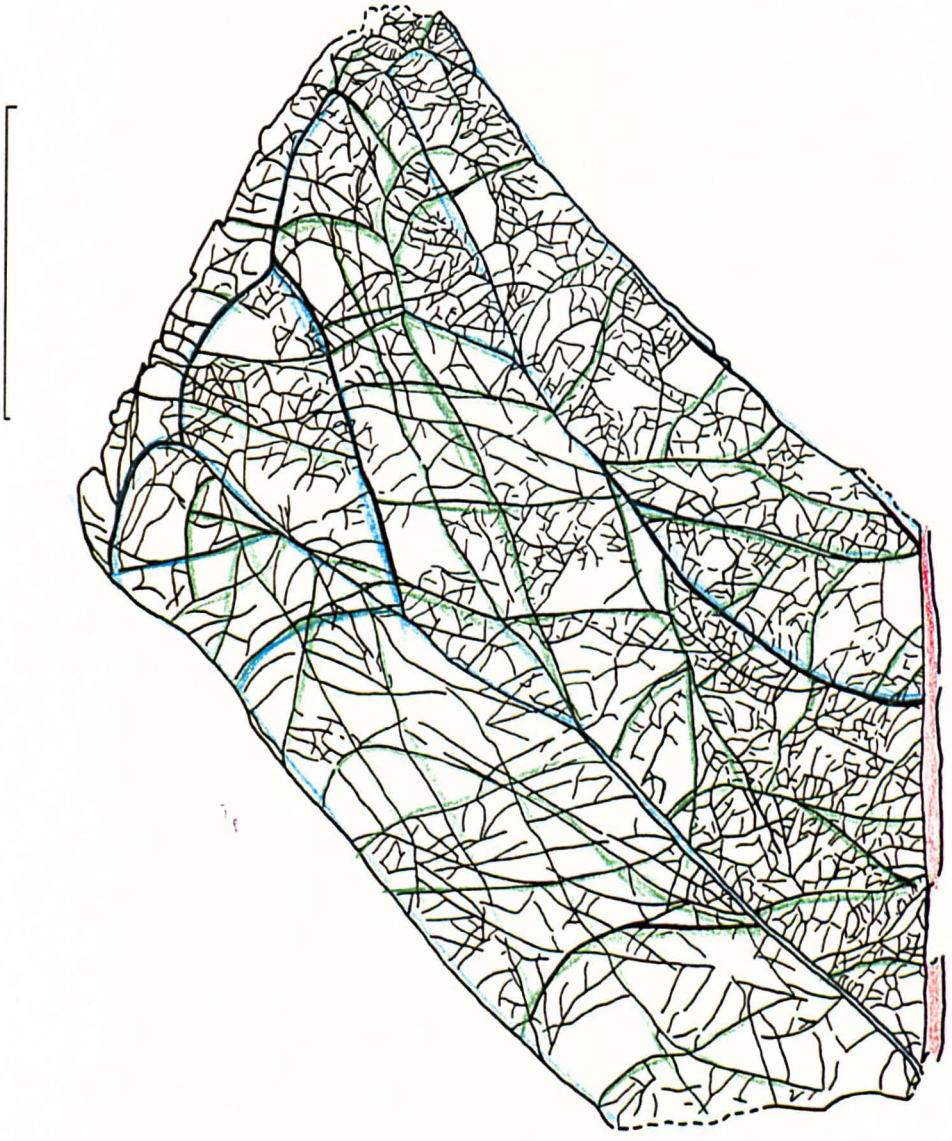

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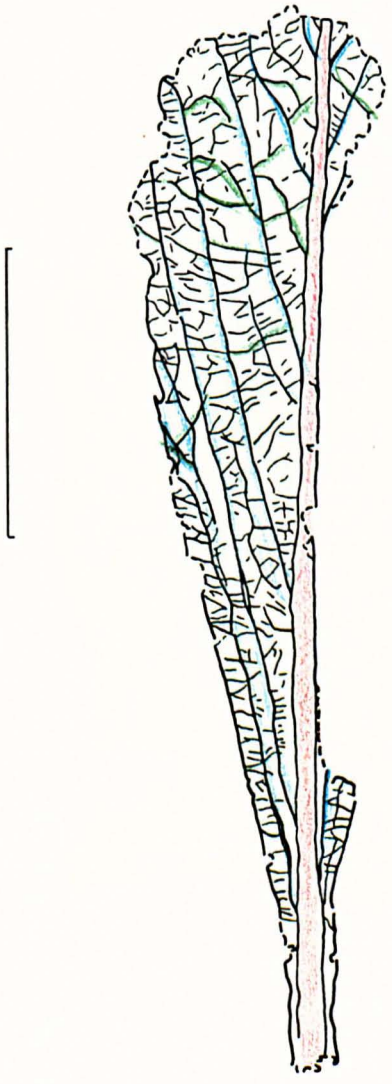

D8605.19Aa
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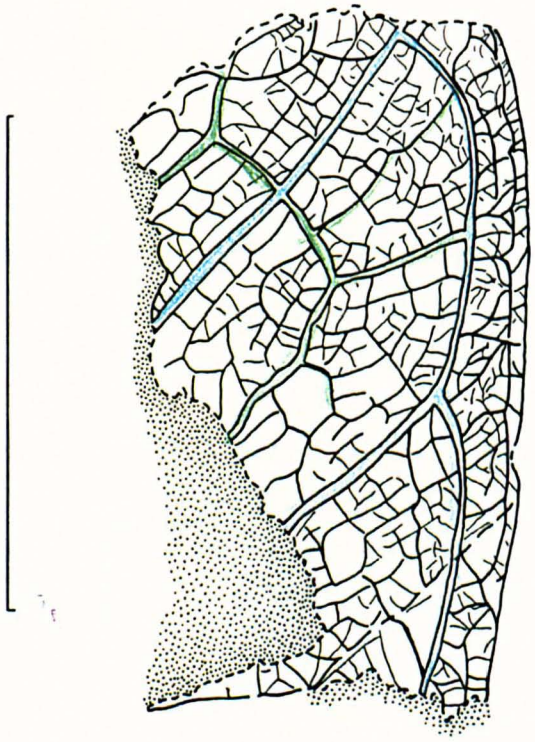

D8605.20a
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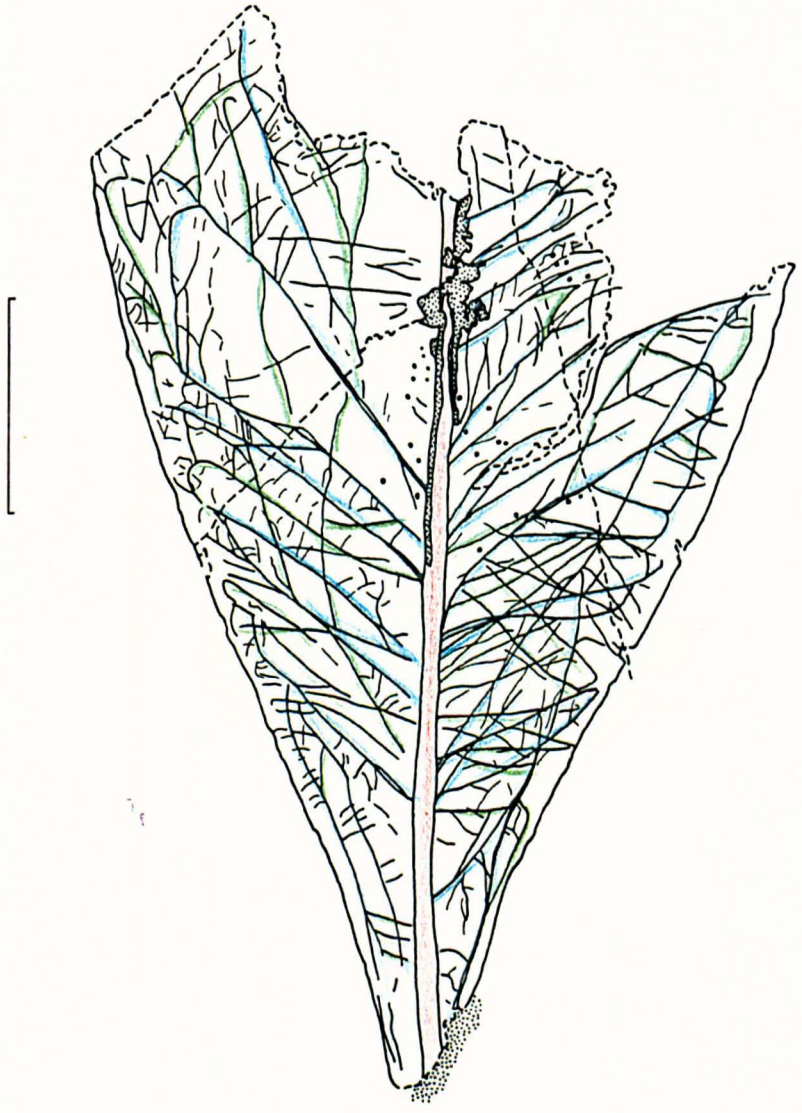
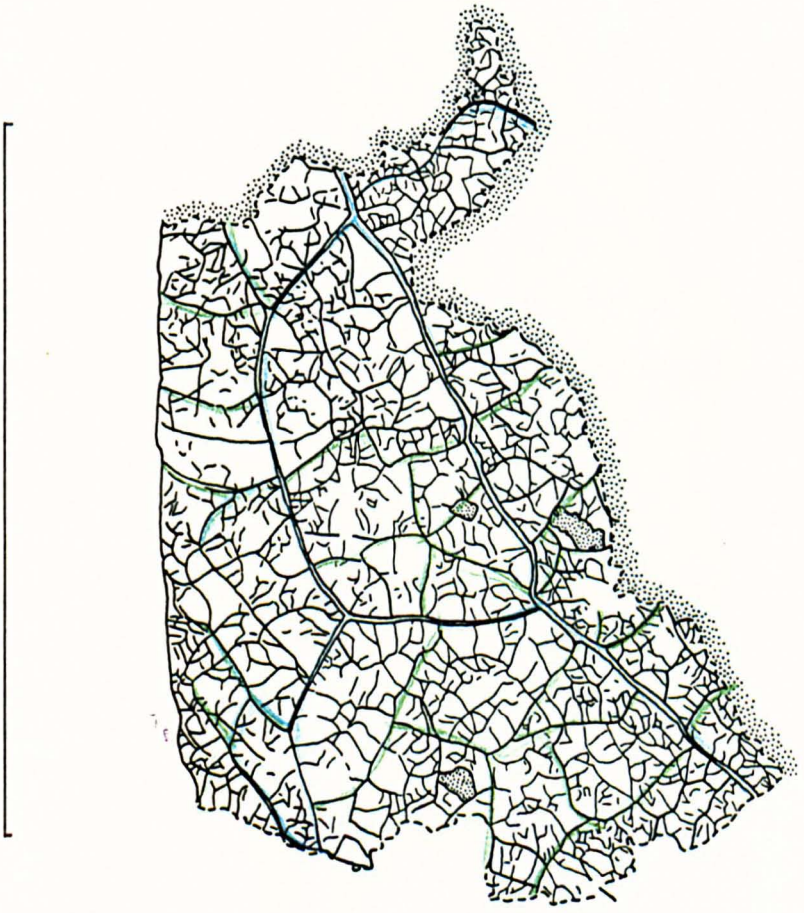
D8605.21Aa
Scale bar 10mm



D8605.21Ba
Scale bar 10mm

D8605.22Ba
Scale bar 10mm



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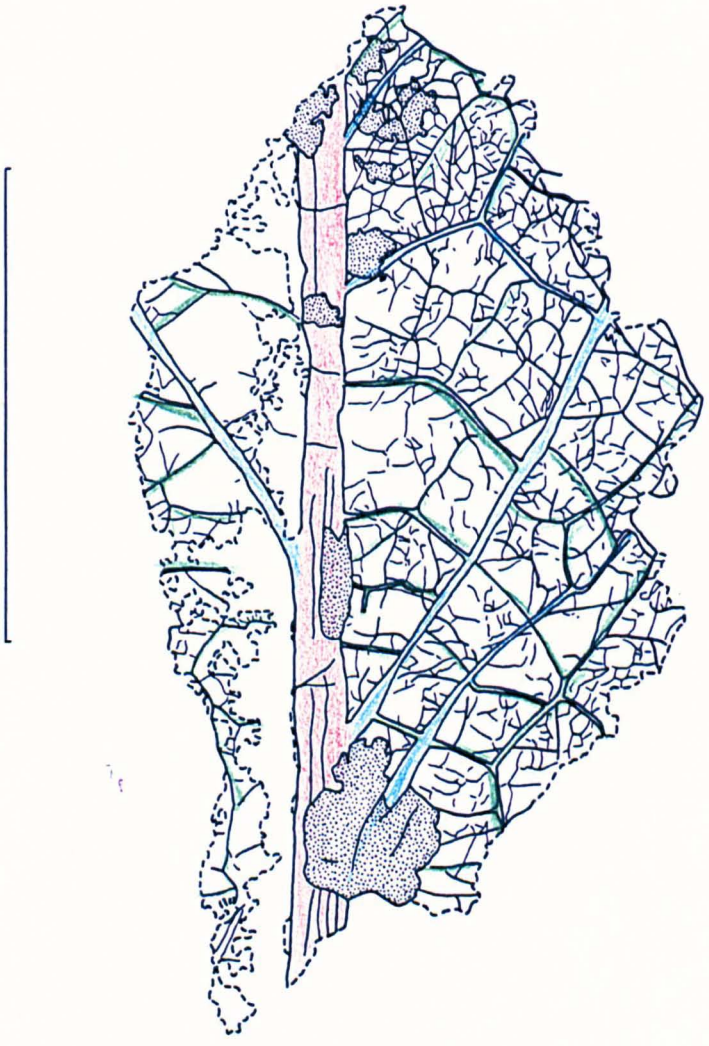

D8605.26a
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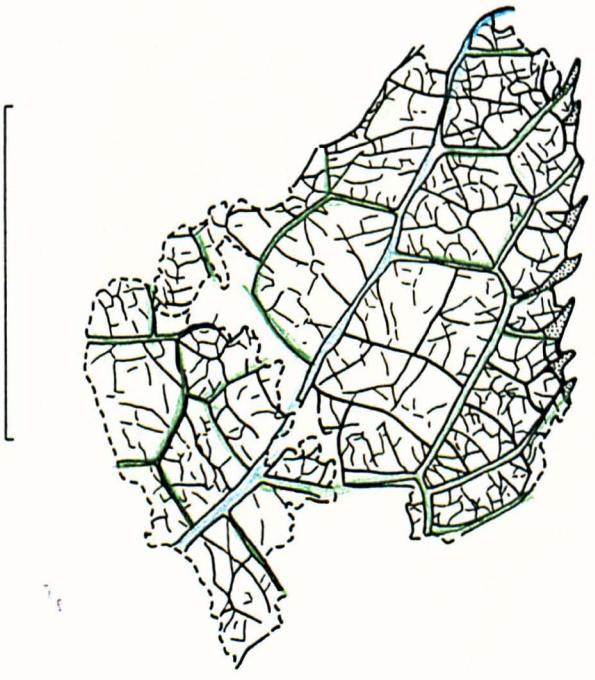
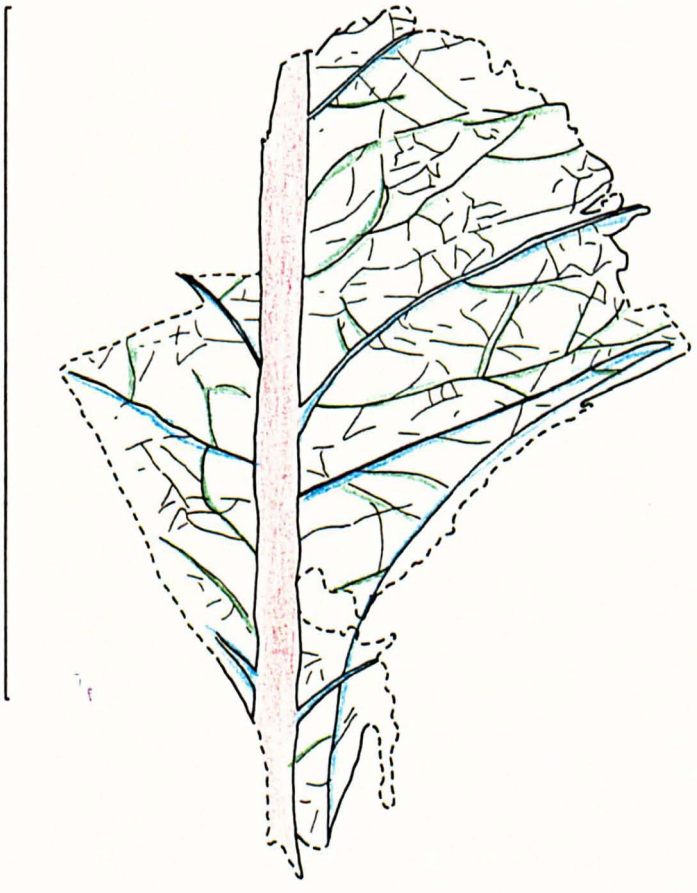


D8605.27Aa
Scale bar 10mm

D8605.27Ba
Scale bar 10mm



D8605.28a
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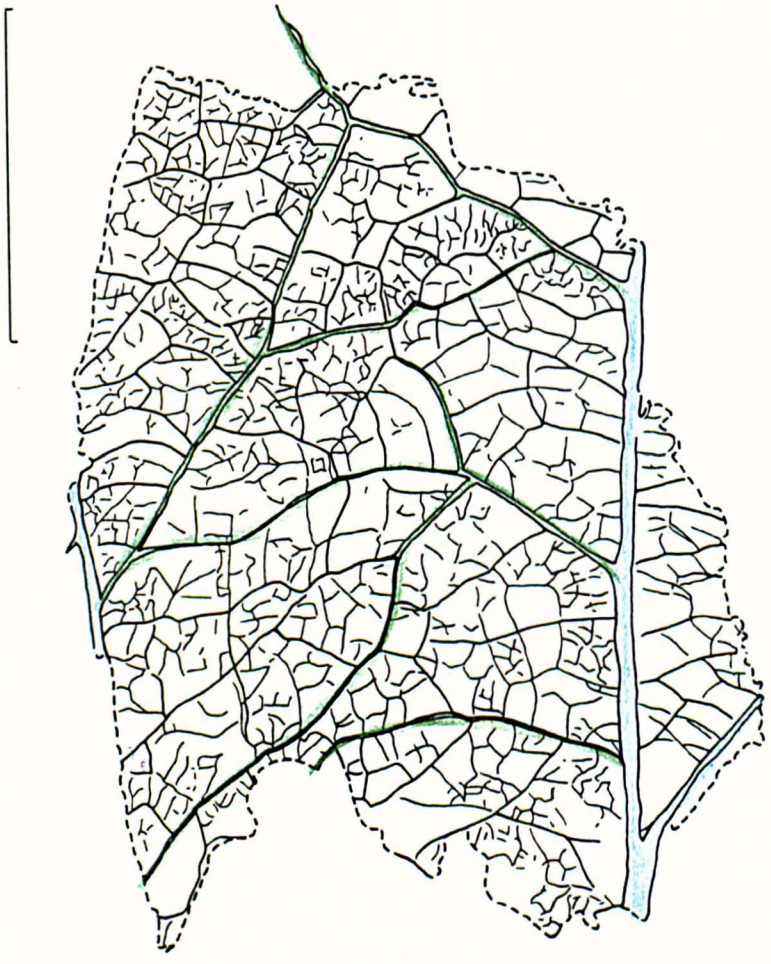

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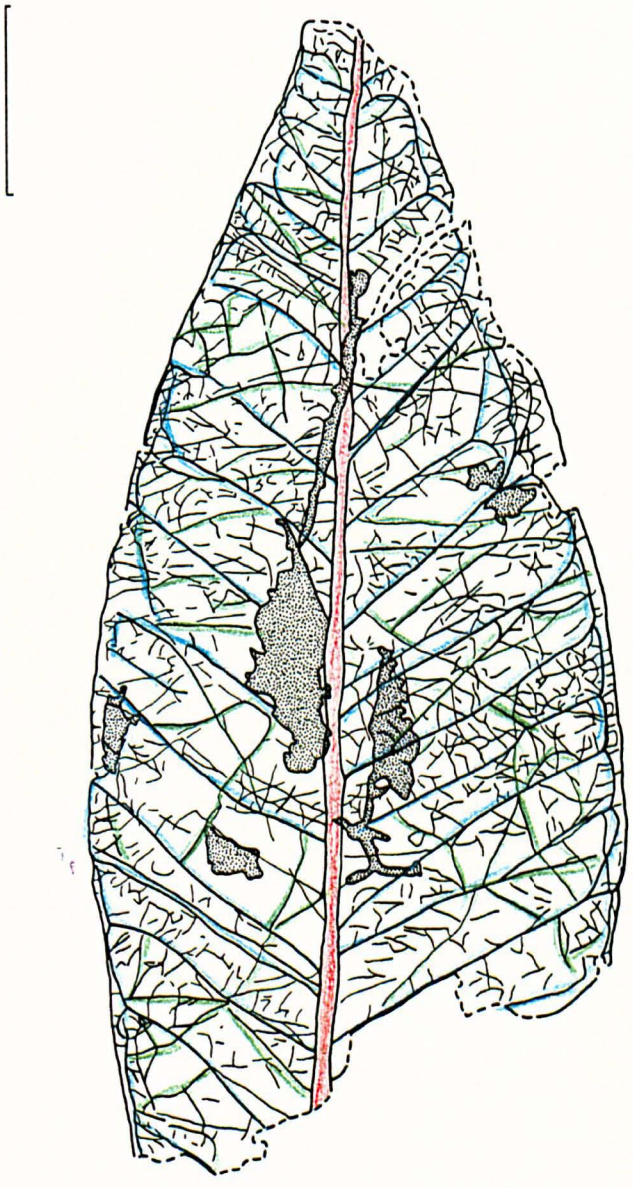

