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Geochemistry of Giuncana eclogite, North Sardinia (Italy) and comparison with coeval Sardinian eclogites

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The Giuncana eclogites are massive to poorly foliated, medium-to fine-grained rocks. The eclogites are embedded within Grt + St + Ky-bearing micaschist and paragneisses. Based on microstructural relationships and mineral assemblages, four stages of mineralogical re-equilibration have been distinguished in the Giuncana retrogressed eclogites. The stage I is characterized by the occurrence of omphacite enclosed in garnet porphyroblasts along with rutile, epidote, quartz, pargasitic amphibole and plagioclase. The stage II is defined by the breakdown of omphacite and formation of two types of symplectitic microstructures: (i) amphibole + quartz symplectite, and (ii) clinopyroxene + plagioclase $\pm$ amphibole symplectite. The stage III is documented by the widespread formation of amphibole as zoned porphyroblasts in the matrix, or as corona-type microstructure around garnet. The stage IV is characterized by the growth of actinolite at the rim of matrix amphibole, and by the growth of albite, chlorite, and epidote in the matrix.
LA-ICP-MS U-Pb zircon data on retrogressed eclogites sampled in the Giuncana locality from the Sardinian Medium Grade Metamorphic Complex yielded a weighted average age of 454 $\pm$ 6 Ma, in agreement with U-Pb zircon ages of 453-460 Ma obtained on eclogites from the High Grade Metamorphic Complex. The Giuncana eclogites are very similar to the other well known Sardinian eclogites. Taken as a whole the Ordovician eclogites from N Sardinia mostly plot in the fields of back-arc basins and continental flood basalts and near the boundary between basaltic andesites and subalkaline basalts. All the Sardinian eclogites show positive anomalies of K, Rb, Ba, U and Pb and negative anomalies of Nb, La, Ce and Sr. Th is depleted in the Giuncana eclogites and enriched in the Punta de li Tulchi and Punta Tittinosu eclogites. All these data reveal a clear crustal contamination of the Sardinian Ordovician mantle. Downgrading LREE and flat HREE patterns typical of N-MORBs characterize all the Sardinian eclogites. In the classical triangular diagrams the Sardinian eclogites plot in the N-MORB and VAB fields. The supply of crustal and calc-alkali materials to the Sardinian mantle during Ordovician is further confirmed by most Sardinian eclogites plotting to the left side and well above the mantle array in the Th/Yb vs. Nb/Yb diagram. In the general Variscan framework of northern Gondwana the Sardinian eclogites are the witness of the most recent back-arc N-MORB basins generated by the northwards opening of the Rheic ocean while the Sardinian alkali WPBs, that yielded the oldest age value of 440 Ma (Gaggero et al., 2012) within the southern branch of the Variscan belt, testify the incipient southwards opening of the Palaeo-Tethys ocean.

References:
Gaggero, L., Oggiano, G., Funedda, A., Buzzi, L., 2012, Rifting and Arc-Related Early Paleozoic Volcanism along the North Gondwana Margin: Geochemical and Geological Evidence from Sardinia (Italy). Journal of Geology v. 120, p. 273-292.