



Petrology of the Pfunderer Berg Cu-Deposit (S-Tyrol, Italy): a high-temperature ore deposit associated with Permian contact metamorphism in the Southalpine basement

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The historic minig district Pfunderer Berg to the west of Klausen in South Tyrol (BZ, Italy) is located in the contact area between Permian magmatic bodies and the Southalpine basement of the Brixner Quarzphyllit. During the Permian extensional event several dioritic dykes and small plutons intruded into the Variscan metamorphic basement near Klausen. This Permian magmatic event led to a strong (ca. 650°C and 0.2 – 0.3 GPa) contact metamorphic overprint of the surrounding phyllites as well as contemporaneous formation of Cu-ore deposits in the contact zone and hence ore mineralisation occurs in the magmatic rocks as well as the contact metamorphic basement rocks. Due to the fact that the geological position of the minig area is in the south of the SAM (southern limit of Alpine metamorphism) these rocks were not affected by the Alpine metamorphic overprint and thus allow to provide P-T constraints on the pre-Alpine metamorphic evolution of this area. The Alpine orogeny only resulted in brittle faulting and occasional remobilization of the ore mineralisation.

The ore assemblage consists mainly of sphalerite, chalcopyrite, galena and fahlore. Most of the galena grains show abundant inclusions of fahlore and acanthite Ag_2S . In one sample we found chalcopyrite grains surrounded by gustavite $\text{PbAgBi}_3\text{S}_6$ and cosalite $\text{Pb}_2\text{Bi}_2\text{S}_5$.

The high temperature of formation of this ore deposit is confirmed by characteristic granular chalcopyrite exsolution textures in sphalerite as well as sphalerite star-shaped exsolutions in chalcopyrite. Chalcopyrite also shows α/β transformation lamellae, which indicate temperatures above 500°C. The Fe content of sphalerite ranges from 0.04 to 0.14 a.p.f.u. Fahlore occurs texturally in two generations, as inclusions in galena and in the matrix. The matrix fahlores are almost pure tetrahedrite with Sb contents ranging from 3.64 to 4.00 a.p.f.u. The Fe and Zn ratio in the fahlores ranges from $X_{Zn} = 0.43$ to 1. The Ag substitution for Cu is also strongly variable and ranges from 0.22 to 1.94 a.p.f.u. The composition of fahlore inclusions in galena differs from the fahlore composition in the matrix. Although they are almost pure tetrahedrite in composition, but the Ag content is much higher ($X_{Ag} = 0.57-0.86$) with lower Zn content ($X_{Zn} = 0.18-0.25$). Since most of the thermobarometric investigations on the Permian contact metamorphic event were conducted in the contact zones associated with granodiorites and since this deposit is associated with diorites, it is the aim of this study to further provide temperature estimates on the higher-grade stage of the contact metamorphic event.