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Geochemical and mineralogical indicators (Cr-spinelides, Platinum Group Minerals) of the geodynamic settings of formation of mafic-ultramafic Ulan Saridag massif (Eastern Sayan)

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Ultramafic Ulan-Saridag massif (USM) is part of Eastern Sayan ophiolite belts, lying between the ophiolites of Southern and Northern branches. Ophiolites of Southern branch were created in mid-oceanic ridges, and Northern one – in island arcs enviroment. Recent data indicate the formation of USM ophiolites in supra-subduction conditions ensimatic island arcs.

Ore podyform chromitites consist of alumochromite, chromite, and chrompicotite (first finding for this region). Chromespinelides are divided into three groups. They refer to MORB-peridotite, supra-subduction peridotites and to complexes of Ural-Alaskan type.

We present first data on PGE mineralization for this massif represented by Os-Ir-(Ru) solid solutions, native Os, Ru, laurite-erlichmanite (Ru,Os)S2, laurite (RuS2), irarsite (IrAsS), zakarinit (RhNiAs).

Solid solutions of Os-Ir-(Ru) were found as idiomorphic inclusions in spinel, and in xenomorphic grains in intergrowths with laurite. They correspond to early high-temperature magmatic Os-Ir solid solution. The phases (Os, Ir, Ru) of varying composition are common as numerous micro - and nano-size inclusions in laurite-erlichmanite. They corresponds to osmium or ruthenium. Native Os0 (Os> 80 wt.%) is recognized in polyphase aggregates, together with chalcosine, laurite, laurite-erlichmanite. Native Ru (Ru=93 wt.%) – occur in the polyphase, together with heazlewoodite, zakarinite, Os-Ir-Ru solid solutions. Laurite and laurite-erlichmanite RuS2 – (Ru,Os)S2 are represented most widely.

There are two groups: 1) laurite-erlichmanite (Ru, Os)S2; 2) laurite RuS2 - phase of variable composition (Ru,Os)S2 rarely forming independent grains, occurring more often in multi-component aggregates of heterogeneous composition, together with laurites and contains a large number of rounded and rectangular micro-inclusions of native Os, (Os-Ir), and Ru. In the chemical composition of laurite-erlichmanite there is some lack of sulphur. Laurite has a homogeneous microstructure and composition consistent with the "ideal" stoichiometric composition (Ru=61,2 wt.%, S = 38.2 wt.%). It forms individual grains in chlorite and serpentine in association with irarsite, sulfides of Ni, Cu and rims around laurite-erlichmanite.

It is known that (Os-Ir) and solid solutions of laurit-erlichmanite are forming before or nearly simultaneously with the segregation of chrome - spinel in the upper mantle at T=1200oC and P= 5-10 kbar. Sulfo-arsenides and arsenides of Ru, Ir, Rh, Ni are formed from the residual fluid phase at post-magmatic stage, together with heazlewoodite. It is possible that in chromitites from USM there are two generation of sulphides. 1-st PGM generation – magmatic solid solutions of laurite-erlichmanite. 2 -nd generation – the newly formed laurite, with primary laurite-erlichmanite or intergrowths with chalcosine, and millerite confined to zones of chloritization. The predominance of Os, Ru sulphides over the solid solutions of Os-Ir-Ru indicates a higher sulfur fugacity in the mantle source of USM. This indicates the distinctive characteristics of PGM of USM compared to PGM from chromitites of the Northern and Southern branches of the ophiolites.

Obtained result evidence about complex history of Ulan-Sardag ultrabasice massif, formed in three geodynamic settings: mid-ocean ridges, primitive ensimatic and ensiallicic island arcs and subduction zone and the conditions of Alaska type magmatism.

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