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Review of magnetotelluric observational evidence of lower crust rheology

J. Ledo

Departament de Geodinàmica i Geofísica, Universitat de Barcelona, Spain

Magnetotelluric studies around the world indicate that the lower crust has, in general, an electrical resistivity lower than the obtained from laboratory measurements. The lower crust resistivity can be decreased by the presence of a mineral grain boundary phase such as saline fluids, graphite, metallic oxides and sulphides or small amounts of partial melt. Among those, the presence of fluids and graphite can play an important role on lower crustal rheology. The presence of fluids at lower crustal depths weakens the rocks. The role of graphite on rheology is more complex, graphite is capable of exerting a profound influence on fluid composition and potentially on rheology during metamorphism and deformation. The presence of graphite is more likely to localize ductile strain. On the other hand, interaction between graphite and fluids can increase pore pressure and the embrittlement of the crust, especially during decompression processes. This paper describes the state of knowledgement of the electrical resistivity of the continental lower crust obtained from the magnetotelluric method, and outlines how hypothesis and models regarding the rheology of the lower crust can be tested using rock's electrical resistivity. We present a review of data and interpretations from various regions around the globe, where the lower crust has been characterized using magnetotelluric data.