



## **Mass-transfer in solution: on the context and cause of spherulitic lacustrine carbonate deposits**

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Understanding how laterally extensive spherulitic carbonate deposits originated in the 'Pre-Salt' Aptian volcanic-influenced lacustrine basins of Brazil and Angola is challenging, especially as few good analog systems are known to compare the Pre-Salt to. Here, we report a particularly good analog system in the Carboniferous of the Scotland (the East Kirkton Limestone), and examine the geochemical and sedimentological context in which spherular radial calcite has developed. Using empirical and theoretical approaches, we analyse the link between metal mobilization from sub-surface volcanoclastic rocks, and the potential precipitation of carbonates, Mg-Si minerals and chalcedony in a lacustrine spherulitic carbonate setting. This suite of minerals at the surface can be explained by CO<sub>2</sub> ingassing to a springwater derived from reaction of alkali igneous rocks in the subsurface with meteoric groundwater. This forms a 'source-to-sink' system occurring entirely in solution in the subsurface, but demonstrably capable of forming significant depositional units at the surface. We hypothesise that analogous processes occurring on a larger scale are implicated in the development of the 'Pre-Salt' spherulitic carbonate deposits.