ACCOMPANYING MATERIAL 2 PILOT MICROSCOPY STUDY

Report on preliminary analysis of lithic residues from Star Carr and Flixton Island, Sept 29-Oct 9, 2014

Goals

- Determine if any residues can be quickly located on tool surfaces on lithic tools from Star Carr and Flixton from the 2013 excavation season, within a 2 week period (Sept 29-Oct 9, 2014).
- Analyse 36 tools from Star Carr and 12 tools from Flixton Island.
- From the investigation, discuss preliminary results and patterns
- See if any differences in residue preservation can be tentatively suggested between lithics from the weakly acidic clay-rich dryland (context 308) and highly acidic peat wetland (contexts 310 and 312) areas of the site. Also examine 12 tools from various trenches and contexts from Flixton Island (VP13).

Notes

- About 57 hours of microscopic analysis was conducted. This does not include cleaning or sample preparation time. Lithics were cleaned with a jet bath and gentle rub with a gloved hand and allowed to dry on a tray lined with cling film.
- A total of 48 Mesolithic tools were analysed (36 from Star Carr, 12 from Flixton).
- Jet bath was not saved for analysis or comparison. No associated soil samples have been mounted on slides for comparison.
- A new glove was used for each artefact handled and at no time were artefacts touched with bare hands.
- Lithics were examined using macro- bare eyes, a low power stereoscope (7x to 45x), and a high power reflected light microscope (80x to 1600x).
- Micrographs were taken of residues that were potentially interesting. However, it was not possible to produce good quality Z stacked composite images because the software needed was not available.
- Thin long lines that appear as metal coloured ‘pencil lines’ are considered trowel marks and should be disregarded in the analysis
- One approach going forward that may be useful is to only record residues that are embedded in polish, as this is a secure micro context that is present due to the use of the tool.

- Lithic numbers marked with an asterisk * denote tools that contain residues with a fair degree of certainty.

Sampled sites, trenches, and contexts

- n=12 from SC13 TR 34 Context 308 description: Layer of grey and orange mottled till.
- n=12 from SC13 TR 34 Context 310 description: Layer of wood peat. During cleaning of tools from this context, it was noticed that the sediment contains some sand mixed in the sediment.
- n=12 from SC13 TR 34 Context 312 description: Layer of reed peat with roundwood.
- n=12 from VP13, from the following areas at the site:
- n= 4 VP13 TR F6 (1001) Humified peat, superseded by 1002 A/ 1002 B
- n= 1 VP13 TR 7 (1000) Topsoil
- n= 1 VP13 TR 7 (1059) Natural till
- n= 1 VP13 TR 7 (1129) Peat in the gully
- n= 1 VP13 TR 9 (1000) Topsoil
- n= 4 VP13 TR 9 (1059) Natural till

Examination procedure

- A holistic approach to analysis using multiple levels of magnification was taken. All surfaces of each tool were examined with bare eyes (macro), then with the stereoscope (low-power). This allowed any prominent areas with high potential for residues to be identified before high-power microscopy was undertaken. Each artefact was then examined with the Leica metallographic microscope (high-power). Initial scanning of each lithic was done with the 10x objective (160x magnification), and higher powers were used when an item required further scrutiny. The areas that were targeted for examination here are all edges around the perimeter of the tool, both dorsal and ventral. Then the interior of the tool was scanned; dorsal or other high ridges were always investigated, as were bulbar surfaces, and random spots in the interior of the dorsal and ventral surfaces. This last check was done to gauge whether any of the residues or micro-wear found on the edges were also present in other locations.

Identification notes

- Hyphae are usually 2-10um across (a human hair is about 80-100um).

- Sediment has a cracked, caked on appearance and forms splits like dried out clay. Sediment adheres strongly to any cortex on the tool due to rough irregular surfaces.
- Often polish is well-developed enough to be visible without any visual aid whatsoever.

Patterns and recurring residues

- **Residue 1.** Very bright white residue usually spotted material that turns black when viewed with the polariser and analyser. It is highly reflective and sometimes appears metallic or rainbow-like. This bright white residue is often associated with what appear to be plant exudates, and other vegetative fragments. This residue has fine lines in the same direction which were initially thought to be striations showing directionality. However, the consistent spacing of these fine lines seen on many specimens suggest that they are present due to structure, highly suggestive of a plant material. The residue is sometimes found in association with or even within polish at the working edges of tools. Looks similar to micrograph of *P. australis* leaf (Crous et al. 2011) and also images of Phragmites leaf in the reference collection. May need closer inspection as to the spacing of the lines and sizes to see if Residue 1 can be split into 2 categories of wood and phragmites leaf.
- **Residue 2.** Amber plant exudates. This residue is shiny and amorphous in surface texture. Comparable with Monnier (2012, 3291): Resin often occurs as a clear and very shiny substance which darkens the underlying stone surfaces.
- **Residue 3.** Bone/antler. Often comparable with bone residue on flint in reference collection: greasy appearance, well-adhering. White residue deposits are not 100% crystalline, but rather contain light brown/beige tissue (secondary residues). SEM by Jahren et al. 1997 says bone lacks distinct morphology, rather has a amorphous greasy appearance. Monnier et al. greasy bone plaques comparable (2012, 3289).

Rare residues (found on only 1 tool, low frequency of occurrence)

- **Residue 4.** Non-starch. Requires further investigation.
- **Residue 5.** Crystalline formations. Calcium oxalate crystals from hazelnuts (Decke 1982)?

General Comments

- Often debris is seen on working edges cannot be differentiated from sediment

- Perhaps a good approach to securely identify residues from working is to exclusively examine those residue items which are trapped within the polish matrix, as polish is a secure micro context that definitively originates from tool use (see example: tool 99276 (312)).
- From this initial analysis, my impression is that formed tools such as axes, burins, awls, and microblades are more likely to harbour residues than simple flakes. It makes sense that tools that were made with some time investment and care are have a higher potential to have been used repeatedly and be curated by people. This will be important to consider during sample selection.
- Tool edge corners and high ridges tend to display polish
- A study by Hather of macrobotanical remains within monoliths from Star Carr found that charred juvenile tissue fragments of leaf and culm of common reed *Phragmites australis* (aka *Phragmites communis*) made up the majority of non-wood remains (1998, 185, 195).

