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Petrophysical properties of deep-seated xenoliths from south-eastern Sicily, Italy: contribution to the Hyblean lithospheric model

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A suite of deep-seated xenoliths from Miocene tuff-breccia pipes of the Hyblean Plateau has been studied in order to provide useful constrains for modelling the lithosphere underneath south-eastern Sicily (Italy). To this aim, a plagioclase-bearing (mafic granulite) xenolith, considered to represent the inaccessible crust, together with two spinel peridotites and one pyroxenite were selected for a petrographic and petrophysical study.
The seismic properties of this suite of deep-seated xenoliths were experimentally determined with a multi-anvil apparatus at confining pressure up to 600MPa (room temperature) and up to 600°C (at 600MPa). Laboratory measurements of Vp and Vs also permitted the P-wave related seismic anisotropy and shear wave splitting to be determined.
On same xenoliths, seismic properties were also calculated on the basis of whole rock composition and mineral chemistry. These data, integrated with measured crystallographic preferred orientations of olivine in peridotites, permitted a correlation between fabric patterns of olivine and the degree of deformation within the Hyblean upper mantle to be set out. Finally, the parameters of the compressional velocity-pressure relationship were computed with the MATLAB program VPPLOT. These calculations endow with important constrains for the calibration of seismic data and therefore for reconstructing the Hyblean litosphere, as they permit the seismic velocities to be extrapolated at any P condition within the stability field of the mineral assemblage of a given rock.