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Diamonds, Super-Reduced and Crustal Minerals in Chromitites of the Hegenshan and Sartohay Ophiolites, Central Asian Orogenic Belt, China

Paul T. ROBINSON*, YANG Jingsui, TIAN Yazhou and ZHU Huang

CARMA, State Key Laboratory of Continental Tectonics and Dynamics, Institute of Geology, Chinese Academy of Geological Sciences, Beijing 100037, China

1 Abstract

The Central Asian Orogenic Belt (CAOB) is a huge tectonic mélange that lies between the North China Craton and the Siberian Block. It is composed of multiple orogenic belts, continental fragments, magmatic and metamorphic rocks, suture zones and discontinuous ophiolite belts. Although the Hegenshan and Sartohay ophiolites are separated by nearly 3000 km and lie in completely different parts of the CAOB, they are remarkably similar in many respects. Both are composed mainly of serpentinized peridotite and dunite, with minor gabbro and sparse basalt. They both host significant podiform chromitites that consist of high-Al, refractory magnesiochromite with Cr#s [100Cr/(Cr+Al)] averaging <60. The Sartohay ophiolite has a zircon U-Pb age of ca. 300 Ma and has been intruded by granitic plutons of similar age, resulting in intense hydrothermal activity and the formation of gold-bearing listwanites. The age of the Hegenshan is not firmly established but is thought to have formed in the Carboniferous.

Like many other ophiolites that we have investigated in other orogenic belts, the chromitites in these two bodies have abundant diamonds, as well as numerous super-reduced and crustal minerals. The diamonds are mostly, colorless to pale yellow, 200-300 μm across and have euhedral to anhedral shapes. They all have low carbon isotopes ($\delta^{14}C$ = -18 to -29) and some have visible inclusions. These are accompanied by numerous super-reduced minerals such as moissanite, native elements (Fe, Cr, Si, Al, Mn), and alloys (e.g., Ni-Mn-Fe, Ni-Fe-Al, Ni-Mn-Co, Cr-Ni-Fe, Cr-Fe, Cr-Fe-Mn), as well as a wide range of oxides, sulfides and silicates. Grains of zircon are abundant in the chromitites of both ophiolites and range in age from Precambrian to Cretaceous, reflecting both incorporation of old zircons and modification of grains by hydrothermal alteration.

Our investigation confirms that high-Al, refractory chromitites in these two ophiolites have the same range of exotic minerals as high-Cr metallurgical chromitites such as those in the Luobusa ophiolite of Tibet. These collections of exotic minerals in ophiolitic chromitites indicate complex, multi-stage recycling of oceanic and continental crustal material at least to the mantle transition zone, followed by uprise and emplacement of the peridotites into relatively shallow ophiolites.

* Corresponding author. E-mail: paulrobinson94@hotmail.com