Extremely Cs-rich alumosilicate melts in ongonites

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Melt inclusions (MIs) with glasses containing 0.5–17.5 wt% Cs_2O are discovered for the first time in ongonites of the Ary-Bulak massif, Eastern Transbaikalia, Russia. As a whole, 11 such MIs were found within 9 quartz phenocrysts from 4 ongonite samples. These MIs occur apart or together with usual silicate MIs and fluid inclusions in both early and late zones of the host mineral. Extremely Cs-rich MIs are filled with semitransparent glasses, and they have large shrinkage vugs. Some of them contain Na-sanidine and mica crystalline phases. On EMPA data Cs within residual and quenched glasses MIs is distributed uniformly. Glasses of some MIs contain Cu (0.6-1.2 wt% CuO). Rare elements and H_2O contents in glasses from 16 MIs are determined by SIMS. Glasses are enriched in (ppm): B (122-1942), Be (16-179), Li (73-1233), Rb (630-2705), Nb (70-180), Ta (11-46), but they are depleted in Ba (0.1-18) and Sr (0.3-8). Usual MIs contain 113–564 ppm Cs and 1.5-7 wt% H_2O whereas in extremely Cs-rich ones (>0.5 wt% Cs) H_2O contents are essentially lower (about 0.6 wt%). Data on thermometry and compositon of MIs reveal that viscosity of alumosilicate melts rises, when the content of Cs is high but H_2O content is rather low.

Before intrusion H_2O- and F-rich ongonite melt of the Ary-Bulak was enriched in Cs, B, Be, Li, Rb, Nb and Ta. At the phenocryst crystallization stage this melt contained rare small “drops” of extremely Cs-rich melts – more viscous and more “dry” than surrounding melt. There is no correlation between Cs and such elements as Si, Al, Na, K and F in residual and quenched glasses of MIs containing up to 7.3wt% Cs_2O. In most cases, the molar ratio $Al_2O_3/(Na_2O+K_2O+Cs_2O+Rb_2O)$ is close to 1. This suggests predominantly “feldspar” relation of Al and alkalies in extremely Cs-rich melts. But glass containing 17.5 wt% Cs_2O has obviously sodium, “pollucite-analcime” specific features. In the process of ongonite crystallization Cs was taken by feldspars and micas. More high Cs contents in matrix of ongonites in comparison with its contents in rocks as a whole, and data on distribution coefficients of Cs (D^{Cs}) reveal that it accumulated at the final stage of the Ary-Bulak massif crystallization. Some part of Cs might be redistributed from melt to fluid. Analysis of data on Cs distribution in rocks and glasses of MIs with regard to $D^{Cs}_{crystal/melt}$, $D^{Cs}_{fluid/melt}$ and the crystallization degree of the massif don’t agree with the traditional fractional crystallization model. It is necessary to attract other models, for instance, crystallization of chemically heterogeneous melts with the availability of fluid flow draining through magmatic chamber.

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