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Magmatism evolution in the Nori'lsk region (Siberian trap province)

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The NW Siberian trap province is very important for our understanding of evolution of huge magmatic system (T1) and origin unique Pt-Cu-Ni deposits. To solve these genetic problems (including correlation between effusive and intrusive rocks) it is necessary to get accurate information about magmatism migration in space and in time inside different tectonic structures in the Noril'sk region. Thed latter takes outstanding place on the Siberian platform due to its geological features.
It consists of two main areas covered by volcanic rocks: I. Kharaelakhsky trough (on West) and II. plateau Putorana (on East) are subdivided by carbonate-terrigenouse rocks (C-P2) of Khantaisko-Rybninsky swell . These two zones differ one from another by thickness of basalts and their composition.The fist zone extents along the Khatanga fault and contains all suits, including three lowest ones – ivakinsky (Iv), syverminsky (Sv), gudchikhinsky (Gd). II zone essentially consists of the middle and upper suits – hakanchansky (Hk), tuklonsky (Tk), nadezhdinsky (Nd), morongovsky (Mr), mokulaevsky (Mk), kharaekakhsky (Kh), kumginsky (Km) and samoedsky (Sm). Usually it is constructed the complete section of the Noril'sk volcanites from rocks of two zones. But every suit has its own areal extent., which to contour it not so easy because volcanic rocks represent very similar tholeiitic basalts (in term of texture and petrochemistry). Their differentiation is just possible using rare elements and isotopes contents in the rocks [1].
We have studied a lot of basalt sections based on their outcrops and cores of drill holes (4 570 m) and intrusive bodies graduated in mineralization (internal structure, geochemistry, mineralogy, isotopes composition). According new data areoles of the lowers and the upper suits separate in space. The thicknesses Iv and Sv suits (TiO2=2-4 mas. %; Gg/Yb = 2.2.) decreases synchronously from NW Kharaelakh and the towards Putorana at 30%. Gd suit (TiO2=1-2 mas.% and Gd/Yb is 2.7-3.2) demonstrates the most dramatic changes in its thickness (from 450 m on the west to 12 m on the east Lake Lama) and compositions (degree of contamination downs in this destination) [3].
The next overlapping Gd basalts, Hakanchansky and Low Nadezhdinsky suits (widespread on the West) consist of very similar tholeiitic basalts. It is important to emphasize that Hk volcanic rocks are analogous to Nd1 tholeiits ones in terms of high HLE and LREE. In contrast them Tk basalts (TiO2=2-4 mas. %; Gd/Yb=1.3) contain normal LREE concentrations. The latter widespread to the west from Khantajsko-Rybninsky swell separated from Hk and Nd1 suits. Perhaps, during this period two types of magma flowed from different sources were separated in space. The first magma type (Nd) is close to average crust composition and differs significantly from other basalts (Tk-Sm). During the late period of magmatism all surface of plateau Putorana was covered by very similar low-Ti lavas and tuffs.
Thus, according to the geological setting and geochemical features, 4 cycles of volcanism in the Noril'sk region can be distinguished: 1) Iv-Sv, 2) Gd, 3) Hk-Nd, 4) Tk, 5) Mr-Sm . What is a place of ore-bearing intrusions in this scenario?
Due to the elevated weighted mean MgO content (10-12 mas.%) in the ore-bearing intrusions (it is believed that the massifs with sulfide mineralization are comagmatic with high-Mg effusive rocks Gd, Tk or Nd suits. But their mineralogo-geochemical features are very different. An additional noril'sk type massifs intrude not only rocks of these suits but Nd and Mr too[2]. So they crystallized from an own portion of magma. They might have been formed after the formation of all volcanic sequences.
References
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