Geochemistry and preservation of fossils in the Prees 2C core (Hettangian-Pliensbachian)

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Abstract

Marine macrofossils – at least for Paleozoic and Mesozoic time – are amongst the most sought-after carriers of palaeoenvironmental information, because they are often large enough to preserve primary geochemical signatures, at least in parts of their thick shells. Furthermore, as a consequence of decade-long dedicated research, their biomineralisation and the structural and geochemical trajectories of diagenesis are well understood.
The Prees 2C core, drilled in 2020 in the Cheshire Basin (NW England) yielded about 560 m of fossiliferous Early Jurassic strata of Hettangian to early Pliensbachian age. Besides forming the basis of a detailed ammonite biozonation, macrofossils are also subject to geochemical assessment. Several hundred specimens, primarily belemnites, bivalves, and brachiopods were taken from the working half of Prees 2C and shell material extracted for geochemical analysis. In addition to this, detailed petrographic observations of bulk rock using scanning electron microscopy gave further insights into shell preservation and secondary mineralisation.

Aragonite – at least in some instances – is still preserved in Prees 2C, which is evidenced by iridescent ammonite shell, but also partially very high Sr/Ca ratios coupled with very low Mg/Ca ratios in originally aragonitic molluscs. Macroscopic assessment suggests good preservation of shell textures in many cases. Large, thick-shelled bivalves are the easiest target for geochemical assessment for most of the Hettangian to middle Sinemurian interval and show element/Ca ratios comparable to those in other UK basins. Belemnites are locally abundant from the middle Sinemurian upwards and show typical enrichment of Sr and Mg over bivalves. Limited brachiopod finds fit into this pattern via intermediate Mg/Ca and Sr/Ca ratios falling between bivalves and belemnites. Mn and Fe contents are mostly low, supporting the good geochemical preservation of the macrofossil material.
SEM observations have added considerably to this macroscopic assessment as they revealed partially pervasive replacement of carbonate with euhedral albite, amongst other – more common – diagenetic features such as infills with carbonate cement, pyrite framboids and occasional sphalerite.

Keywords: Jurassic, macrofossils, diagenesis, geochemistry

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