Strontium stable isotope variations accompanying continental weathering with implications for the marine radiogenic strontium record

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Variations in seawater $^{87}Sr/^{86}Sr$ ratios over time reflect changes in the flux and composition of material delivered to the oceans, and provide a precise chronostratigraphic technique for dating marine carbonates (e.g. [1]). Measured $^{87}Sr/^{86}Sr$ ratios are corrected for instrumental mass fractionation assuming all natural samples have the same stable isotope $^{88}Sr/^{86}Sr$ ratio. Recent data indicates that the $^{88}Sr/^{86}Sr$ value of modern seawater is significantly heavier than that commonly used for such normalisation [2], in which case the actual $^{87}Sr/^{86}Sr$ ratio of seawater is more radiogenic. If seawater has always posssesed the same $^{88}Sr/^{86}Sr$ composition then all relative shifts in the $^{87}Sr/^{86}Sr$ record remain the same. However, if there are differences in the $^{88}Sr/^{86}Sr$ composition of strontium fluxes into or out of the ocean then it is inevitable that the marine $^{88}Sr/^{86}Sr$ and $^{87}Sr/^{86}Sr$ record will also change.

This study presents high-precision $^{88}Sr/^{86}Sr$ for rivers draining granitic and basaltic terrains. These results indicate an $^{88}Sr/^{86}Sr$ variation of at least 0.9‰ in rivers, which if imparted to seawater through chemical weathering will result in variations in the $^{88}Sr/^{86}Sr$ ratio of seawater and modify the true seawater $^{87}Sr/^{86}Sr$ composition. Preliminary data for a quaternary marine foraminiferal record indicate a shift of ~90 ppm in the $^{88}Sr/^{86}Sr$ over this interval, changing both the pattern and magnitude of change seen in the marine $^{87}Sr/^{86}Sr$ record. These results indicate that, while chronostratigraphy based on variations in the normalised $^{87}Sr/^{86}Sr$ ratios remains a robust technique, information on changes of strontium fluxes into and out of the oceans (i.e. the cause of the $^{87}Sr/^{86}Sr$ variations) are only revealed through reconstruction of both stable and radiogenic marine Sr records

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LA-MC-ICP-MS dating of zircon using petrographic thin sections: An investigation of buried Archean basement in southern Alberta

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A novel *in situ* LA-MC-ICP-MS U-Pb dating technique developed recently at the University of Alberta permits geochronological investigations of accessory minerals to be conducted routinely using standard petrographic thin sections [1]. The MC-ICP-MS instrumentation (NuPlasma) employed houses a collector block containing a combination of twelve Faraday collectors and three discrete-dynode electron multipliers (ETP multipliers). The latter permit acquisition of low Pb ion signals with high precision and consequently laser ablation analyses consume small sample volumes. The advantages of dating accessory minerals *in situ* within petrographic thin section by LA-MC-ICP-MS cannot be overstated; for example, it provides the opportunity to link age information *directly* with deformational fabrics or textures, and pressure-temperature data derived by electron microprobe analysis of minerals in the same thin section.

Previous fragmentary U-Pb dating of the Archean basement beneath the Western Canada Sedimentary Basin led to this project. Cores from deep drilling were augmented by xenoliths from Tertiary dykes in southern Alberta and outcrop samples from areas to the north and south. The geographical extent of the 28 thin sections investigated ranges from the Little Belt Mountains (western Montana) to Daly Lake area (NW Saskatchewan). Zircons were ablated using a 20 micron spot size. U-Pb ages range from 3.3 Ga for a core from Home Pacific Knappen to 2.5 Ga for an outcrop sample from Daly Lake. Ages for crustal xenoliths from dykes range from 2.9 to 2.6 Ga. The spread of U-Pb ages is similar to that for the Wyoming Craton. The geographic distribution of U-Pb ages can be reconciled with proposed Late Archean crustal accretionary models for southern Alberta [e.g. 2].

[1] Simonetti *et al.* (2006) *Int. J. Mass Spectrom*. **253**, 87-97. [2] Clowes *et al.* (2002) *Can. J. Earth Sci.* **39**, 351-373.