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An Overview of Variscan Migmatites from Northern Sardinia, Italy

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The Variscan chain of Sardinia belongs to the southern European Variscides. The inner zone of the chain consists principally of pelites, semipelites, calc-silicate nodules and acid and mafic igneous rocks, multideformed and metamorphosed during Variscan orogeny. Three main types of migmatites can be distinguished: migmatised orthogneiss, amphibole migmatite and pelite migmatite.

The oldest structure in the migmatite is a gneissose layering (D_1) followed by D_2 deformation, associated with tight folds and regional S_2 schistosity. D_2 is characterised by non-coaxial deformation with a top to NW shear component, followed by non-coaxial deformation with a top to SE shear component. D_2 deformation is followed by later folding associated with more or less pervasive foliation.

The orthogneiss, mostly of Ordovician age, shows evidences of incipient to extensive partial melting and occurs as widespread lenticular bodies several hundreds of meters in length, enclosed in pelitic migmatites. The leucosomes, granitic in composition, are folded by D_2 deformation or intruded along shear zones.

The amphibole-migmatites occur as a lens-shaped body a few hundreds of meters in length at Punta Sirenella (Olbia). They show a layered structure defined by alternating biotite-rich mesosomes and poorly-foliated leucosomes principally made up of plagioclase, quartz, biotite, amphibole, $\pm$ K-feldspar and $\pm$ garnet. The mesosome usually shows a S_2 pervasive fabric, mainly defined by the alignment of biotite flakes.

The pelite migmatites are the most common migmatite type in Sardinia. Leucosomes occur as D_2 folded centimetric thick layers or as discontinuous small patches and pods parallel to S_2 schistosity. Trondhjemitic leucosomes are the most common in the field

and consist of quartz, plagioclase, biotite, $\pm$ garnet, $\pm$ kyanite, $\pm$ fibrolite and rare K-feldspar. Granitic leucosomes, generally parallel to S_2 schistosity, consist of quartz, plagioclase, biotite, K-feldspar, $\pm$ garnet and $\pm$ fibrolite. Variable amounts of retrograde muscovite up to 3-4 cm in size have commonly been observed in both types of leucosomes. The mesosome commonly shows pervasive foliation defined by the alignment of biotite, muscovite and fibrolite. Poorly-deformed millimetric to centimetric fibrolite-rich pods and veins are at times widespread in the mesosome. Melanosomes occur as elongated biotite trails or very thin irregular selvedges.

The various types of leucosomes were generated by different partial melting reactions: trondhjemitic leucosomes were generated by H_2O-fluxed melting, while granitic ones seem to have been formed by muscovite dehydration melting at higher temperatures. Leucosomes in the amphibole migmatite were formed by partial melting of the biotite+plagioclase+quartz assemblage, with the contribution of a fluid phase.

After leucosome formation, migmatites underwent metamorphic re-equilibration, with the formation of fibrolite-rich nodules or veins and the retrograde growth of biotite on garnet and/or amphibole. The last stage of metamorphic re-equilibration is documented by the pervasive growth of coarse-grained muscovite on K-feldspar, kyanite, fibrolite and biotite in the pelite migmatite.

Metamorphic evolution and geothermobarometric data suggest a clockwise P-T path for the migmatite, with a maximum P $\sim$ 10-12 kbar and thermal peak at about 700-750˚C (Franceschelli et al. 1989; Ricci et al. 2004). The P-T path of Sardinian migmatite is similar to that described by Thompson and England (1984) for continental belts subject to homogeneous thickening. According to Franceschelli et al. (1989), the Variscan chain of Sardinia underwent crustal thickening and partial melting as a consequence of Carboniferous continental collision. Ages of about 345 Ma and 325 Ma are tentatively attributed to the thickening stage or the beginning of exhumation and to thermal syn-S_2 metamorphism (Ricci et al. 2004). After the Carboniferous continental collision, migmatites surfaced in a short time, as suggested by Permian volcanites resting on high-grade metamorphics.

References

Franceschelli M., Memmi I., Pannuti F., Ricci C.A. (1989) Diachronous metamorphic equilibria in the Hercynian basement of northern Sardinia, Italy. In: "Evolution of metamorphic belts". Daly J.S., Cliff R.A., Yardley B.W.D. (eds.). Geol. Soc. Spec. Publ., 43, 371-375

Ricci C.A., Carosi R., Di Vincenzo G., Franceschelli M., Palmeri R. (2004) Unravelling the tectono-metamorphic evolution of medium-pressure rocks from collision to

exhumation of the Variscan basement of NE Sardinia. Periodico di Mineralogia, 73, 73-83

Thompson A.B., England P.C. (1984) Pressure-temperature-time paths of regional metamorphism. II. Their inference and interpretation using mineral assemblages in metamorphic rocks. Journal of Petrology, 25, 929-953