D8605.30a
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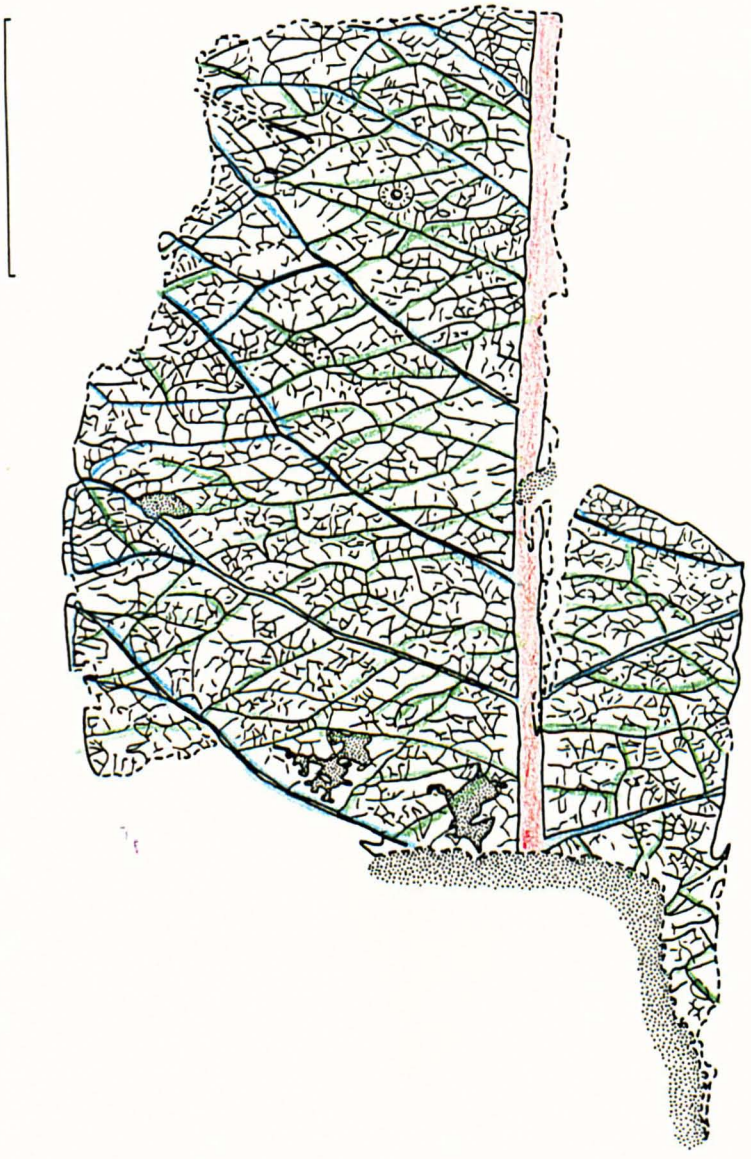

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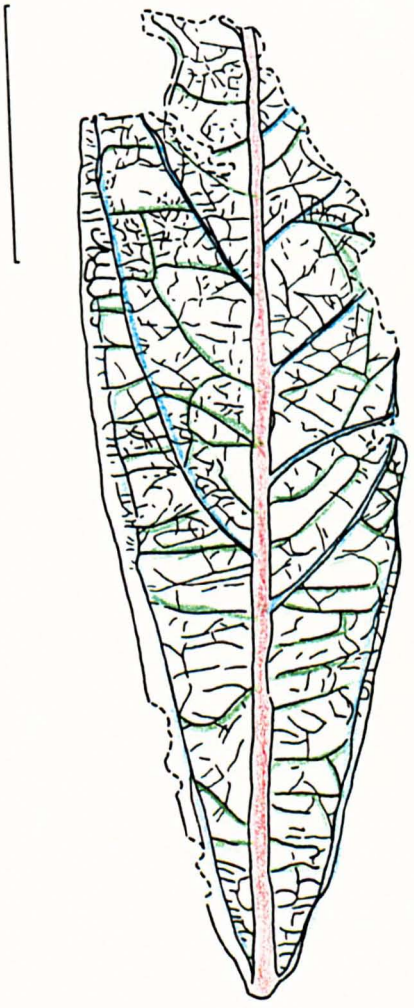

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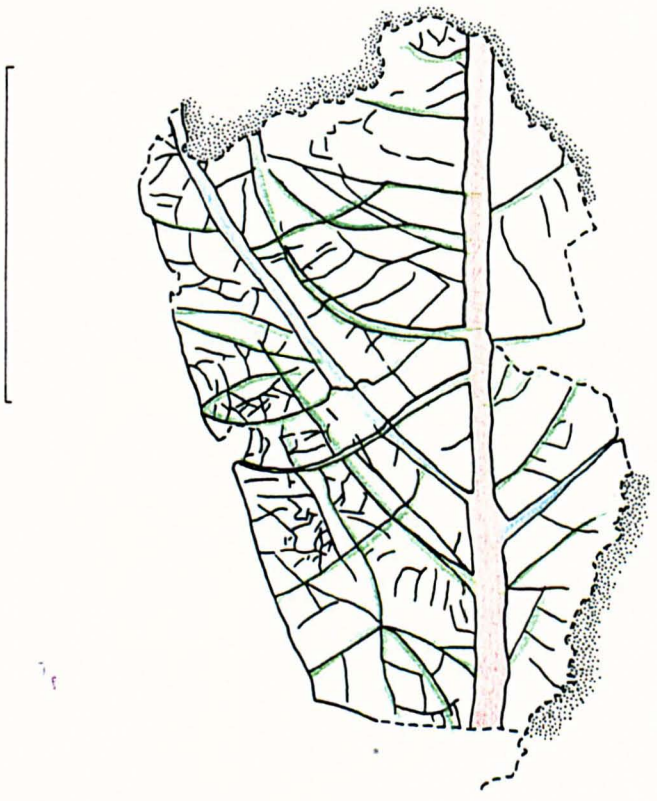
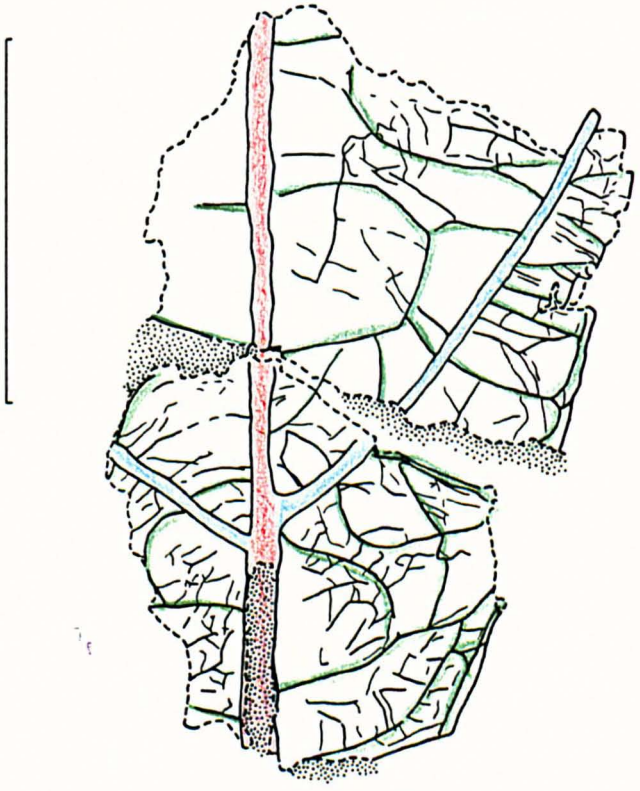
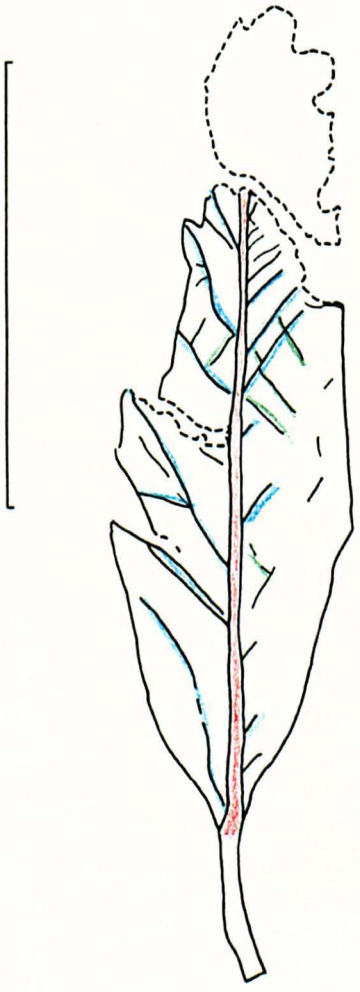


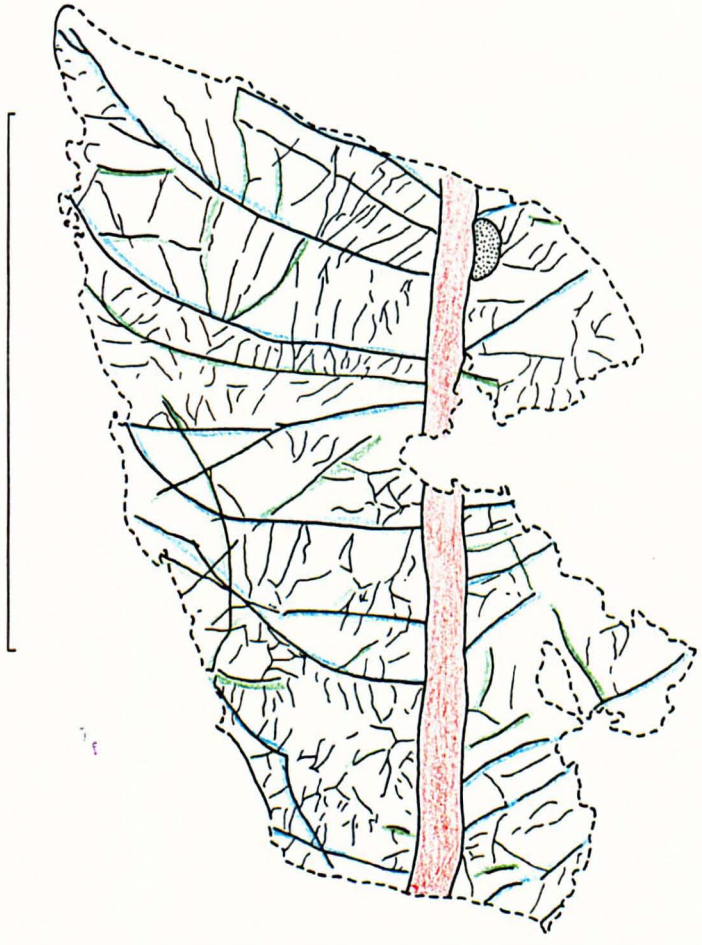
D8606.4Aa
Scale bar 10mm



D8606.4Ba
Scale bar 10mm



D8606.5a
Scale bar 10mm



D8606.6a
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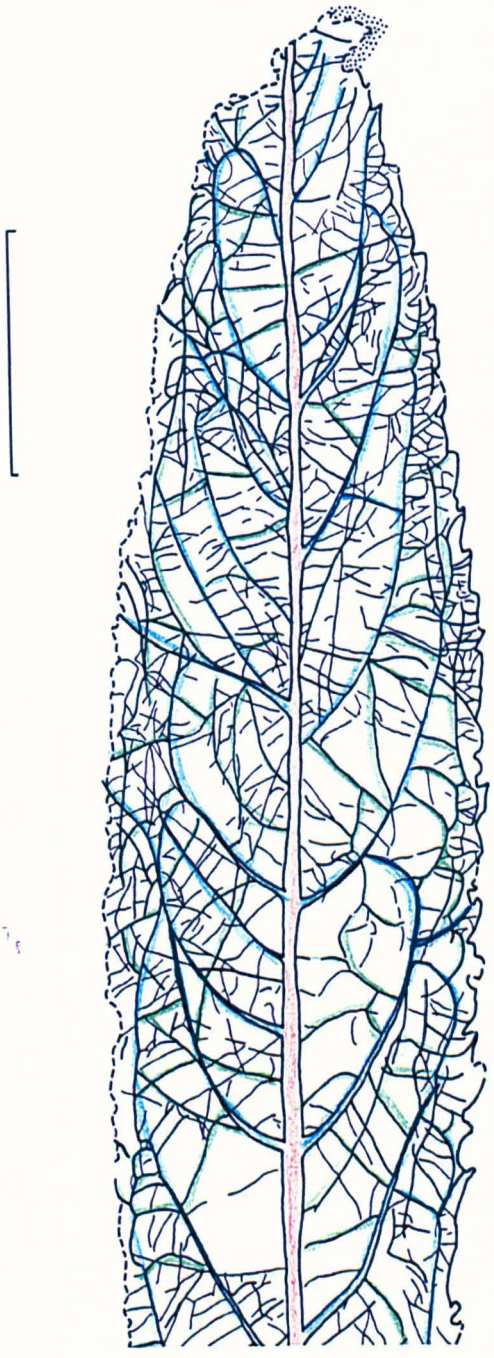

D8606.7Aa
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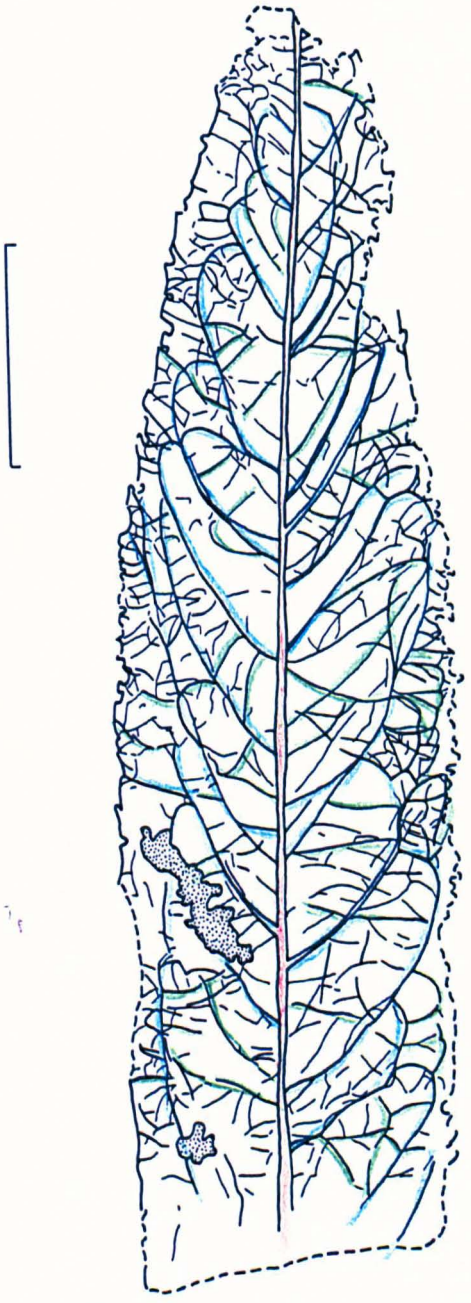

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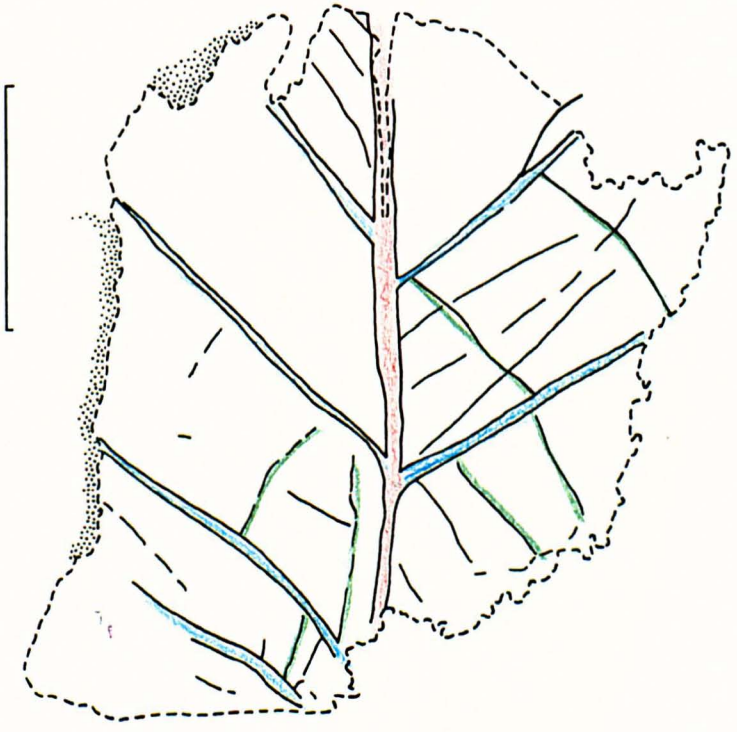
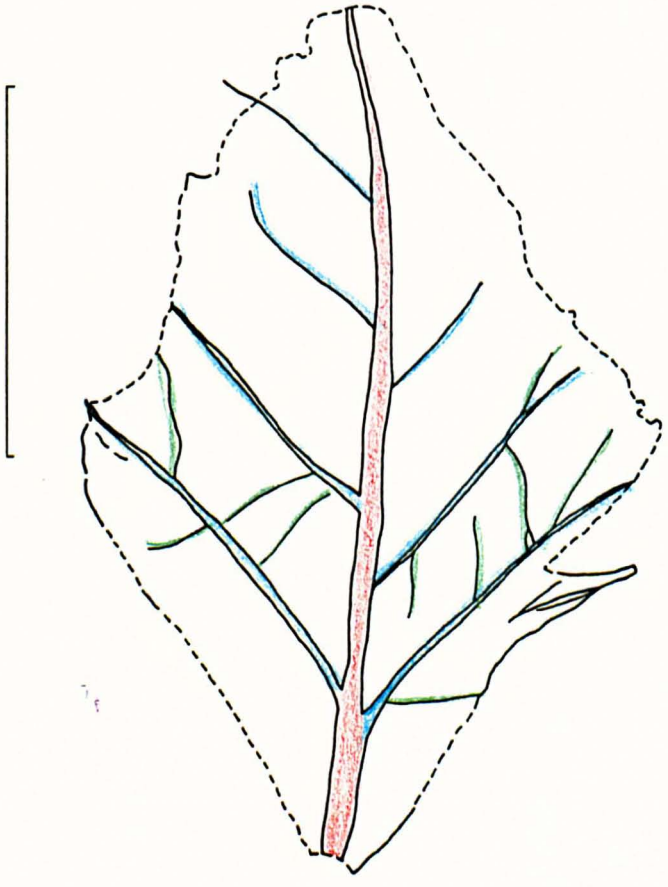


D8606.8a
Scale bar 10mm

D8609.147a
Scale bar 10mm

D8610.1Aa
Scale bar 10mm

D8610.1Ba
Scale bar 10mm



D8616.74a
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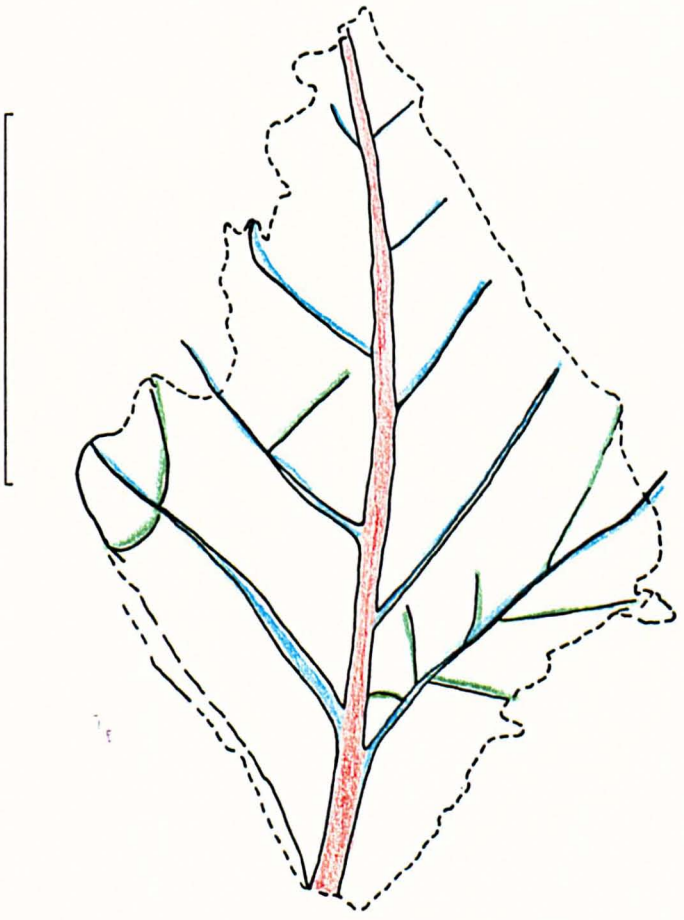

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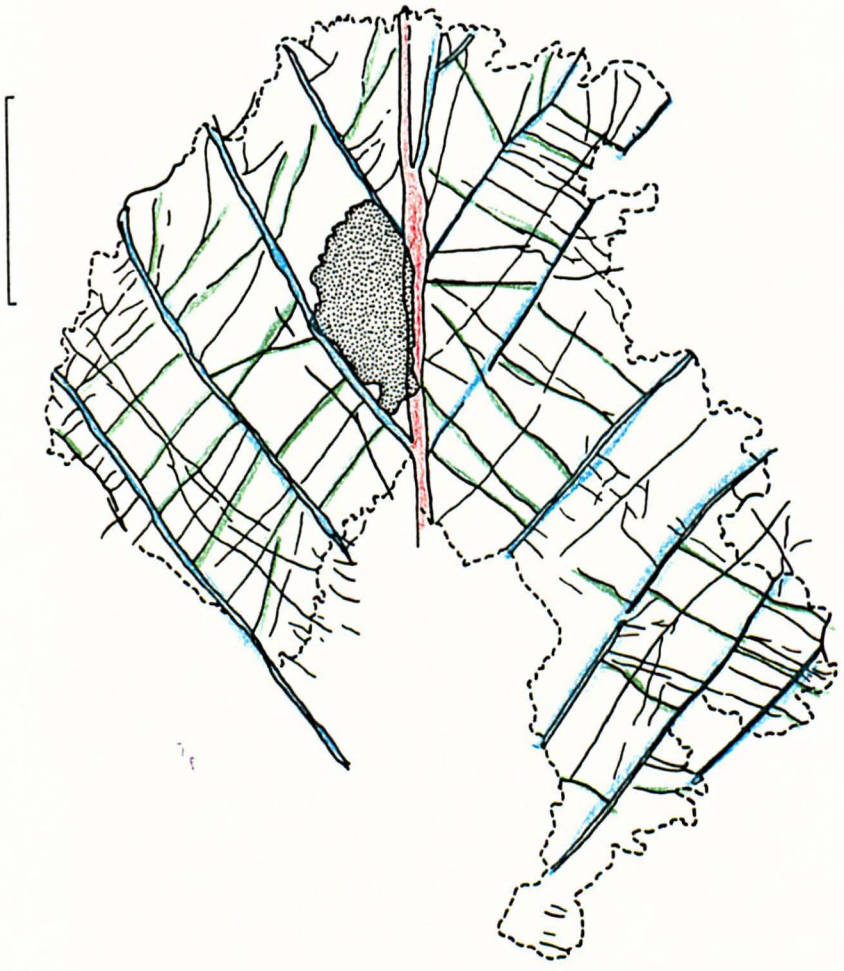

