Enriched in Oxygen and Aluminium fluoride-calcium melts in ongonites

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The ongonite massif Ary-Bulak (Eastern Transbaikalia, Russia) forms a domal stock about 0.8 km^2, cross-cutting sedimentary-volcanogenic rocks. The center of the massif is composed of porphyric ongonites holding phenocrysts of quartz, sanidine, albite, sometimes topaz and mica. The matrix of rocks consists of quartz grains (20-30 μm), tabular albite (30-80 μm) rimmed with sanidine (5-20 μm) and the spicular topaz. In the endocontact zone porphyric rocks are replaced by glassy aphyric rocks lying 50-200m from the contact with hosting schists. The porphyric ongonites incorporate varieties with high CaO (3.3-21.8 wt%) and F (2.7-16 wt%). The rocks of this type occur are mostly abundant in the marginal zone. High CaO (7.8-18 wt%) and F (7.1-15.5 wt%) are characteristic of aphyric rocks. The porphyric and aphyric Ca-rich rocks display direct correlation between Ca and F. The interstices between minerals of the matrix of this rocks are filled with submicron concretions of glassy "fluorite" and "potash feldspar" phases. The "fluorite" phase commonly contains impurities (wt%): O (3-12), Al (0.5-3.3), Si (0.2-1.5), infrequently Sr (up to 1.3), Na (up to 0.5) and S (up to 0.3). The albite phenocrysts are partially or completely replaced with "fluorite" phase, in places together with "potash feldspar" phase, prosopite and mineral of dickite type. Besides, dickite forms the ingrowths in "fluorite" phase. The aphyric rocks have numerous separations of rock-forming prosopite $CaAl_2F_4(OH)_4$ (from 6 to 26 wt%).

It is assumed that "fluorite" and "potash feldspar" phases result from partial crystallization of micro-emulsion of immiscible O- and Al-rich fluoride-calcium and alumosilicate melts. The crystallization of degree of fluoride-calcium glass varying from 20 to 83% was defined by X-ray method. It was proposed that the O and Al admixtures are primarily concentrated in fluoride-calcium glass ($O^{2-}+Al^{3+}\rightarrow F^{-}+Ca^{2+}$). The O- and Al-rich fluoride-calcium and alumosilicate residual melts coexisted at the temperature below $\beta\rightarrow\alpha$ transition of quartz (585-595ºC at 0.8-1 kbar). Crossing veinlets in the aphyric rocks, filled with "fluorite" phase with prosopite and aqueous Ca-alumofluorides (gearksutite, carlhintzeite), also suggest presence of fluoride-calcium melts enriched with O, Al and fluid at <450-500ºC after crystallization of overwhelming part of the Ary-Bulak massif. These unusual melts are close to supercritical fluid in their high penetrating ability (low viscosity). Now conditions are obscure wherein such melts can appear and exist. It is proposed that presence of O and Al stabilizes this fluoride-calcium melt and prevents crystallization of fluorite from it.

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