Isotopic composition of the Early Precambrian crust of the South-Western Siberian Craton: Implications for crustal growth and mantle-crustal interaction through time

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Isotopic Sm-Nd whole-rock and Lu-Hf zicon analysis is a powerful approach for tracing crustal growth and evolution through time. New isotopic data on Early Precambrian metamorphic complexes and granitoids from the south-western Siberian Craton are used to constrain main stages of crustal growth via magmatism and to trace mantle-crustal interaction during lithosphere evolution.

The oldest crust of the south-western Siberian Craton consists of Paleoarchaean (3.3-3.4 Ga) TTG and felsic granulite complexes. The isotopic signatures (ε_{Nd} from +3.1 to -1.0 and ε_{Hf}=2.1-3.3) suggest involvement of pre-3.3 Ga crust in their formation. Felsic metamagmatic and granitoid complexes were formed through a time interval from 2.9 to 1.85 Ga and are mostly characterized by negative ε_{Nd} values suggesting their crustal-derived genesis. The ε_{Nd} values decrease through time but deviate from the isotopic evolution trend of the Paleoarchaean crust. The higher ε_{Nd} values are indicative of mantle contribution to the genesis of the felsic rocks. Both, the T_{Hf} (DM) of 3.0-3.2 Ga and ε_{Hf} from -1.6 to +2.4 of the 2.7 Ga felsic metavolcanics, confirm involvement of older crustal and mantle sources in their formation. The studied mafic metamagmatic associations vary in age from ca. 3.4 to 2.6 Ga. The Paleo- and Mesoarchaean amphibolites compositionally correspond to tholeiitic basalts. Their flat REE patterns $(La/Yb)_n$=0.6-1.4) and ε_{Nd} values (1.1-4.4) suggest derivation from depleted mantle. On the contrary, the Neoarchean (2.6-2.7 Ga) mafic granulites, which protoliths correspond to subduction-related basalts, are mostly enriched in LREE and possess variable ε_{Nd} (+3.9 to -0.2) and ε_{Hf} (7.2-2.2). These features suggest contamination of their mantle sources by crustal material probably via sediment subduction. Thus, the available isotopic data provide evidence of mantle-crustal interaction during the Early Precambrian evolution of the south-western Siberian Craton. Contribution of mantle sources in the formation of felsic rocks is traced during the whole Early Precambrian, while the reverse proccess of recycling of crustal material into the mantle are marked in the Neoarchaean mafic rocks only.

Rapid assembly of an 'S-type' batholith in New Zealand: The plutonic equivalent of a supereruption?

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Plutonic bodies are an integral part of most orogenic belts and reflect the plumbing system by which mantle and lower crustal melts are fractionated and crust is formed. A critical step in understanding the formation of the Earth's crust is investigating the physical and chemical processes that lead to the formation of large-volume silicic caldera-forming magmatic systems.

Recent research has suggested that some plutons were produced by incremental growth and solidification over several millions of years and therefore do not retain large volumes of eruptible magma at any stage in their construction. In contrast, caldera-forming eruptions require rapid accumulation of large volumes of silicic magma.

We present preliminary high-precision U-Pb ID-TIMS geochronology from the Devonian Karamea Suite in western New Zealand that suggest the entire suite of 'S-type' granites was emplaced within ~2.1 Ma The Karamea magma flux rates (~85-125km^3/km arc/Ma)[1] are comparable to, or in excess of, those estimated for volcanic 'flare-up' events (supereruptions) which are typically associated with large volumes of silicic magma. We hypothesise that the Karamea high magma production rates required intimate interaction between voluminous hot asthenospheric magma and the lowermost sialic crust, necessitating emplacement within an extensional intra-arc setting similar to that observed in the active Taupo Volcanic Zone of New Zealand. Detailed O- and Hf-isotopic studies in zircon, and geochemical characterisation of mafic end members of the suite will allow us to test these hypotheses, and also to determine the relative contributions of juvenile and recycled continental crust to magma generation.

[1] Tulloch *et al*. (2009) *GSA Bulletin*. **121**, 1236–1261.