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Multilayer corona textures in the ultramafic amphibolite of Montiggiu Nieddu, NE Sardinia, Italy

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A lenticular-shaped, 40 m thick body of ultramafic amphibolite is hosted in a km-sized metabasite lens at Montiggiu Nieddu, 8 km NE of the town of Olbia, in the Variscan Migmatite Complex of NE Sardinia. This amphibolite outcrops as a dark-green to black mass and preserves relics of igneous minerals (mostly olivine and plagioclase). On the basis of modal contents and microstructures, three main compositional layers were distinguished (layers A, B, C; Scodina et al., 2018 and references therein). Layer B is characterized by the occurrence of impressive coronitic microtextures growing around the aforementioned igneous relics. Millimetre-sized olivine is surrounded by a thin layer of orthopyroxene followed by a discontinuous layer of clinopyroxene. Plagioclase is enveloped by a discontinuous thin layer of spinel and/or a symplectite of spinel + Al-rich clinopyroxene. This layer is surrounded by a thick garnet layer which is separated from the clinopyroxene + spinel symplectite by corundum lamellae. Coronitic garnet also contains spinel and/or corundum lamellae, as well as a spinel + Al-clinopyroxene symplectite. All these coronitic microstructures are overgrown by matrix amphibole and amphibole + spinel symplectite. The matrix amphibole is locally replaced by actinolite.
The metamorphic evolution of the coronitic textures in layer B can be ascribed to three stages that followed an igneous stage represented by relics of olivine, plagioclase, clinopyroxene and orthopyroxene: Stage I is documented by the formation of coronitic orthopyroxene, clinopyroxene, spinel + Al-rich clinopyroxene symplectite, corundum and finally garnet from the igneous phases. The corona minerals are arranged according to low diffusion rates of Al and Ca, because minerals with high Al contents (spinel) formed close to plagioclase, whereas minerals with no, or little, Al and Ca contents (orthopyroxene) grew only in contact with olivine. Stage II is represented by the growth of brown and green amphibole, along or associated to symplectitic spinel, replacing the corona minerals. Stage III is documented by the local growth of late phases such as actinolite, chlorite and epidote. Applying conventional geothermobarometry and P-T pseudosection modelling, we constrained the P-T conditions of all stages. The ultramafic amphibolite experienced an anticlockwise P-T path, characterized by an igneous stage at 780 - 850 °C and 0.2 – 0.6 GPa and subsequent cooling and increasing pressure to granulite facies conditions of 650 - 730 °C and 1.0 - 1.4 GPa. Decompression towards amphibolite and greenschist facies conditions followed.

Scodina M., Cruciani G., Franceschelli M., Massonne H.-J. (2018). Anticlockwise P-T evolution of amphibolites from NE Sardinia, Italy: geodynamic implications for the tectonic evolution of the Variscan Corsica-Sardinia block. Lithos, 324-325, 763-775.