



Reverse telescoping in distal skarns at Campiglia Marittima (Italy)

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Skarn deposits commonly results from the metasomatic alteration of a rock, usually carbonate-rich, by infiltration of hydrothermal fluids.

Most carbonate-hosted skarn deposits show a direct spatial relationship with magmatic intrusions and an intimate relationship with porphyry copper deposits. Their primary mineralogical and geochemical features indicate metasomatism by high-temperature magmatic fluids. Conversely, many distal Pb-Zn-Ag skarns pose an important challenge because there is no apparent association with magmatic intrusions and external, meteoric and/or basinal fluids should become increasingly dominant with increasing distance from the igneous source. Nevertheless recent investigation of distal skarn deposits indicates that ore-forming fluids match the composition of proximal magmatic fluids in granitoid-related mineral deposits.

Besides that metal producer (Pb, Zn, Ag, Cu, Fe, W, Sn), skarn deposits can be key to understanding fluid dynamics at the periphery of magmatic-hydrothermal systems, unraveling pathways to hidden ore deposits (e.g porphyry copper). In this scenario, research on distal skarns opens new perspectives for deep mineral exploration and/or modeling of intrusion centered geothermal systems, because they should represent the outer limit of the hydrothermal system dominated by magmatic aqueous fluids.

Here we present exceptional evidences from a distal Pb-Zn-Ag skarn deposit in Campiglia Marittima, Italy, where the magma, after having released the metasomatic fluids, fled up chasing its own fluid stream and invading large pockets of the newly formed skarn bodies at shallower level. Detailed underground mapping and petrologic data indicate that, after the formation of a typical distal Pb-Zn-Ag skarn, the intrusion of the parent magma produced prograde reactions in the skarn silicates, mobilization of the Pb-Zn-Ag sulfides and precipitation of a new Cu-Fe sulfide assemblage. This is a very unusual case of reverse telescoping during which the early and shallower distal skarn ores were overprinted by higher temperature ore minerals typical of proximal skarn systems.