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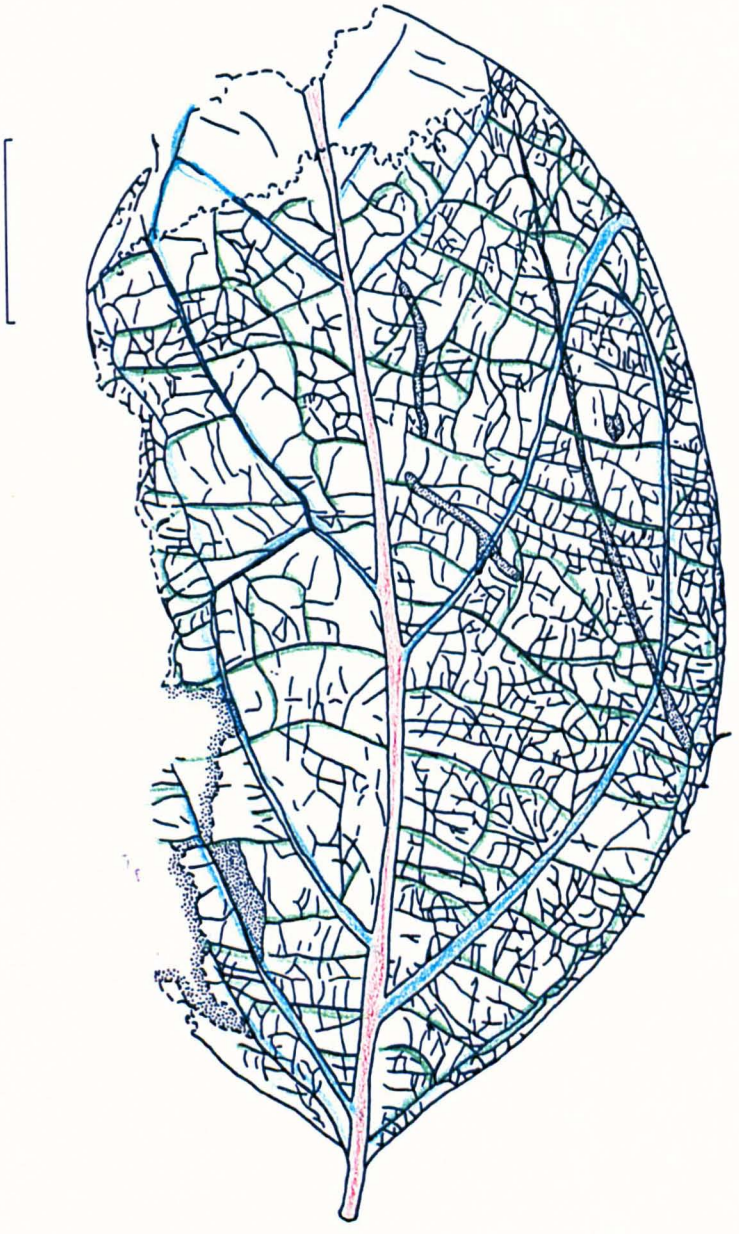
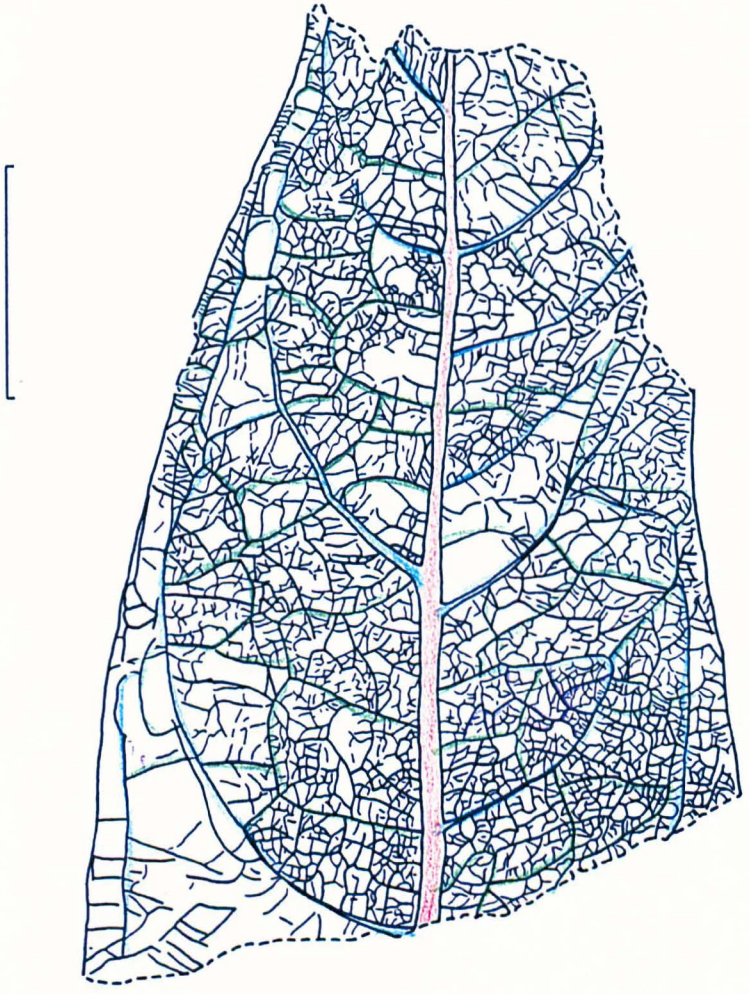


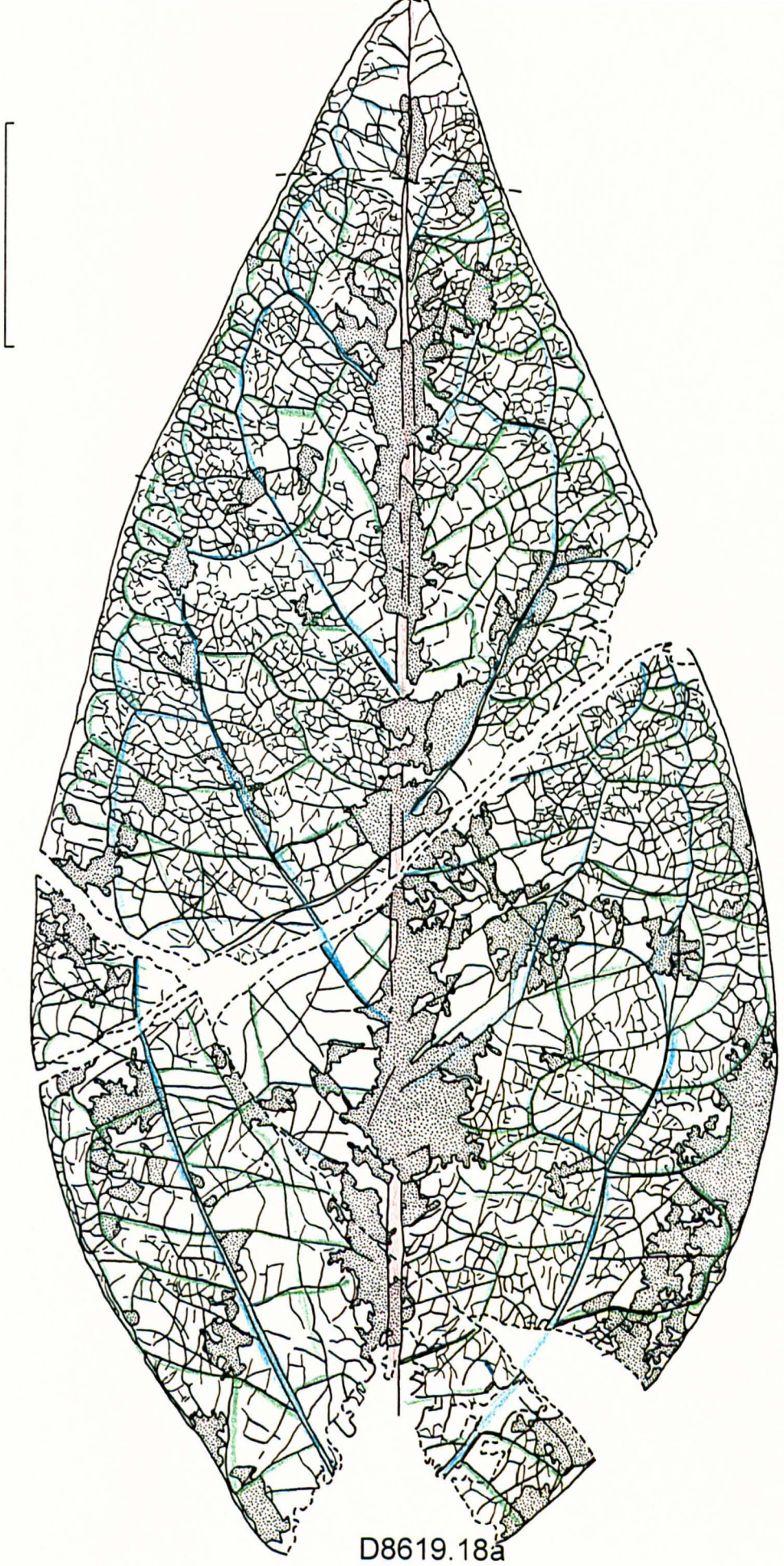
D8618.106a
Scale bar 10mm

D8619.6a
Scale bar 10mm



D8619.7a
Scale bar 10mm

D8619.12a
Scale bar 10mm



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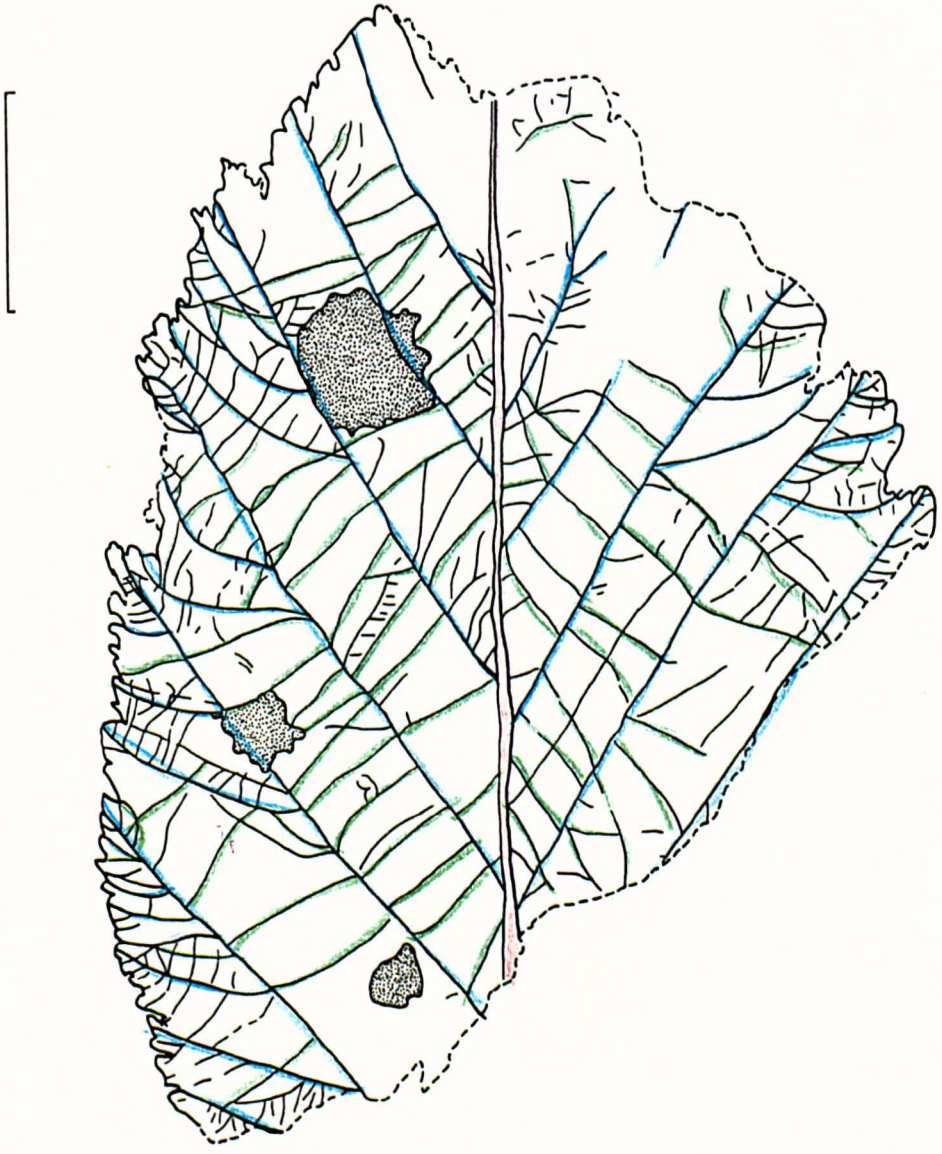

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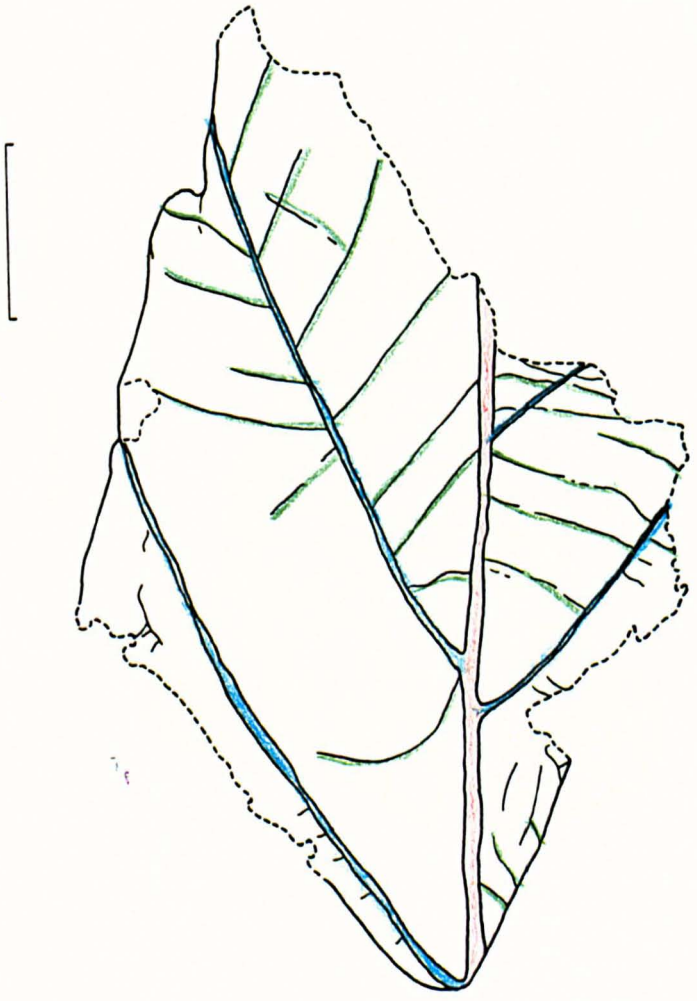

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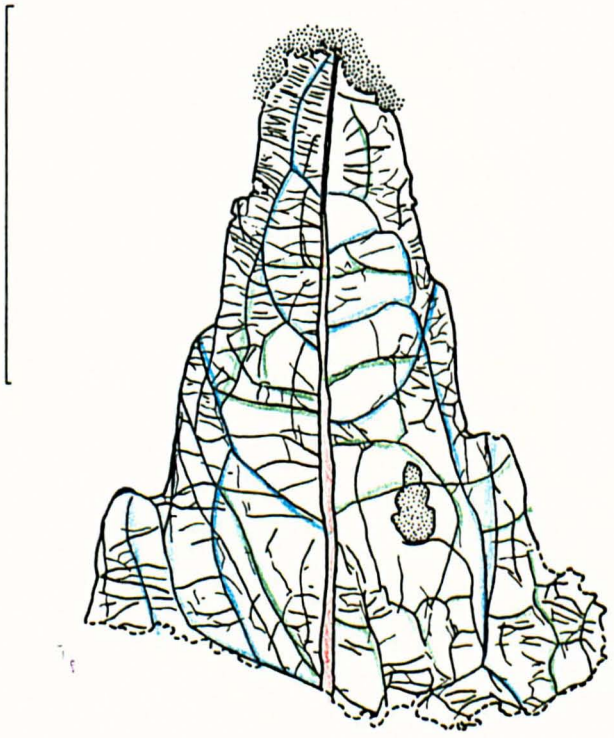
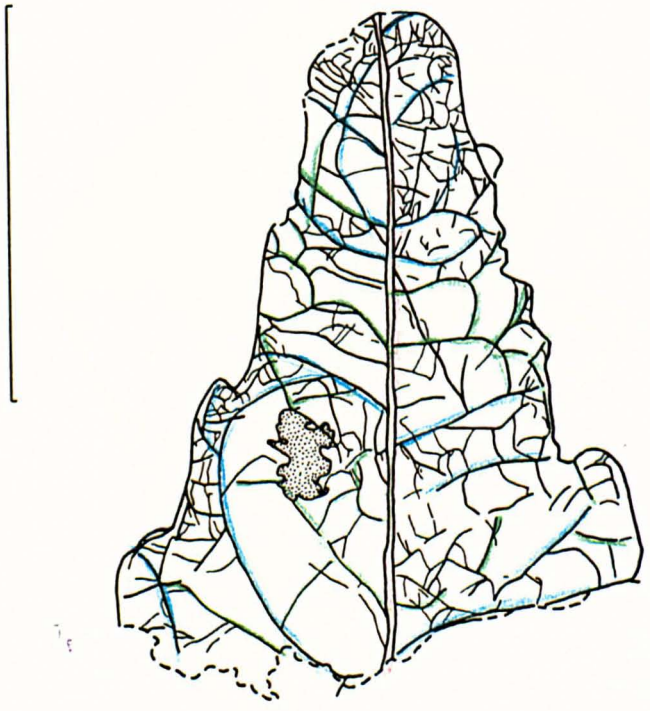
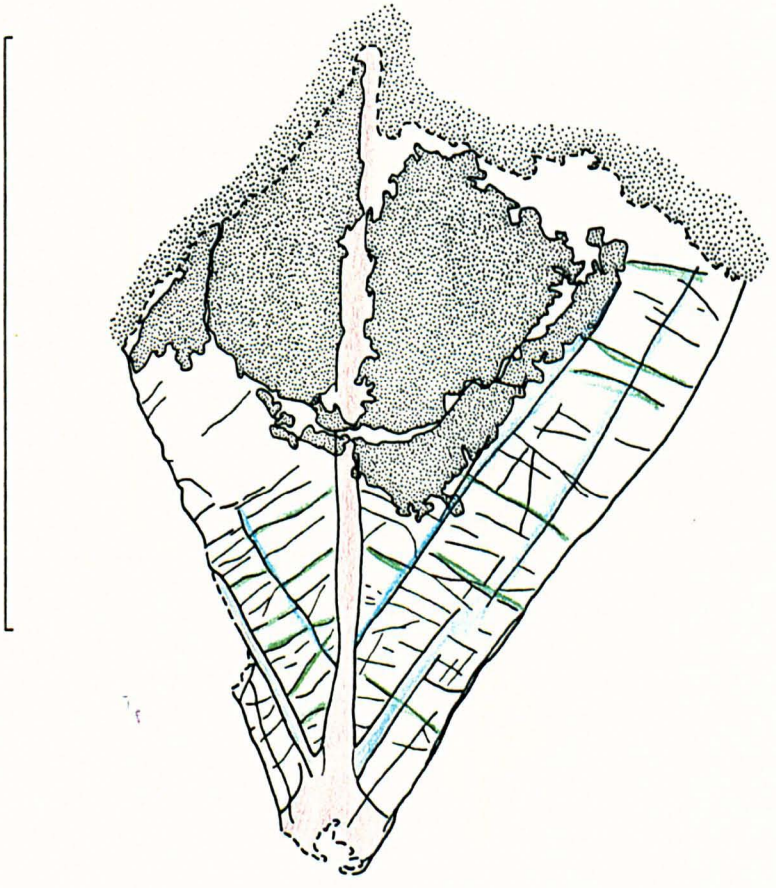


