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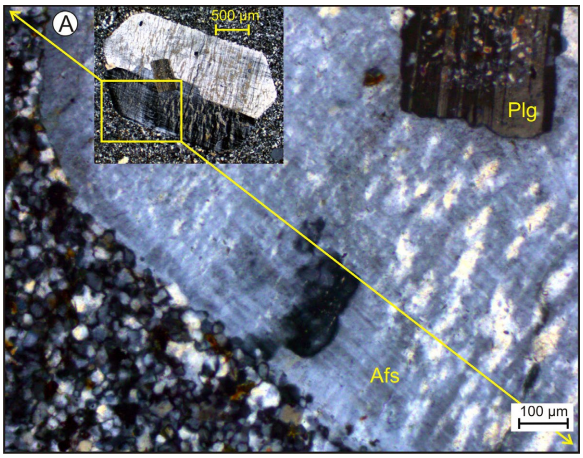
Deep fluid-mediated hypersolidus microstructures in the Bundelkhand granitoid, India

MR. ABHISHEK KUMAR MADHESIYA[1] AND SARAJIT SENSARMA[2]

[1]University of Lucknow, Lucknow
[2]University of Lucknow
Presenting Author: mithabhishek1994@gmail.com



Mineral compositions record processes and conditions of crystallization (pressure, temperature, and volatile content) of magma (e.g., mixing, assimilation, degassing) [1]. Here, we report the role of deep melt/fluid in developing syn-crystallization microstructures in the ~2.6 Ga Bundelkhand granitoid. Primary microstructures in the rocks include euhedral oscillatory zoned and unzoned microcline, plagioclase (albite-oligoclase), euhedral plagioclase inclusions in exsolve microcline (Fig. A), and euhedral apatite. Euhedral amphibole, epidote and biotite are common mafic minerals. Rounded shape with embayed margins in feldspars, quartz, and amphibole are also present. 'Recrystallization' of exsolve microcline, plagioclase, and quartz are common.

Similar Rb, K contents, consistent ratios of immobile incompatible trace elements, and REE patterns of the samples rule out meteoric water action and/or near-surface alteration. There is no evidence of thermal metamorphic effects either. 'Recrystallization' of microcline, plagioclase, and quartz occurred in hypersolidus conditions during crystallization of the magma and not products of subsolidus recrystallization.

The temperature (716°-856°C) estimates and Ba contents (0.36-2.03 wt. %) across microcline show a sawtooth pattern. The FeO (3687-6770 ppm) and CaO (979-1623 ppm) contents also follow a similar trend in the same crystal. We attribute the compositional profile patterns in feldspar to thermal fluctuations linked to magma recharge in the crystallizing granitoid mush. Compositional variations in amphibole, particularly in terms of Fe^{2+}/Fe^{3+} at different depths, are also attributed to multiple recharge events to varying depths in the crystallizing mush. Smaller mafic patches/clots in granitoid crystallized at different P-T conditions bear physical evidence of quenched mingled mafic melt in crystallizing granitoid mush. Fine-dark green thin dykelets, along with feldspars and quartz margins and shear/fracture planes, are common (<15-20 in volume %) in granitoid. The dykelets show chlorite-like look (but not chlorite), and consistently yield high FeO (27-40 wt. %), but low total under backscattered electrons (~80-88 wt. %), interpreted as silicate-dissolved aqueous fluid. The high temperature fluid activity had mafic affinity likely of deep crust-mantle origin that mediated 'recrystallization' of minerals; restricted chemical exchanges may have resulted in amoeboid/rounded shape with embayed margins to earlier crystallized minerals.

[1] Ginibre C *et al.* (2007) Elements **3(4)**, 261-266.