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Discovery of Platinum-Group Minerals in the polymetallic vein-type deposits of Sainte-Marie-aux-Mines, Vosges, France

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The Sainte-Marie-aux-Mines (SMM) polymetallic deposits are well known due to the past production of silver. A large variety of other metals are also present in the mineralized veins hosting various proportions of Cu, Pb, Zn, As, Co and Ni. The Altenberg N-S veins are Pb-Zn-Ag deposits and the Neuenberg E-W veins were also mined for Cu and As, besides Pb, Ag and Zn. The SMM veins were emplaced during Late Hercynian time, because they cut hercynian migmatitic gneisses and the group of varied gneiss. The latter comprise para- and ortho-gneisses, marbles, amphibolites and serpentinites.

The Platinum-Group Minerals (PGM) were found in an amphibolite - a former metabasalt - sampled from the wall of the Saint-Jacques vein in the Gabe Gottes mine, Neuenberg area. The PGM were discovered in a heavy mineral concentrate (d>2.88) from a magnetic fraction (177-125 μm). The PGM, very fine-grained (<5μm), are included in a REE-rich silicate hydroxide as observed from a polished section.

One white PGM has a composition close to the phase Pd17Te4 defined in the experimental Pd-Te system. This phase is cubic and known to exist over a large range of temperature, however it disappears towards 760-770°C. The shape of the crystal observed in SMM is compatible with the cubic system. The Pd telluride is associated with several grains having a composition of RuO_2. The transition-metal dioxide compound, RuO_2, has a tetragonal rutile-type structure and the crystals observed in SMM are compatible with this crystallographic system. In addition, the RuO_2 crystals are bireflectant and show a bluish color as do those experimentally obtained.

In SMM, it is suggested that the PGM assemblage observed within a REE- rich silicate hydroxide are relevant of a late-stage oxidation process which involves REE and PGE mobilization. If Pd may have derived from the host basaltic rock, taking into account the PGE pattern of basaltic liquid, Ru should rather have derived from the leaching of ultramafic rocks, known to occur in the host gneissic formation.