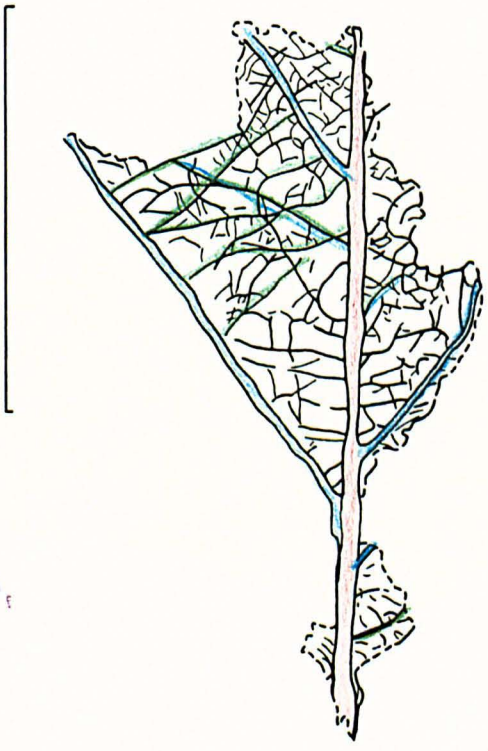
DJ134.2Aa
Scale bar 10mm



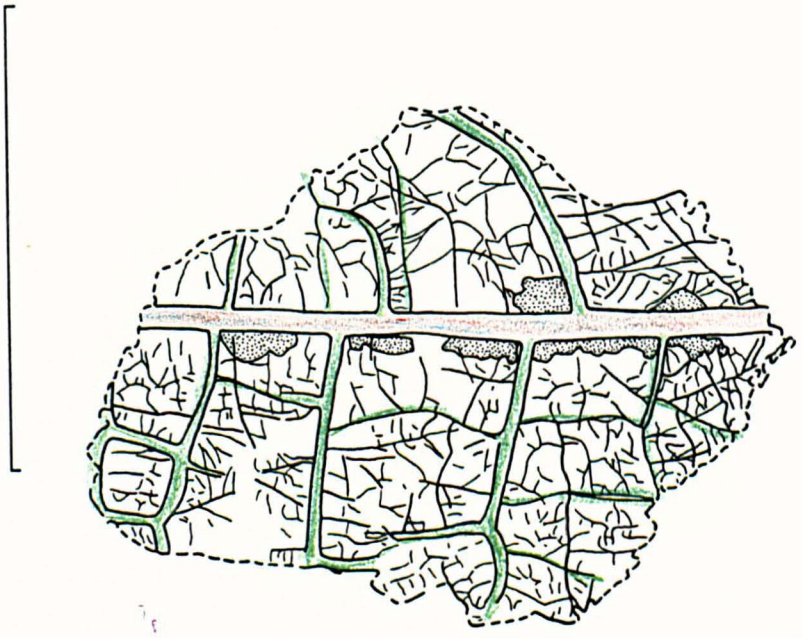
DJ134.2Ba
Scale bar 10mm



DJ134.6a
Scale bar 10mm



DJ134.11a
Scale bar 10mm



DJ134.12Aa
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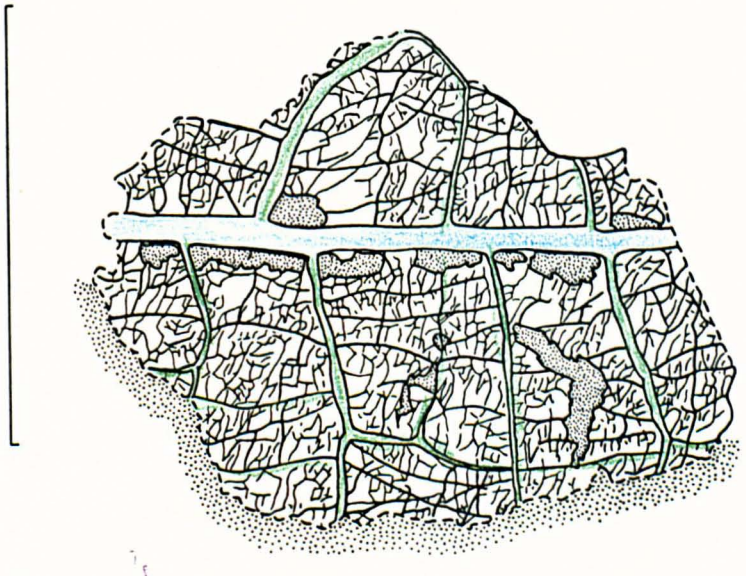
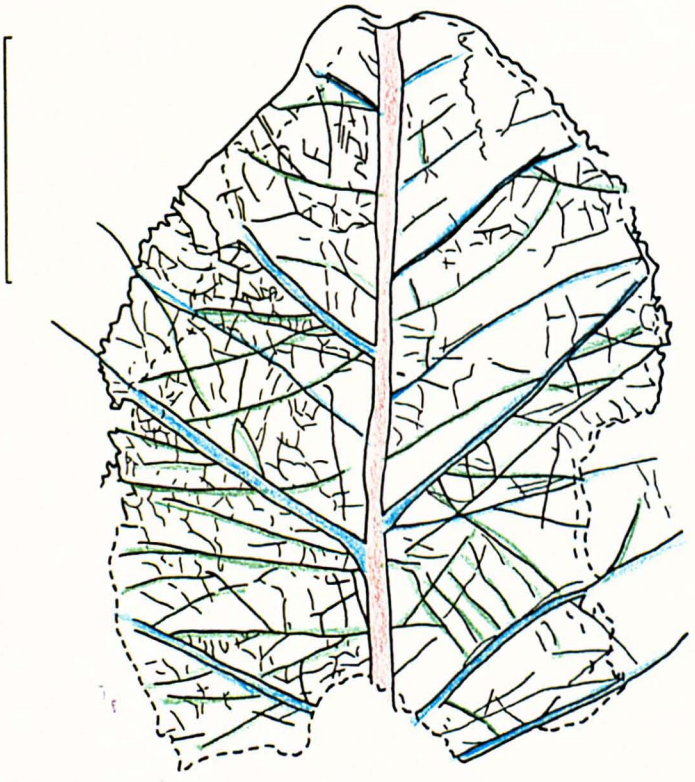
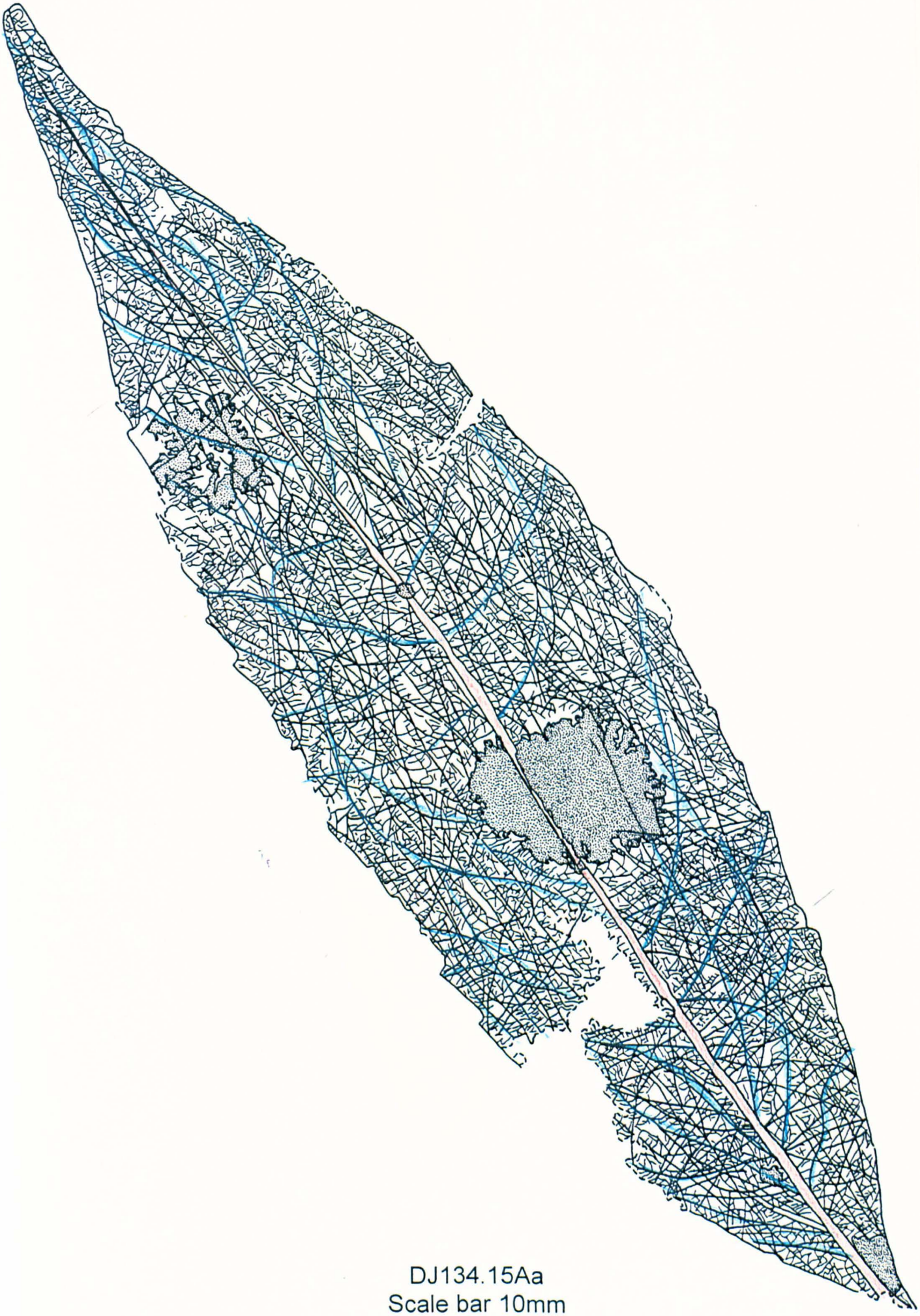


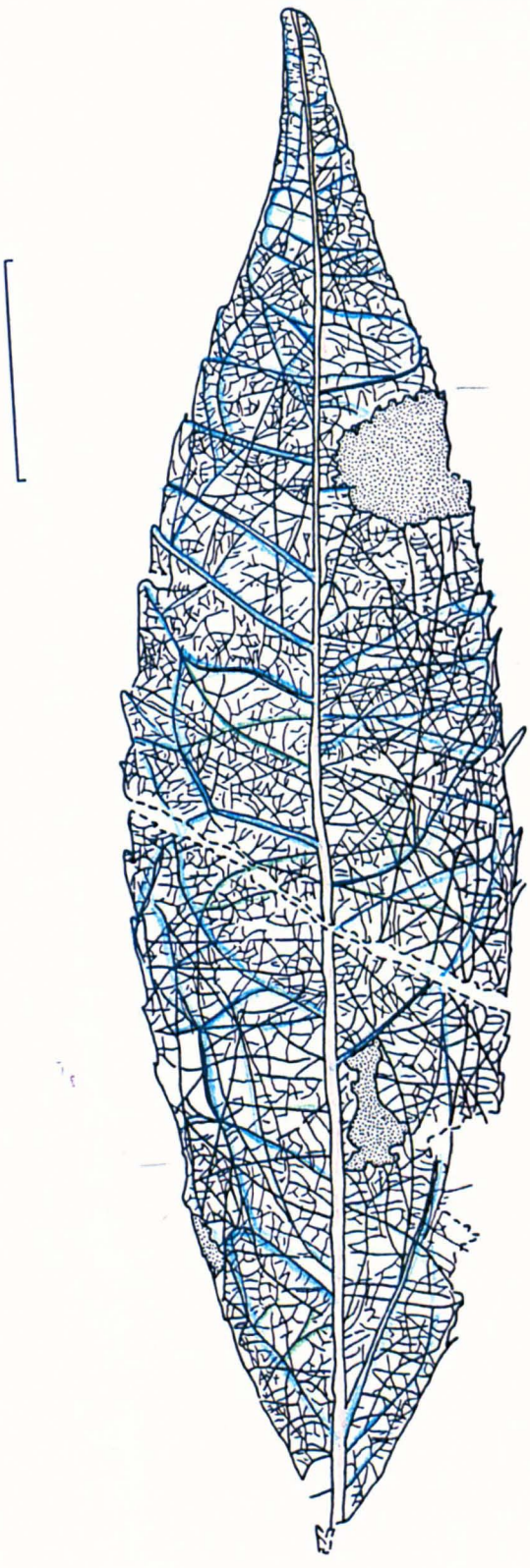
DJ134.12Ba
Scale bar 10mm



DJ134.13a
Scale bar 10mm



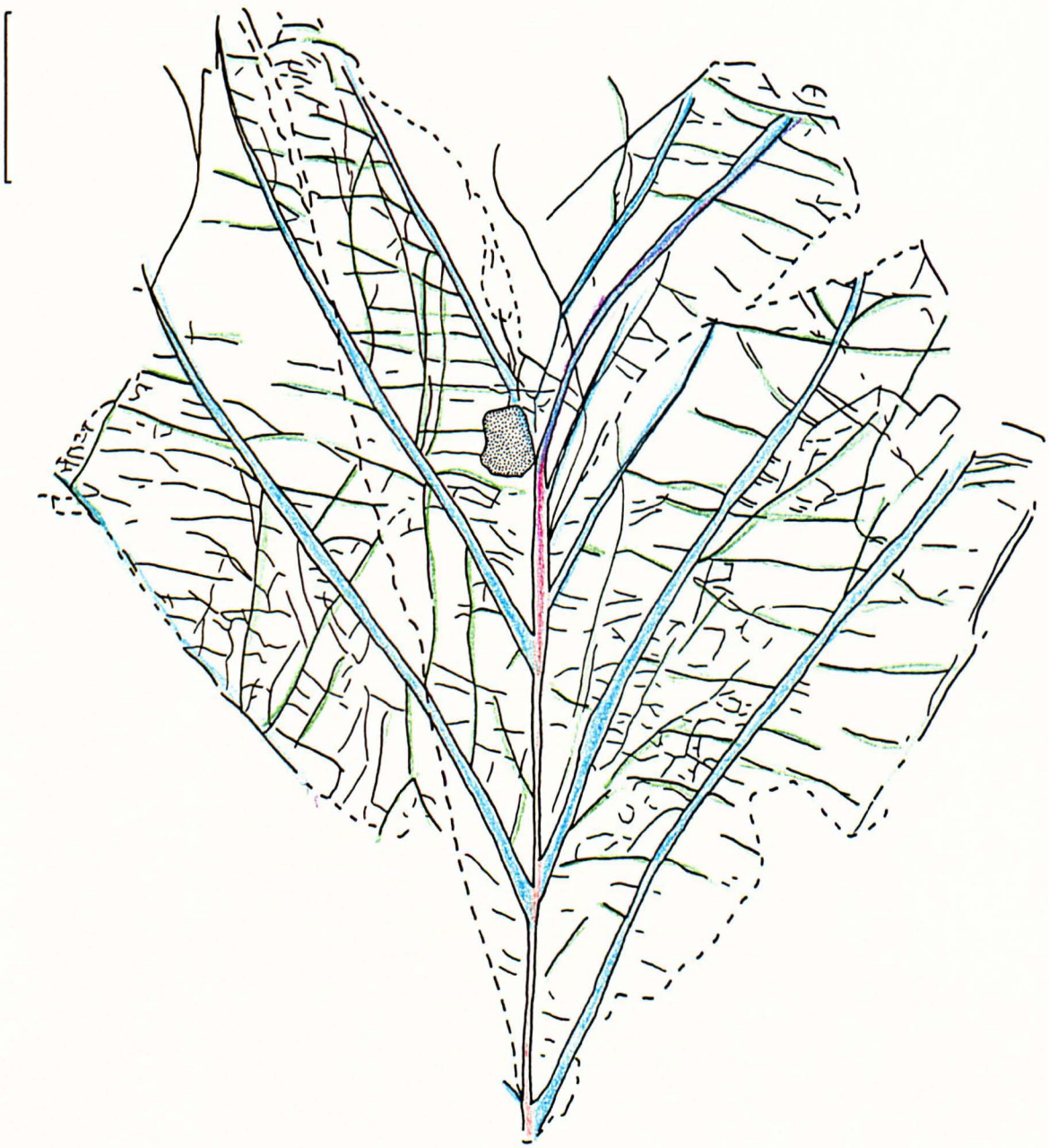
DJ134.15Aa
Scale bar 10mm



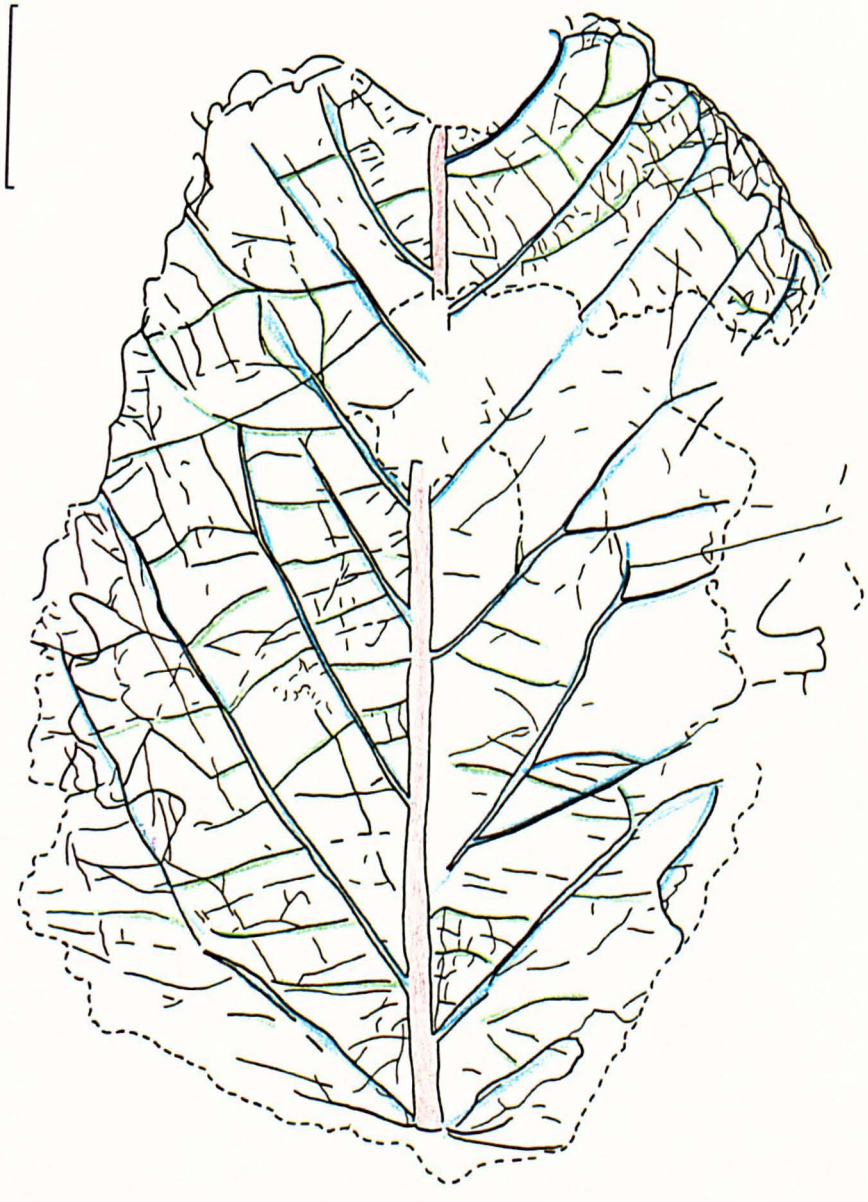
DJ134.15Ba
Scale bar 10mm

DJ134.16a
Scale bar 10mm

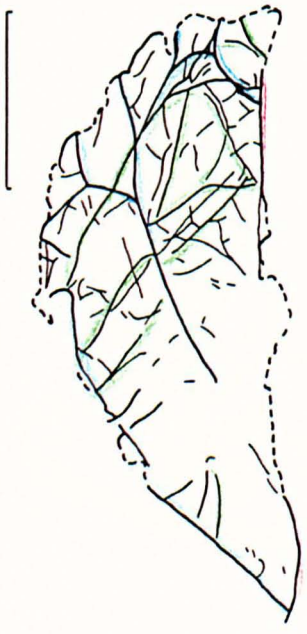
DJ134.21A/Ba
Scale bar 10mm



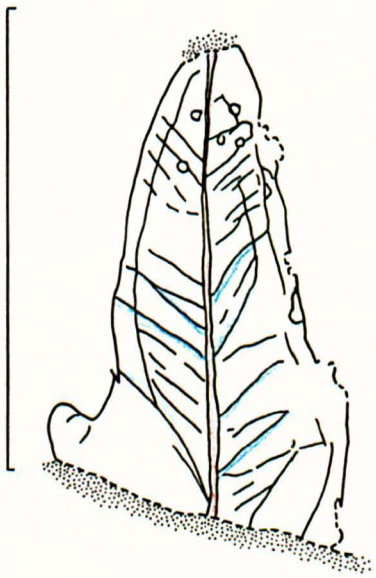
DJ134.22A/Ba
Scale bar 10mm



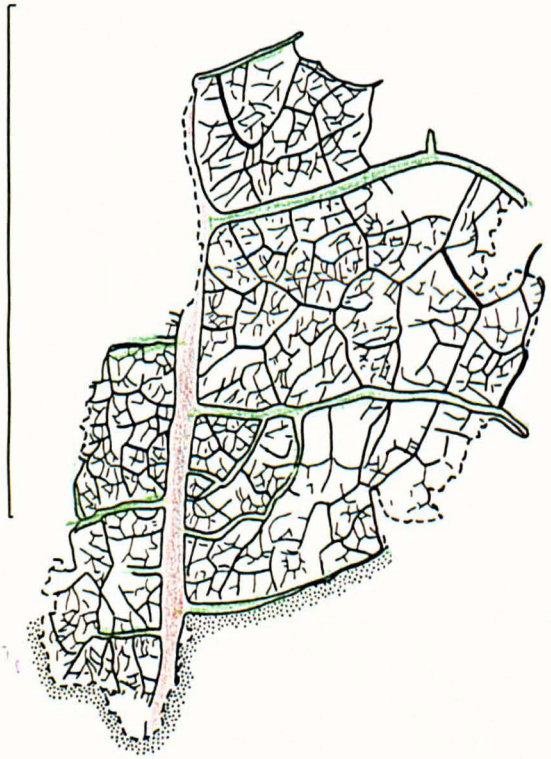
DJ134.27Ba
Scale bar 10mm



DJ134.28a
Scale bar 10mm



DJ147.1a
Scale bar 10mm



DJ147.3a
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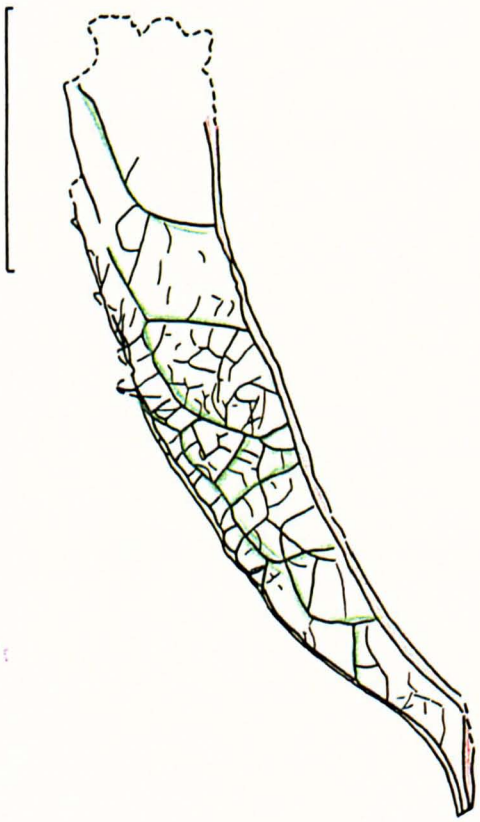
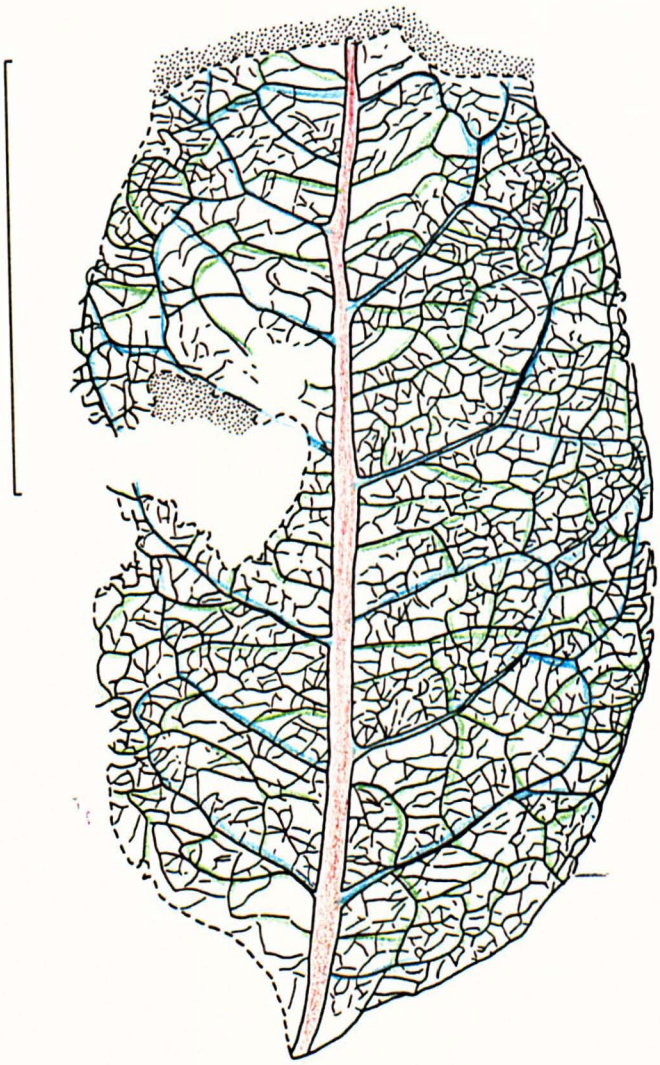
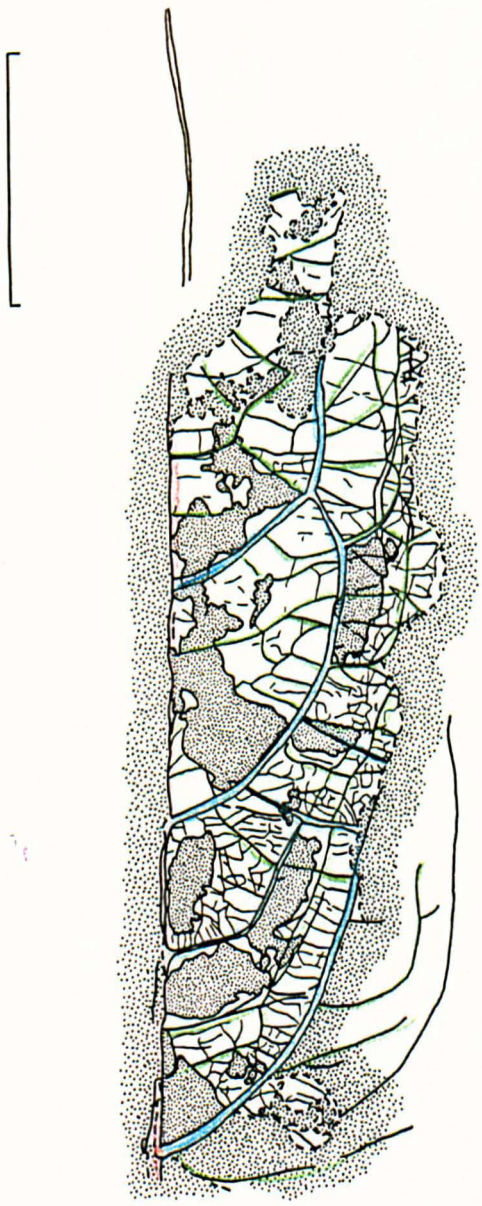


