PhD research project proposal

The cold climate landform legacy of north Dartmoor

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The Dartmoor landscape has traditionally been associated with long term fluvial and periglacial processes and one that has been untouched by glacier ice. Indeed, geomorphology textbooks present the Dartmoor landscape as the product of deep granite weathering and subsequent periglacial slope processes and tor development, a two-stage evolution model made popular by David Linton (1955) and central to the traditional view that it was a mature periglacial landscape that had evolved in an upland region of the British Isles which escaped glaciation. 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).

A number of recent developments have encouraged a re-assessment of the Quaternary landscape evolution of north Dartmoor: 1) the development of numerical palaeo-ice sheet modelling for the British Isles has repeatedly 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; 2) an expanding body of knowledge on the geomorphology of marginally glaciated terrains, as well as plateau icefield styles of glacierization, reveals that evidence of glaciation in such settings is predominantly very subtle, especially on the high elevation dispersal centres (Dyke 1993; Rea et al. 1996a, b, 1998; Rea & Evans 2003, 2007); glacial depositional imprints are restricted to the valley heads that have been 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; 3) the advent of cosmogenic nuclide dating techniques have facilitated the first estimations of tor ages on Dartmoor with some surprising results; Gunnell et al. (2012) have discovered that the tors may not be very old at all but in fact may date only to MIS 3. (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 & 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. This project will address outstanding ambiguities in this debate by undertaking the first comprehensive mapping of cold climate landforms on north Dartmoor. This will involve geomorphological mapping in ArcGIS using existing aerial photograph archives 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) will 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.

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