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# MCC formation in the Cyclades (Aegean domain): thermomecanical modeling constrained by P-T-t- data

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Well preserved High Pressure - Low Temperature (HP-LT) rocks in metamorphic core complexes (MCCs) are paradoxical. On the one hand, warm thermal profiles are believed to be the main cause of the rheological stratification responsible for the MCC formation. On the other hand, limited to absent retrograde heating is required for the preservation of HP-LT parageneses. The Cyclades in the Aegean domain are one of the best studied example of this apparent paradox.

We addressed this question through thermomecanical modeling constrained by a large set of new and published Pressure-Temperature-time-strain data from the Cycladic MCCs. We explored the effect of three possible crustal stratifications (homogeneous, reversed with horizontal layering, reversed with a flat-and-ramp geometry), three thermal profiles (cold, intermediate and warm), as well erosion and mantle rheology. The models are validated by a comparison between the natural data (P-T paths, radiometric ages, schistosity pattern and finite strain intensity) and their synthetic counterparts.

The main parameter allowing for cold MCCs is the rheological layering. A MCC can develop in crusts with low thermal gradients if the lithological layering is reversed. HP-LT units are then exhumed without retrograde heating. In homogeneous crusts, no MCC forms, even with high thermal gradients. High thermal gradients are therefore neither sufficient nor necessary for the development of MCCs in thickened crusts submitted to post-orogenic extension.

Among the tested setups, the cases considering a lithologically reversed crust (with or without a wedge geometry) and an intermediate thermal gradient reproduce an overall finite geometry, that compares with the Cycladic MCCs, and cool P-T-t paths for the exhumed metamorphic units. The wedge geometry has nevertheless a strong impact on the dynamics of exhumation: it allows for the development of a self-sustained channel that feeds the dome. The effect of the other parameters which are second order is also discussed.