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An Integrated Geochemical and Facies Analysis of Paleogene Aged Fluvio-Lacustrine Sediments in the Petrockstow and Bovey Basins, UK

Mohammed S. Chaanda (1), Rhodri Jerrett (2), Stephen T Grimes (1), Gregory D Price (1), and Mark Anderson (1)

(1) School of Geography, Earth and Environmental Sciences, Plymouth University, Drake Circus, PL4 8AA, United Kingdom (mohammed.chaanda@plymouth.ac.uk), (2) School of Atmospheric, Earth and Environmental Sciences, University of Manchester, Oxford Road, Manchester, M13 9PL, U.K (rhodri.jerrett@manchester.ac.uk)

The Petrockstow and Bovey basins are two similar pull apart (strike slip) basins belonging to the Sticklepath – Lustleigh Fault Zone (SLFZ) in Devon, SW England. The SLFZ is one of the several faults on the Cornubian Peninsula and may be linked to Variscan structures rejuvenated in Palaeogene times. The bulk of the basins' fill consists of clays, silts, lignites and sands of Palaeogene age, comparable to the Lough Neagh Basin (Northern Ireland), which is also thought to be part of the SLFZ. The greater part of the British Isles was a land area throughout the Palaeogene. The basin-fills therefore, provide rare, potentially expanded sections through the Palaeocene Eocene Thermal Maximum (PETM), and the Eocene-Oligocene (Oi-1) cooling event in the U.K. Facies analysis has been undertaken on sediments of the Petrockstow and Bovey basins in order to provide a tectonic and palaeoenvironmental context for palaeoclimate reconstructions using palynology, organic geochemistry Methylation Branched Tetraethers/Cyclisation Branched Tetraethers and carbon isotope analyses which have identified the Carbon Isotope Excursion (CIE) associated with the PETM. The following lithofacies types from two boreholes from the Petrockstow Basin (boreholes 1A and 1B) and from outcrop exposed in the Bovey Basin. The lithofacies identified are (a): Silty clay; (b): Red mottled and sideritic clay; (c): laminated silty clay; (d): Minor sand and gravel; (e): Major coarse sand and granules and (f): Lignite. Our new facies model involves: firstly Sand filled fluvial channels, secondly a lake with ready supply of organic debris, and thirdly a lake prone to drying-out. The abrupt transition from sand filled fluvial channels to Lake Facies is coincident with the recognition of the CIE. The possible effect of the Oi-1 glaciation may be linked to the third phase of a lake prone to drying-out facies which is ambiguous in the Bovey Basin. Repeated sub aerial exposure suggests that the lakes present in both basins were shallow, however typical shallow-water indicators, such as wave ripples are absent, possibly because of the small basin which prevented the development of a significant wave-base. There is the potential that the lake was stratified into an upper, oxic level and a lower, anoxic level. It is also suggested that the lake may have experience changes in the position of the stratification, probably driven by climate change, which influenced the preservation potential or organic material supplied to the lake. Alternatively, cyclic climate change may have led to changes in the supply of organic and/or clastic material to the lake. The fining upward cycles are thought to represent short periods of sedimentation and partly attributed to subsidence.