European Mineralogical Conference
Vol. 1, EMC2012-385, 2012
European Mineralogical Conference 2012

Nambulite bearing rock from the Ossa-Morena Central Belt (Iberian Massif, SW Spain)

N. Velilla (1) and J. Jiménez-Millán (2)

(1) Department of Mineralogy and Petrology, University of Granada, Granada, Spain (velilla@ugr.es), (2) Department of Geology, University of Jaén, Jaén, Spain (jmillan@ujaen.es)

Nambulite-bearing rock was taken from manganiferous metatuffs containing braunite nodules in a volcano-sedimentary complex of Upper Cambrian-Lower Ordovician age, belonging to the Ossa Morena central belt (Iberian Massif, SW Spain) (Velilla and Jiménez-Millán, 2003).

Mineral assemblage is made of nambulite, rhodonite, rhodochrosite, quartz, braunite, hematite, pyrophanite, cryptomelane, albite, K-feldspar, spessartine, phlogopite, magnesioriebeckite and aegirine. The average empirical formula for nambulite (based on 5 Si atoms and H=1 pfu) is: $Si_{5.00}$ $Fe^{2+}_{0.08}Mn^{2+}_{3.60}Mg_{0.32}Ca_{0.07}Na_{0.05}Li_{0,94}H_{1.00}$. Nambulite always occurs in intimate intergrowth with other hydrous pyroxenoid as anhedral to subhedral grains that usually range in size from 50 μm to 150 μm, very rarely up to 400 μm. These grains contain abundant inclusions of quartz, braunite and rhodochrosite. Hydrous pyroxenoids form parallel domains with face of contact {010}, which are of very variable size ranging from the nanometre scale to tens of micrometres thick. Diffraction patterns from selected areas (SAED) and lattice fringes images (HRTEM) were obtained revealing the existence of a lamellar texture corresponding to disordered intergrowths parallel to (010) of nambulite labs (with a chain periodicity of five tetrahedra) and a hydrous piroxenoid labs (with periodicity of seven tetrahedra). Nambulite is the prevailing phase but domains of pure zones of the hydrous piroxenoid with size greater than the area covered by the HRTEM images have been observed

Petrographic and geochemical data indicate that nambulite rocks come from the mixture of hydrogenic and volcanic materials. Geochemical features of the braunite nodules included in the manganiferous metatuffs such as high Mn/Fe ratio, positive Ce-anomaly and good correlations among Mn, Fe, Co, Cu and REE contents indicate that the protolith of the braunite-nodules was precipitated from oxidising sea water (Velilla and Jiménez-Millán, 2003). In the nambulite-bearing rock, REE patterns and As-Fe-Mn contents indicate of a clear hydrothermal influence as well. The Variscan metamorphism under greenschists conditions produced on the protoliths a successive reduction of Mn^{4+} to Mn^{3+} and Mn^{2+} favouring the crystallisation of braunite, spessartine, and phlogopite in the Al-rich domains of the rocks. Rhodonite formation was limited domains with higher Mn^{2+} availability. Subsequent to the main metamorphic phase, the access of Li-rich carbonated hydrothermal fluids produced the crystallization of hydrous pyroxenoid intergrowths as filling of thin veinlets and also as a product of reaction replacing rhodonite crystals.

References

Velilla, N. and Jiménez-Millán, J. (2003). Origin and metamorphic evolution of rocks with braunite and pyrophanite from the Iberian Massif (SW Spain). Mineralogy and Petrology , 78: 73-91.