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Early Jurassic hyperthermals in the context of a long, continuous, integrated stratigraphy (the JET project)

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During the Early Jurassic, the Earth 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 Myr, coeval with the now well-characterised hyperthermal, 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 placing the T-OAE, and other Early Jurassic hyperthermals, in a long-term stratigraphic and timescale context. At Mochras, the drillcore represents 27 Myr of Early Jurassic time with sedimentation rate of approximately 5 cm/kyr. Through the Integrated Early Jurassic Timescale and Earth System project (JET), 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. Initial results define a continuous integrated astrochronological timescale for the Pliensbachian and Toracian 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. This project is funded by the International Continental Scientific Drilling Programme (ICDP) and the UK Natural Environment Research Council (NERC).