# Pore size, shape and connectivity in tills (subglacial sediments) and their relationship to subglacial deformation processes

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**Introduction:** Our research area is glacial sediments in modern and past glacial environments. We are especially interested in the sediment that underlies glaciers: the till bed. Till beds are composed of the debris that is eroded by or over-ridden by the glacier; till is composed of clay to boulder sized material. In the past 20 years the microscopic examination of the composition and structure of glacial sediments has provided insights into the textural and structural properties of tills. This research has shown that tills, in general, possess deformational characteristics. This has been confirmed by field experiments which show that up to 70% of the forward movement of glaciers occurs in the till bed. However, our knowledge of how the till bed behaves is still very poor and remains a problem for modelling glacier dynamics. Note that even with modern drilling technology and equipment, it is not possible to 'get under' modern glaciers to directly measure deforming bed processes.

**Aims:** The principal aim of our research is to describe and interpret the structures that develop in till beds in order to better understand the processes by which these sediments deform. This research can then be a) be used to improve ice sheet models for existing and ancient glaciers, and b) improve prediction of till characteristics, in formerly glaciated areas (for example most of Northern Europe and North America).

**Methods:** To date our main method has been the examination of large thin sections (8x14cm or 4.5x6cm) of resin-impregnated sediments. We have also used scanning electron microscopy and, occasionally, x-ray. Using these methods has led to a great deal of new information regarding the structure of tills, but has of course been confined to two-dimensions. By using micro x-ray computed tomography we will be able to examine in three dimensions the structures we have already commonly observed in two dimensions and by doing this we expect to get a more complete picture of these structures and hence an understanding of how till beds deform. Our samples originate geographically from the Arctic to the Antarctic, and stratigraphically from those just-formed and sampled at modern glaciers, to Precambrian examples.
Recently, we have been examining till porosity in detail; we know that pore shape, size and connectivity (like most other micro-structures) are indicative of either plastic or brittle subglacial deformation. We are beginning our microtomography work on till pores for this reason and because they are relatively easy structures to isolate from the rest of the till material. Till porosity is also an important geotechnical property but has been little explored in the literature.

**Discussion:** The use of 2D micromorphological techniques has allowed insights into the formation of tills that would not otherwise be possible. However, the introduction of x-ray computed tomography to our toolbox will give us a much needed 3D visualisation of these structures. We will be the first to describe till microstructures in three-dimensions. The combination of these methods will advance subglacial till dynamics research and are beneficial for mapping and describing tills for applied (for example groundwater protection) as well as academic purposes.