Multiple melt sources and shallow processes in a Cambrian magmatic arc (Morozumi Range, Antarctica)

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Growth of continental crust in accretionary orogenic belts takes place through repeated cycles of subduction–accretion of supra-subduction zone forearc, magmatic arc and backarc rocks. An ancient example relevant to magmatic arc accretion histories is represented by the remnants of the Cambrian-Ordovician Ross Orogen in Victoria Land (Antarctica). There, the Neoproterozoic schists of the Morozumi Range are host to an intrusive complex which preserves a record of multiple magma pulses emplaced under a variable stress regime in a rather short time span: (1) a main granite, with K-feldspar megacrysts defining a subvertical igneous foliation; (2) fine-grained dioritic stocks and dykes intruding the main granite with both sharp and diffuse contacts, (3) a muscovite-bearing peraluminous granite; (4) a tonalitic-granodioritic dyke swarm either conformably interlayered with the foliated metasedimentary host rock, or crosscutting the granite foliation.

LA-ICP-MS U-Pb zircon dates cluster at late Cambrian times for all these units, yet they carry different cargoes of relict cores. Unique geochemical-isotopic signatures for both the less evolved magmas (diorite and dyke tonalite) and the most acidic ones (granite and peraluminous granite) indicate that each one of them originated from distict sources at depth. Additionally, field relationships and chemical evolutionary trends testify for a variety of shallow level open-system processes, such as magma mingling/mixing between diorite and main granite magmas, as well as progressive assimilation of the host schists by the dyke tonalite magma.

In summary, crustal growth in the Morozumi intrusive complex was contributed by fresh mantle magma issuing from the metasomatized mantle wedge, while the production of other melts did recycle different crustal portions/layers: the main granite derived from Grenville-age granulitic lower crust; the peraluminous granite from late Proterozoic upper crust; the adakitic tonalite magmas from remelting of young amphibolite material in the deep subarc crust, coupled with digestion of local metasedimentary rocks.