

**Mg-carpholite bearing assemblages in the exhumed siliciclastic units of the Monticiano-Roccastrada Ridge
(inner Northern Apennines): evidences of a HP-LT metamorphic evolution**

GIOVANNA GIORGETTI (*), ANDREA BROGI (*), RENZO REGOLI (*)

(*) Dipartimento di Scienze della Terra, Università di Siena

New petrologic data clarify the tectono-metamorphic evolution of the siliciclastic succession (Triassic Verrucano Group) cropping out in southern Tuscany (Northern Apennines) and exhumed during the Middle-Late Miocene extensional tectonics.

The siliciclastic succession consists of Early-Middle Triassic quartz metaconglomerate, metasandstone, metasilite and phyllite affected by contractional structures mainly ascribed to two deformation events (D_1 and D_2) related to the Northern Apennines Tertiary collisional event.

During the first deformation event (D_1), reverse faults and isoclinal folds (F_1) developed. F_1 folds consist of mainly N–S and/or NE–SW striking meso- to map-scale structures. An axial planar tectonic foliation (S_1), consisting of a pervasive schistosity, mainly developed in the fine grained lithotypes. The successive deformation event (D_2) was typified by mesoscopic to map-scale asymmetric folds (F_2) and an associated, locally pervasive, crenulation-cleavage (S_2). F_2 fold axes are mainly NNE–SSW-oriented, frequently exhibit recumbent attitude and overturned shorter limbs. S_2 is very pervasive in the metapelites but results discontinuous in the metasandstones and metaconglomerates.

Mg-carpholite bearing quartz veins, centimeter to decimeter in thickness, grew during the D_1 deformation event and contemporaneously with the development of the S_1 composite tectonic foliation. Such evidences, coupled with the dynamic crystallization of muscovite + pyrophyllite + chlorite + chloritoid + quartz on the S_1 tectonic foliation, support for HP-LT metamorphic condition ($P \sim 1\text{Gpa}$, $T \sim 400^\circ\text{C}$) which took place during the D_1 deformation event.

Cookeite, pyrophyllite, kaolinite, sudoite replace carpholite and they represent a retrograde assemblage probably formed during the D_2 deformation event under lower P conditions and still relatively high temperature.

A comparable tectono-metamorphic setting has been described, by many authors, for the same succession exposed in the Monte Argentario, Monte Leoni, and Tuscan Arcipelago (Giglio and Gorgona Islands).

In this framework, our data indicate that HP-LT metamorphism characterizes also the northern part of the Monticiano-Roccastrada Ridge, in the Monticiano area. This evidence supports for a widespread HP-LT metamorphism affecting the whole inner part of the Northern Apennines during the development of the orogenic belt, mainly ascribed to the D_1 deformation event. The D_2 deformation event developed in a shallower structural level during the uplift of the Northern Apennines. The HP-LT metamorphic units are presently exposed in the Tuscan Arcipelago and southern Tuscany due to their exhumation mainly produced by the activity of low-angle normal faults.