



Hidden Ice Worlds – Pleistocene glacial deposits in Essex, England. Application of the novel systematic approach to thin-section description.

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In the 'Hidden Ice Worlds' research project a novel systematic approach for thin-section description (Leszczynska et al., 2011) is applied to analyse the internal structure of 8 m thick periglacially disturbed sequence from the Royal Oak Pit - a small disused quarry in East Anglia, Essex, east of Chelmsford, near Danbury. Danbury Hill is situated on the south-eastern margin of the Elsterian (Anglian) till sheet. This area was glaciated only once, during the Pleistocene, Elsterian (Anglian) glaciation (480-420 ka BP), however two local ice-sheet margin fluctuations are envisaged (inter alia Turner, 1970 and others).

The stratigraphical sequence of the Royal Oak Pit comprises: massive gravel, arranged in sheets, overlain by fine silty-clay and silty-sand with ripple marks and planar cross beds, overlain by a 50 cm thick unit of massive gravel gradually changing into periglacially disturbed silty-clayey-gravel with the bottom 50 cm of fine laminated silty clay. This sequence is situated on the lee side of Danbury Hill, at over 50 m OD. This is an atypical location for the periglacially disturbed deposits of such a substantial thickness (up to 8 m), which usually occur in the lower areas.

The deposits at this site were investigated at a macro-scale using field-section logging, ground penetrating radar survey, clast lithology, clay mineralogy analysis and loss-on-ignition and at a micro-scale using thin-section analysis.

There are two main aims of the project presented:

- To describe the genesis and to discern the main processes associated with the formation of the unusually thick periglacially disturbed unit at the Danbury Hill slope and
- To test the novel, tree-based, systematic approach as a guiding tool for thin for thin-section description of Quaternary deposits (Leszczynska et al., 2011).

The results of the micromorphological analyses of the deposits from the Royal Oak Pit allow a new hypothesis for the origin of the sequence to be put forward. The main process responsible for the evolution of the deposits consist of multiple phases of freezing and thawing of the deposit and associated physical reworking, subsequent to Elsterian (Anglian). Inversion of the topography is proposed as a necessary condition for the formation and preservation of the periglacially disturbed sequence on hill slope at such elevated location. The novel systematic approach proved to be a useful tool in guiding the thin-section description, regardless of the type of the deposit and the aim of the research.

Reference:

Leszczynska, K., Boreham, J. and Boreham, S., 2011. A novel methodological approach for thin-section description and its application to periglacially disturbed Pleistocene deposits from Danbury, Essex, UK. *Netherlands Journal of Geosciences* 90: 271-291.

Turner, C., 1970. Middle Pleistocene deposits at Marks Tey, Essex. *Philosophical Transactions of the Royal Society of London, series B* 257: 373-440.