

Biogeochemical changes in a hypersaline sabkha of the Late Permian: stable isotopes and organic geochemistry

JACK SALISBURY¹, DR. DARREN R GRÖCKE, DPHIL¹,
VINCENT GROSSI² AND ROSS COLLIN³

¹Durham University

²Laboratoire de Géologie de Lyon

³British Gypsum

Presenting Author: jack.salisbury@durham.ac.uk

The Late Permian Eden Shales Formation (Cumbria, England) consists of evaporite-rich sandstones, siltstones, and mudstones that were deposited during the Late Permian. Sulphur isotope analysis of evaporitic sulphate ($\delta^{34}\text{S}_{\text{evap}}$) and carbon isotope analysis of sedimentary organic carbon ($\delta^{13}\text{C}_{\text{org}}$) were performed to explore biogeochemical changes during the evolution of a hypersaline sabkha environment. The base of the sampled interval (i.e., A Bed of the Eden Shales), exhibits the greatest $\delta^{34}\text{S}_{\text{evap}}$ variability, with values ranging between -3.6 ‰ to +8.4 ‰. The $\delta^{34}\text{S}_{\text{evap}}$ record recovers quickly from around -2 ‰ to stabilise between +6 ‰ to +12 ‰, which is characteristic of Late Permian evaporites. The $\delta^{13}\text{C}_{\text{org}}$ record exhibits typical Late Permian marine values between -25 ‰ and -20 ‰ at the base of the sampled interval for approximately 30 m; with no significant excursions. The upper most 15 m of the Eden Shales (including the B and C Beds) records substantial isotopic variability between -23.7 ‰ and +1.6 ‰. Interestingly, the variability between $\delta^{34}\text{S}_{\text{evap}}$ and $\delta^{13}\text{C}_{\text{org}}$ record are decoupled, with the negative $\delta^{34}\text{S}_{\text{evap}}$ interval occurring during very stable $\delta^{13}\text{C}_{\text{org}}$ values, and the stable $\delta^{34}\text{S}_{\text{evap}}$ interval occurs during the fluctuating $\delta^{13}\text{C}_{\text{org}}$ interval. To explore the possible driving mechanisms behind the observed variability in $\delta^{34}\text{S}_{\text{evap}}$ and $\delta^{13}\text{C}_{\text{org}}$, we performed lipid biomarker analyses on select samples dispersed throughout the sampled section. Although preliminary, the resultant biomarker data show the occurrence of carotenoid pigments concomitant with the $\delta^{34}\text{S}_{\text{evap}}$ and $\delta^{13}\text{C}_{\text{org}}$ excursions that suggest changes in primary productivity and/or planktonic community structure during the evolution of a Late Permian hypersaline sabkha environment.