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Testing whether early diagenesis of skeletal carbonate is different in non-marine settings: contrasting styles of molluscan preservation in the Upper Jurassic of Portugal

V. Paul Wright^{a*}, Lesley Cherns^b, Ana C. Azerêdo^c, M. Cristina Cabral^c

^aNatural Sciences, National Museum of Wales, Cathays Park, Cardiff, CF10 3NP, UK v.vpw@btopenworld.com

*Corresponding author

^bSchool of Earth and Ocean Sciences, Cardiff University, Park Place, Cardiff CF10 3AT, UK cherns@cardiff.ac.uk

^cUniversidade de Lisboa, Faculdade de Ciências, Departamento de Geologia and Instituto Dom Luiz (IDL), Campo Grande, Ed. C6, 4^o piso, 1749-016, Lisboa, Portugal acazeredo@fc.ul.pt; mccabral@fc.ul.pt

Abstract

This study tests the hypothesis that the early diagenesis of aragonite shells should differ fundamentally between marine and freshwater environments. This is predicted to be the case because aragonite is highly susceptible to dissolution in the TAZ (Taphonomically Active Zone) in low energy marine settings due to acidity caused largely by the oxidation of H₂S generated by sulphate-reducing bacteria, but reduced sulphide activity in freshwater settings should result in less early dissolution of aragonite. To test this hypothesis a range of fresh-brackish-hypersaline and marine limestones were sampled from the Upper Jurassic (mid Oxfordian) Cabaços Formation of central western Portugal. In these freshwater and brackish deposits, molluscs are preserved mostly as sparite shell replacements indicating that the original aragonite was preserved through the TAZ and was later replaced during subsequent burial by calcite cement. In limestones deposited in more marine to hypersaline settings, molluscan remains mostly consist of the calcitic layers of bimineralic bivalves, as shell where the original was wholly calcitic, or as gastropod steinkerns. Exceptions occur and reflect other factors such as higher energy conditions during deposition whereby organic matter, as the drive for microbial decay processes, was removed. The implications for molluscan preservation including some hydrocarbon reservoirs are discussed.

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