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REPLACEMENT OF BASE METAL SULFIDES BY ACTINOLITE, EPIDOTE, CALCITE, AND MAGNETITE IN THE UG2 AND MERENSKY REEF OF THE BUSHVELD COMPLEX, SOUTH AFRICA

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Abstract

Interaction of base metal sulfides (pyrrhotite, pentlandite, and chalcopyrite) with aqueous fluids in the UG2 chromitite layer and the Merensky reef in the western Bushveld Complex has produced four common replacements: (1) replacement of sulfides and orthopyroxene by actinolite or tremolite, (2) replacement of sulfides and plagioclase by epidote, (3) replacement of sulfides by calcite, and (4) replacement of sulfides by magnetite. The first three replacements are directly related to the presence of sulfides in the rocks and occur at the grain scale; silicate minerals that are not in direct contact with sulfides are usually not affected. The replacement of sulfides by magnetite accompanies regional serpentinization superimposed on the Union section. Platinum group minerals, including Ru, Pt, and Pd sulfides, Pt and Pd tellurides, and Pd arsenides, occur in replacement aureoles around sulfide aggregates as well as within the aggregates, suggesting that the platinum group minerals are more resistant to hydrothermal alteration than the associated base metal sulfides. Redistribution of chalcopyrite, at least at the millimeter scale, variable losses of S and Ni, and perhaps decoupling of Pt and Pd at the centimeter scale took place during secondary hydrothermal alteration. These effects should be considered before models of primary mineralization processes can be meaningfully applied.

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