Number	**Orange-red deposits**	**White crystals, possible bone/antler**	**Colourless crystals (gypsum)**	**Other notes**
Context 308 n=12				
93351	no	no	no	
93368	yes	yes	no	
93380	no	no	no	
93463	yes	no	no	
93770	yes	yes	no	
94405	no	yes	no	
94409	no	no	no	
94554	yes	no	no	
94859	yes	yes	no	
~~94860~~	no	no	no	natural
94882	yes	yes	no	
95431	no	yes	no	
	6	**6**	**0**	
Context 310 n=12				
93360	yes	yes	no	
94067	no	yes	no	

94083	yes	no	no	
94255	no	no	no	
94362	yes	yes	lath gypsum	
94878	yes	no	gypsum lath	
95243	yes	yes	no	
95828	yes	yes	no	
97308	no	no	no	
97331	no	yes	white crystal rosettes- gypsum	
98305	no	no	gypsum lath and rosettes	
98817	yes	yes	no	
	7	**7**	**4**	
Context 312 n=12				
93199	yes	no	no	
93807	no	no	lath	
93823	no	no	no	
98375	no	no	no	
98376	yes	no	rosettes	
98901	no	no	large deposit of gypsum rosette, lath, rhombus	
98902	yes	no	no	
98942	no	no	no	
98957	no	no	no	
99276	yes	yes	lots of microcrystals gypsum twinned swallowtail, lath, needle, and sheet	non-fish scale and other strange circular deposits present. yellow 'fan-shaped' deposits are possibly goethite and/or lepidocrocite (Lindbo et al. 2010:130), which are both iron oxyhydroxides
99568	yes	no	no	
99569	no	yes	gypsum lath and rhombus	

	5	**2**	**5**	
Total	**18**	**15**		

Individual results by tool

Star Carr (n= 36)

SC13 TR34 Context 308 (dryland) n=12

SC13 TR34 93770 U30 (blade with edge damage, red)

- Macro:
  - Tool appears relatively clean.
- Stereoscope:
  - Red/brown film restricted to left ventral edge, near proximal end. Film also visible (but not as prominent) carrying over to the dorsal side. Likely iron oxide.
- Reflected light:
  - Some polish development on working edges of tool. Minimal polish also seen on raised dorsal edges.
  - White crystalline flakes visible on left dorsal edge, distribution is very close to edge and does not extend very far onto tool surface (viewed on edge, photos taken). Appears similar to bone/antler. Cannot find crystalline flakes on right dorsal edge (viewed on edge). (photos taken)

SC13 TR34 94554 G29 (blade fragment)

- Macro:
  - Some small bits of clay sediment still adhering to surface.
  - Microchipping on right and left ventral edges.
- Stereoscope:
  - No hafting residues
- Reflected light:
  - What appears as irregular spots of hafting residue found on snapped edge on ventral side (photos taken).
  - Micro edge removal scars present.
  - Minor polish on proximal ventral edge.

    - Black item on proximal ventral edge (hafting tar?, photo taken).
    - Microstriations present on dorsal snapped edge (photo taken).
    - Loc1-4 red resin? This has been reinterpreted as most likely iron oxide.
    - Loc5 thin resinous residue associated with polish
    - Loc6 line of translucent residue along right ventral mid edge
    - Loc7 resinous residue covered in sediment with amber bit peeking out within the residue
- Other notes:
    - For residue. GC-MS performed by S. Croft

SC13 TR34 93380 C26 (cortical flake)

- Macro:
    - Some clay and vegetative material stuck to the surface.
- Stereoscope:
    - Poor quality flint.
- Reflected light:
    - No polish, does not appear to be utilised. No apparent retouch.
    - No micrographs taken

*SC13 TR34 95431 H23 (meche de foret, grey speckled)

- Macro:
    - No residues visible in macro
    - Large amount of polish on this tool, this is a well-used tool
    - On ventral surface, large polish spots visible in the mid section and at the tip
- Stereoscope:
    - No residues immediately visible with stereomicroscope
- Reflected light:
    - Well-developed polish showing interlinking on both raised edges and flat surfaces, present on both proximal and distal ends, evident at 160x. Polish on distal end could be a hafting polish? (Rots 2010, 56).
    - Polish clearly developed over the entire left ventral edge, from proximal to distal.
    - ‘Line’ visible on ventral side, near middle. Bright spots and possible hafting residue appear to be in association in a line. Amber residue overlies polish and bright spots.
    - Intense polish that is so well developed, appears as ice or glass. Located on right distal edge (photo taken)
    - Possible hafting residue on dorsal proximal end: amber red with shiny areas. Appears similar to softwood tree resin in reference collection.

Confidence level on this ID is low, since other residues found on the dorsal distal pointed end appear similar, away from where the tool would have been hafted.
    - Residue 2. Large area of polish with raised tan coloured lumps residue embedded and distributed in small lumps throughout. Located on ventral distal surface, edges and middle surface. (photos taken). Striations within the polish are in an edge to edge orientation, perpendicular to the length of the tool. Same residue with associated polish on middle ventral surface (photos taken). Same residue with associated polish ventral left lower mid edge. Same residue on the other side of the tool, dorsal middle surface, proximal (photo taken). One of these residues contains white crystal material and bright white/black specks that turn black when viewed with polariser/analyser (good photo taken).
    - Residue 1. Bright white speckles that turn black when polariser/analyser are used, fine striations (photo taken). Polish associated. Located middle of ventral surface, near 'hump' in material surface.
    - Rainbow effect noted
    - Polish on bulbar surface and proximal ventral edge
    - Yellow spherical bag object, left ventral proximal edge (photo taken). Associated with polish.
    - Black piece embedded in polish, left ventral proximal edge (photo taken)
    - Line (residue?) with associated polish, left ventral distal edge, near tip (photo taken). Not fungal hypha. Perhaps a seam in the stone material?
    - White raised residues (?) on dorsal middle surface (photo taken). Probably part of natural stone surface.

SC13 TR34 94409 F31 (shatter fragment, large flint angular piece)

- Macro:
    - Clayey vegetative sediment present.
- Stereoscope:
    - No use-wear or residues visible.
- Reflected light:
    - No use-wear or residues visible.

SC13 TR34 93463 F31 (blade, distal end snapped off, flint)

- Macro:
    - Clayey vegetative sediment present.
- Stereoscope:
    - Microchipping/microscarring present on right and left edges dorsal.
- Reflected light:

    - Residue associated with polish left dorsal edge.
    - Polish on left dorsal edge.
    - Amber residue associated with white residue on left dorsal edge. (photo taken)
    - Black patch embedded in dorsal left edge. (photo taken)
    - Rainbow polish ventral left edge proximal. (photo taken)
    - Plant tissues with cellular structure evident, amber coloured
    - Thin yellow/amber film restricted to right ventral edge.

SC13 TR34 93368 B26 (blade)

- Macro:
    - Sediment patches present.
- Stereoscope:
    - No use-wear or residues visible. Doesn't appear to be a used tool at low magnifications, edges appear 'freshly' knapped.
- Reflected light:
    - White crystalline flakes on right ventral edge. (photo taken)
    - Rainbow effect noted.
    - Polish and residues together on bulbar surface? (photo taken)
    - No polish seen on what would be the working edge.

