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Terrestrial influences on carbonate $^{87}Sr/^{86}Sr$ in a land-attached marine platform

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Temporal changes in the global seawater $^{87}Sr/^{86}Sr$ are well studied, with carbonate rocks reflecting its past isotopic record [1]. However, local effects may alter carbonate $^{87}Sr/^{86}Sr$ values.

The Jigunsan and Duwibong formations, the two uppermost marine-deposited strata in the Seokgaejae section of the central-eastern Korean Peninsula, were deposited in an embayment during the Middle Ordovician when global seawater $^{87}Sr/^{86}Sr$ remained constant at ~0.7088 [1,2,3]. The surrounding landmass, Yeongnam Massif, consisted of rocks with high $^{87}Sr/^{86}Sr$. This study evaluates the influence of terrestrial materials on carbonate $^{87}Sr/^{86}Sr$ during deposition and diagenesis in a land-attached platform.

Samples from the Jigunsan and upper Duwibong formations exhibit $^{87}Sr/^{86}Sr$ values higher than contemporary global seawater and relatively lower $\delta^{13}C$ and $\delta^{18}O$ values compared to other samples. Their high $^{87}Sr/^{86}Sr$ suggests terrigenous water inflow into the restricted platform [3,4].

While samples from the lower Duwibong Formation show $^{87}Sr/^{86}Sr$ values close to contemporary seawater, samples from the middle Duwibong Formation show extremely high values (0.7103~0.7182). This variation cannot be explained by late diagenetic alteration and likely reflects differences in early diagenetic conditions. Lower Duwibong samples were deposited in an oolitic shoal with freely circulating seawater. In contrast, middle Duwibong samples formed in a backshoal environment as the shoal prograded, leading to restricted seawater circulation [8]. The detrital sediments derived from the Yeongnam Massif may have supplied ^{87}Sr-enriched Sr into the system during sediment-buffered diagenesis.

Typically, elements in carbonate sediments are recycled in such environments, and changes in isotopic ratios are relatively small. Therefore, an anomaly in $^{87}Sr/^{86}Sr$ values may not necessarily indicate poor preservation of non-radiogenic stable isotope systems with narrower natural isotopic ranges.

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