Splicing the Hettangian record using legacy core: the Wilkesley and Prees 2C cores in the Cheshire Basin (NW England)

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Abstract

Following the upheavals of the latest Triassic, the Hettangian interval saw large-scale readjustment of faunal assemblages and geochemical cycles. Associated with the gradual break-up of Pangea, marine sedimentation was established in numerous basins in a nascent Laurasian epicontinental seaway where many of the key sections and drill sites yielding strata that recorded this critical interval of Earth history are situated. Even though these sections and drill cores have allowed us to establish detailed biostratigraphic schemes and to assess Earth system evolution, key questions about the duration of the Hettangian and integrated stratigraphy remain open.
While reducing the challenges of weathering, accessibility and completeness that outcrop sections are often fraught with, core records are by necessity limited to a small cross section and biostratigraphic constraints from macrofauna are therefore usually much looser than in surface exposures. To address this issue for the newly drilled Prees 2C core that yielded a virtually complete sequence of upper Triassic (Norian?-Rhaetian) to Pliensbachian strata from the Cheshire Basin, NW England, the archived remains of the Wilkesley core were utilised. Wilkesley was drilled as an exploration core, about 10 km NE of the Prees site in 1959-60, with a much larger diameter than Prees 2C, and the Jurassic part was entirely broken up for biostratigraphy, providing a wealth of stratigraphically significant specimens.

Registered core specimens of Wilkesley, which were retained in intervals of 30 cm, were used to generate chemostratigraphic records of organic carbon isotope ratios, carbonate and TOC content, and element geochemistry (Rb/Zr ratios) to supplement the rich ammonite record for this core. These datasets were used to correlate to equivalent records from Prees 2C, allowing combination of the ammonite evidence for an improved biozonation of Prees 2C.
Correlations between the two cores could be achieved with high fidelity throughout the entire Hettangian record, indicating lateral continuity of major rock properties over 10 km. These correlations indicate that sedimentation at Prees 2C, located closer to the depocenter

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of the basin, was on average 14 % higher than at Wilkesley. Correlations drawn on the basis of chemostratigraphic markers also always agree with biostratigraphic constraints, allowing reduction of the overall biostratigraphic uncertainty for Prees. These additional constraints will be instrumental in ongoing study of the Prees 2C core to assess the duration of the Hettangian and its biozones, and hence Earth System behaviour in the Early Jurassic.

Keywords: Jurassic, correlation, chemostratigraphy