SC13 TR34 93351 C26 (blade with edge damage, microdenticulation, cortex inclusions)

- Macro
    - Sediment present.
- Stereoscope:
    - Edges appear unused.
- Reflected light:
    - Edges do not appear to be used.
    - No residues seen.

SC13 TR34 94860 A25 (natural)

- Macro:
    - Sediment present.
    - Looks like a waste product.
- Stereoscope:
    - No use-wear or residues.
- Reflected light:
    - Edges unused.
    - Vegetative material with cellular structure present in the middle of the piece ventral.

SC13 TR34 94405 F31 (bladelet fragment with edge damage)

- Macro:
    - Clayey vegetative sediment present.
- Stereoscope:
    - Use-wear and residues not visible
- Reflected light:
    - White residue right ventral edge? (photo taken). Appears similar to bone residue on flint in reference collection: greasy appearance, well-adhering. White residue deposits are not 100% crystalline, but rather contain light brown/beige tissue (secondary residues). SEM by Jahren et al. 1997 says bone lacks distinct morphology, rather has a amorphous greasy appearance.
    - Vegetative tissue with cells visible, believe to be a contaminant from the burial environment, right ventral edge.
    - Use-wear not evident.

SC13 TR34 94859 A25 (flake with possible edge damage)

- Macro:
    - Some sediment present
    - Microchipping evident
- Stereoscope:
    - Polish seen on dorsal ridges
- Reflected light:
    - Polish and microscarring (from microflake removals) along the entire right ventral edge. There is a clear line that delimits the extent of working and are seen on the right ventral edge. (photo taken) The ventral side of this edge does not show polish or the line, but microchipping is visible (left ventral edge).
    - Microscar removals on right ventral distal edge (photo taken)
    - Possible bone residue on right ventral proximal edge (photo taken)
    - Polish on dorsal ridges confirmed
    - No polish present on the length of the right ventral edge

SC13 TR34 94882 B25 (flake, flint)

- Macro:
    - Small amount of sediment adhering to surface.
- Stereoscope:
    - Flaky white material along ventral distal edge
- Reflected light:

    - few spots of weak polish on ventral distal mid edge
    - Flaky white material loosely adhering along ventral distal edge (photo taken)
    - Weak polish on distal dorsal edge, white flakes also visible

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SC13 TR34 Context 310 (wetland) n=12

SC13 TR34 97308 T13 (blade fragment with edge damage, proximal tip broken off, blue grey and white flint)

- Macro:
    - Sediment preferentially stuck to white portions
- Stereoscope:
    - No polish or residues visible
- Reflected light:
    - Weak polish development on left ventral mid edge
    - Weak polish development on distal broken straight edge
    - Weak polish development on right ventral distal edge
    - No images taken

SC13 TR34 97331 X9 (fragment with edge damage, large grey blue poor quality flint with cortex)

- Macro:
    - No visible polish or residues
- Stereoscope:
    - Stone material has rectangular pieces within the flint
- Reflected light:
    - Perhaps very weak polish on left ventral proximal edge
    - Rainbow effect noted in several spots on the tool surface
    - White crystal mineral ‘roses’ (photo taken)
    - Mineral crystals within rectangular depression within stone material (photo taken). Looks similar to fresh bone/antler, however the mineral crystals are very clear and colourless.
    - Photo of cortex taken for reference. Could be mistaken for bone/antler.
    - Weak polish on dorsal right mid edge
    - Yellow spot on dorsal right mid edge- part of material or a residue? (photo taken)

SC13 TR34 94083 A25 (blade with possible edge damage, grey flint)

- Macro:
    - Perhaps weak polish on dorsal ridges
- Stereoscope:
    - Microchipping on right ventral distal edge
- Reflected light:
    - Weak polish on dorsal left mid edge
    - Rainbow effect noted in several places
    - Microchipping, striations, polish on left ventral mid edge
    - Polish and microchipping on distal ventral tip
    - Spore found on distal ventral tip (photo taken)
    - Likely iron oxide deposits

SC13 TR34 95828 X13 (Burin on a break, grey flint)

- Macro:
    - Polish on dorsal ridges (confirmed with LM)
- Stereoscope:
    - Polish on distal ventral snapped edge
    - Microchipping ventral right distal edge
- Reflected light:
    - Polish on right ventral distal edge
    - Brown fungal hyphae with septa hanging off right ventral distal edge
    - Circular white pattern in flint stone surface, located right ventral distal edge. Foraminifera test.
    - Polish bright spots found distributed over entire ventral surface
    - Weak polish on right dorsal distal edge
    - Q amber coloured hafting residue? dorsal right proximal edge. The residue contains super shiny white material throughout (photos taken). Residue contains plant material? Plant exudate? The very shiny white parts of the residue appear black when examined with polariser and analyser (photo taken). The residue is clearly something other than sediment. This deposit contains what appears to be white mineral flecks.
    - Very weak polish on left distal edge
- Other notes
    - Residue. GC-MS performed by S. Croft

SC13 TR34 98305 V10 (flake, retouched, large blue grey flint with cortex)

- Macro:
    - Appears to have one potential cutting edge
    - Polish on dorsal mid ridge
- Stereoscope:

    - Good deal of microchipping on right dorsal edge
- Reflected light:
    - Weak polish along left ventral edge
    - Relatively well-developed polish on ventral distal tip
    - Polish seen on ventral distal tip, cortex edge (photo taken)
    - Rectangular crystals with iridescent rainbow effect, left ventral mid edge (photo taken). I originally thought these rectangular pieces were minerals from the cortex, but on this tool they are located well away from cortex. Also, the shape of the rectangular pieces is not seen in cortex or flint edges, which contain crystals that are more irregular in shape. Could be degraded plant material?
    - Rainbow effect noted in several locations
    - Bulbar surface and ventral surface show a few bright spots of polish

*SC13 TR34 98817 P14 (blade with edge damage, blue grey flint with white patches)

- Macro:
    - No polish visible with bare eyes
    - Vegetal remnants from the soil environment adhering to dorsal and ventral surfaces
- Stereoscope:
    - Polish on dorsal ridges
    - Polish on left ventral proximal edge
- Reflected light:
    - Polish streak on ventral tip (photo taken). Brown/amber amorphous residue is located within the depressed polish streak (photo taken). Same residue with associated polish found about 5mm away from the tip on the left ventral distal edge (photo taken). Same residue with associated polish just below projection on left ventral edge. Same residue with associated polish left ventral mid edge (photo taken)
    - Not as much polish on tip of tool as would be expected if this was the main point of contact between tool and material worked.
    - Well-developed polish showing interlinking on both pointed projections on the left edge, also along the rest of the left ventral distal edge
    - Polish spots on proximal ventral end edge
    - Polish along right ventral distal edge, including polish streaks on high points of microtopography
    - Crystalline pieces adhering right on edge of left ventral distal edge, believed to be the stone material
    - Very bright white/rainbow spots that turn black under polarised light with analyser, left ventral edge.