DJ147.4a
Scale bar 10mm

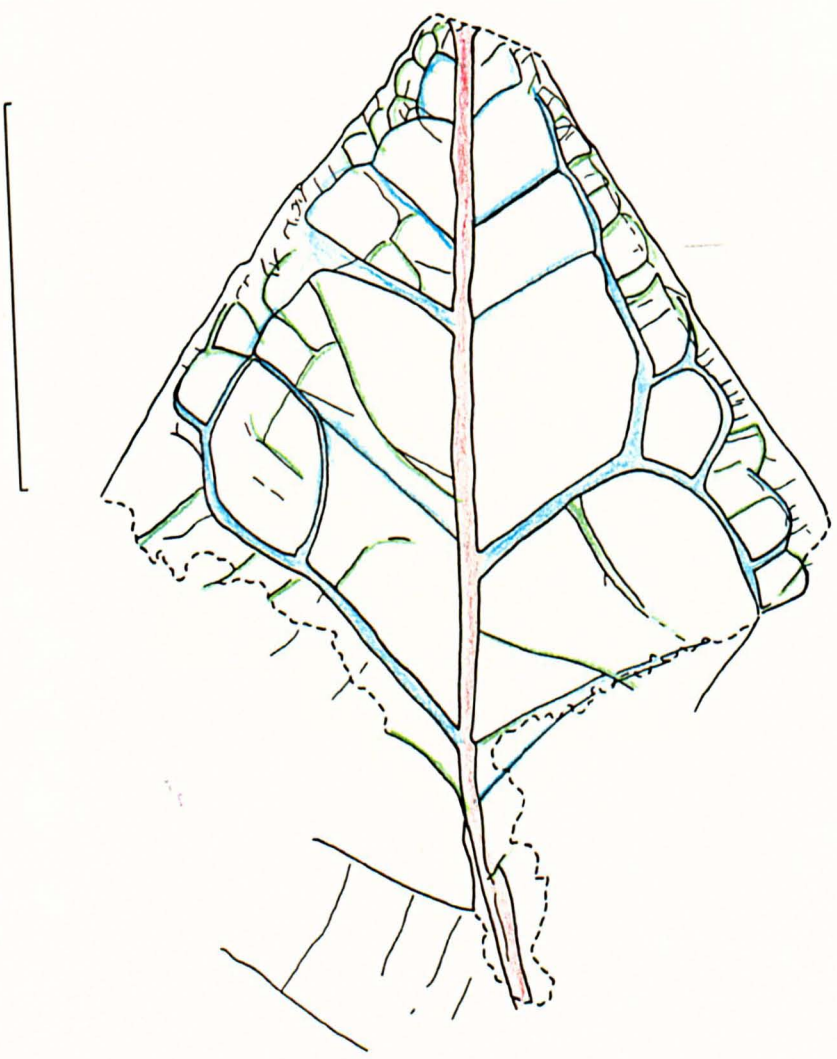


DJ147.6a
Scale bar 10mm



DJ147.7a
Scale bar 10mm

DJ147.8a
Scale bar 10mm



DJ147.9a
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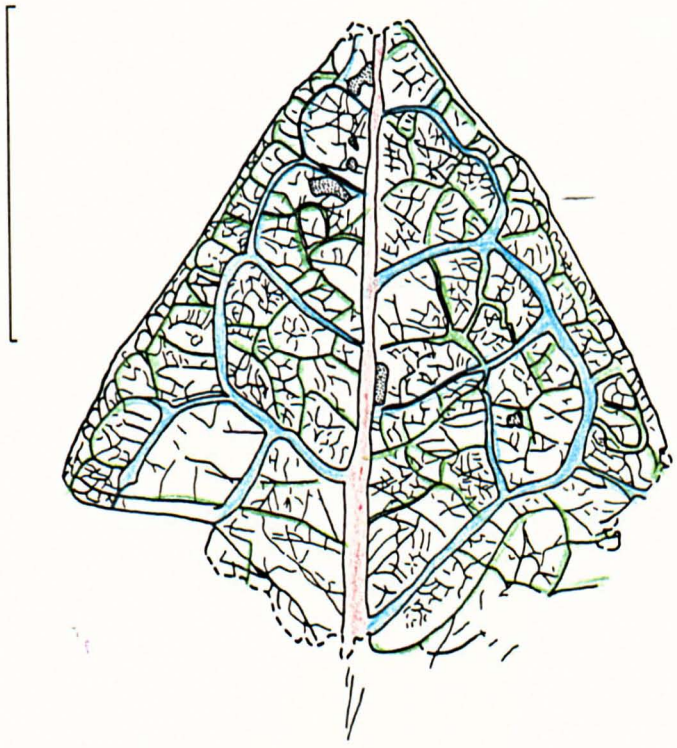

DJ147.15a
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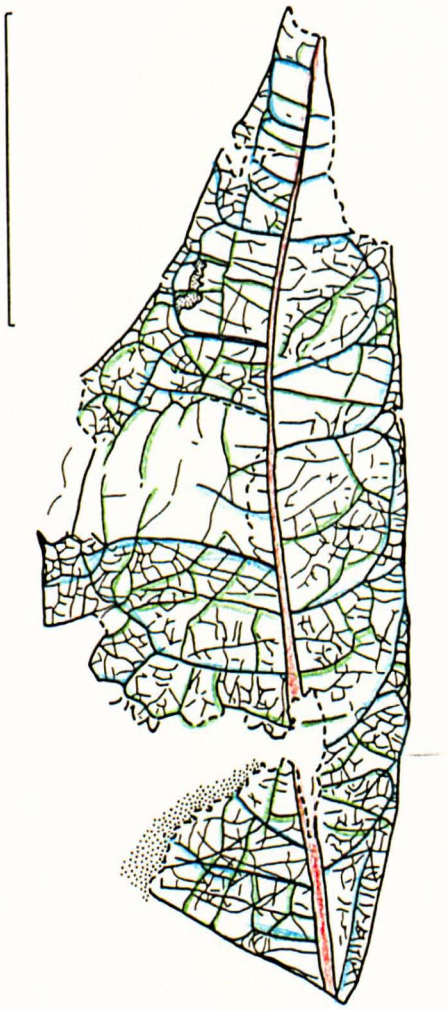
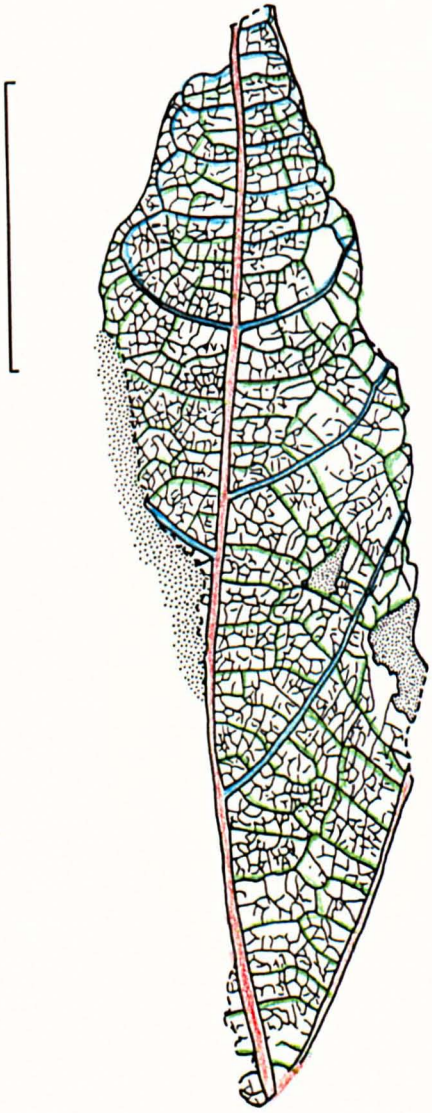


DJ147.10a
Scale bar 10mm



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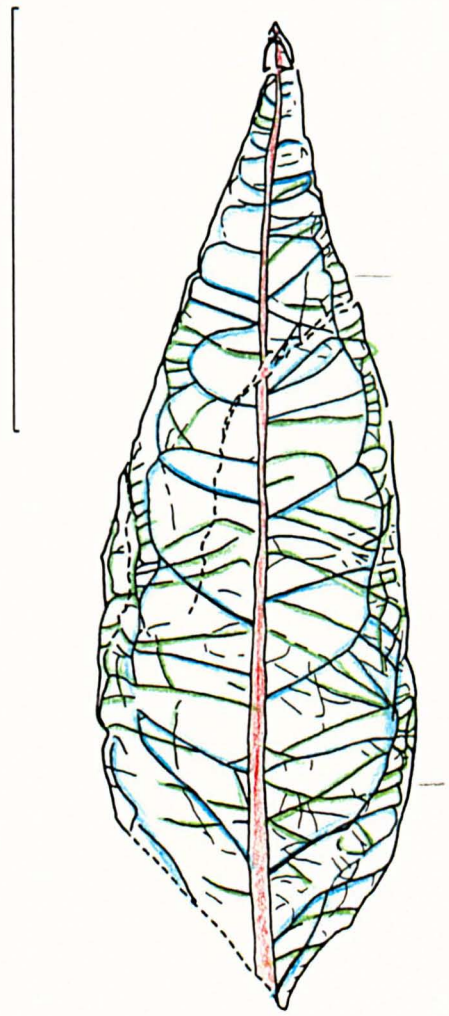
Scale bar 10mm



DJ147.12Aa
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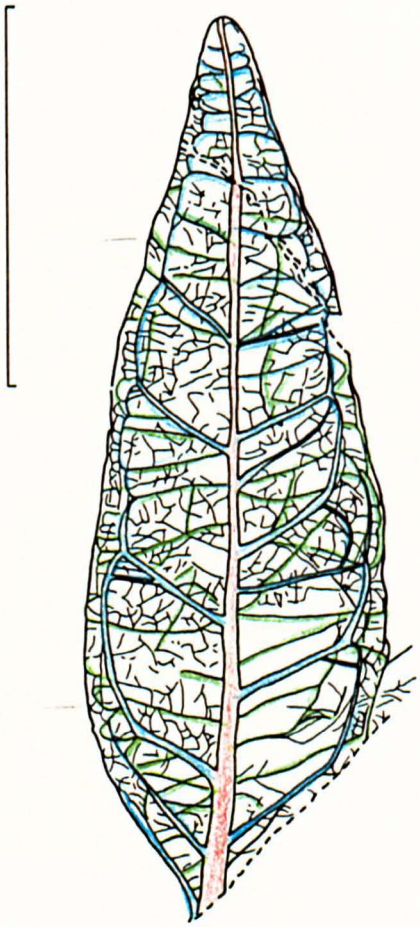

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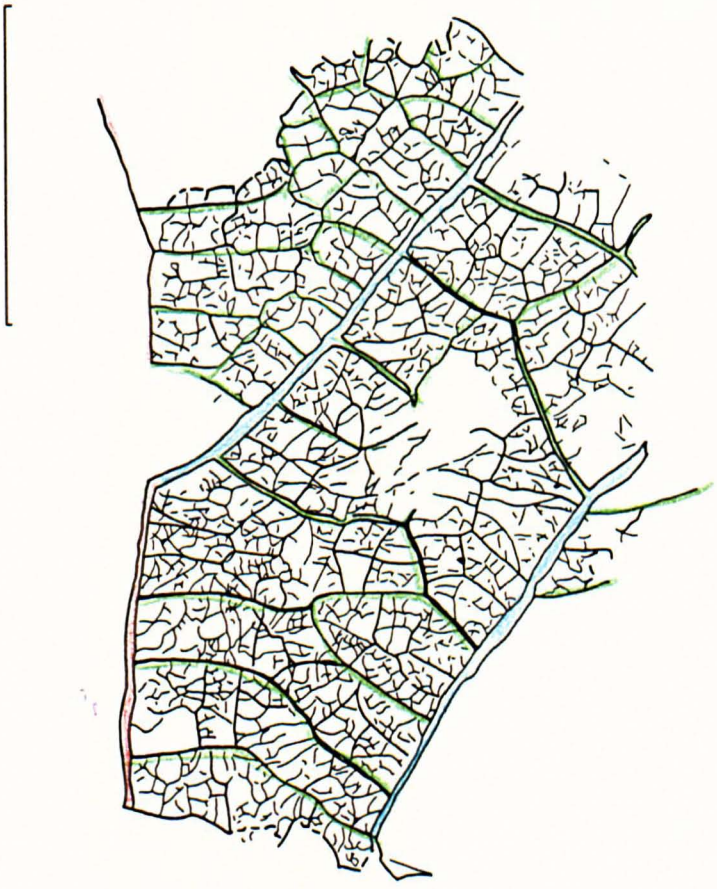

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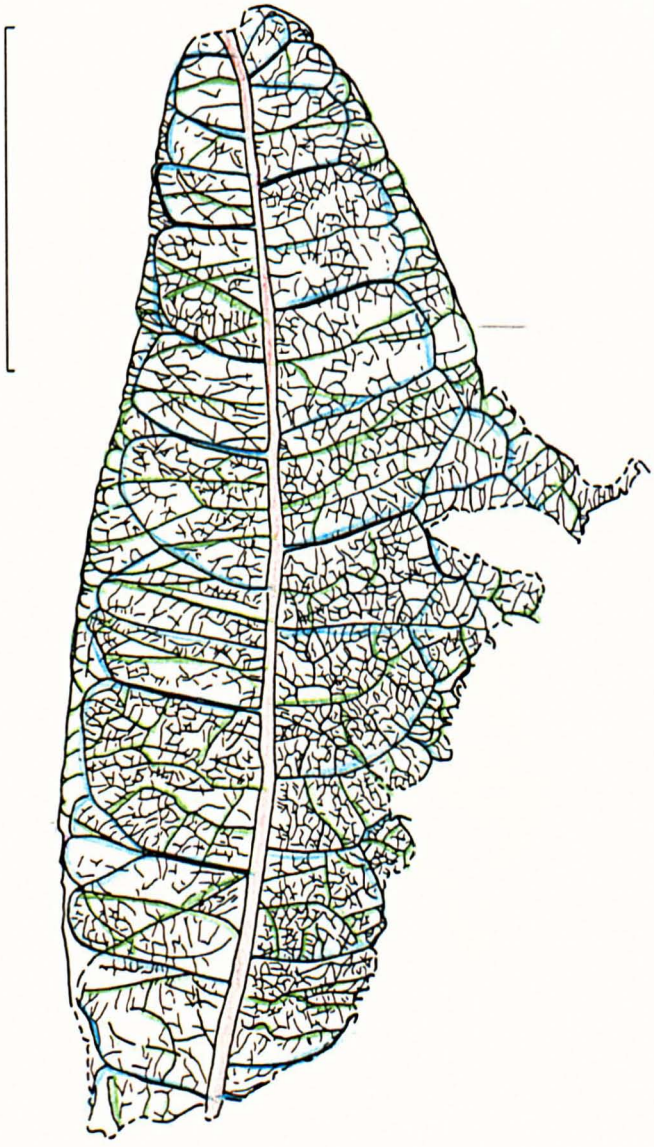

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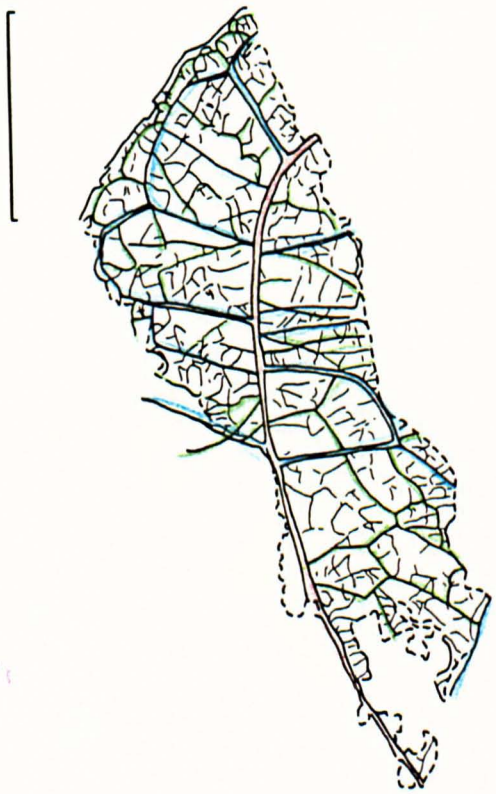

DJ147.17a
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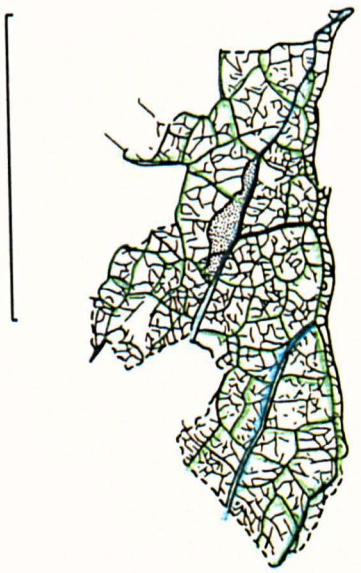
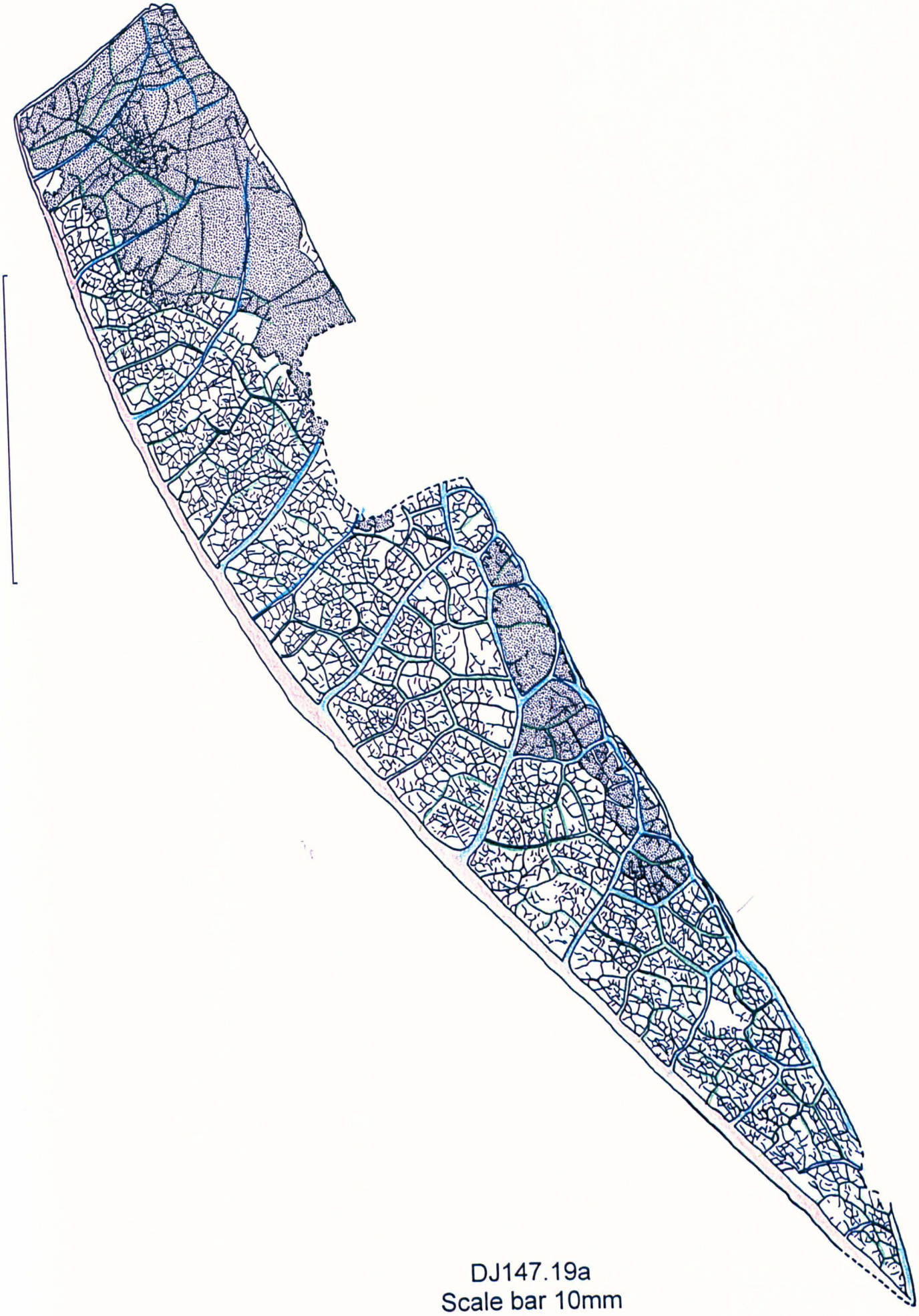
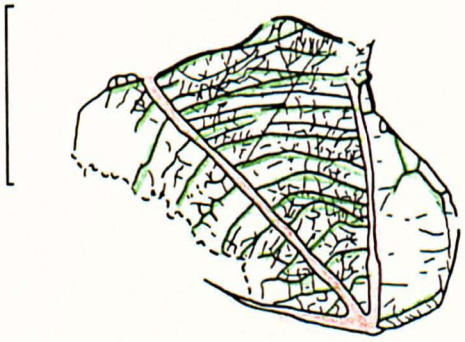


