5.1

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5.1. Isoferroplatinum: parallel intergrowth of three cubic crystals with cavities after weathered and fallen out silicate grains.
15 x 7 x 7 mm, 5.4 g.
Gokhran of Russia.
Photo: Michael B. Leybov.

CHAPTER 5. PLACER-FORMING PLATINUM MINERALS: SPECIFIC FEATURES OF ONTOGENY AND GENESIS

Placer occurrences of platinum-group metals (PGM) were found within the Inagli, Konder and Chad alkaline-ultramafic massifs in the Aldan shield in the course of the 1950s geological surveys. In 1958–1960, I.S. Rozhkov and V.I. Kitsul, researchers of the Yakutsk Institute of Geology (Russian Academy of Sciences) classified these placers and primary PGM occurrences to the Aldan type. S.S. Borishanskaya and L.V. Razin investigated mineralogy of the samples collected by Kitsul and Bogomolov (Rozhkov *et al.*, 1962). After the study of PGM from the placer at the Inagli River in Aldan, Razin (1978) attributed them to the Inagli-type of late magmatic platinum-group elements (PGE) deposits in chromitites of forsterite dunite.

Most researchers linked the formation of the platinum-group metals placers of the Konder Massif to the process similar to that in gabbro-pyroxenite-dunite massifs of the Urals Platinum Belt and Alaska. Primary sources for the Ural PGM placers are concentrically zoned massifs of the Urals-Alaska type, which have long been drawn attention as probable PGM deposits. The study of PGM prospects in the gabbro-pyroxenite-dunite massifs of the Urals starting from Inostrantsev (1893) gave some genetic concepts on the PGM formation in them.

The formation of PGM in the Urals Platinum Belt is predominantly associated with the stages of intrusive magmatic crystallization of the melts from which dunite, pyroxenite, and gabbro were progressively formed. Vysotsky (1913, 1923) and Duparc (1913) believed that major PGM, namely intermetallic Pt-Fe compounds and Os-Ir solid solutions, were formed together with chrome spinels at high-temperature stage of the dunite crystallization. Zavaritsky (1928), Betekhtin (1935), Kashin (1956), Genkin (1997), and Johan (1989, 2000) considered that PGM were precipitated at various stages in formation of the gabbro-pyroxenite-dunite cumulative complexes, and most PGM, associated with chromitite, crystallized at the late magmatic stage of the dunite formation from residual fluids and melts containing PGE and Cr. During evolution of igneous complexes, previously formed PGM were dissolved and PGE were transported. Then the latter were precipitated as metacrystals in chromitite epigenetic ores. These researchers also showed that primary magmatic PGE mineralization was slightly altered during serpentinization and weathering of dunite. E.P. Emelyanenko, A.N. Maslovsky, A.M. Lennikov, R.A. Oktyabrsky, and I.Ya. Nekrasov (Emelyanenko *et al.*, 1987; Nekrasov *et al.*, 1994, 1999) supported this view on the genesis of PGM in dunite of the Konder Massif. They noted that part of the placer–forming PGM is associated with kosvite and alkaline syenite.

Auger (2005) attributed the PGM formation in the gabbro-pyroxenite-dunite plutons to the magmatic process, but with the difference that they crystallized from chrome-platinum ore-silicate melt, which could liquate from silicate melt. Marakushev (1987)