

Isotopic and geochemical characteristics of late Neoproterozoic oceans from the Dalradian Supergroup of Scotland: Local basin infilling or global signatures?

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Recent studies have suggested that there are 3 glacial deposits in the Neoproterozoic succession of Scotland and Ireland and that the well-known Port Askaig tillite represents a Sturtian (720 Ma) glaciation. The identification of a boulder bed and overlying cap carbonate above an unconformity in the Easdale subgroup of Ireland suggest that it represents a Marinoan (640 Ma) glacial event (McCay *et al.*, 2006).

New studies have focused on localised black shales and limestones from the middle Easdale subgroup of Western Argyll, Scotland, which are intermittently rich in sulphides. Unlike much of the Dalradian Supergroup, this area has been only subjected to chlorite-grade metamorphism and relatively low levels of deformation. While the organic carbon isotopes have been reset by metamorphism with an enrichment in ^{13}C of around 15‰, the trend still parallels that of ^{13}C carbonate. Geochemical data (K, Ba, Rb) indicate a period of high continental input to the ocean leading to high nutrient levels, elevated organic carbon contents (TOC) and ^{13}C enrichment for the Degnish Limestone. The magnitude of the isotope excursion is very similar to those for the pre-glacial Islay and Tayvallich limestones at lower and higher levels respectively, in the Dalradian sequence (McCay *et al.*, 2006).

Pyrite ^{34}S cycles between +11 and +21‰ in the same sequence of black shales and overlying limestones and this can be correlated with continental inputs and basin infilling, resulting in probable restrictions to sulphate recharge.

The transition from limestone to overlying phyllites with minor limestones is associated with a sudden decrease to very low TOC and a negative carbon isotope excursion for carbonates, paralleled by the curve for organic carbon. $\delta^{34}\text{S}$ continues to rise in the phyllites before falling to ^{34}S depleted values, the lowest stratigraphic level in the Dalradian for which ^{34}S depletion is recorded. Global Neoproterozoic $\delta^{34}\text{S}$ records for pyrite show that the first depletion post-dates the Marinoan glacial period and is related to a significant increase in the oxygenation of the oceans and hence sulphate content (Hurtgen *et al.*, 2005). This suggests that the Easdale subgroup in Scotland can be correlated with the Marinoan, despite there being no evidence so far for glacial deposits, and confirms the findings of McCay *et al.* (2006) for similar stratigraphic levels in Ireland.

References

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Isotopic geochemistry of Dexing porphyry Cu-Au deposit of Jiangxi Province, China

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The Dexing porphyry Cu-Au deposit including Tongchang, Fujiawu and Zhushahong ore district is related to the Early Jurassic granodiorite porphyry stocks. The SHRIMP zircon U-Pb age of both the Fujiawu and the Tongchang porphyries are $171\pm 3\text{Ma}$ (Wang *et al.*, 2004). The ^{187}Re - ^{187}Os isochron age of molybdenite from Tongchang ore district is $170.4\pm 1.8\text{Ma}$ and is remarkably consistent with that of the porphyry stocks, suggesting that the formation of the Cu-Au ores was genetically related to the magmatism (Lu *et al.*, 2005). The Cu isotope also indicates the copper was derived from the magmatic rocks (Lu *et al.*, 2004).

The Si isotopic compositions of 17 quartz samples from the Dexing deposit were analyzed. The $\delta^{30}\text{Si}$ values of two quartz samples from the Tongchang porphyry are 0.2‰ and 0.3‰ respectively. The $\delta^{30}\text{Si}$ values of 11 quartz veinlet samples from the Tongchang deposit range from -0.2‰ to 0.5‰, most of which vary from 0.2‰ to 0.4‰. The Si isotopic compositions of the three quartz samples from the Fujiawu porphyry are -0.1‰, 0.0‰ and 0.4‰ respectively. One quartz sample from the Fujiawu ore has the $\delta^{30}\text{Si}$ values of 0.0‰. The Si isotopic compositions of quartz from the ore-forming quartz veinlets are compatible with those of quartz from the related porphyries.

The characteristics of the isotopic geochemistry of the Dexing deposit show that the ore-forming materials might have been derived from the magmatic rocks.

References

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