



Mafic magma underplating and convection in a partially molten metasedimentary crust

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The El Oro Complex, southwestern Ecuador, is a tilted section of the metasedimentary Ecuadorian forearc, which has been partially molten during Triassic times due to gabbroic magma emplacement. This complex underwent a single and short (less than 10 Ma) anatectic event and is an ideal location to study magmatic underplating, migmatite formation, magma migration and granitoid emplacement. In the garnet-bearing diatexite zone of the migmatitic unit the metamorphic conditions indicate that the maximum temperature across this 7-8 km thick unit varies between 880°C at the base and 760°C at the top, thus giving an anomalously low geothermal gradient of ~16°C/km. In order to investigate the heat transfer processes in the El Oro Complex during the anatectic event, we carried out 1D thermal modelling of basic magma emplacement. Our results show that neither diffusive nor advective models account for the low metamorphic gradient in the garnet-bearing diatexites. We demonstrate that in the El Oro Complex convection of the migmatite/diatexite layer is the only heat transfer process that explains all the petrological, geochemical and metamorphic data. This study has implications for the persistence of partially molten mid-crust region such as for the "channel flow" model in Tibet. Moreover, the early stages of the plutonic sequence exhibit a compositional trend from tonalite to granodiorite that can be used as an analogue to study Archean T.T.G. formation.