*SC13 TR34 94362 S12 (flake with possible edge damage, grey flint, about 3cm long, 1.5cm wide)

- Macro:
    - Vegetative material adhering to ventral surface
- Stereoscope:
    - No polish or residues visible
- Reflected light:
    - Weak polish streaks seen on left ventral edge
    - Very bright white vegetative residue with cell walls visible, turns black with polariser/analyser. Compares well with charcoal residues in the reference collection. Located on left ventral mid edge (loc2). There are what appear to be plant exudates directly associated with the vegetative residue. This same bright orange residue also seen nearby on edge, with weak polish and amber plant exudates(?) (loc 1) Possible hafting residue spots or droplets and plant fibre binding?
    - Polish visible on bulbar surface
    - Minor polish on right dorsal edge and raised surfaces
    - No polish seen on left edge, dorsal or ventral
    - On dorsal surface, bright black plant residue only found on edges, not present in the interior of the tool
- Other notes
    - SEM analysis at LacCore, University of Minnesota
    - FTIRM analysis at the Characterization Facility, University of Minnesota
    - Solvent extraction and GC-MS, BioArCh, University of York

SC13 TR34 94067 A26 (blade fragment, grey flint with cortex, proximal end snapped off)

- Macro:
    - Polish on dorsal ridges (LM shows that polish is well-developed)
- Stereoscope:
    - Vegetative tissue and sediment adhering
- Reflected light:
    - Faint polish on right ventral mid edge
    - Polish on ventral proximal straight edge
    - Polish left ventral proximal edge
    - Polish streak centre of ventral surface
    - Well-developed polish streaks and spots along proximal dorsal corner
    - Microchipping flake scars and polish dorsal right mid edge
    - Rectangular silica pieces right dorsal proximal edge (photo taken)

    - Polish and white crystals, dorsal proximal straight edge (photo taken)

SC13 TR34 94255 A26 (flake with edge damage, mottled blue grey flint)

- Macro:
    - Sediment and vegetative tissue adhering to ventral surface
- Stereoscope:
    - Minor microchipping, no polish visible
- Reflected light:
    - Perhaps minor polish on right ventral mid edge, but this is very weak. Weak polish on ventral distal tip. Weak polish left dorsal proximal edge.
    - No residues can be seen on ventral left and right edges.
    - Minor microchipping left dorsal mid edge

SC13 TR34 95243 V12 (blade with modern damage, grey flint)

- Macro:
    - Vegetative and sediment flecks on surface
- Stereoscope:
    - No polish
    - Microchipping?
- Reflected light:
    - Microchipping not confirmed, no flake scars seen
    - Essentially no polish on right ventral edge
    - Weak polish on distal tip ventral
    - Questionable bone residue on right proximal dorsal edge

*SC13 TR34 94878 A23 (burin on a truncation, with retouch on other end, grey blue flecked flint, with cortex)

- Macro:
    - Microchipping on right dorsal edge
    - Polish on dorsal ridges (confirmed with Leica)
    - Difficult to tell what is proximal/distal. Pointed end seems proximal due to location of ripples?
- Stereoscope:
    - Pointed end damaged from use
- Reflected light:
    - Polish on proximal ventral tip
    - Polish on ventral right edge
    - Microchipping at/near ventral tip and distal edge
    - Round white fossil(?) within flint material, near ventral tip
    - Very well developed polish patch on left ventral proximal edge

    - Q RES: Fine needle-like silica material with rainbow effect, left ventral distal edge (photo taken). No distinctive or consistent structure can be identified with these objects, so they are not raphides or calcium oxalate crystals. These items are located adjacent to an area of polish.
    - Bright white residue that turns black with polariser/analyser found on ventral distal surface, about 2mm in from the edge. Not in direct contact with an area of polish, but about 2mm away from polish found at the edge. Associated with possible plant exudate and other vegetative fragments. This residue was seen in a streak on the dorsal distal surface, about 4 mm from distal edge (photo taken).
    - Drawing of organic debris in crevice shows fine striations, is brown to black in colour, highly reflective in brightfield, turns black with polariser and analyser.
    - White crystals located on dorsal distal crevice. (photo taken, drawing)
    - Rainbow effect noted in several locations (photo taken). Rainbows seems to be associated with tiny pieces of the stone surface that are ‘lifting’, areas that are damaged from impact
    - Bright red piece on ventral distal edge (right side) (photos taken). Associated with polish on raised edge.
    - No polish or residues noted on interior middle ventral surface
    - Unusually, there are micro flake removal scars on dorsal ridges near what is presumably the working tip of the tool

SC13 TR34 93360 C22 (blade fragment, distal, grey blue flint with cortex inclusions, proximal end missing)

- Macro:
    - Hole in middle of tool
    - Polish on dorsal ridges
- Stereoscope:
    - Hole was formed as a natural point of weakness in the tool, no wear marks visible on either side of the hole.
- Reflected light:
    - Brown fungal hyphae noted
    - No micro striations or scratches found around hole to indicate its presence is due to cultural modification
    - Rainbow effect noted
    - Weak polish on right ventral mid edge
    - Crystal material found hanging on right ventral mid edge
    - Polish on left ventral distal edge. This polish is diffuse and extends into the interior surface, i.e. the polish not concentrated just at the edge. This may

be because the material worked was soft, so the tool edge penetrated farther into the worked material.
    - Minor microchipping left ventral distal edge, right dorsal proximal edge
    - Weak polish spot proximal dorsal snapped mid edge
    - Large area of well-developed polish with interlinking on dorsal surface, where the 2 ridges meet in a 'Y' shape.
    - Polish on all dorsal ridges pronounced
    - Minor polish on distal edge
    - Residue 1 with associated plant exudate and large area of well-developed dorsal surface polish, dorsal proximal centre ridge (photo taken).
    - Very small depressions with bright polish within; surface appears 'pock-marked'. The depressions are believed to be present in the raw stone material, but the polish may be due to granular material getting caught in the depressions and rubbing the surfaces smooth. Located on right dorsal distal edge (photo taken)

SC13 TR34 Context 312 (wetland) n=12

SC13 TR34 98942 V12 (blade with use damage and denticulation, white flint)

- Macro:
    - Traces of vegetation and sediment
- Stereoscope:
    - Retouch, left dorsal proximal
- Reflected light:
    - Light polish on ventral right mid edge

SC13 TR34 98375 U9 (flake with edge damage, brown/olive flint)

- Macro:
    - No residues or sediment visible
- Stereoscope:
    - microscarring
- Reflected light:
    - Microscarring visible on both sides of acute edge
    - Rainbow effect noted in several spots on the ventral surface, and distal right edge (photo taken)
    - Polish ventral right mid edge
    - Line delimiting extent of worked edge, right ventral mid edge (photo taken)
    - Polish proximal bulbar ventral surface possible hafting residue associated (photo taken)

