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Rheological properties of the lower crust and upper mantle beneath Baja California: a microstructural study of xenoliths from San Quintin

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Baja California is an active transtensional rift zone, which links the San Andreas Fault with the East Pacific Rise. The erupted basalts of the Holocene San Quintin volcanic field contain xenoliths, which sample the lower crust and upper mantle beneath Baja California. The aim of this research is to gain insight in the rheology of the lower crust and the upper mantle by investigating the xenolith microstructure.
Microstructural observations have been used to determine the dominant deformation mechanisms. Differential stresses were estimated from recrystallized grain size piezometry of plagioclase and clinopyroxene for the lower crust and olivine for the upper mantle. The degree of deformation can be inferred from macroscopic foliations and the deformation microstructures.
Preliminary results show that both the lower crust and the upper mantle have been affected by multiple stages of deformation and recrystallization. In addition the dominant deformation mechanism in both the lower crust and the upper mantle is dislocation creep based on the existence of strong crystallographic preferred orientations. The differential stress estimates for the lower crust are 10–29 MPa using plagioclase piezometry and 12-35 MPa using clinopyroxene piezometry. For the upper mantle, differential stress estimates are 10-20 MPa.
These results indicate that the strength of the lower crust and the upper mantle are very similar. Our data do not fit with the general models of lithospheric strength and may have important implications for the rheological structure of the lithosphere in transtensional plate margins and for geodynamic models of the region.