5.3.P14

Geochemical characteristics and genesis of the Late Paleozoic metamorphic rocks in eastern Tianshan, Northwest China

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Two Late Paleozoic metamorphic belts have been identified in eastern Tianshan, northwest China . One is the Kushui metsmorphic belt to the south, and the other is the Harlik metamorphic belt to the north.

The Kushui metamorphic belt consists of schistose epimetamorphic rocks, phyllite, schist, granulite and amphibolite. Metamorphism is largely of a middle-temperature (465~640^{o}C) and middle-pressure (4Kb) facies with assemblages that include kyanite, staurolite and sillimanite. The study of chemical characteristics of metamorphic rocks displays that most metamorphic rocks are derived from volcanic protoliths, and others are from sedimentary protoliths. The compositions of the main rock forming minerals such as muscovite, hornblende, garnet and staurolite indicate that the Kushui metamorphic belt underwent hormblend facies metamoephism. A whole rock Rb-Sr ischron age of 291.8±28.5Ma implies that metamorphism occurred at the end of the Carboniferous. Although the strata of the Kushui metamorphic belt were deposited in an extensional setting, the middle-pressure type regional metamorphism is related to post-extension compressional tectonism.

The Harlik metamoephic belt passed two metamorphoc stages, that is, thermal metamorphism and regional dislocation metamorphism. The thermal metamorphism, which formed metamorphic hornstones indicated by high-temperature (T=922~780^{o}C) and low-pressure mineral compositions, such as cordierite, andalusite etc, was closely associated with intra-island-arc tension caused by B-type subduction of the ancient oceanic plate. A zircon U-Pb age of 305.9±2.9Ma represents the age of the thermal metamorphism. The regional dislocation metamorphism, formed crystalline schists indicated by middle-temperature (T=450~670^{o}C) and middle-pressure (P=2.3~4.1Kb) mineral composition of almandine, staurolite and sillimanite, was closely related to regional faulting caused by A-type subduction in the process of collision orogeny. The zircon U-Pb dating ranges from 293.8±3.3Ma to 296.3±3.5Ma, which represents the age of the regional dislocation metamorphism.

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5.3.P15

PGE geochemistry of chromitites and dunites of the Nidar Ophiolite, Himalaya

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Numerous ophiolites occur in the Indus Suture Zone, and the Nidar ophiolite is the largest on the eastern Ladakh, Himalaya. It consists of radiolarian cherts, pillow lavas, dykes, cumulates, rodingites, peridotites and chromitites. Spinel bearing harzburgites and dunites are the dominant ultramafic rock types. Chromite, chalcopyrite, pyrrhotite, pyrite and arsenopyrite occur as disseminations in ultramafic rocks. Harzburgites and dunites are serpentinized to varying degrees and the sulfide assemblage suggests a reducing environment during serpentinization.

Nidar peridotites have low TiO_2 (0.02-0.03 wt. %), Al_2O_3 (2-3 wt. %), CaO (0.58 wt. %), Zr (40 ppm) and Y (30 ppm), and enriched in Cr (3000-5000 ppm) and Ni (3000 ppm). Ni positively correlates with MgO content. TiO_2 and CaO concentrations decrease with increasing MgO content. They host podiform chromitites (Cr # = 0.82) of metallurgical grade. The geochemistry of peridotites and Cr # of the chromitites suggest its formation by high degrees of partial melting in a supra-subduction zone environment involving fluids/volatiles.

PGE were determined by laser ablation ICP-MS after preconcentration into a NiS mini-bead. The chromitites have relatively higher concentrations of PGE (Pt = 0.275-0.716 ppm; Pd = 0.223-0.918 ppm; Ru = 0.186-0.595 ppm; Rh = 0.084-0.352 ppm; Os = 0.077-0.142 ppm; Ir = 0.053-0.106 ppm and Au = 0.057-0.270 ppm) with the total PGE (excluding Au) ranging from 0.898 to 2.75 ppm. The CI chondrite-normalized abundances are variable, fractionated and show a negative Pt anomaly. The host serpentinized dunites have very low concentrations of noble metals (total PGE = 0.5 ppm) and their chondrite-normalized PGE patterns are similar to those of the chromitites, except their low abundances which suggests that serpentinization has not affected the whole-rock PGE chemistry. The relative abundances of PGE are probably dependent on the number of PGE bearing phases present within the chromites. Such PGE patterns are common to the magmatic sulfide deposits suggesting a magmatic source for the PGE.

The geochemistry of ultramafic rocks and the mineral chemistry of podiform chromite, indicate a fluid-rich supra-subduction zone environment for the formation of Nidar ophiolite, and a magmatic source for the PGE. Ophiolites formed in a supra-subduction zone environment constitute a potential host for mineral deposits.