SC13 TR34 99569 T9 (blade with edge damage, cortex)

- Macro:
  - Relatively sediment-free
  - Possible polish on dorsal ridges
- Stereoscope:
  - Microchipping
- Reflected light:
  - Microscarring but no polish on left dorsal edge
  - Possible bone left dorsal distal edge, appears to be loosely adhering. Contaminant? (photo taken)
  - White flakes associated with micro flake scars, flakes adhering to left dorsal distal edge (photo taken)
  - Microchipping left dorsal edge
  - Polish on dorsal ridges confirmed
  - Heavy polish spots dorsal proximal end
  - Rectangular siliceous pieces. Do not appear to be phytoliths, mineral formations? Ventral left mid edge. (photo taken)
  - Polish on bulbar surface, ventral
  - Rainbow effect noted

SC13 TR34 98901 W7 (flake, cortical, olive grey flint)

- Macro:
  - Microchipping
  - Little sediment
- Stereoscope:
  - Microchipping
- Reflected light:
  - Small amount of microscarring ventral distal end
  - Rectangular crystal pieces seen, likely mineral content from nearby cortex. Some formations look like a calcium oxalate druses?. Very high frequency of these items found along ventral edge (photos taken). These have been reinterpreted as likely gypsum in rosette, lath and rhombus crystal shapes.
  - Rainbow effect noted

SC13 TR34 93823 A18 (blade with edge damage, grey flint)

- Macro:
  - No residues or use-wear visible
- Stereoscope:
  - Vegetative tissue adhering

    - Edge rounding right dorsal distal edge
- Reflected light:
    - Weak polish on ventral left edge
    - Microscarring dorsal left mid edge
    - Rectangular dark brown vegetative pieces, dorsal mid surface (photo taken). Probably from burial environment.

SC13 TR34 99568 T9 (microlith, flint)

- Macro:
    - Appears clean
- Stereoscope:
    - Matter embedded in tiny flaws/depressions in flint surface
- Reflected light:
    - Polish and microscarring right dorsal edge (photo taken)
    - Example of dried/cracked sediment dorsal right proximal edge (photo taken)
    - Rainbow effect noted
    - Light polish ventral distal end

SC13 TR34 98902 W7 (flake, used. The piece is ‘W’ shaped and poor quality flint, doesn’t look like a tool but a waste product)

- Macro:
    - Small amount of sediment
- Stereoscope:
    - No residues or usewear seen
- Reflected light:
    - Light polish visible on right ventral mid edge
    - Light polish on left dorsal mid edge
    - Light polish on dorsal ridges
    - Brightspot right ventral distal edge (photo taken)
    - Fungal hyphae right ventral distal edge (photo taken). A hypha also seen on ventral left inner ‘wing’ edge of the ‘W’. Hyphae seen in other locations as well.
    - Black spots within depression located about 2mm inwards from the ventral right mid edge (photo taken). Surface texture of black spots are reticulated. Possible residue? Not able to image surface texture with single shots. After comparison with sediment, likely that the black spots are just dirt.

* SC13 TR34 93199 A17 (flake fragment with retouch, grey flint)

- Macro:
    - Microchipping from working present
- Stereoscope:
    - Perhaps striations?
- Reflected light:
    - Crystals, left dorsal mid edge (photo taken)
    - Fungal hyphae noted on left dorsal mid edge
    - Rainbow effect noted
    - Weak polish on ventral right mid edge (photo taken)
    - Weak polish on ventral left distal edge
    - Microchipping ventral right proximal edge, ventral left distal edge
    - Possible residue surrounded by polish ventral left mid edge (photo taken)

SC13 TR34 98957 X6 (wedge, grey flint)

- Macro:
    - Relatively clean except for cortex
- Stereoscope:
    - Microchipping
    - Striations?
- Reflected light:
    - Polish on dorsal surface

**SC13 TR34 99276 (312) R8/R9 (bladelet with damage on end, grey flint with cortex)

- Macro:
    - Microchipping on ventral left proximal edge
    - Very clean
- Stereoscope:
    - Polish on ventral left proximal edge
- Reflected light:
    - Loc1 circular ringed objects about 17um in diameter
    - Very strong polish development dorsal right proximal edge. Perhaps additive polish that was deposited, has objects embedded in polish. (photos taken) Perhaps the ‘polish’ is actually a fatty deposit, similar to the fatty fish residue in reference images.
    - At least 10 circle depressions within the polish were seen (photos taken), but their edges appear more regular unlike the irregular edges of the circular depressions seen in the fish residue reference images. On some of these circles, defined ringed edges were able to be seen (photo taken). Smooth and also rugged surface textures of circles noted.

- White circular objects with associated shiny light brown residue on edge, dorsal right distal edge (SC13_99276_50x_QcircleRes.tif;)
- Lots of ovate grains clustered in several aggregates, but also occur singly. Located on dorsal right proximal edge. These residues are embedded within polish. Clear structural units seen which consist of ovate units with round dots in the middle arranged in aggregations of various shapes. Aggregation shapes include linear, irregular linear, ovate-globular. There are also single ovate units. Ovate units are not all the same size. Ovate units have a ‘dotted’ or a ‘dashed line’ around their edges. Plant material? (photos taken). Rainbow effect on ovate grains seen. No rotating extinction cross when analyser is rotated in polarised light. Starch is unlikely given the unusual ‘dotted’ appearance of the edges and failure of the extinction crosses to rotate. Also, no lamellae or were visible.
- Ovate grains sometimes in direct association with another amorphous residue attached to the grains. NOT seen in association with fungal hyphae.
- Ovate grains possible to be the spherical spores of fungal conidia, which form individually or in chains, and dozens of species are <5um, and even more are <10um (Haslam 2006, 116). Conidia *may* display a rotating extinction cross (2006, 114). The dotted or dashed lines around the grains could be indicative of fungal spore surface ornamentation.
- Some phytoplankton and zooplankton with crystalline calcareous protective shells exhibit a maltese cross. Coccoliths are the calcium-rich plates or structures that form the protective test (shell) around unicellular planktonic algae called coccolithophores (Loy 2006:124)
- 2 hyphae, but no septa (cross walls) or clamp connections identified (photo taken)
- Rainbow effect noted on surface of dorsal proximal
- Over 100 quadrilateral siliceous pieces seen embedded in polish on dorsal right proximal edge (photo taken). Same quadrilaterals seen embedded in polish on other side- left ventral proximal (photos taken). Also found in edge left ventral distal.
- No quadrilateral or diamond siliceous pieces seen in cortex edge, right ventral distal edge.
- Possible bone right on the edge of the dorsal right proximal edge (photo taken). Not embedded in polish.
- Microchipping on left ventral proximal edge in association with quadrilaterals.

