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Sulfide minerals as new Sm-Nd geochronometers for ore genesis dating of mafic-ultramafic layered intrusions

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The main method of dating the ore process was the Re-Os method of sulfides (Luck, Allegre, 1983; Walker et. al., 1991). However, studies of Re-Os systematics of sulfide minerals do not always give the correct ages and showing the disturbances of the Re-Os systematics. At the same time, Sm-Nd age of sulfides in good agreement with the U-Pb dating on zircon and baddeleyite and suggests that the Sm-Nd system of sulfides is more resistant to secondary alteration processes. Our studies have shown that along with rock-forming, ore minerals (sulfides) can be used to determine the ore genesis time of industrially important geological sites, since exactly with the sulfides the industry Pt-Pd mineralization is closely connected.

The Sm-Nd investigations steadily employ new minerals-geochronometers. Of these, sulfides of PGE-bearing layered intrusions are quite important in terms of dating the process of ore origin. Studying the REE distribution in the sulfides of MOR hydrothermal sources has shown possible REE presence in the sulfide lattice (Rimskaya-Korsakova et. al., 2003). These are difficult to carry out because the concentrations of Sm and Nd isotopes in sulfides are much lower than chondrites (Rimskaya-Korsakova et. al., 2003).

For the first time in Russia with sulfide and rock-forming minerals and WR in Sm-Nd method have been dated impregnated and brecciform ores of the following objects: Pilguyarvi Cu-Ni deposits, Pechenga (1965±87 Ma); impregnated (2433±83 Ma) and redeposited (1903±24 Ma) ores of Ahmavaara intrusion (Finland); ore gabbronorites of Penikat PGE-bearing layered intrusion (2426±38 Ma (Ekimova et.al., 2011); Pt-Pd gabbro-pegmatite ores (2476± 41 Ma, which agrees with the U-Pb zircon age - 2470±9 Ma (Bayanova, 2004) and gabbronorites (2483±86 Ma) of PGE Kievei deposit and Fedorova Tundra metagabbroids (2494±54 Ma); Monchetundra gabbronorites – 2489±49 Ma.

In (Kong et. al., 2000) sulfides from two metamorphosed chondrites studied by instrumental neutron activation analysis (INAA) and ion probe. As shown, the level of REE in the sulfide phase determined by the ion probe is quite similar to that obtained by INAA. Although the concentrations of REE in the enstatite and the Fe, Si, Cr-rich inclusions are comparable to those in sulfide, estimates based on mass balance calculations show that the silicate inclusions would not noticeably contribute to the REE budget in sulfides (Kong et. al., 2000).

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