N. S. RUDASHEVSKY, V. N. RUDASHEVSKY. MINERAL PROCESSING OF POOR SULPHIDE Au-Ag ORES OF THE VOLCANIC FORMATION (VELADERO DEPOSIT, ARGENTINA)

CNT Instruments LLC, Saint Petersburg, Russia

The Au-Ag Veladero deposit is one of the largest resources of gold ores in Argentina. The ores are processed by heap alkali cyanide leaching. However, the main part of silver (> 90 %) is not being recovered. It was assumed previously that the bulk of silver in the ores is represented by acanthite Ag_2S, which is present in the form of very fine inclusions (1—2 μm) inside quartz, thus leached poorly. The following samples of the ores have been studied: 1) characteristic Au-Ag ore (Au 3.17 ppm, Ag 44.3 ppm, SiO_2 98.2 %, S 0.06 %), and 2) Ag-type ore (Au 0.3 ppm, Ag 236 ppm, SiO_2 98.0 %, S 0.03 %). These ores were studied by 3D-mineralogical technology. For the sample 12 the following minerals of Au and Ag were found in the composition of 358 grains of the heavy mineral HS concentrates: native gold (Au,Hg,Ag), petrovskaite AuAgS, acanthite Ag_2S, chlorargyrite AgCl, iodargyrite AgI, imiterite Ag_2HgS_2. Ag-minerals are associated with Hg-minerals. The high-grade (Au_{avg} 95.4) and Hg-rich (Hg_{avg} 3.0 %, up to 6.6 %) native gold forms fine grained aggregates (ECD-equivalent circle diameter is 0.5—48 μm, average 7 μm) with collomorphic structure. The Ag-minerals of this sample are much larger (2—6 times) than native gold mineral grains. Native gold is the earliest component of the Au-Ag-mineralisation (in relation to Ag- and Hg-minerals). The second Ag-type ore (sample RC636) has resulted heavy mineral HS-concentrates with ~1500 particles of the following Ag-minerals (407 particles were studied under microprobe): iodargyrite and chlorargyrite, rare grains of bromargyrite Ag(Br,Cl), native silver, acanthite and naumannite Ag_2Se. Ag-halides of the studied ores are followed by new generation of Hg-minerals. It is determined that native silver of the sample is replaced by iodargyrite and chlorargyrite, and native gold remains (as relict inclusions) inside 8 iodargyrite grains. Average grain size (ECD) of Ag-Au-minerals (selection of 407 grains) is 55 μm. Veladero is one of the characteristic poor-sulphide deposits of volcanogenic formation of the Pacific belt. Its hydrotherms has mainly meteoric source with an influence of magmatic components. The process of contamination of magmatic components which was carrying precious and heavy metals and volatile elements by meteoric waters saturated with oxygen as well as Cl, I and Br has determined intense acidic pre-ore metasomatism of the ore-bearing horizons on a large scale — removal of most petrogenic components, except for SiO_2 and TiO_2 (large volumes of pre-ore predominantly quartz metasomatites). This data clearly shows that the high technological losses of silver, especially compared to those of gold in the hydrometallurgical ore processing tailings are not anyhow related to a problem of poor recovery of Ag-minerals as the result of ore crushing and grinding. The main Ag-minerals of the ores — acanthite, chlorargyrite and iodargyrite are not dissolvable (under normal conditions) in alkaline cyanides. Thus, proposed new technological solutions uses unique features of the distribution of Au and Ag minerals among quartz metasomatites (97—98 % quartz). Au-Ag mineralisation of the Veladero deposit represents just 2—3 % of the total mass of the ore. This suggests stepwise extraction primarily of Au, followed by Ag from the tailings of the first technological stage of mineral processing. The losses with tailings of Ag-minerals (represents over 90 % of Ag) and Au-minerals (~ 10 % Au) can be separated into relatively small volume (2—5 % of the mass of all tailings) gravity concentrate. Further mineral processing of the new heavy mineral Ag-rich concentrate should involve alcaline cyanidation of heat-treated sulphide and halide compounds of Ag and Au.

Key words: 3D-mineralogical investigation technology, electric-pulse disaggregation, hydroseparation, gravity separation and enrichment, technological losses of silver and gold, Ag halides.