- Diamond silica(?) crystal pieces in polish located 2mm in from the ventral left mid edge, buried in crack. (photo taken). Possible: crystals originating from hazelnuts (Decke 1982, 189)?
- Unknown squiggly disjointed linear structure located 2mm in from the ventral left mid edge, buried in crack. (photo taken). This is a contaminant because it is lying above the stone surface and is not in the same micro context as the polish and other residues.
- Circular white pattern in flint stone surface, located middle of tool ventral side. (photo taken). Foraminiferan test.
- Ruffled edge residue? Crystal formations? Clear and colourless, embedded in polish. 3 concentric lines or circuli with perpendicular lines (radii) emanating from centre, ruffled edge, roughly oval shaped. Located left ventral distal edge. (photos taken). Possible otolith from a juvenile fish? (the eel and spiny eel orders have small to very small otoliths). Not an eel scale, as the structure of the eel scale is rather distinctive, having an overall elongate-oval shape, and showing circuli made up of rows of medallion shaped plates (Tesch 2003, 13). Fish scales, an operculum, and fin rays from have been found within food crusts on 25 Ertebølle pottery sherds from the Late Mesolithic site of Tybrind Vig, Denmark, (Prangsgaard 2013, 290). The species identified on one of these sherds was small cod (*Gadus morrhua*). Appears to be a cycloid fish scale (salmon and carp).
- Group of 5 ruffled edge residues. Located in a groove on left ventral distal edge. (photos taken). In 2 of these ruffled residues, the concentric lines are less visible.
- Group of 6 ruffled edge residues seen on left ventral distal edge. (photo taken)
- Ruffled edge residue could be a faecal spherulite (Canti 1998; 1999)?
- Huw Barton- it looks like a crystal formation. Oct 29, 2014.
- Andrew Jones- not a fish scale because some crystal formations do not show circuli. November 3, 2014.
- Scales Examined from comparative collection:
    - Brown Trout (*Salmo trutta*) No radii or ruffled edge. Focus smooth to slightly corrugated, with irregular edges.
    - Tench (*Tinca tinca*) Scale is elongate rectangular no ruffled edge
    - Common Rudd (*Scardinius erythrophthalmus*) large ruffled edges present, radi present, correct overall shapes
    - Pike (*Esox lucius*) ruffled edge present, scales examined had large foci, not like the one seen on the microblade. All of the scales, large and small contain pigment to one side of the foci

- Common Carp (*Cyprinus carpio*) Has ruffled edges, overall irregular ovate shape correct, one edge or side of each scale is pigmented (just less than half of the scale) to one side of the focus.
- Crucian Carp (*Carassius carassius*) Has ruffled edge, but this is concentrated on one side of the scale only. Overall correct irregular ovate shapes, reticulated look around the focus, the specimen from the microblade also looks to have this feature. One edge or side of each scale is pigmented (just less than half of the scale) to one side of the focus
- Common Roach (*Rutilus rutilus*) Big ruffles on edges. Smaller scales from this species does not exhibit much pigmentation, but larger scales do show pigmentation to the side of the focus which is less frilly. Foci do not appear reticulated, but rather as a raised 'spider' with radi legs emanating. Correct overall shape (roughly circular to ovate)
- Grayling (*Thymallus thymallus*) ruffled edges, correct overall shape (irregular ovate), pigmentation of scales on less ruffled side of the foci. Foci do not appear reticulated, but some exhibit a slightly corrugated appearance. Focus is usually smooth and irregular ovate in shape.
- European chub (*Leuciscus cephalus*) All scales show distinct pigmentation on one edge. Banding of the circuli does not occur evenly around the focus, but is rather bunched more closely together to the side of the focus without pigmentation. Focus is small and has an irregular corrugated appearance.
- Gudgeon (*Gobio gobio*) Banding of the circuli does not occur evenly around the focus, but is rather bunched more closely together to the side of the focus without pigmentation. Ruffled edges present. Foci diffuse and difficult to discern the borders. Foci corrugated. Overall shape is irregular circular to ovate.
- Barbel (*Barbus barbus*) Only large scales available for this species for reference. Focus is raised and 'spider like' in appearance, with radi arms extending in all directions. Corrugated appearance surrounding focus. Very dark pigmentation covering about 20% of the surface of each scale. Edges only broadly frilly. Overall ovate shape similar to specimen from microblade.
- *Common or European whitefish (*Coregonus lavaretus*) Focus can appear reticulated or patchy and smooth, and shows irregular to frilly edges. Larger scales contain 'pigment explosions' which look

like mold on a petri dish growing in all directions. Edges are ruffled and overall shape of the scales is irregular ovate.

- **Comments**
    - Many of the modern reference scales examined show very deep radii (some of these may be exaggerated due to damage. Flattening of naturally convex scales may have occurred during slide mounting).
    - It seems that the focus can appear quite different between scales from the same individual. Focus can be smooth and well-defined in one scale, and appear reticulated and without clear edges in another.

- Other notes
    - Residue. GC-MS performed by S. Croft

SC13 TR34 98376 V12 (wedge)

- Macro:
    - Large piece, blue grey stone material
    - Large flake scars on working edge
- Stereoscope:
    - Quadrilateral siliceous pieces seen on striking platform?
- Reflected light:
    - Rainbow effect noted in several places (photo taken)
    - Cracked dried sediment, ventral distal edge (photo taken)
    - No polish seen on presumed working edge, ventral distal edge
    - Modern contaminant noted- blue fibre (photo taken) right ventral edge, sitting on top of stone surface
    - Long crystal bundles, perhaps raphides or crystal sand? Found on striking platform (*Sambucus* sp. contain raphides) (photo taken). If they were siliceous sponge spicules fossilised in the flint, they would be embedded in the stone surface, which these are not.

