

Environmental and organic-matter characterisation of the Toarcian lacustrine Da'anzhai Member, Sichuan Basin, China

WEIMU XU^{1*}, JOHAN W.H. WEIJERS², ERDEM F. IDIZ¹,
MICHA RUHL¹, OLGA GORBANENKO¹, ERIK W.
TEGELAAR², HUGH C. JENKYNS¹, JAMES B. RIDING³,
STEPHEN P. HESSELBO⁴

¹ Department of Earth Sciences, University of Oxford, Oxford
OX1 3AN, UK (*weimu.xu@earth.ox.ac.uk)

² Shell Global Solutions International B.V., Shell Technology
Centre Amsterdam, Grasweg 31, 1031 HW, Amsterdam,
The Netherlands

³ British Geological Survey, Keyworth, Nottingham NG12
5GG, UK

⁴ Camborne School of Mines and Environment and
Sustainability Institute, University of Exeter, Penryn
TR10 9FE, UK

The upper Lower Jurassic Da'anzhai Member (Sichuan Basin, China) is the first lacustrine record identified as coeval with the early Toarcian Oceanic Anoxic Event (T-OAE; ~183 Ma). Lake formation and/or expansion and massive lacustrine organic productivity and carbon drawdown during the T-OAE, as a result of elevated hydrological cycling and nutrient supply, have been conducive for the formation of the Toarcian organic-rich Da'anzhai Member.

Here, we combine molecular biomarker, organic petrography, Rock-Eval and palynology analyses to constrain changes in depositional environment and main biomass producers during deposition of the Da'anzhai Member.

Biomarker and palynological data suggest increased lacustrine algal growth during the T-OAE, forming the bulk of the organic-matter flux to the lake floor. Water-column stratification during the T-OAE, based on elevated gammacerane indices, likely facilitated reducing conditions developing at the lake bottom, enabling increased organic-matter preservation and the formation of organic-rich black shales. The notably high abundance of rearranged hopanes and steranes (17 α -diahopanes, 18 α -neohopanes (Ts, 29Ts), early eluting rearranged hopanes, and diasteranes) is not primarily a result of maturity but likely resulting from (intensive) clay-catalyzed rearrangement during diagenesis. The C₂₉ 28-Nor-spergulane (29Nsp), commonly and abundantly found in oils from lacustrine source rocks in South East Asia, is also present in the Da'anzhai lacustrine shales, and is generally abundant in concordance with elevated concentrations of the rearranged hopanes, suggesting the same precursors as indicated in previous studies.