

High-K ankaramitic and high-Al magmas in the Eastern Srednogie continental arc: Comparison between melt inclusion geochemistry and lavas

Peter Marchev¹, Svetoslav Georgiev², Zoltán Zajacz², Simone Tomassini³, Piero Manetti³, Albrecht von Quadt²

¹Geological Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria,
pmarchev@geology.bas.bg

²University of Florence, Italy, toms@unifi.it; manetti@unifi.it

³ETH Zurich, IGMR, Switzerland, georgiev@erdw.ethz.ch; zajacz@erdw.ethz.ch;
vonquadt@erdw.ethz.ch

Two olivine and clinopyroxene-rich high-Mg cumulitic rocks (24.5 wt. % and 12.0 wt%, respectively) from the Upper Cretaceous Srednogie continental arc, Bulgaria, contain melt inclusions with much less mafic compositions. Olivine (Fo₉₁₋₈₅)- and clinopyroxene (Mg#89-69)-hosted melt inclusions in the more mafic rock are characterized by high-calcium, nepheline-normative compositions (MgO=7.5 - 10.8 %, CaO/Al₂O₃>1), with high total alkalis and K₂O/Na₂O>1, which can be classified as shoshonitic ankaramites. The inclusions in olivine (Fo_{84.2-83}) and clinopyroxene (Mg#86.9-75.3) in the less mafic rock are also nepheline-normative, but with lower (MgO=3.1 - 5.6 wt.%, CaO/Al₂O₃ <1), with similar high K₂O/Na₂O ratio, but at 2-3 times higher alkali contents. Chemical composition of this magma can be determined as high-K trachybasalts. Major and trace element composition of the ankaramitic melt inclusions are similar to the bulk rock compositions of some lavas and dykes, from the central part of the Eastern Srednogie, indicating that they have been formed from melts of similar composition. These rocks are strongly porphyritic, composed by phenocrysts of olivine and large clinopyroxene, resembling the high-potassic ankaramites from several other continental and oceanic arcs. Rocks with compositions, similar to the high-K trachybasaltic melt inclusions were not found, although more evolved ultra-K magmas are largely distributed in the area. Isotopic (Sr and Pb) similarity of the cumulitic rocks containing ankaramitic and trachybasaltic melt inclusions indicate derivation from similar source and progressive fractionation of olivine and clinopyroxene from ankaramitic parental (in proportions similar to those in the cumulitic rocks) can result in production of high-K trachybasalts. The most likely source of the Eastern Srednogie primitive high-calcium, silica-undersaturated magmas is a clinopyroxene-rich, phlogopite-bearing mantle source. Garnet-bearing peridotites and clinopyroxenite cumulates are alternative but less realistic sources.