SC13 TR34 93807 A18 (blade with edge damage, grey and white flint)

- Macro:
    - No obvious polish or residues
    - very clean
- Stereoscope:
    - No polish visible on dorsal edges
- Reflected light:
    - Rainbow effect noted in several places

- Few quadrilaterals found on dorsal surface, 3mm in from left dorsal mid edge. (photo taken)
- Weak polish developed on right ventral edge
- Brown hyphae noted on right ventral distal edge

Flixton Island (n= 12)

Flixton Island VP13 from various trenches and contexts n=12

VP13 TR F6 (1001)Base 104111 I-6 (grey flint bladelet segment)

- Macro:
  - Left dorsal edge appears to have flakey residue adhering
- Stereoscope:
  - Microchipping right dorsal edge
- Reflected light:
  - Q bone/antler residue along whole of left dorsal edge (photo taken)
  - Polish on ventral right proximal edge.
  - Q residue. Appears to be embedded in polish. Right ventral proximal edge (photo taken)

* VP13 TR F6 (1001)Base 103885 H-4 (brown flint combination of dihedral burin and scraper end)

- Macro:
  - Polish streaks on dorsal surface and one on right dorsal distal edge
  - Polish on dorsal ridges
- Stereoscope:
  - Polish and microchipping on dorsal proximal edge
  - Lots of sediment in crevices and flake scars along dorsal proximal edge
- Reflected light:
  - Well-developed polish with interlinking on right side of ventral proximal edge (photo taken). This polish is not consistent on the whole curved edge as expected, but rather is broken into sections.
  - Polish streak extending from edge of ventral proximal in towards the tool.
  - Polish on right ventral edge near where the curved distal edge meets the ‘straight’ edge.
  - Polish on right ventral ‘straight’ edge, microchipping
  - Q bone ventral left ‘straight’ edge (photo taken)
  - Polish on left ventral ‘straight’ edge, microchipping
  - Rainbow effect noted in several places
  - Q bone on proximal pointed tip associated with polish (photo taken)

    - Polish on dorsal left and right distal curved edge
    - Strange collection of bright residues containing black/green/brown/rainbow matter. This is different from polish, which is shiny, but always the same colour as the stone surface (photos taken). Very bright areas of residue showing distinctive evenly-spaced fine structure. Originally, I thought these might be use-wear striations showing directionality. However, the 'striations' always appear perfectly in line with each other and never overlap. If they were use-wear striations, one would expect some of the lines to be more irregularly spaced, and the lines would cross and overlap. Associated with possible plant exudates. Distal dorsal curved edge. These are not found in the centre of the tool or away from the distal curved edge.
    - Black bright residues concentrated on distal dorsal curved edge (near dorsal ridge). Clear distribution along curved edge. This residue was also found (the black speckled variety) along flat edge of right ventral, at the midpoint.
    - Q hafting residues (photo taken)
    - Polish on proximal tip

VP13 TR F6 (1001)Base 103886 H-3 (grey blue flint scraper / attempted truncation burin, with cortex)

- Macro:
    - Microchipping
- Stereoscope:
    - Polish on edges of microchipping scars on ventral side
- Reflected light:
    - Well-defined polish on left ventral mid edge, shows interlinking
    - Rainbow effect in several locations (photo taken)
    - Dark residue embedded in polish, left ventral mid edge (photo taken)
    - Polish on edges of microchipping bulbar scar on ventral side (photo taken)
    - Polish on ventral distal tip
    - White residue underneath/embedded in polish, ventral distal and mid right edge. Also seen on dorsal proximal edge near striking platform (photos taken). This white residue also occurs as spots near working edge (photo taken of white spots on dorsal left proximal edge), but are not seen in centre of tool.
    - Flake scars are steep on dorsal left proximal edge, tool probably used with a good deal of force.

* VP13 TR F6 (1001)Base 103875, grid square unknown (grey/brown flint blade segment with snapped distal tip)

- Macro:
    - Microchipping on right and left ventral edge
- Stereoscope:
    - Long dark hair-like inclusion within stone material
    - Polish around bulbar scar edges
- Reflected light:
    - White material underneath/embedded in polish, ventral right distal snapped tip and ventral right proximal edge (photos taken). I've deciphered that this white material is simply be part of the raw stone material.
    - Polish on both ventral edges, polish on both dorsal edges as well
    - Polish streak near ventral right mid edge
    - Polish on ventral proximal end near striking platform/bulb
    - Polish along whole central dorsal ridge
    - Clear crystals seen ventral right mid edge, but these could be from breakage of the stone material itself.
    - Q: Softwood tracheid fragment ventral right mid edge (photos taken). Bordered pits appear as 'donut' shapes with holes in middle (cannot see maltese crosses in polarised light). The item is located next to an area of intense polish.
    - Rainbow effect noted in several places
    - Clear crystal flakes at left dorsal mid edge
    - Brown residue embedded in polish, left dorsal mid edge (photo taken)
    - Brown hypha with septa (cross walls), dorsal left proximal edge (photo taken)
    - Q: Tracheid with bordered pits, dorsal central mid edge (photo taken). Associated with an area of well-developed polish.

* VP13 TR 7 (1000) 104850 A9 (red/white/brown flint attempted tranchet aze / adze)
- Macro:
    - Large polish area on right proximal ventral end
    - Smaller polish spot on left proximal ventral end
    - Polish area on dorsal right proximal end corner, and there is a nearby polish spot
    - Polish on high point dorsal left proximal
    - There remains a good deal of sediment on the axe even after jet bath cleaning
- Stereoscope:
    - Stone material is very heterogeneous
- Reflected light:

    - Raised granular white to yellow lumps embedded in very-well developed glassy polish area on dorsal right proximal end corner (good photos taken). Some of the white lumps have bluish tinge, could be fatty material? White spots associated with polish on dorsal left proximal edge, appear to have very fine holes or spots on them. This white matter within polish, has very fine holes, located dorsal left proximal edge. It is not shiny like the surrounding polish (photos taken). Is it just the stone surface?
    - Polish contains striations in an edge to edge or perpendicular direction
    - Brown fungal hyphae noted in several locations
    - Natural stone surface has raised white patches? (photo taken)
    - Faint polish on distal ventral raised edges
    - Highly reflective rainbow piece ventral distal edge. No discernable structure (photo taken)
    - Black material associated with polish ventral distal edge(slightly to the left) (photo taken). Residue? Same black material associated with polish, ventral middle raised ridge (photos taken).
    - Weak polish on ventral raised ridges
    - Plant fibre?, light brown/tan/yellow. Located on ventral middle ridge (poor photo taken, needs Montage). Not fungal hyphae because of the uneven thickness of the fibre and the branch coming off of it is narrower than the ‘main’ branch. Fungal hyphae are also usually a much darker brown colour.
    - Polish on dorsal right distal edge
    - Amber orange material associated with polish and black material, dorsal right distal edge. (photo taken)
    - Polish streaks on dorsal proximal surface
    - Polish and yellow fatty deposit? Located on dorsal proximal raised ‘double’ edge. (good photo taken). Associated with black material
    - Polish glassy bright spots and streaks on left dorsal edges

* VP13 TR 7 (1059) 104901, grid square unknown (yellow/brown/olive distal portion of a blade segment, with cortex)

- Macro:
    - Red smear of dirt(?) left ventral edge
    - Perhaps polish on right ventral mid edge
- Stereoscope:
    - Red smear contains black specks
- Reflected light:
    - Brown fungal hyphae