DJ147.18a
Scale bar 10mm

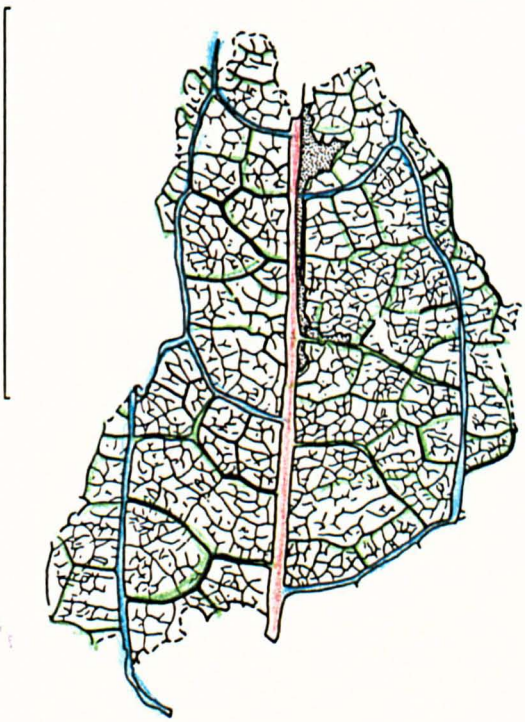


DJ147.19a
Scale bar 10mm

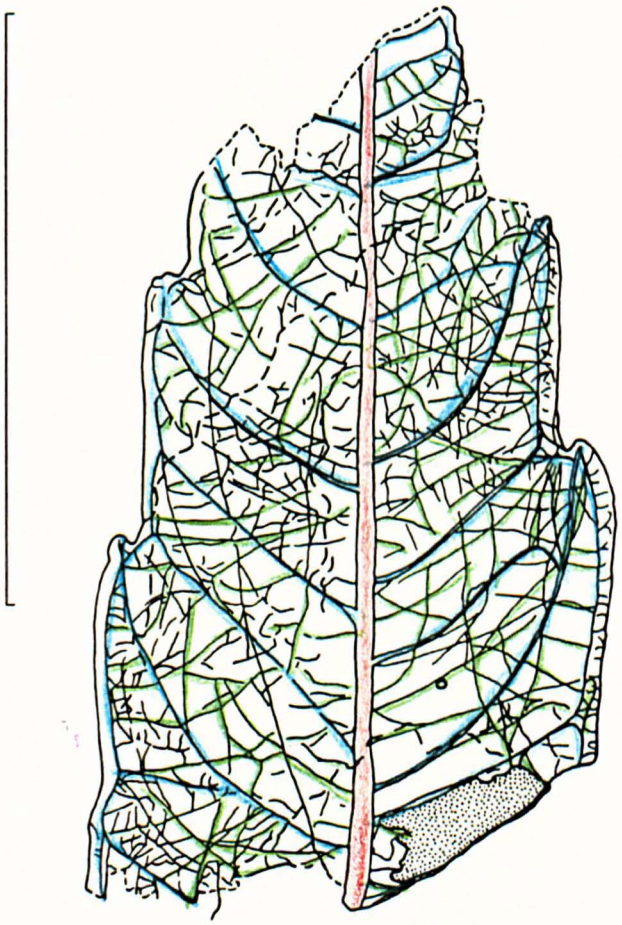
DJ147.54a
Scale bar 10mm



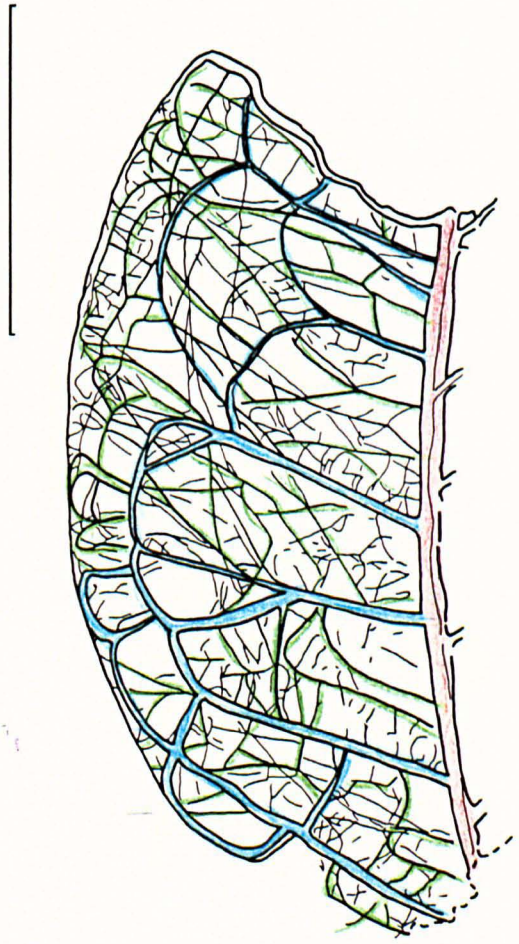
DJ147.20a
Scale bar 10mm



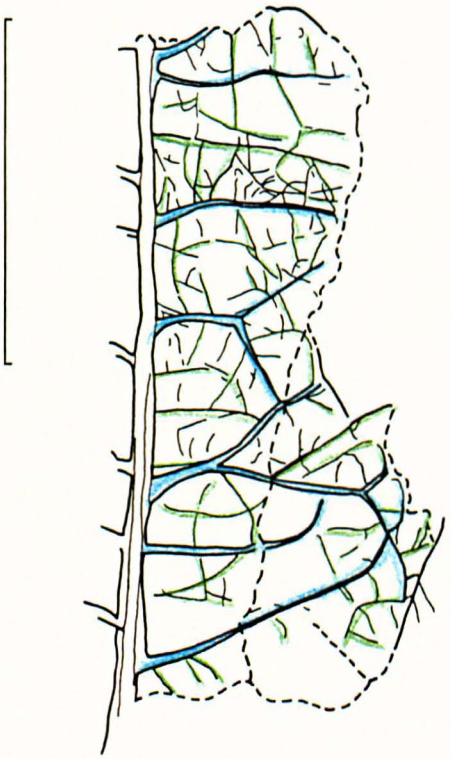
DJ147.23a
Scale bar 10mm



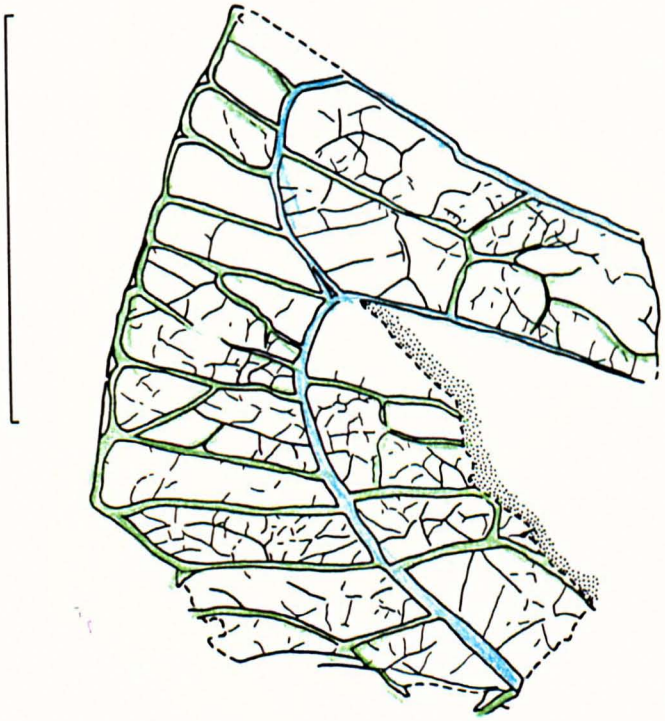
DJ147.24a
Scale bar 10mm



DJ147.25a
Scale bar 10mm

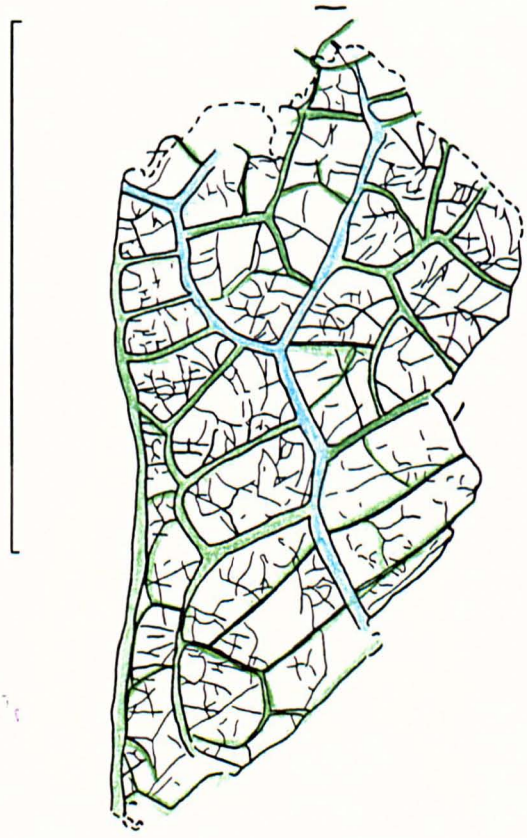


DJ147.25a
Scale bar 10mm

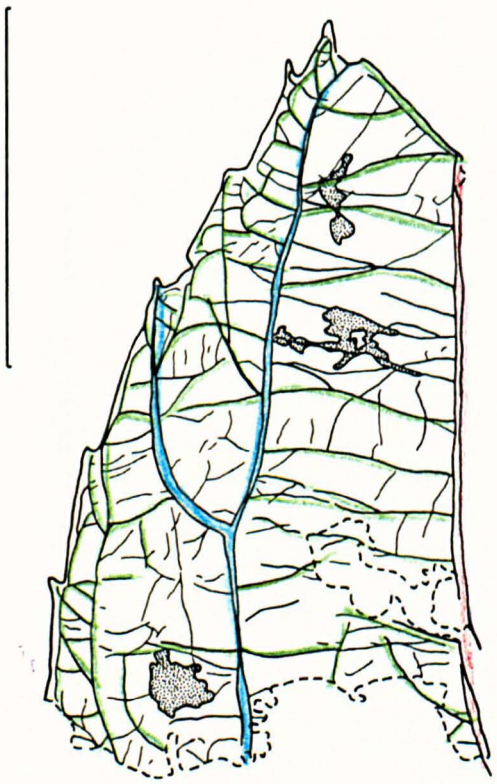


DJ147.26a
Scale bar 10mm

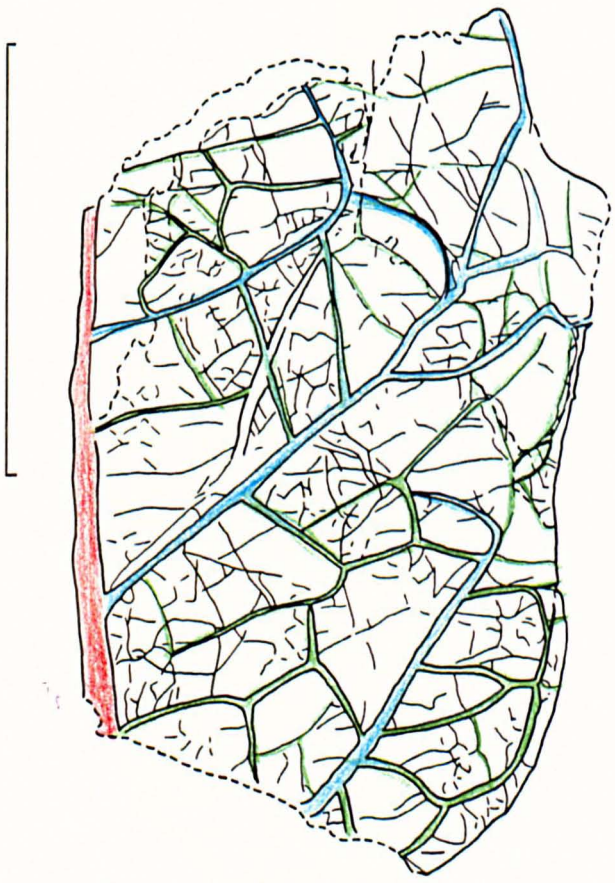
DJ147.28a
Scale bar 10mm



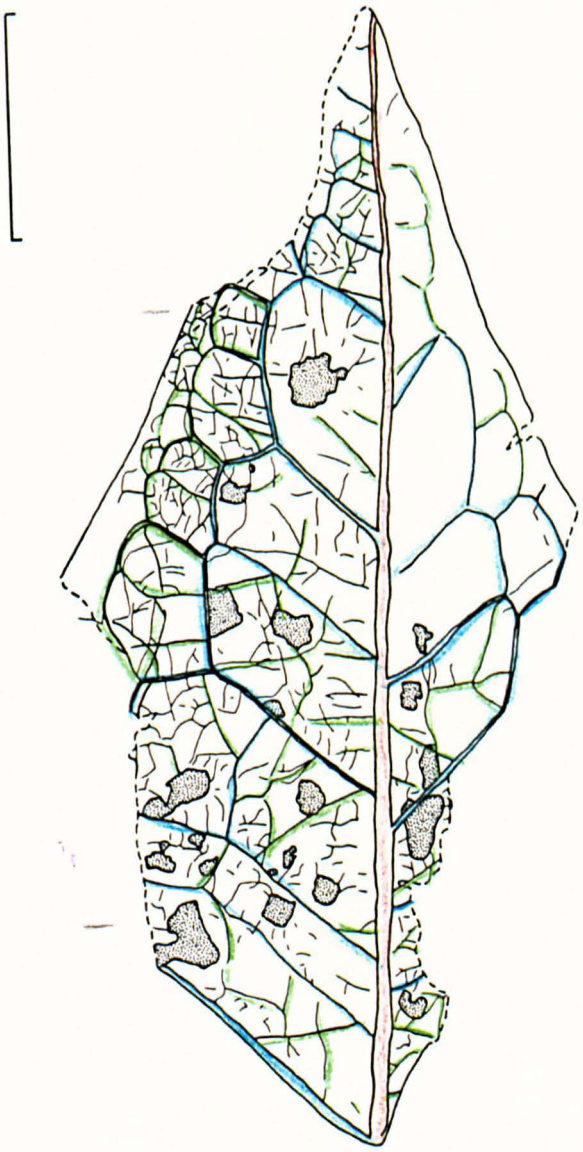
DJ147.29a
Scale bar 10mm



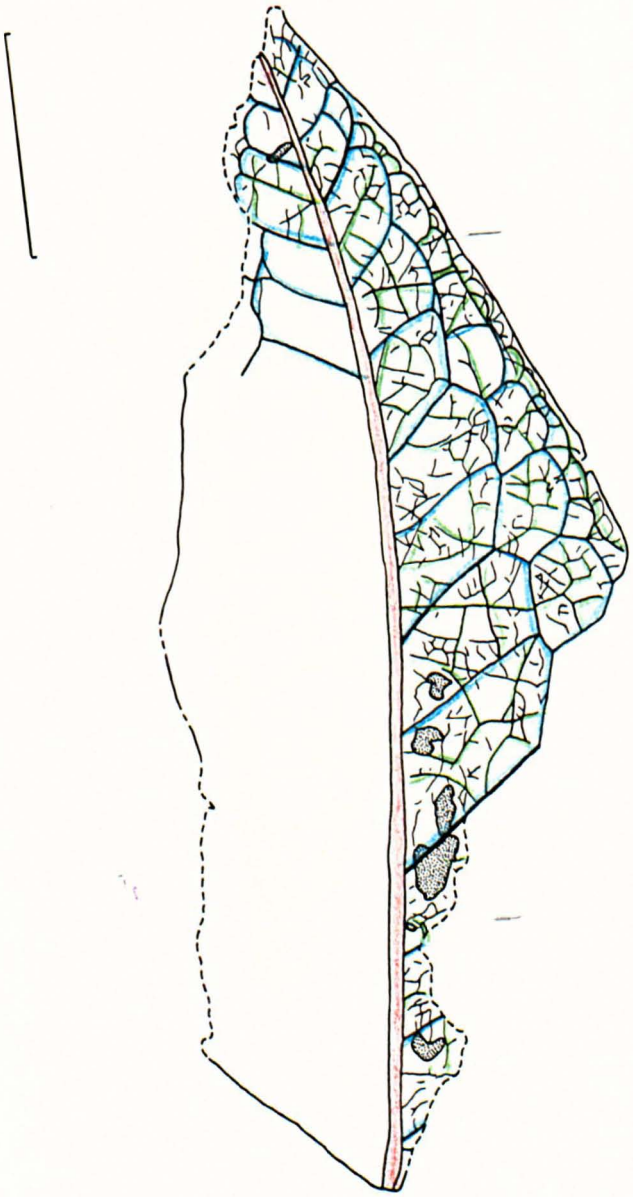
DJ147.30a
Scale bar 10mm



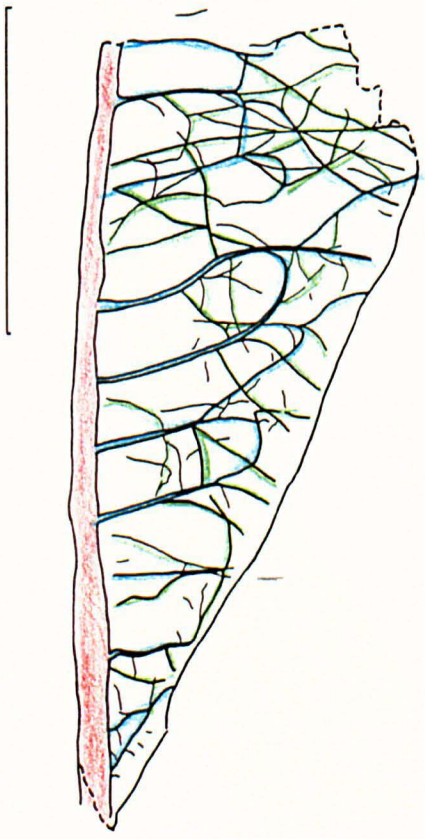
DJ147.31a
Scale bar 10mm



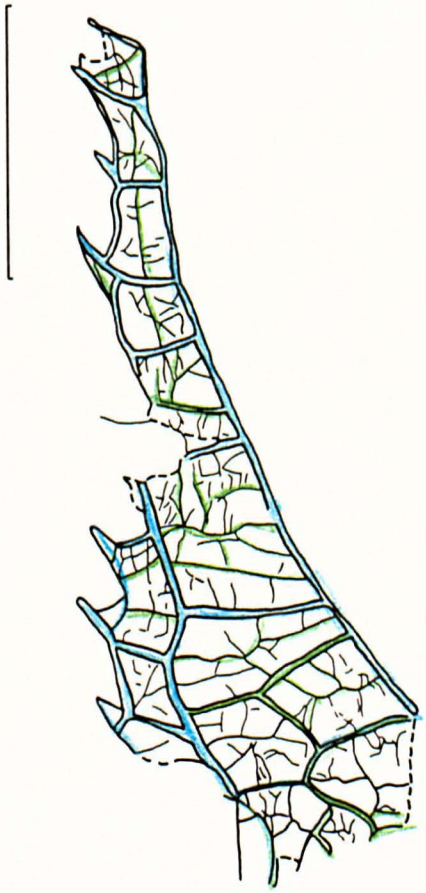
DJ147.32a
Scale bar 10mm



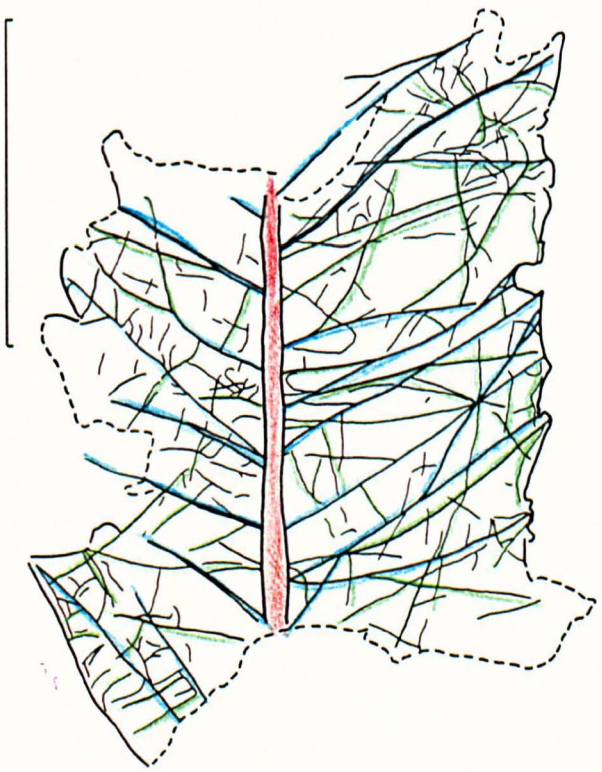
