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The Cu-Fe-Ni-Co Sulphide Ore Deposits of the Monte Ramazzo-Lagoscuro Mines

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Sirio Consani,a Donato Belmonte,b Roberto Cabella,b Cristina Carboneb

aDipartimento di Scienze della Terra, Università di Pisa, Pisa, Italy
b aDipartimento di Scienze della Terra, dell'Ambiente e della Vita, Università degli Studi di Genova, Genova, Italy. sirio.consani@dst.unipi.it

The Cu-Fe-Ni-Co sulphide ore deposits hosted in ophiolitic rocks of the Sestri-Voltaggio Zone (Genova, North-West Italy) have a great interest due to the several new minerals discovered here and for the processes which are recorded from such mineralisations. Sulphides in the Monte Ramazzo-Lagoscuro mines occur in stockwork-vein and seafloor stratiform orebodies associated with serpentinised mantle peridotites and serpentinite breccias [1]. The primary mineralisation records severals stages of evolution due to geological processes happened both before and after orogenesis. Fluid-rock interaction, hydrothermal mobilisation, and multi-stage alteration processes led to sulphide reconcentration and recrystallisation along tectonic structures. Moreover, metal reworking and formation of secondary phases, such as (Ni,Co)-bearing oxy-hydroxydes, carbonates, and silicates took place. The mineral assemblage occurring in the Monte Ramazzo-Lagoscuro ore deposit is quite different from other hydrothermal sulphide mineralisation described so far in ophiolites from the Eastern Liguria, where (Ni,Co)-enrichment occurs mostly in pyrite and/or accessory minerals like millerite, siegenite, and pentlandite [2-4]. The aim of then present work was to fully understand and unravel the several stages of evolution recorded by the sulphide mineralisation. In order to achieve this goal, we applied a multi-analytical approach (Optical Microscope, Scanning Electron Microscope, and Powder X-ray Diffraction). Our observations allowed us to understand that the primary sulphide ore deposits where composed of pentlandite and first generation pyrrhotite. During the phase of cooling, first generation hexagonal pyrrhotite exolved in a monoclinic pyrrhotite, a more stable phase at this T condition [5]. Ni- and Co-rich pentlandite transformed to violarite (NiFe2S4) and second generation pyrrhotite. Another alteration stage of the sulphide ore led to the formation of first generation magnetite and valleriite (2[(Fe,Cu)S]1.53[(Mg,Al)(OH)2]). Finally, during the orogenesis the Sestri-Voltaggio Zone underwent pumpellyite-actinolite facies metamorphism [6]. This peculiar moment led to the formation of second generation magnetite and andraditic garnet, probably related to hydrothermal fluid circulation.
Further data are needed in order to unravel the fate of Co and Ni during the different evolution stages. The relationships between the Cu-Fe-Ni-Co primary mineralisation and secondary phases would shed a light on the effect of hydrothermal fluids in Ni vs. Co selective mobilisation and enrichment.

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Primary author: Dr CONSANI, Sirio (University of Pisa)

Co-authors: Prof. BELMONTE, Donato (University of Genova); Prof. CABELLA, Roberto (University of Genova); Prof. CARBONE, Cristina (University of Genova)

Presenter: Dr CONSANI, Sirio (University of Pisa)

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