    - There are polish streaks bordering the red smear, which looks like sediment.
    - Polish with sediment underneath? Located left ventral mid edge (photo taken)
    - Polish, polish in grooves, and microchipping on ventral distal tip
    - Polish spots continue on ventral right distal edge, and are also found just away from this edge
    - Rainbow effect noted in association with polish
    - Polish spots and polish striations distributed across ventral surface
    - Polish on ventral proximal straight mid edge (photo taken)
    - Plant Residue 1? Bright white/black with fine structure, left ventral mid edge, part of red streak (photo taken). Turns black when the polariser/analyser are inserted.
    - Polish with amber colour, located right dorsal mid edge, where a bit of the red smear continues from the ventral to the dorsal side (photo taken)
    - Polish on dorsal ridges

VP13 TR 9 (1059) 106872 Y-3 (red brown flint blade segment with tip snapped off)

- Macro:
    - Polish patches on ventral in many places on surface
    - Polish on eraillure scar, right ventral edge
- Stereoscope:
    - Microchipping
- Reflected light:
    - Brown fungal hyphae noted
    - Faint polish on left ventral mid edge

* VP13 TR 7 (1129) 104872 E12 (yellow brown flint blade segment, distal tip missing)

- Macro:
    - Lots of polish on this tool
    - Rough ‘line’ of polish spots on ventral proximal surface, crossing the tool from left to right edge.
    - Large area of polish about 5 mm across, on dorsal proximal surface. This polish does not form a ‘line’.
    - Polish on dorsal ridges, dorsal edges and edges of micro flake scars
    - Microchipping on right and left ventral edges
- Stereoscope:
    - Polish also on ventral central surface near white spot
    - Polish on distal edge
- Reflected light:

    - Brown fungal hyphae
    - Wavy edged rectangular phytolith (corn cob shape), this is a grass phytolith
    - Polish on right ventral mid edge (photo taken)
    - Large area of polish with micro striations within on ventral proximal middle surface, part of the polish identified with no microscope as a ‘line’ of polish across the tool (good photo taken). Micro striations within the polish are oriented running lengthwise and perpendicular to the tool, in prox-distal and left-right directions.
    - Polish bright spots are found distributed across the entire ventral surface
    - White crystals associated with polish, right ventral distal corner edge (photo taken)
    - Well-developed polish along left dorsal proximal edge, contains striations within
    - Polish on dorsal ridges, dorsal distal snapped edge, and dorsal proximal edges
    - Q Unknown residue (?) associated with polish on dorsal ridge (where the scar is) (photo taken)
    - Good deal of damage to dorsal ridge, with flake scars along ridge
    - Filaments associated with large area of polish on dorsal proximal surface. Fungal hyphae or an unknown residue. (photo taken)

* VP13 TR 9 (1000) 106522 B-4 (red flint flake fragment with no retouch)

- Macro:
    - Polish on edges of platform and dorsal ridge
- Stereoscope:
    - Ragged edges but little evidence for microchipping flake scars
- Reflected light:
    - Polish on dorsal right proximal edge
    - Weak polish on right ventral distal edge
    - Very high amount of brown fungal hypha noted near working edge- right ventral distal edge
    - Very bright residue with black to rainbow inclusions, associated with polish, (photo taken with analyser). Residue is on bulb (ventral side). Striations with directionality difficult to discern in this example.
    - Microchipping on right dorsal mid edge
    - Lots of brown fungal hyphae; seen near edges and present in middle area of tool.
    - Clear crystalline material on right dorsal mid edge
    - Polish on snapped dorsal edge (distal end)

    - Clear/rainbow filaments on dorsal ridge, just off central ridge to the right. Appear to have stippled surface or bordered pits? (photo taken with analyser)

VP13 TR 9 (1059) 106691 Z-2 (red flint blade segment with cortex, including a broken flake)

- Macro:
    - ‘Mega polish’ on dorsal left proximal edge (I think this is what Van Gijn calls bright spots). Also seen as patches on ventral side near mid edge
- Stereoscope:
    - Striations in mega polish along dorsal left proximal edge
- Reflected light:
    - Bright spots, dorsal ridge, near proximal end (photo taken)
    - Mega polish containing scratches (or possibly trapped filaments?) (photo taken), dorsal left proximal edge
    - Mega polish 2mm in from right ventral mid edge (photos taken). Mega polish can have ripples within.
    - Lots of polish also present on ventral bulb

* VP13 TR 9 (1059) 106699 A-5 (brown/red flint blade segment, distal end missing)

- Macro:
    - Trowel marks present on ventral surface
    - Dorsal ridges show polish
- Stereoscope:
    - Perhaps a small amount of polish on right ventral proximal end
- Reflected light:
    - Possible hypha with metallic colouring, right ventral mid edge (photo taken)
    - Brown fungal hyphae noted in several locations
    - Minor spots of polish, right ventral mid edge
    - Microchipping, right ventral mid edge
    - 2 circular white pattern in flint stone surface, located right ventral mid edge. (photos taken). Ancient sea creature fossils from limestone? It’s a foraminifera test fossil, possibly from one of the following genera: Cibicides, Globigerina, or Globotruncana!
    - Polish on ventral striking platform edge and on eraillure scar: hafting polish? Polish on bulbar surface within what resemble ‘jagged rivers’ associated with striations (photos taken). Some areas of polish have developed within striations, could be evidence for granular/mineral inclusions in a haft that left striations due to friction during tool use.

    - Clear crystal flakes noted on left ventral proximal edge
    - Very bright white residue along dorsal right distal edge (photo taken) with fine striations. This substance has a slight rainbow appearance.
    - Black super shiny pieces associated with very bright white residue and normal polish on edge (poor photos taken), possible residue, perhaps charcoal? Very fine pitting noted on a few black residues, appear to be tracheids or vessel elements (photos taken). Pits have proved very difficult to image without z stacking software. The pits are not showing characteristic maltese crosses in cross polarised light, perhaps because the wood has been damaged by burning and thus birefringence has been lost. Many of these black charcoal wood pieces are embedded in polish and must be present from the use of the tool. Langejans micrograph of charcoal is a match for this residue (2009, 275).
    - Minor polish on dorsal proximal area
    - Minor polish and microchipping on dorsal left proximal edge
    - Minor polish on snapped dorsal distal edge

* VP13 TR 9 (1059) 106681 E-1 (brown/grey core with cortex)

- Macro:
    - Polish on edges of flake removal scars
- Stereoscope:
    - Very shiny residue(?) on one face close to the base
    - Fine faint grey lines on 2 faces (trowel marks?)
- Reflected light:
    - Brown fungal hyphae noted
    - Shiny residue in stereoscope is now interpreted as ‘mega polish’ (photos taken). This appears as a streak in the middle of the face, streak of ‘mega polish’ also seen in the middle of an adjacent face of the core tool. This does not make sense to be polish due to its location in a depressed area.
    - White shiny discontinuous residue with fine striations (photo taken), on same face as mega polish
    - Polish present on edges of largest face
    - White shiny discontinuous residue with fine striations also seen on large flat face, appears to be a streak