

Thermal architecture and deformation structures in the Alpi Apuane (NW Tuscany Italy): new insights for the metamorphic and tectonic history of the inner northern Apennines

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A Raman spectroscopy study on carbonaceous material (RSCM) has been applied in the Northern Apennines with particular focus on the Alpi Apuane (NW Tuscany, Italy) and surrounding areas in order to constrain peak metamorphic temperatures and their variability in the different continent-derived units of the nappe stack. Peak temperatures in the range of ~ 530–320 °C were found in the Alpi Apuane, whereas in the nearby metamorphic core of the Monte Pisano and Punta Bianca lower peak temperatures of 305–315 °C and 350 °C were found, respectively. The Tuscan Nappe in La Spezia area (west of Alpi Apuane) shows temperatures in the range of 295–246 °C, whereas the same unit in the Lima Valley (east of the Alpi Apuane) shows temperatures lower than 230 °C.

Using the presented data will discuss the thermal architecture of the inner northern Apennines and the relationships with regional-scale deformation structures to provide new constraints for the thermo-mechanical evolution and exhumation history of the inner Northern Apennine and its geodynamic setting. In particular we support the interpretation of the Alpi Apuane as a cold metamorphic core complex in which the preserved paleothermal structure and part of the exhumation are related with crustal thickening while the final exhumation stages (depth ≤ 15 km and ambient crustal temperature ≤ 350 °C) are associated with crustal thinning still ongoing in the area.