DIAMONDS ORIGINATED BY METEORITE IMPACT: MAGNETIC AND OTHER PROPERTIES V.L. Masaitis[1], G.I. Shafranovsky[1], L.J. Pesonen[2] and K.A. Kinnunen[2], [1]Karpinsky Geological Institute (Sredny Prospect 74, St. Petersburg 199026, Russia; vsg@sovam.com), [2]Geological Survey of Finland (P.O. Box 96, FIN-02151 Espoo, Finland; Lauri.Pesonen@gsf.fi).

About 25 years ago the large Popigai impact structure was discovered in the northern part of East Siberia (Masaitis et al., 1972). The structure originated 35 Ma ago due to collision of an 8 km size asteroid with the Earth. The diameter of the complex crater is ~100 km, and it is filled by impactites: melt rocks and strongly shocked target rocks. Small graphite crystals in the metamorphic target rocks (e.g., gneiss) were transformed into diamonds due to high pressure exceeding 35 GPa. Such impact diamonds are included in some varieties of the Popigai impactites.

The impact diamonds, because of their microgranular structure, are very tough compared to more fragile kimberlite diamonds and may therefore be used as industrial diamonds. Generally their diameters are of the order of < 3 mm but may reach up to 1 cm.

These diamonds inherit the tabular shape and some other pattern of graphite precursors and possess many mineralogical features which are distinct from the single crystal diamonds from kimberlite pipes. The impact diamonds are polycrystalline and are composed of cubic and hexagonal (lonsdaleite) high-pressure phases of carbon forming structurally arranged microcrystals. The diamonds may be sometimes transparent but more often they are yellow, brown and black. Some unusual optical features may be observed under the polarizing microscope: high birefringence, entirely straight extinction and others. Carbon isotopic composition of impact diamonds were formed due to polymorphic transition of the precursor.

In order to further distinguish the impact diamonds from diamond types (such as kimberlite diamonds, carbonados, other mantle diamonds and industrial diamonds), we have measured their magnetic properties. The Popigai impact diamonds reveal relatively strong diamagnetic susceptibility ranging from -1000 to -8000x10^{-6} SI. Similar range of susceptibility values are found in kimberlite diamonds. However, one order of magnitude lower value of diamagnetic susceptibility is found in a carbonado sample from Central Africa. In contrast, the industrial diamonds reveal relatively high ferrimagnetic susceptibilities ranging from 3600 to 5000 x 10^{-6} SI, because of the common presence of iron-nickel contaminations in them. Thus, impact diamonds can be distinguished from industrial diamonds (and perhaps from carbonados) on the basis of magnetic susceptibility determinations (the method is rapid and harmless). The Popigai diamonds reveal also measurable Natural Remanent Magnetization (NRM) with an intensity varying from 20 to 260 mAm^{-1}. One specimen showed that the NRM is relatively hard and stable against alternating magnetic field demagnetization treatment. The carriers and origin of this NRM are unknown and will be studied in future.

At present impact diamonds of the Popigai type are found in several impact structures in Russia, Ukraine, Germany and Canada. There are opportunities to find new occurrences of impact diamonds in other impact structures around the world. Good candidates are structures which have diameters greater than ~4 km and in which the target rock contains graphite (or other carbonaceous minerals). Several such structures exist in the Fennoscandian shield like the Jänisjärvi, the Lappajärvi, the Sääksjärvi and the Suvasvesi North structures.

References: Masaitis V.L. *et al*., 1972. Letters of VMO 1, 108-111 (in Russian)