# The Causes and Implications of Microstructures in Glacial Sediments

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

# Abstract

This thesis examines how microstructures in glaciogenic sediments reflect the processes forming them, and how these microstructures then affect the conditions around them, through a series of field studies, laboratory tests, models, and statistical analyses. Following literature reviews, a deformational chronology is developed for diamictons at Criccieth, North Wales, and their microstructures are used to indicate the stress, hydraulic, and environmental changes the materials have undergone. Microstructures of the lowest diamict indicate clast lodgement. The processes reflected in the microstructures of this lowest diamict are built into a quantitative model that estimates its residual strength (20 - 50 kPa) and the ice velocity during lodgement (20 - 50 m $a^{-1}$). The response of sediment to glacial stress is further examined by triaxial testing of diamict from Yorkshire, and the subsequent examination of its micromorphology. Shears in the material are disrupted by clasts, and this may be responsible for work hardening seen during the tests. Fabric compression, and the development of immobilised shears or hydraulic fractures buffer pore fluid pressure to ~470 kPa. The information from previous chapters is then used to analyse other material from the Yorkshire coast. This analysis confirms the presence in the area of meltout tills that have undergone low strain, as well as providing evidence for the decoupling of the ice and sediment in this region, and the nature of drainage systems within and above the diamicts during glaciation. Overall this thesis details the processes forming three 'classic' microstructures found in glacial sediments; omnisepic fabrics, lattisepic fabrics, and melanges, and provides evidence for the processes involved in forming diamict pebbles and skelsepic fabrics. In addition this thesis details how such structures reflect coupling and decoupling processes between glaciers and their beds, and examines the manner in which microstructures affect the response of a subglacial sediment body to stress and hydraulic conditions.

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