Syn-orogenic extrusion of HP-LT blueschists in the northern Tyrrhenian Sea (northern Apennines, Italy)

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High pressure-low temperature (HP-LT) rocks, such as blueschists and eclogites, help us to understand deep processes that shape collisional zones during underplating, accretion, and exhumation. A key question in geoscience is which processes drive the exhumation of deep-seated, underplated rocks. To answer this question, we studied glaucophane- and lawsonite-bearing metabasites, calcschists, and marbles, which are exposed on the Island of Elba (Italy) in the northern Tyrrhenian Sea. These rocks record HP-LT metamorphism, which is related to the Oligocene –Early Miocene continental collision in the northern Apennines. The HP rocks on Elba are characterized by a top-to-the-west mylonitic deformation that is related to their exhumation within a pile of west-dipping and east-verging nappes. Detailed analyses of bulk rock and minerals and phase equilibria modeling of metabasites from Elba constrain peak metamorphic conditions to 1.5-1.8 GPa and 320-370 ˚C and indicate nearly isothermal exhumation to greenschist-facies conditions at 0.2 GPa. During exhumation, peak metamorphic assemblages were overprinted and partially obliterated by epidote-blueschist and, subsequently, albite-greenschist facies metamorphic assemblages. Geochronological data indicate that exhumation occurred over a period of time of 15 Ma between the early Miocene (20-19 Ma) and the late Miocene (6 Ma) with exhumation rates around 2.5-3.7 km/Ma.

Based on this study, we propose that continental units were brought to greater depths than previously reported for the northern Apennines. We show that syn-orogenic extrusion acted as the main exhumation mechanism for continental and oceanic units during early continental collision in this orogenic section.

Keywords: exhumation, extrusion, blueschist, phase equilibria modeling, northern Apennines, Mediterranean Sea