ORBITAL TUNING OF A COASTAL SUCCESSION OF LATE EOCENE-EARLY OLIGOCENE AGE: CLAYS, CYCLES AND SEA-LEVEL CHANGE IN THE SOLENT GROUP, ISLE OF WIGHT, UK.

Gale A.1, Palike H.2, Laurie E.1, Huggett J.1, Hailwood E.3

1 School of Earth and Environmental Sciences, University of Greenwich, Medway Campus, Chatham Maritime, Kent ME4 4TB UK. E-mail: asg@nhm.ac.uk
2 Godwin Institute, Department of Earth Sciences, University of Cambridge, New Museums Site, Pembroke Street, Cambridge CB2 3RS, UK
3 Core Magnetics, The Green, Sedbergh Cumbria LA10 5JS, UK.

The Solent Group in the Hampshire Basin UK comprises over 200m of clays, silts, limestones and infrequent sands of Late Eocene-Early Oligocene age deposited in continental (fluvatile and lacustrine facies with many palaeosols), estuarine and rarely shallow marine facies. The accumulation rate was rapid (40-60m/Ma), and the succession displays conspicuous sequence-scale sea-level cycles (10-30m) representing transitions from transgressive shallow marine/estuarine envrionments through brackish floodplain highstands to ephemeral freshwater carbonate lakes representing lowstands. Stratigraphy has traditionally been based on mammals and charophytes, although a number of levels provide sufficient nannofossils to identify NP Zones. We have used these important horizons, in conjunction with a new magnetostratigraphy, to correlate with the global chronostratigraphical scale. Although the succession is not conspicuously cyclic on the scale of bedding, high-resolution clay mineralogy and elemental geochemistry display striking cyclical changes on several frequencies. We have chosen one parameter, the percentage of illite and illite-smectite in the clay fraction of the sediment, to investigate orbital controls on the succession. Illite/illite smectite in this succession is neoformed in gley palaeosols, and was formed by repeated wetting and drying of the sediment in response to strongly contrasting seasons (ie high seasonality). There is a strong correlation between illite abundance and the occurrence of the pulmonate gastropod Lymnaea, which has a selective advantage in ephemeral ponds because it can breathe air. Because the orbital configuration which maximises seasonality has high eccentricity and obliquity values, we tuned high illite values to eccentricity maxima, and hypothesised that conspicuous groups of high illite peaks correspond with long eccentricity (400Ka) maxima. We anchored this age model to the global chronostratigraphical scale using magnetic chrons; C13n (base of chron) and C15n (top of chron) and the results compared closely with published timescales for this interval. Filters of the tuned dataset recovered convincing short eccentricity (100Ka) and obliquity (41 Ka) signals, but little evidence of precession. Spectral analysis using the Blackman-Tukey method demonstrated eccentricity, obliquity and precession peaks, and supports our assumption that major variations in clay mineralogy are linked to the long eccentricity cycles. An important conclusion of this study is that the sequence-scale changes, reflecting the major sea-level changes, are directly related to the 400Ka cycle, and presumably were responses to changes in volume of Antarctic ice cover. A major hypothesised ice-growth event in the Early Oligocene has been interpreted by various authors from a heavy oxygen isotope shift approximately coincident with the base of chron 13n. The corresponding level in the UK does not display any evidence of significant sea-level change in the coastal plain deposits of the Isle of Wight.