Geophysical Research Abstracts
Vol. 19, EGU2017-2805, 2017
EGU General Assembly 2017

Environmental and faunal change in the Jurassic Sundance Seaway, western United States: a stratigraphic palaeobiological approach

Silvia Danise (1,2) and Steven Holland (2)

(1) School of Geography, Earth and Environmental Sciences, Plymouth University, Drake Circus, Plymouth, United Kingdom (silvia.danise@gmail.com), (2) Department of Geology, University of Georgia, 210 Field Street, Athens, USA

Understanding how regional ecosystems respond to sea level and environmental perturbations is a main challenge in palaeoecology. Here we use quantitative abundance estimates, integrated within a sequence stratigraphic and environmental framework, to reconstruct benthic community changes through the 13 myr history of the Jurassic Sundance Seaway in the western United States. Faunal censuses of macroinvertebrates were obtained from marine rocks of the Gypsum Spring, Sundance and Twin Creek formations at 44 localities in Wyoming, Montana and South Dakota. Fossils were identified to species wherever possible. Ordination of samples shows a main turnover event at the Middle–Upper Jurassic transition, which coincided with the shift from carbonate to siliciclastic depositional systems in the Seaway. This shift was probably initiated by the northward migration of the North American Plate, which moved the study area from subtropical latitudes, fostering an arid climate, into progressively more humid conditions, and possibly also by global cooling at this time. Turnover was not uniform across the onshore–offshore gradient, but was higher in offshore environments, in both carbonate and siliciclastic settings. Both the Jaccard and the Bray-Curtis similarity measures indicate that taxonomic similarity decreases from onshore to offshore in successive third-order depositional sequences, although similarity values are low for both onshore and offshore environments The higher resilience of onshore communities to third-order sea-level fluctuations and to the change from a carbonate to a siliciclastic system was driven by a few abundant eurytopic species that persisted from the opening to the closing of the Seaway and that were not restricted to single depositional environments or sequences. Lower stability in offshore facies was instead controlled by the presence of more volatile stenotopic species. Such increased onshore stability in community composition contrasts with the well-documented onshore increase in taxonomic turnover rates, and indicates the need for ecological studies to complement taxonomic studies of macroevolutionary events. This study also shows how a stratigraphic palaeobiological approach is essential for understanding the link between environmental and faunal gradients, and for understanding the long-term changes in these gradients over time that produce the local stratigraphical pattern of changes in community composition.