DISCOVERY, PETROGRAPHY, MINERALOGY, AND CHEMISTRY OF PALLASOVKA, A NEW PALLASITE FROM RUSSIA. D. A. Sadilenko[1], S.E. Borisovskiy[2], A. V. Korochantsev[1], A. M. Abdrakhimov[1], M. A. Ivanova[1], and D.I. Zhuravlev[2], [1] Vernadsky Institute of Geochemistry and Analytical Chemistry, Kosygina St. 19, Moscow, 119991, Russia, e-mail: meteorites@geokhi.ru, [2]Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry of Russian Academy of Sciences, Staromonetny per. 35, Moscow, 119017, Russia.

Introduction. Pallasovka, a new stony-iron meteorite, was found recently in the Volgograd region of Russia. It belongs to the main group of pallasites [1], but it is characterized by unusual chromite. The chromite differs in composition from that in the main and Eagle Station pallasite groups. Here we report the history of discovery and results on petrography, mineralogy and chemistry of the pallasite.

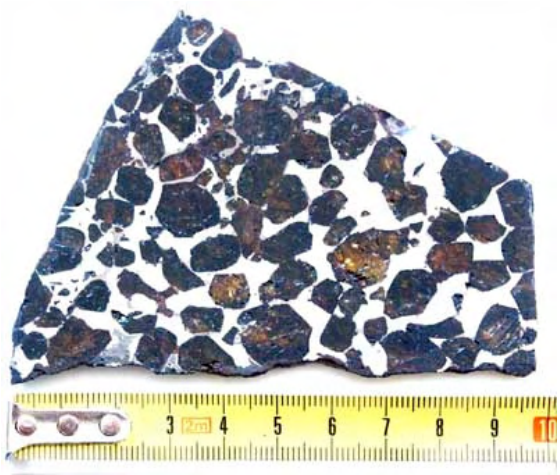

Fig. 1. Interior view of Pallasovka meteorite.

Discovery. This meteorite was found in summer 1990 in the Volgograd region, 27.5 km southwest of Pallasovka town. Local resident N.F. Kharitonov found the meteorite on the shore of a pond. A single specimen of 198 kg was lying on the top of a dyke, partly submerged in clay. The pond and dyke were built using explosives in 1978. The specimen may have been lifted to the surface from the depth of 2 m or so (the depth of emplacement of the explosives) and then deepened in clay by the grading of the dike. In fall 2004, Kharitonov gave a small fragment of the meteorite to A.E. Milanovskiy, who proved its meteoritic origin.

In May 2005, a scientific expedition visited the find site to search for additional samples. Eighty-eight small fragments weighing 190 g were recovered at the original find site: probably traces of Kharitonov's attempts to break pieces off the main mass in 1990. The scientists then conducted a preliminary search for additional fragments. Radial searches with metal detectors were tried in six different directions for distances up to 4 km. Continuous searching for three days did not result in new finds. Interviews were then carried out with local residents, who reported no additional finds in the area. The question of whether the new meteorite is a single specimen or part of a meteorite shower may be answered after additional thorough examination of the nearby territory.

The new meteorite belongs to the class of stony-iron meteorites - pallasites, named for the German naturalist and traveler P.S. Pallas, who served Empress Catherine The Great in the eighteenth century. Pallas was the first to describe stony-iron meteorites in 1772. It is remarkable that the new meteorite was found near the town of Pallasovka, named after the same P.S. Pallas who had worked nearby describing the nature of the steppe. In an even more unlikely coincidence, the new meteorite was recognized in 2004, the year the town celebrated its 100th anniversary.

Results and discussion: The new meteorite is a smoothed, elongated polyhedron of 40x45x55 cm. On one side is a cone-shaped hole 17 cm in diameter and 10 cm deep, possibly formed by fragmentation in the Earth's atmosphere. Traces of ablation are visible on few sides only: regmaglypts up to 10 cm in diameter and 4 cm deep. This may indicate that the meteorite is a fragment of a bigger body. The meteorite's surface

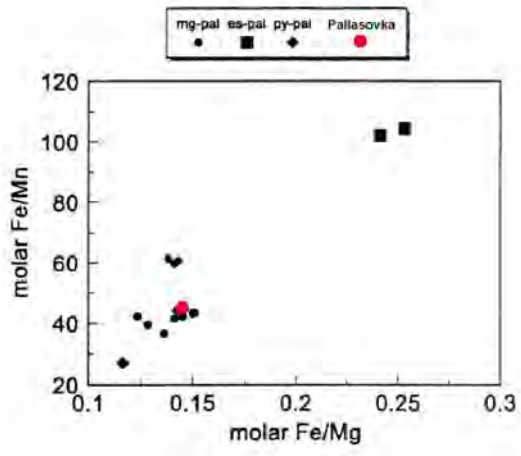

Fig. 2. Olivine compositions of pallasites (main group, Eagle Station and pyroxene-pallasite grouplets) compared with Pallasovka data [1].

