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# Can a partially molten metasedimentary sequence convect? Insights from the El Oro Complex (Ecuador) and 1D thermal modelling.

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It is now widely accepted that the formation and the evolution of high elevation plateaus such as the Tibet and the Altiplano-Puna are strongly linked to mantel magma underplating at crustal root level and partial melting of the lower crust. Understanding the rheological behavior of the deep continental crust during these episodes is therefore crucial to constrain the evolution of such plateau. In this study we present results obtained from pressure-temperature estimates and thermal modeling of gabbro underplating at crustal root level (25km) in the El Oro Metamorphic Complex (Ecuador).

The aim of this study is: (1) to complete previously published P-Tmax estimates in the northern part of the migmatitic unit, close to the magmatic contact with the gabbroic unit, to obtain better constraints on the metamorphic gradient during partial melting, (2) to characterize the effects of melt extraction, latent heat capture and release and a temperature-dependent thermal diffusivity on the thermal evolution of the system using a specifically developed numerical model, and (3) in the light of the thermal modeling results, to discuss the geological processes involved during partial melting of the metasedimentary crust.

Our modeling results show that the estimate metamorphic gradient cannot be reproduced when solely taking into account latent heat, melt extraction and thermal-dependent diffusivity. In the light of geological, geochemical and modeling evidence we show that the lower migmatitic unit, controlled by biotite-dehydration melting reactions was subject to convective motion that contributed to lower the metamorphic gradient and rapidly transfer heat upward. For a biotite-rich rock ($\sim$20%) containing 15-20% of melt, we estimate the maximum viscosity of the rock that allows convection at $\sim$7.5e17 Pa.s. Our results also suggest that convection can be maintained as long as heat is provided and that temperature lies in the stability field of biotite-dehydration melting (750-900°C).