DJ147.32a
Scale bar 10mm



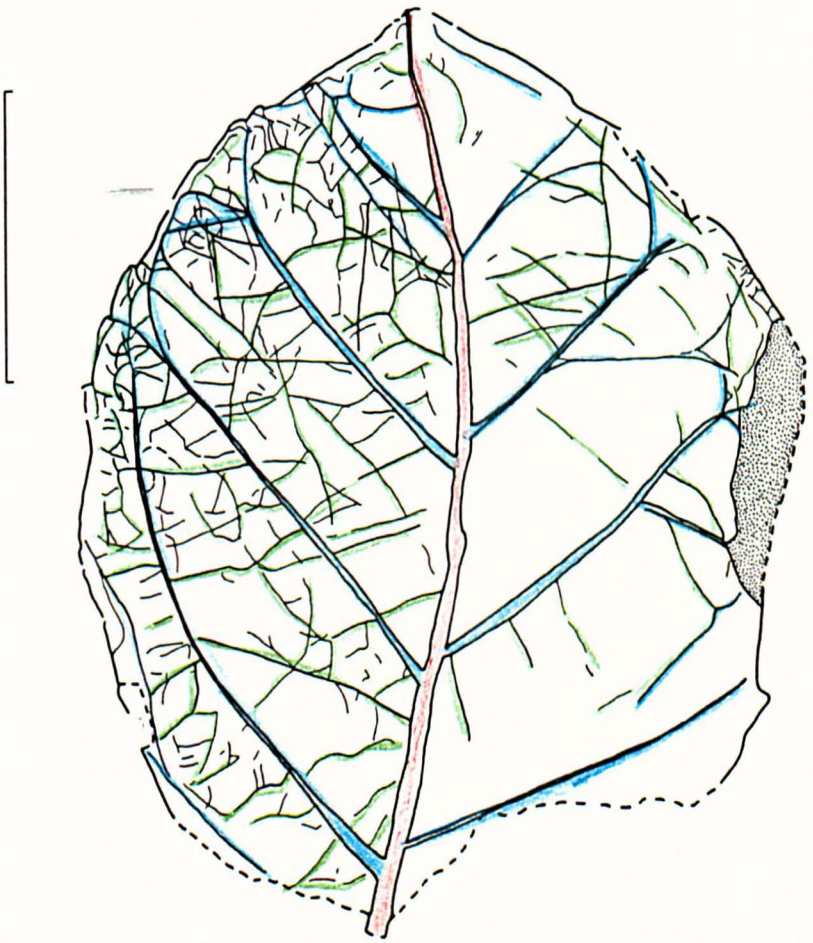
DJ147.33a
Scale bar 10mm



DJ147.34a
Scale bar 10mm



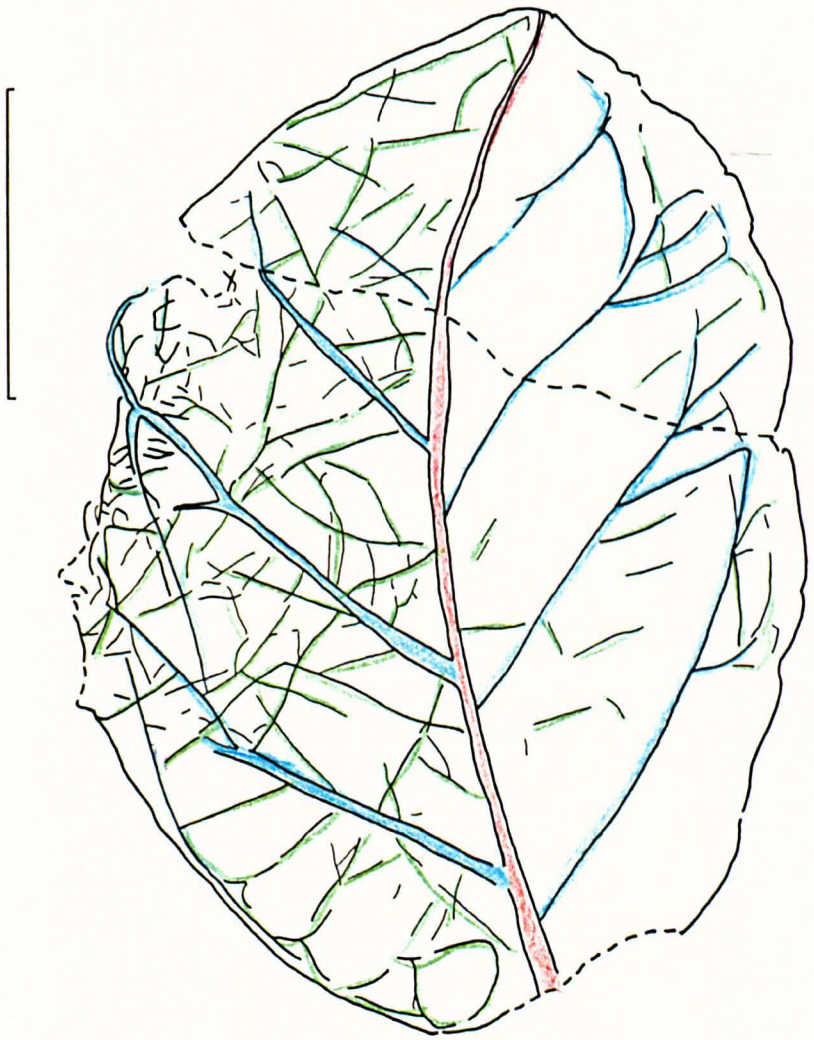
DJ147.35a
Scale bar 10mm



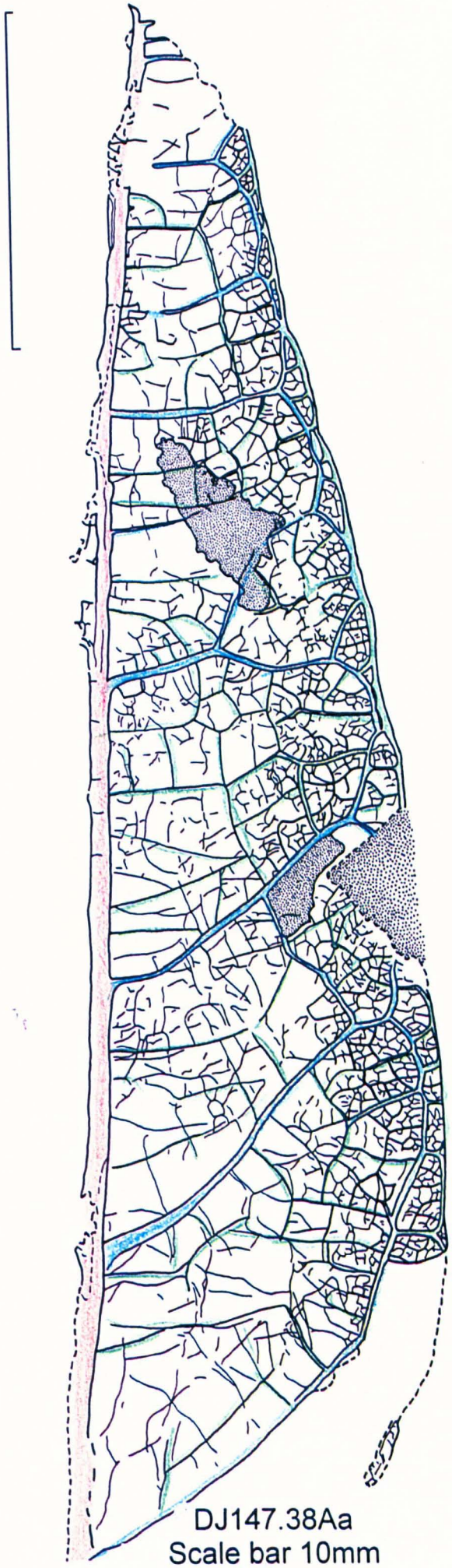
DJ147.37Aa
Scale bar 10mm

DJ147.37Aa
Scale bar 10mm

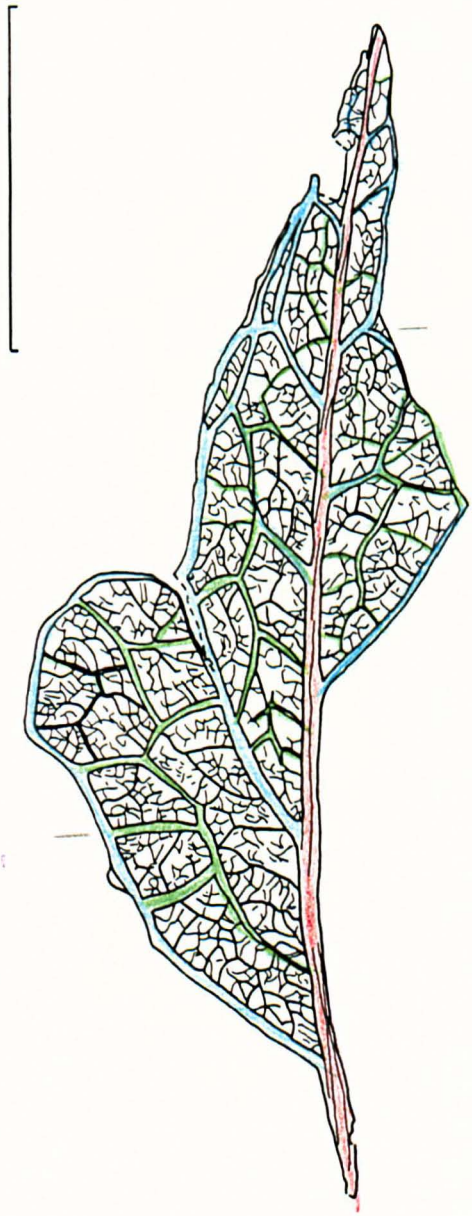
DJ147.37B/Ca
Scale bar 10mm



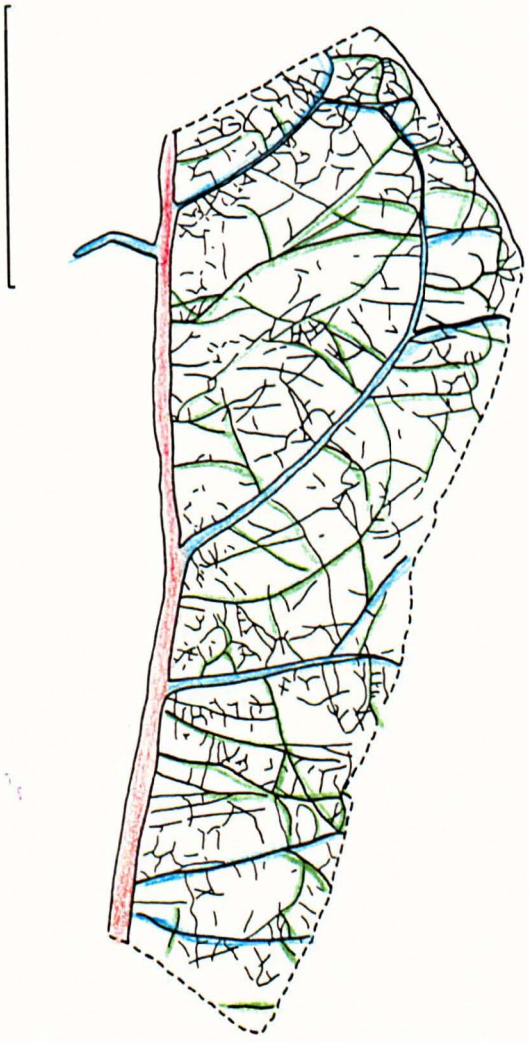
DJ147.37B/Ca
Scale bar 10mm



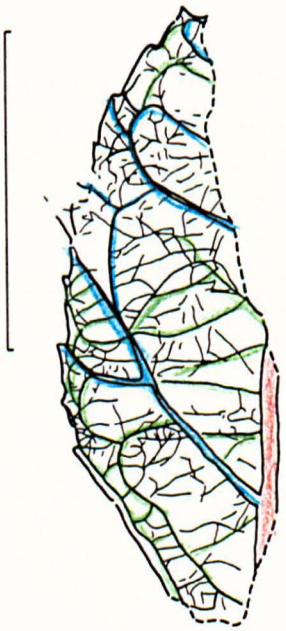
DJ147.38Aa
Scale bar 10mm



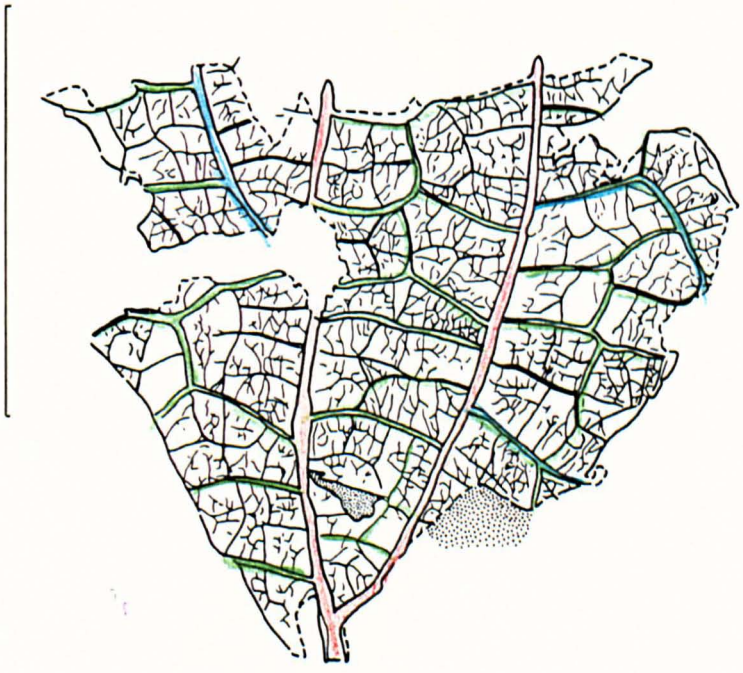
DJ147.39a
Scale bar 10mm



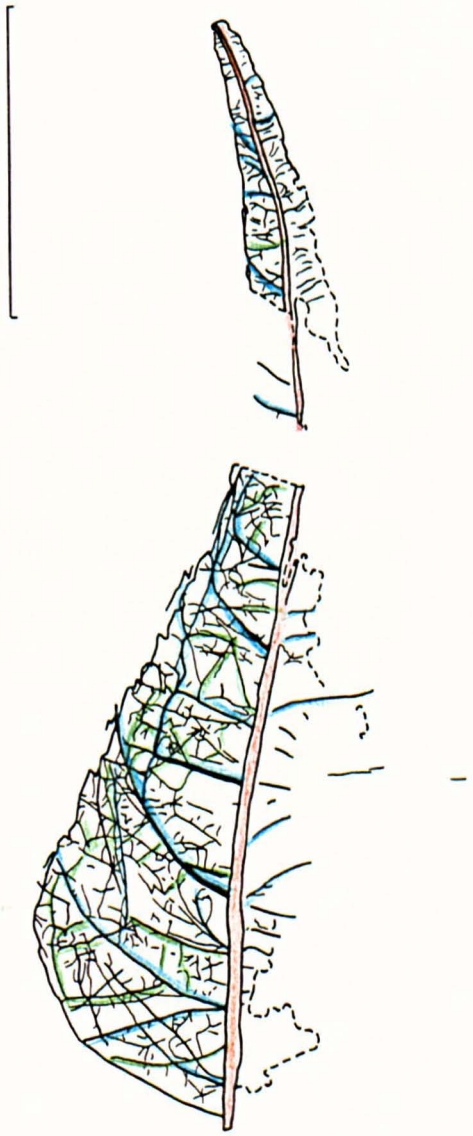
DJ147.40a
Scale bar 10mm



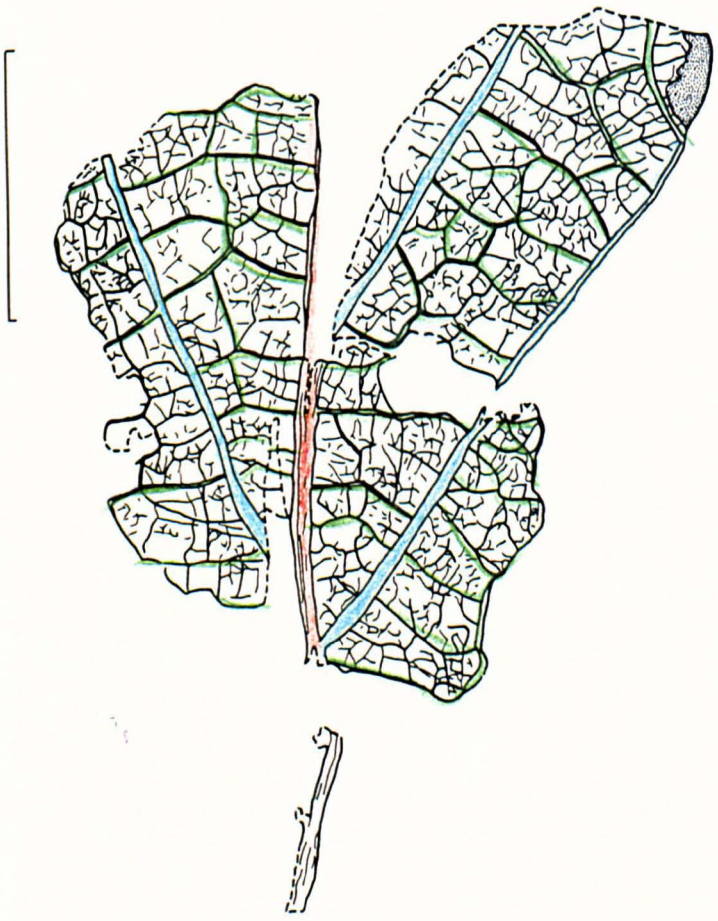
DJ147.41Aa
Scale bar 10mm



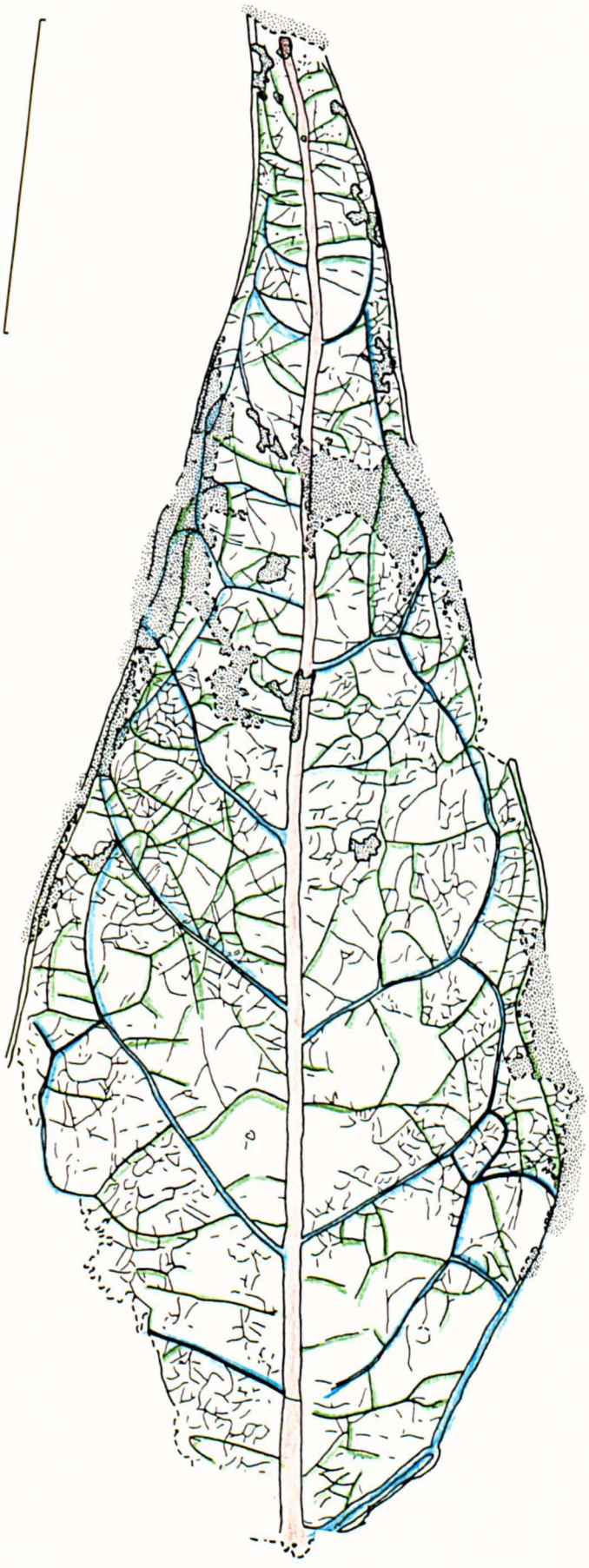
DJ147.43a
Scale bar 10mm



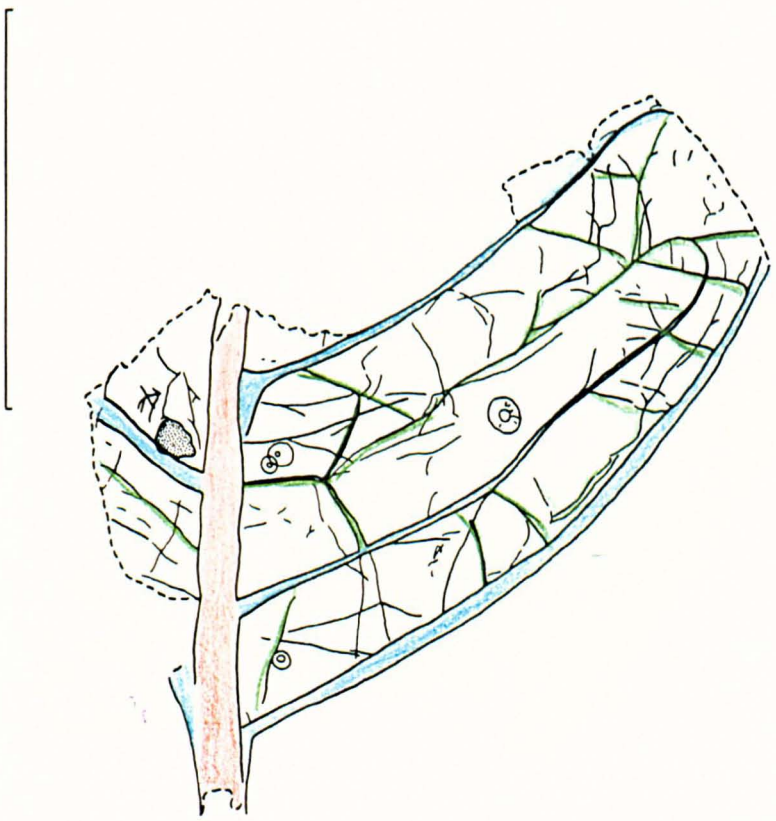
DJ147.44a
Scale bar 10mm



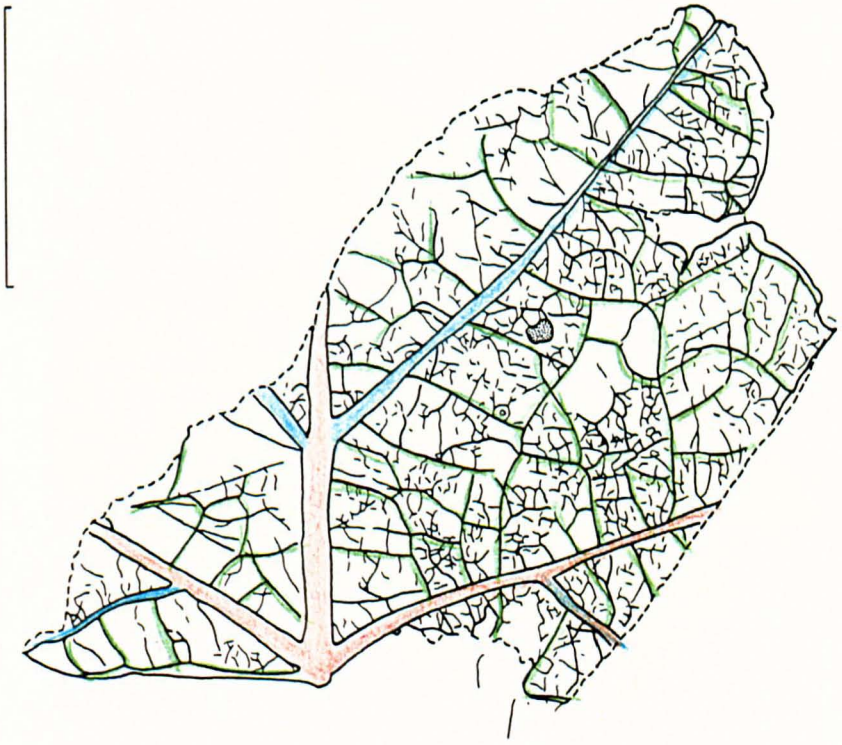
