Spatial and temporal variability of $\delta^{13}C_{carb}$ and $\delta^{18}O_{carb}$ of the Voëlwater Subgroup, South Africa

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The ca. 2.2 Ga old Voëlwater Subgroup is a virtually undeformed, unaltered and unmetamorphosed sedimentary succession in the Transvaal Supergroup, deposited on the Kaapvaal Craton, South Africa. It contains the Hotazel Formation, the world's largest minable manganese ore resource. The Hotazel Formation can be subdivided into chemosedimentary cycles that commence with cherty hematite-magnetite BIF, hematite lutite, jacobsite lutite and Mn-rich braunite lutite. The final BIF unit of the Hotazel Formation grades upward into carbonate turbidites, stromatolitic dolomites and limestones of the Mooidraai Formation that represent the stratigraphic top of the Vöelwater Subgroup. As part of a multidisciplinary study, we report a detailed investigation of C and O isotopes throughout this succession.

Overall, the C isotopic composition ranges from –21.8 to +1.5 ‰. Correlations exist with stratigraphy, carbonate mineralogy and total inorganic carbon content (TIC). Fe-dominated carbonates are more ^{13}C depleted than Mn-carbonates. Limestones and dolomites of the overlying Mooidraai Formation have the heaviest carbonate C isotope values. This suggests an overall development towards more oxidizing shallow water conditions up-section. Second-order variations in respect to carbonate mineralogy are discernible. Furthermore, clear differences exist between sections from different paleogeographic positions. In particular, Fe-dominated carbonates from the northern part of the depositional basin are more ^{13}C depleted than in the south, pointing to primary differences in the depositional conditions. Hence, carbonate isotope geochemistry clearly records paleoenvironmental variability.

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The influence of crustal composition on magmatic differentiation across five major crustal terranes: The British-Irish Palaeocene Igneous Province (BPIP)

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The BPIP is an ideal testing ground for the influence of crustal composition on ascending magmas as four isotopically distinct tectono-stratigraphic terranes are affected by Palaeocene magmatism. We have analysed more than 200 new samples of mafic to felsic compositions for Sr, Nd and Pb isotopes from the igneous centres of Rum, Ardnamurchan, Mull, Arran, Slieve Gullion and Carlingford. Together with new data on crustal lithologies from surface exposures and xenoliths, our results suggest that the local crust has indeed had a significant influence on the majority of magma compositions at the six centres investigated. A broad correlation between crustal terrane and isotopic composition of BPIP exists (crustal provincialism). For example, the mantle Sr-isotope ratio at 60Ma (0.7023–0.7032) is considerably lower than most basaltic samples from the area (0.7028 to 0.7111). Felsic rocks yield elevated values (0.7066 – 0.7226), with crustal lithologies ranging from 0.7065 to 0.7379. Styles of contamination differ not only between centres, but also within individual centres, e.g. through time. Our data underline that only very primitive, high MgO rocks are unequivocally suited for extraction of sensible information on primary magma sources. In turn, mafic rocks frequently display lower crustal influences, while felsic rocks regularly record a more complex, multi-stage evolution, reflecting the cumulative effects of progressive magma-crust interaction in deep and shallow crustal reservoirs.