PhD research project proposal

The cold-climate landforms and sediments of south Dartmoor

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Dartmoor's landscape has traditionally been attributed to weathering, fluvial and periglacial processes operating on granite and the surrounding metamorphic aureole. David Linton (1955) popularized a two-stage landscape evolution model of deep granite weathering during the Palaeogene and Neogene followed by periglacial stripping of regolith and exposure of tors during periglacial episodes in the Quaternary. Early views on a perceived glacial legacy were largely ignored, especially as the emerging theories on Dartmoor landscape evolution proposed lengthy periods of periglacial activity rather than glaciation and extreme ages for tor development (Palmer & Neilson 1962).

Several recent developments have encouraged a re-assessment of the Quaternary landscape evolution of north Dartmoor. First, numerical palaeo-ice sheet modelling for the British Isles has generated glacier ice cover for the uplands of southwest England (Hubbard *et al.* 2009), which is unsurprising considering that they constitute plateaux of sufficient altitude to have lain well above the equilibrium line altitudes of the main British-Irish Ice Sheets. Second, increasing knowledge of marginally glaciated terrains, as well as plateau icefield styles of glacierization, reveals that evidence of glaciation in such settings is subtle, especially on the high elevation dispersal centres (Dyke 1993; Rea *et al.* 1996a, b, 1998; Rea and Evans 2003, 2007); glacial depositional imprints are restricted to the valley heads incised into plateau margins, an excellent example being that of Exmoor (Harrison *et al.* 1998, 2001). Hence the more expansive uplands of Dartmoor constituted a prime site for the testing of plateau icefield styles of glaciation in southernmost Britain. Third, cosmogenic nuclide dating has provided the first estimations of tor ages on Dartmoor with some surprising results; Gunnell *et al.* (2013) have suggested that the tors may not be very old based on apparent exposure ages clustering around 50,000–36,000 years. (4) There is growing stratigraphic evidence (James 2004; Brown 2012) that permafrost developed in the lowlands of Devon and Cornwall during the Quaternary, which is consistent with perennial snowbanks and/or glaciers developing at higher elevations wherever snow cover persisted through ice age summers. An assessment of the geomorphology of north Dartmoor has prompted a reconstruction of former glaciation by a plateau icefield on north Dartmoor (Evans *et al.* 2012a, b; Evans and Harrison 2014), although landforms and sediments of ambiguous origins required significantly more systematic evaluation in terms of morphology, sedimentology and distribution before periglacial versus glacial origins can be verified. In this project, we will focus on south Dartmoor, that is south of a line between Merrivale and Widecombe-on-the-Moor, where the exact nature of cold-climate Pleistocene processes and their impact on the landscape remains to be established.

The project will address the research question: *how have cold-climate processes influenced the landform and sediment record of south Dartmoor?* The aims are to: (1) elucidate the cold-climate geomorphological and sedimentological processes that have operated on south Dartmoor, (2) reconstruct the palaeoenvironmental conditions associated with these processes, and (3) develop a ground model of cold-climate processes operating on different bedrocks and weathering profiles. To achieve these aims, the specific objectives are to: (1) undertake the first comprehensive mapping of cold-climate landforms and sediments on south Dartmoor; (2) analyse the landform and sediment properties in order to reconstruct the geomorphological and sedimentological processes and palaeoenvironmental conditions; and (3) determine the stratigraphy and age of cold-climate

deposits and weathering profiles. Landform mapping will involve geomorphological mapping in ArcGIS using existing aerial photograph archives, any LiDAR data available and ground-truthing. Sedimentological and stratigraphic assessments will be undertaken on all available exposures and archived data (e.g. from ground investigations). Geophysical methods (e.g. GPR) may be undertaken to determine near-surface sediment stratigraphy, regolith and rockhead characteristics. In order to verify process-form relationships and hence periglacial versus glacial legacies, the candidate will be required to develop an advanced understanding of the diagnostic criteria used in distinguishing cold-climate landforms of various genetic origins. Additionally, he/she will investigate relationships between bedrock and regolith properties on the one hand and landform and stratigraphic properties on the other. Optically stimulated luminescence dating of quartz grains within aeolian, colluvial or alluvial deposits may be carried out in order to determine the time of sediment deposition or reworking. Possibly, some cosmogenic dating may be carried out if the understanding of geomorphological processes is sufficient to warrant it.

References

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