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# The Ioko-Dovyren layered massif (Southern Siberia, Russia): 1. Internal structure, magma compositions, and fingerprints of open magma chamber behavior

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The Yoko-Dovyren massif (YDM) is located ∼60 km to NE of the Baikal Lake, being morphologically a ridge of 26 km long and up to 2114 m high. Geologically, the pluton is a lens-shaped body (up to 3.5 thick) which together with associated peridotite sills, diabase dikes, and overlying volcanics represents a volcanic-plutonic association (728+/-2.4 Ma [1]), formed in the Late Riphean within a huge rifting system (the Olokit trough) at the southern margin of the Siberian craton. A unique feature of the regional geology is the concordance of the igneous rocks with the enclosing carbonate-terrigenous sediments along its strike and dip, which is nearly vertical due to post-intrusive folding. This allows one to sample the intrusive complex across the strike, from the lower to upper contacts. The modal layering of YDM includes a bottom unit of plagioclase lherzolites (100-150 m) followed by a succession of cumulates including: Pl-bearing and adcumulate dunites (Ol+Chr, 800-900 m), troctolite (Ol+Pl+Chr, ∼700 m), Ol gabbro (Pl+Ol+Cpx, Pig-gabbro and quartz gabbronorites (Pl+Cpx±Opx±Pig). Despite its Precambrian age, YDM was not metamorphosed significantly, so that most of intrusive rocks are very fresh, preserving both their igneous textures and original mineralogy. Parental magma compositions have been evaluated based on studies of the chilled zones and underlying ultramafic sills. The most primitive rocks of YDM have been discovered at the lower contact composed of chilled diabases and picritic rocks containing variable amounts of Ol, and ophitic textures of their groundmass. The FeO-MgO trend displayed by these high porosity cumulates suggests them to contain originally olivine ∼Fo88. The COMAGMAT model calculations indicate the initial temperature of the heterogeneous magma is to be of 1310oC, with the magmatic melt containing ∼12% MgO [2]. Using this composition as starting one, we simulated the parent crystallization sequence which corresponds to that observed in the YDM cumulates. Estimates for Ol-gabbronorites and Pl-dunites from ultramafic sills result in more evolved magma containing Ol∼Fo85 at T∼1190oC. Both geochemical and cumulate structure of YDM is indicative of a significant amount of mafic melts to be extracted from the original cumulate piles, followed by their expulsion from the magma staging chamber. Fingerprints of such an open-system behavior are recorded in (1) strong depletion in incompatible elements of the bulk YDM composition with respect to parental magmas, (2) a complimentary “over-enrichment” with Ol cumulates and sulfides, (3) insignificant variations of Ol composition throughout the Layered Series, and (4) the absence of the Upper Border Series as a marginal compositional reversal.

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[1] Ariskin et al. (2013) Geochem. Intern. [2] Ariskin et al. (2012)Abs. 12th Intern. Ni-Cu-(PGE) symp. (China)