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Mantle hydrous-fluid interaction with Archaean granite.

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Water content/species in alkali feldspars from late Archaean Closepet igneous bodies as well as growth and re-growth textures, trace element and oxygen isotope composition have been studied (Słaby et al., 2011). Both processes growth and re-growth are deterministic, however they differ showing increasing persistency in element behaviour during interaction with fluids. The re-growth process fertilized domains and didn't change their oxygen-isotope signature. Water speciation showed persistent behaviour during heating at least up to 600oC. Carbonate crystals with mantle isotope signature are associated with the recrystallized feldspar domains. Fluid-affected domains in apatite provide evidence of halide exchange. The data testify that the observed recrystallization was a high-temperature reaction with fertilized, halide-rich H_2O-CO_2 mantle-derived fluids of high water activity.
A wet mantle being able to generate hydrous plumes, which appear to be hotter during the Archean in comparison to the present time is supposed by Shimizu et al. (2001). Usually hot fluids, which can be strongly carbonic, precede asthenospheric mantle upwelling. They are supposed to be parental to most recognized compositions, which can be derived by their immiscible separation into saline aqueous-silicic and carbonatitic members (Klein-BenDavid et al., 2007). The aqueous fractions are halogen-rich with a significant proportion of CO_2. Both admixed fractions are supposed to be fertile.
The Closepet granite emplaced in a major shear zone that delimitates two different terrains. Generally such shear zones, at many places, are supposed to be rooted deep into the mantle. The drain, that favoured and controlled magma ascent and emplacement, seemed to remain efficient after granite crystallization. In the southern part of the Closepet batholiths an evidence of intensive interaction of a lower crust fluid (of high CO_2 activity) is provided by the extensive charnockitization of amphibolite facies (Stähle et al., 1987).The previously published data as well as the new ones point to volatile elements from both mantle and crust playing a prominent role in the petrogenesis of magmatic rocks during the Archaean. Their composition differs significantly in regard to water and CO_2 activity. The present contribution gives an evidence of hydrous mantle-derived fluids. Taking under consideration two-end members model proposed for Archaean mantle, the contribution favours wet-mantle model.

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Klein-BenDavid, O., Izraeli, E.S., Hauri, E. & Navon, O. (2007). Fluid inclusions in diamonds from the Diavik mine, Canada and the evolution of diamond-forming [U+FB02]uids. Geochimica et Cosmochimica Acta 71, 723–744.
Słaby, E., Martin, H., Hamada, M., Śmigielski, M., Domonik, A., Götze, J., Hoefs, J., Hałas, S., Simon, K., Devidal, J-L., Moyen, J-F., Jayananda, M. (2011) Evidence in Archaean alkali-feldspar megacrysts for high-temperature interaction with mantle fluids. Journal of Petrology (on line). doi:10.1093/petrology/egr056.
Stähle, H.J., Raith, M., Hoernes, S. & Delfs, A. (1987). Element mobility during incipient granulite formation at Kabbaldurga, Southern India. Journal of Petrology 28, 803-834.