EGU Galileo Conferences
GC5-Mass-91, 2019
Mass extinctions, recovery and resilience

Milankovitch forcing of Early Jurassic wildfires

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The Early Jurassic was characterized by major climatic and environmental perturbations which can be seen preserved at high resolution on orbital timescales. The Early Jurassic is a period of overall global warmth, and therefore serves as a suitable modern-day analogue to understand changes in the Earth System. Presently, Earth's climate is warming and the frequency of large wildfires appears to be increasing. Recent research has indicated that Quaternary deposits reveal that wildfires respond to orbital forcings; however, to date no study has been able to test whether wildfire activity corresponds to changes over Milankovitch timescales in the deep past.
A high-resolution astrochronology exists for the Upper Pliensbachian in the Llanbedr (Mochras Farm) borehole (NW Wales). Ruhl et al. (2016) show that elemental concentration recorded by hand-held X-ray fluorescence (XRF), changes mainly at periodicities of ∼21,000 year, ∼100,000 year and ∼400,000 year, and which can be related to visually described sedimentary bundles.
We have quantified the abundance of fossil charcoal at a high resolution (10-15 cm) to test the hypothesis that these well-preserved climatic cycles influenced fire activity throughout this globally warm period. Preliminary results suggest that variations in charcoal abundance are coupled to Milankovitch forcings over periods of ∼21,000 and ∼100,000 years. We suggest that these changes in fire relate to changes in seasonality and monsoonal activity that drove changes in vegetation that are linked to variations in the orbital forcing. Supplementary to the charcoal record, a high-resolution clay mineralogy dataset has been generated to further explain the climatic cyclicity observed in the wildfire record regarding the hydrology on land.