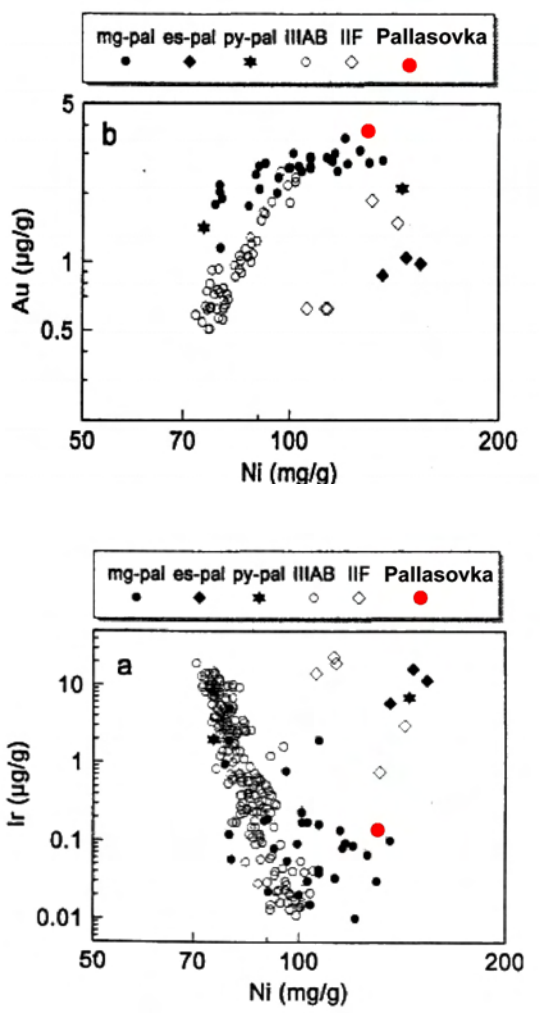

Fig. 3. Diagrams of Ir vs. Ni and Au vs. Ni for metal from pallasites (main group, Eagle Station, and pyroxene-pallasite grouplets) and some iron meteorites compared to Pallasovka metal [1].

lacks a fusion crust. The 198 kg specimen is covered by oxides 0.3-1.0 cm thick. Traces of oxidation occur deeper in cracks as thin 10-15 μm veins of iron hydroxides on the olivine-metal and troilite-metal borders. In this case troilite inclusion edges are enriched in Ni.

The mineral composition of the new pallasite is typical for meteorites of this class. It consists mainly of Fe-Ni metal and olivine, with olivine about 60% by volume (Fig. 1). The grains are rounded and have many cracks. Some grains approach 3 cm in diameter. Olivine compositions are typical for pallasites of the main group [1]: Mg/(Mg+Fe)(at) - 0.88, Fe/Mn(at) - 45.2, Fe/Mg(at) - 0.14 (Fig. 2). Etching with nital solution 2% reveals Widmanstatt structure. Kamacite (Ni - 7.2 wt %, Co - 0.61 wt %) beams thickness is close to fine octahedrites (0.2 - 0.3 mm). Plessitic fields are surrounded by a taenite border 7 - 10 μm thick. The maximum concentration of Ni in taenite is 46.7 wt %, and the concentration of Co varies within 0.1 - 0.35 wt %. Ni concentration in the plessitic field has the typical M-shape. Grains of troilite up to 5 mm occur in the metal. Troilite composition exactly matches FeS (Ni - 0.41 wt %). Bow-shaped schreibersite occurs at the junction of kamacite beams. Rare 100 - 200 μm chromite grains occur on metal-olivine contacts. Chromite composition is unusual: Mg/(Mg+Fe)(at) is 0.36, Fe/Mn(at) is 48.9, Cr/(Cr+Al)(at) is 0.77. This differs from chromite in the main and Eagle Station pallasite groups, which have Mg/(Mg+Fe)(at) of 0.24 - 0.36, Fe/Mn(at) of 28 - 33, and Cr/(Cr+Al)(at) of 0.84 - 0.97 [1].

Several element concentrations in the metal phase were determined by ICP-MS: Ni - 13.1 wt %, Ir - 0.12, Au - 2.8, Pt - 3.2, Ga - 22.5, Ge - 24.9 ppm. These concentrations resemble main-group pallasites (Fig. 3).

Conclusion: Based on mineralogical and chemical characteristics Pallasovka is the pallasite of the main group, though there is a difference in chromite composition of this meteorite and main group pallasites [1].

References: [1] Mittlefehldt D.W. et al. (1998) Planetary Materials. *Reviews in Mineralogy* **36**, chapter 4.