Geophysical Research Abstracts,
Vol. 11, EGU2009-12671, 2009
EGU General Assembly 2009

The three-dimensional microscopic 'signature' of strain within subglacial sediments – initial results

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X-ray computed microtomographic analytical techniques have been used to create volumetric three-dimensional (3D) models of the internal composition and structure of undisturbed subglacial soft sediment samples for the purposes of identifying and analysing kinematic indicators. A methodology is outlined addressing some of the specific issues relating to the investigation of unlithified, polymineralic sediments. The technique provides variable levels of compositional/structural differentiation, largely dependent on the number of, and contrast between, density phases within each specimen.

Samples were selected based on their proximity to 'type' rotational structures originally identified in micromorphological thin-section and cited as evidence of ductile deformation in response to an applied shear stress associated with glacial flow. It has not generally been possible to effectively isolate the relevant compositional elements indicating rotation, but 3D visualisation of associated fractures provides significant additional information complementing the thin-section evidence. Initial findings indicate that complex, polymodal/polyphase (brittle/ductile) deformation histories are common in subglacial soft sediments and the local (microscale) environment (composition/structure) appears to play a significant role in rheological control. It has been demonstrated that the technique offers significant potential for elucidating subglacial soft sediment kinematics, including the objective quantification of certain sediment characteristics such as clast fabrics.