Formation of rapakivi feldspar by fluid-induced alteration of granites

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Rapakivi feldspars found in many granitoids comprise alkalifeldspar megacrysts mantled by plagioclase, usually of oligoclase composition [1]. The formation of such feldspars has been attributed to magmatic or dry subsolvus processes [2]. Granites from the Malani Igneous Suite in western India have perthitic and antiperthitic feldspar megacrysts mantled by oligoclase or albite. Microtextural evidences such as the pitted, porous, and turbid nature of the feldspars, the coarsening of braid perthite to vein and patch perthite, the presence of an epitactic relationship between the megacrysts and the plagioclase mantle, the development of the oligoclase/albite mantle as pseudomorphs, the presence of hierarchical system of fractures within the interiors of the megacrysts as well as within the mantle, the presence of secondary inclusions of hematite, sericite, biotite, and zoisite are suggestive of a secondary origin for the rapakivi texture by a fluid-mediated dissolution-reprecipitation replacement process. The feldspar megacrysts crystallized from their parental magmas at temperatures >720ºC. At 465-490ºC, the megacrysts reacted with deuteric fluids which dissolved the braid perthite/antiperthite along an inward moving reaction interface and simultaneously precipitated the oligoclase/albite mantle. The pseudomorphic nature of the replacement indicates that the dissolution and reprecipitation processes were coupled. As the replacement front progressed inward, fluids infiltrated the interiors of the relict megacrysts along fractures and braid boundaries and coarsened the braid perthite to vein and patch perthite. At temperatures of 253-283ºC, the feldspars were partially albitized during which the oligoclase patches and the plagioclase mantle were partially replaced by albite. The replacement processes that formed the plagioclase mantle and the patch perthite/antiperthite were not isochemical with the fluid composition being externally buffered for many elements. However, concentrations of elements normally incorporated in the feldspar structure were internally controlled by the dissolution-reprecipitation reactions. These results indicate that in addition to magmatic processes, fluid induced replacement processes can also produce igneous-looking rapakivi textures in feldspars.

[1] Eskola (1930) *Bull. de la Comm. Géol. dela Fin*. **92**, 96–105. [2] Vernon (2016) *Aus. J. of Earth Sci*. **63:6**, 675-700.