Superimposed lithogeochemical patterns and trains as pathfinders to concealed ore deposits

S.S. SHEVCHENKO*, S.V. SOKOLOV, A.G. MARCHENKO AND Y.V. MAKAROVA

A.P. Karpinsky Russian Geological Research Institute (VSEGEI), Sredny pr., 74, St.-Petersburg, 199106, Russia (*correspondence: sergey_shevchenko@vsegei.ru) (sergey_sokolov@vsegei.ru, alexey_marchenko@vsegei.ru)

Terrains, covered with drifts of various origin, are principal targets for exploration aimed at discovering new economic deposits. However, routine surface geochemical prospecting surveys are not effective enough in such areas due to low contrast or absence of geochemical anomalies related to ores, e.g. dispersion patterns and trains of economic ore deposits and mineralized zones. Hence, now there is an urgent need to develop and apply leading-edge geochemical techniques that are deep-penetrating ones and enable revelation of concealed ore deposits.

The deep-penetrating methods are those with taking geochemical samples at the surface but receiving geochemical signals from the depth. The principal signals of this kind are the superimposed geochemical dispersion patterns and trains in overburdens formed by the phenomenon of jet-flow vertical migration of chemical elements from the deep-seated objects up to the surface. Lithogeochemical dispersion patterns and trains, related to ores in bedrock, appear in soils and stream sediments as results of migration of mobile forms of elements within the gaseous and water upward flows with sequential secondary fixation of elements in solid media due to their sorption in clayey particles, Fe and Mn hydroxides, and other natural substances. However, geochemical exploration using revelation of superimposed dispersion patterns and trains requires application of special geochemical methods. Among techniques of that kind is the Method of Analysis of Superfine Fraction (MASF) developed in VSEGEI, that uses extraction and selective analysis of superfine fraction of soils and stream sediments (<3-10 μm).

Re-Os isotope constraints on the genesis of the Lüliangshan garnet-peridotites in the North Qaidam UHP belt, Tibet

R.D. SHI[1,2,3]*, B.H. DING[2], X.C. ZHI[2] AND G.C. ZHAO[3]

[1]The Institute of Tibetan Plateau, Chinese Academy of Sciences, Beijing, 100085, China (*correspondence: shirendeng@itpcas.ac.cn)
[2]School of Earth and Space Sciences, University of Science and Technology of China, Hefei, 230026, China
[3]The Department of Earth Sciences, the University of Hong Kong, Pokfulam Road, Hong Kong SAR, China

Small volumes of the layered garnet peridotite occur as lens in the North Qaidam ultrahigh-pressure (UHP) metamorphic belt, Northern Tibetan Plateau in west China [1, 2]. Previous studies suggested that protolith of the garnet peridotite formed as magmatic cumulates and was exhumed from depths of > 200 km [2, 3].

The concentrations of Re and Os are 0.01~0.13 ppb and 1.27~2.98 ppb for the Lüliangshan garnet peridotites, respectively. The Re/Os ratios ranging from 0.01 to 0.05 are lower than that of chondrite (0.08), the $^{187}Re/^{188}Os$ ratios range from 0.0317 ± 2(2σ) to 0.2231 ± 26(2σ), lower than that of primitive upper mantle (PUM, 0.4346), the $^{187}Os/^{188}Os$ ratios are between 0.11374 ± 19(2σ) and 0.12616 ± 20(2σ), also lower than that of PUM (0.1296), and the T_{RD} ranges from 1.3Ga to 2.1Ga (except one is 0.5Ga). With the PUM value of 0.1296, the garnet peridotites yields an errochron age of 2.1 Ga with initial $^{187}Os/^{188}Os$=0.11279, which is similar to the Os model ages of mantle peridotites from the Yangtze craton, but contrast markedly with the Archean ages of the subcontinental mantle of the North China craton. We suggest that: 1) the garnet peridotite formed as a residue mantle by melt extraction instead of magmatic cumulation; and 2) the garnet peridotites formed around 2.1 Ga ago, likely originated from the mantle of the Yangtze craton. This result supports that the lithospheric mantle of the Yangtze craton in the northern Qaidam block was subducted to depths of >200 km as in the Sulu-Dabie area in eastern China.

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