DJ147.45a
Scale bar 10mm



DJ147.46a
Scale bar 10mm

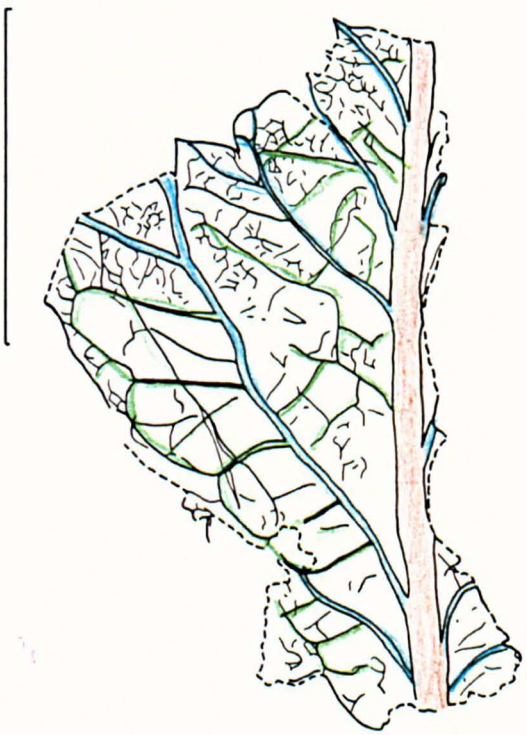


DJ147.48a
Scale bar 10mm

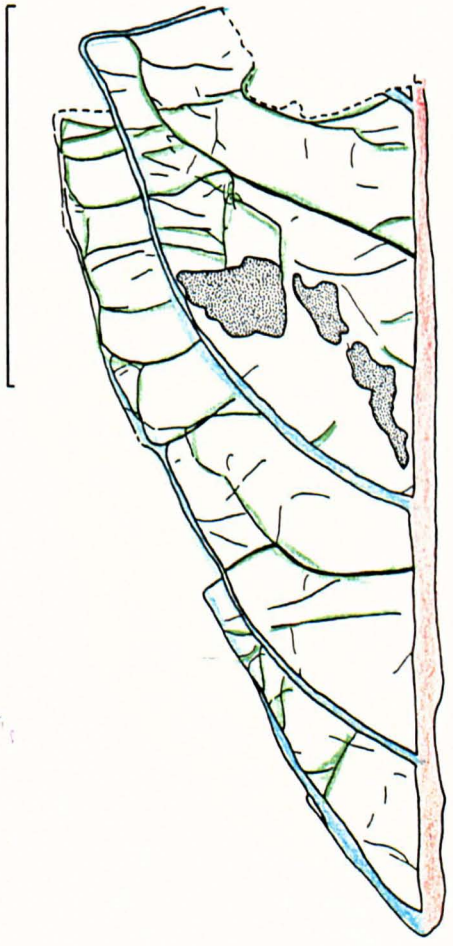


DJ147.49Aa
Scale bar 10mm

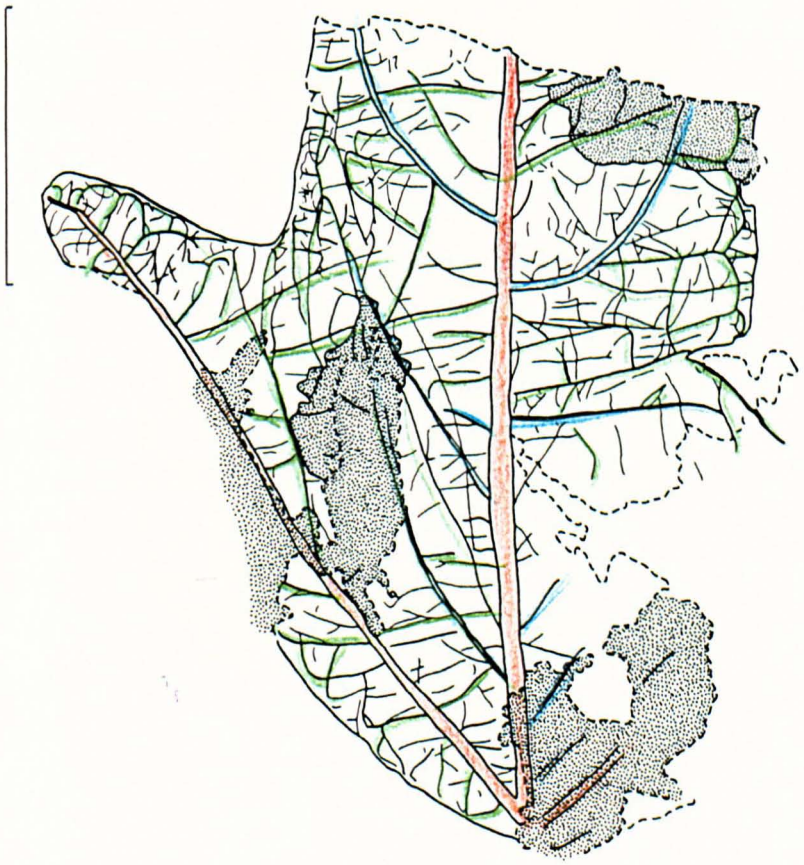
DJ147.49Ba
Scale bar 10mm



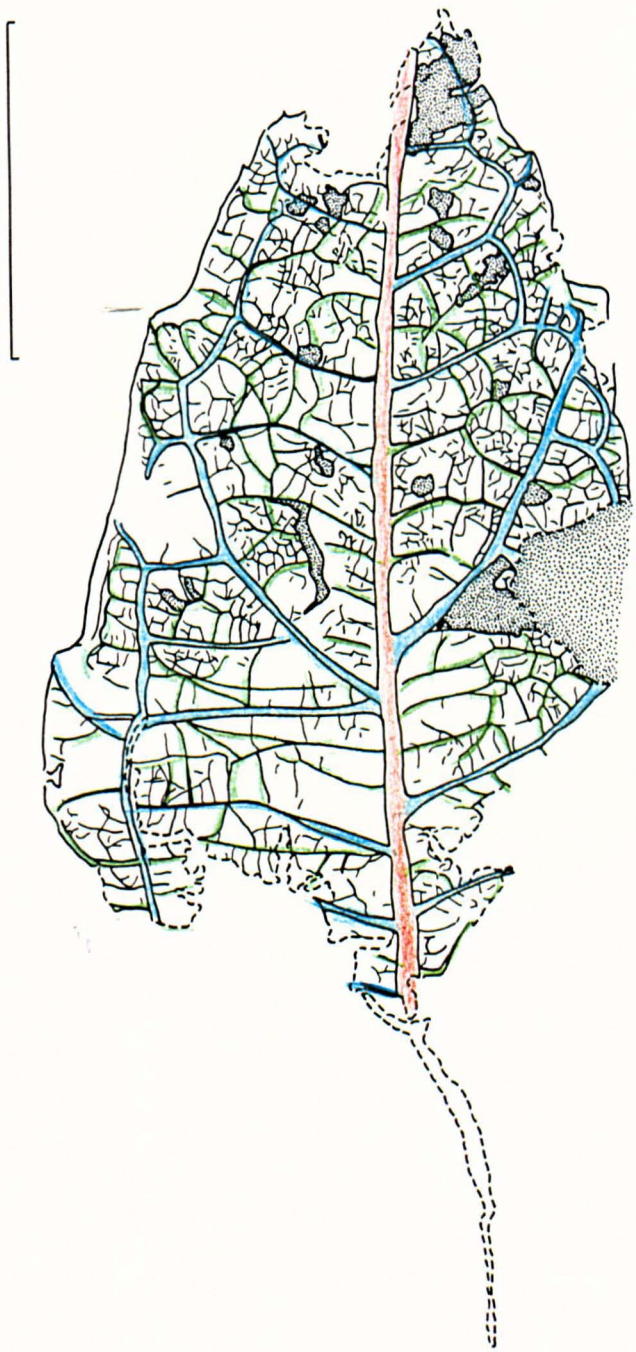
DJ147.51a
Scale bar 10mm



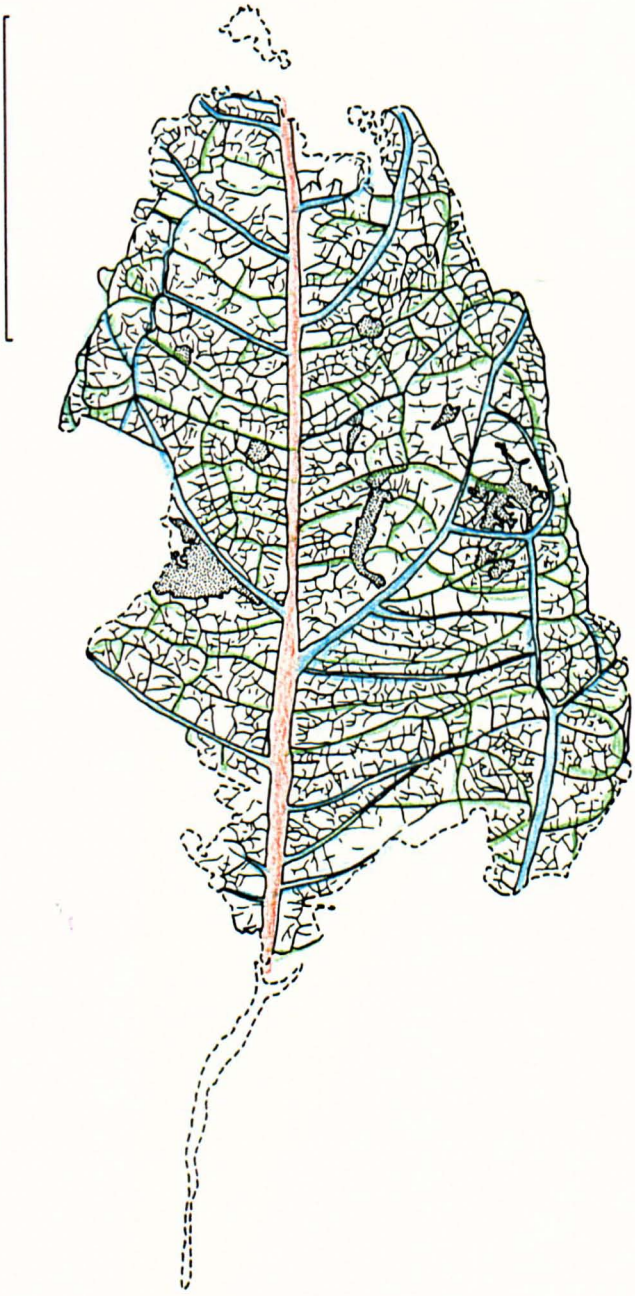
DJ147.52a
Scale bar 10mm



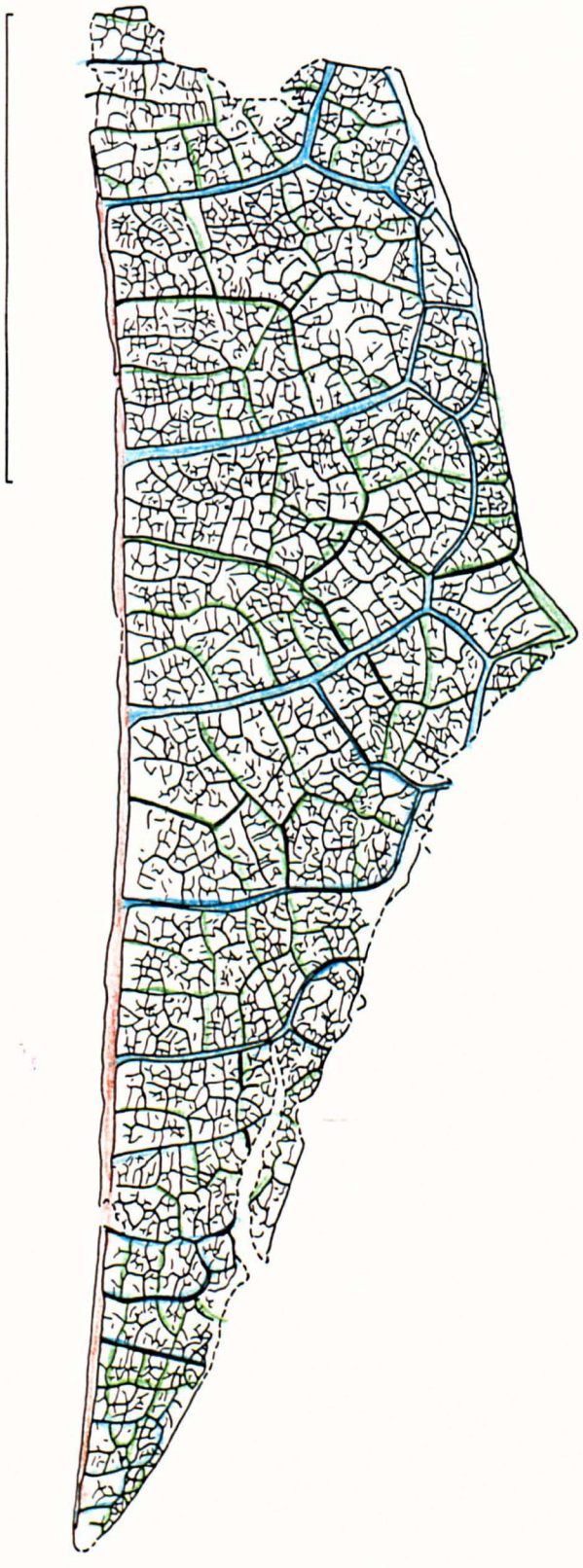
DJ147.53a
Scale bar 10mm



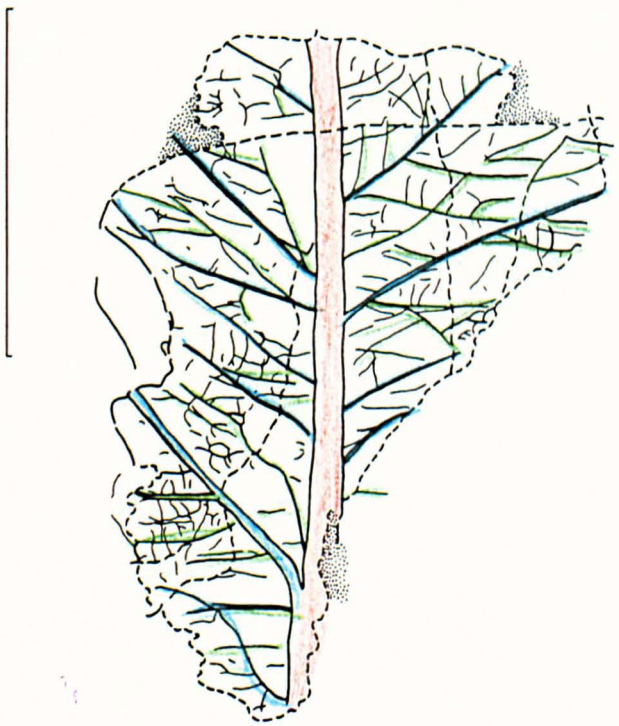
DJ147.55Aa
Scale bar 10mm



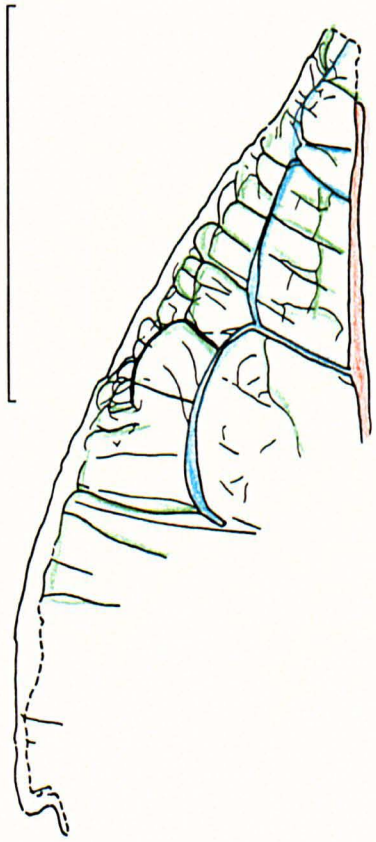
DJ147.55Ba
Scale bar 10mm



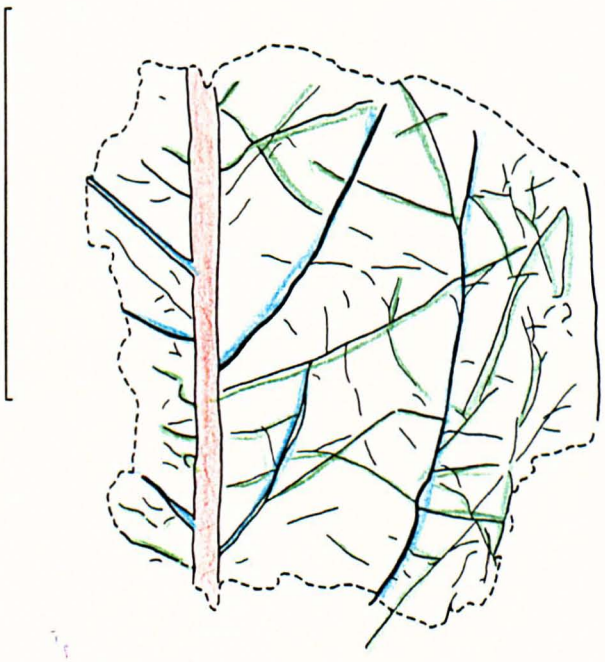
DJ147.56a
Scale bar 10mm



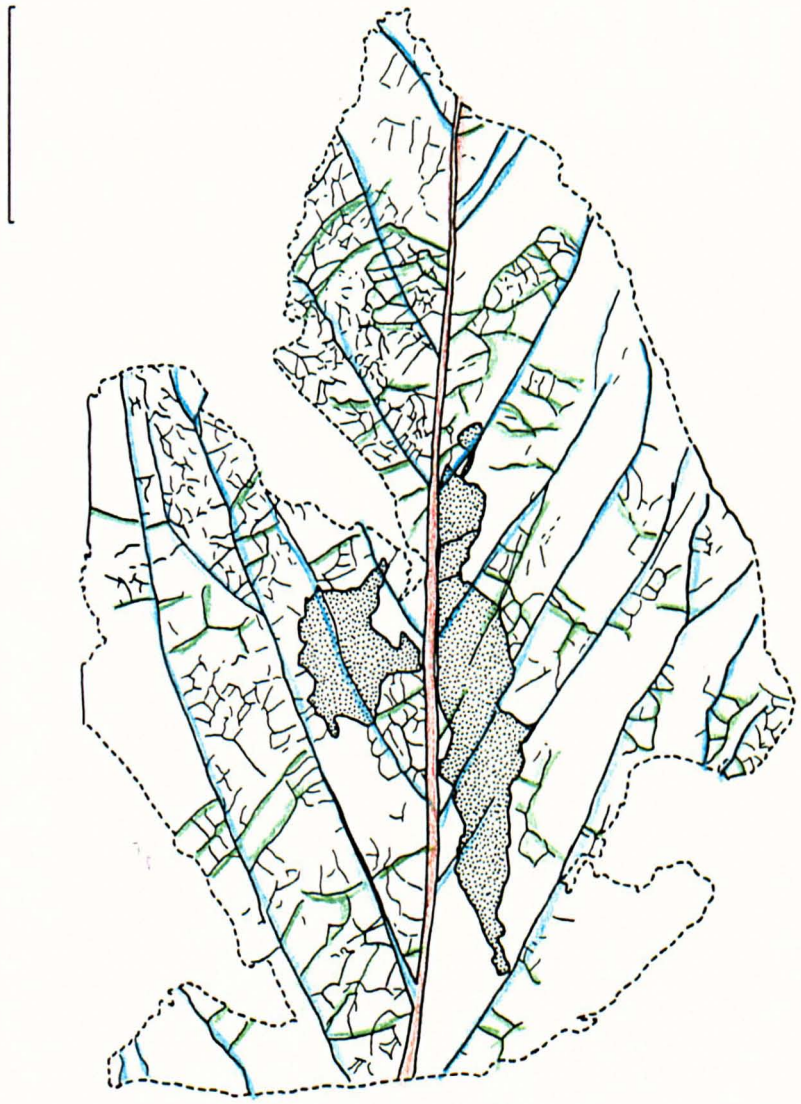
DJ147.59a
Scale bar 10mm



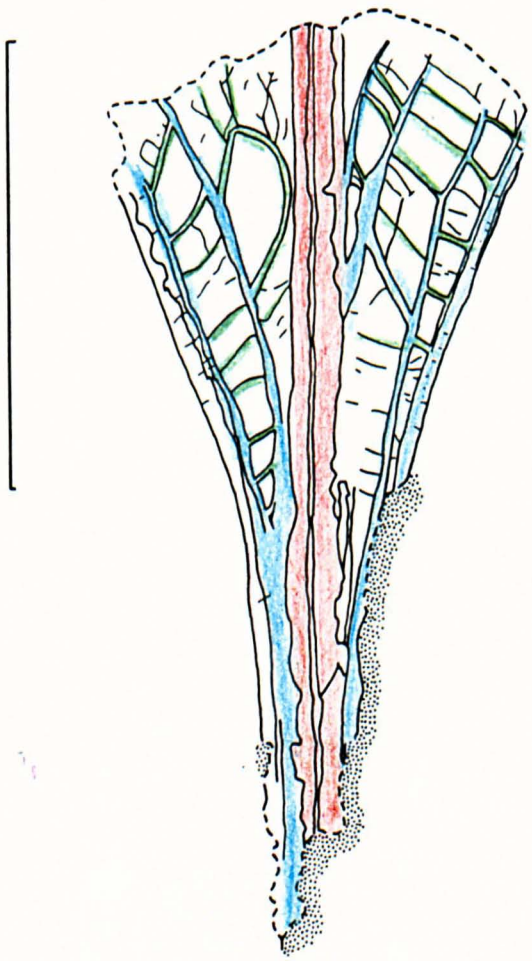
DJ147.60a
Scale bar 10mm



DJ147.60b
Scale bar 10mm



DJ451.7a
Scale bar 10mm



DJ452.2a
Scale bar 10mm