Early Jurassic Earth System and Timescale project (JET): towards an integrated stratigraphy for the Early Jurassic based on the Mochras borehole, Cardigan Bay, Wales

Stephen P. Hesselbo and the JET Project Science Team

University of Exeter, Camborne School of Mines, Penryn Campus, Penryn, Cornwall TR10 9FE, United Kingdom

During the Early Jurassic, the planet was subject to distinctive tectonic, magmatic, and orbital forcing, and fundamental aspects of the modern biosphere were becoming established in the aftermath of the end-Permian and end-Triassic mass extinctions. The breakup of Pangaea was accompanied by biogeochemical disturbances including the largest magnitude perturbation of the carbon-cycle in the last 200 Ma, the Toarcian Oceanic Anoxic Event (T-OAE). Knowledge of the Early Jurassic is, however, based on scattered and discontinuous datasets, meaning that stratigraphic correlation errors confound attempts to infer temporal trends and causal relationships, leaving us without a quantitative process-based understanding of overall Early Jurassic Earth system dynamics.

The Llanbedr (Mochras Farm) borehole in west Wales, originally drilled 50 years ago, provides the basis for construction of an integrated biostratigraphic, magnetostratigraphic, chemostratigraphic, and astrochronological timescale for the entire Early Jurassic. At Mochras, the drillcore represents 27 Ma of Early Jurassic time with a calculated sedimentation rate of approximately 5 cm/ ka. The Integrated Early Jurassic Timescale and Earth System project (JET) is a multi-faceted, international programme of research on the functioning of the Earth system. New data from the old Mochras core will be combined with data from a new core to provide an understanding of global change and quantify the roles of tectonic, palaeoceanographic, and astronomical forcing on hyperthermal and hypothermal events at this key juncture in Earth history. Analysis of this record will also be used to understand the functioning of the Laurasian Seaway, its effects on climate and depositional patterns, including the distribution and nature of organic-rich black shales (potential hydrocarbon source rocks).

Initial results define a continuous integrated astrochronological timescale for the Pliensbachian and Toarcian stages, and through the principal hyperthermal interval document significant changes in background sedimentation style (related to eustatic sea-level rise) and local sediment input driven by climate change in the adjacent source areas. We acknowledge funding from Shell, the International Continental Scientific Drilling Programme (ICDP), the UK Natural Environment Research Council (NERC), and the Deutsche Forschungsgemeinschaft (DFG).

doi: 10.4138/atlgeol.2018.014