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The Sudbury structure presents a case of the world class Ni-Cu-PGE sulfide ores generated by a meteorite impact [1]. There is no evidence for similar sulfide deposits being associated with any other known impact structure elsewhere in the world; some small-scale impact-related base metals deposits had been reported before [*see* 2, 3 for references], though. This fact begs the question: is Sudbury unique or some factors favorable for sulfide accumulation in impact craters could be revealed? To solve the problem, it is necessary to study the sulfide mineralization in different impact craters. Apart from economic aspects, this mineralization could be of interest as an example of sulfide formation during the melting of upper crustal rocks without the input of abyssal matter; it could be considered as an indicator of crystallization conditions of impact melts as well.

In this report, data on sulfide mineralization in Russian impact craters including three large ones – Popigai (100 km), Kara (65 km), and Puchezh-Katunki (80 km) are summarized to show principal features of distribution and composition of sulfides within impact structures. These craters are distinct in their inner structure, target rock compositions, amount and mode of distribution of impact melt; thus, sulfide occurrences in various impact-related environments are considered. When compared with other impact structures including Sudbury, the data represented give a good basic knowledge to simulate probable impact-derived processes leading to the sulfide concentration.

To date, any sulfides were reported from about 35 impact structures. In many of them, only pyrite is mentioned; however, a detailed study reveals commonly a wide range of sulfides. The list of sulfides (and tellurides) known in astroblemes includes altaite, arsenopyrite, bornite, bravoite, chalcocite, chalcopyrite, galena, marcasite, molybdenite, millerite, pentlandite, pyrrothite, pyrite, sphalerite, and talnachyte. They occur in all impact lithologies including crater lake sediments. However, their appearance is amounted commonly to scattered dissemination or thin veins alone. Three genetic groups of sulfide associations are distinguished: (1) pre-impact, (2) syngenetic, (3) epigenetic.

Pre-impact sulfides are those, which are already in existence prior the impact, they undergo modification and redistribution during impact, though. A millerite-pentlandite-chalcopyrite assemblage (replaced partly by pyrite/marcasite) in Popigai crater is a case. Two other groups resulted mostly from modification, transfer, and redeposition of pre-impact sulfide matter. This is argued, e.g., by the correlation of sulfur isotope composition between pre-impact and impact-generated sulfides [4]. If composition and abundance of the latter are determined to a large extent by original sulfide oiccurences in target, their distribution and possible concentration depends on conditions of impact melt solidification and post-impact hydrothermal fluids.

Syngenetic sulfides are formed by impact melt crystallization. They are represented mostly by pyrrhotite; pentlandite, millerite, and chalcopyrite are common. Characteristic elements are Fe, Ni, Cu, and Co. Syngenetic mineralization was found out in Popigai, Boltysh, Kara, Moroqweng, East Clearwater etc, but Sudbury gives an only economic case.

Epigenetic sulfides are derived from the impact-generated hydrothermal circulation. A chalcopyrite-galena-sphalerite-marcasite-pyrite association is typical (Lockne, Siljan Ring, Kara, Puchezh-Katunki, Zapadnaya and other impact structures including Sudbury). Characteristic elements are Fe, Cu, Zn, and Pb.

Thus, an impact event can produce two genetic types of sulfide mineralization: (1) syngenetic low-sulfur Co-Ni-Cu mineralization (millerite pentlandite chalcopyrite pyrrhotite) in impact melts and (2) hydrothermal high-sulfur Cu-Pb-Zn-Ag mineralization (galenite sphalerite chalcopyrite pyrite) in diverse impact lithologies. These types are observed in all astroblemes studied in detail including Sudbury. Both types can form economic occurrences. When impact structures comprising sulfide deposits, and sulfide-lacking astroblemes being compared, some factors favorable for sulfide concentration in impact structures can be distinguished: (a) geochemical and metallogenic enrichment (specialization) of target by metals; (b) heterogeneous target comprising lithologies contrasting in composition; (c) formation of a voluminous impact melt sheet screened by a thick suevite/breccia cover; (d) predominance of massive impact melt rock among impact-derived lithologies; (e) formation of heterogeneous (due both original and crystallization differentiation) impact melts; (f) wide spread occurrence of post-impact hydrothermal processes.

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