Using the methods of X-ray and Mössbauer spectroscopy, scanning electron microscopy, there were studied the samples of Norilsk ore types in order to identify compounds containing Cu, Ni, Co, Fe, S. Depending on elemental composition there were singled out two sample series. Maximum concentration in percentage of selected elements for this series is presented below.

1: Ni (0,7); Cu (15,3); Co (2,1); S (17,2); O (20,2); H (0,02); Fe (24,1); Ca (0,1); Mg (0,67); K (0,54); Al (2,05).

2: Ni (1,94); Cu (23,4); Co (0); S (25,5); O (9,91); H (0,39); Fe (25,9); Ca (0); Mg (0); K (0); Na (1,12); C (2,51); Si (7,92); Al (1,31).

The research conducted by using the method of scanning electron microscopy and the X-ray microanalysis showed that iron and sulfur are spread uniformly over the scanned area. Sulfur is absent in the inclusions containing Fe and Ni. There are areas, strongly enriched by Fe (Fig. 1). The inclusions of rectangular and rhomboid shapes contain Ni as the content of Fe increases (Fig. 2).

There were identified the inclusions having a high content of Cu, with a maximum concentration of Ni (Fig. 3). The distribution of Co is shown in Fig. 4.

The phases, containing Cu, Ni, Co, have a complex composition.

1: pentlandite (Fe1,63 Ni1,82 Co5,6 S8) - 5,14%; chalcopyrite (CuFeS2) – 44,4%; magnetite (Fe3O4) – 5,77%.

2: pentlandite (FeNiS2) - 3,44; chalcopyrite (CuFeS2) – 66,2%; magnetite (Fe3O4) – 4,68%; bornite (Cu5FeS4) - 0,84%; nickelhexahydrite (NiSO4[6H2O]) – 3,64%.

The ingrowths of CuFeS2 are characterized by the degree of the structure defectiveness, by various impurities, which are reflected in the studied parameters.

As regards the other sample series the spectra are the superposition of the unsolved doublet, which shows the presence of paramagnetic areas.

The isomer shifts of the samples range from 0,429 до 0,509 mm/s (series 1) and from 0,509 to 1,394 mm/s (series 2). Quadrupole splitting ranges from 0,509 to 2,800 mm/s (series 1) and from 0,509 to 2,688 mm/s (series 2). This indicates that the local electronic structure depends on the genesis of compounds.

Thus, most of the bulk of Cu, Ni is not dissipated in the crystal lattices of the ore, but it is part of the ore sulphides. The presence of the characteristic structures of the solid solutions decomposition shows a wide temperature range of sulphide crystallization.
Fig. 1: The distribution of Fe in the scanned area, x500

Fig. 2: The distribution of Ni in the scanned area, x750

Fig. 3: The distribution of Cu in the scanned area, x750

Fig. 4: The distribution of Co in the scanned area, x750