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Determining the Crustal Structure of Cyprus and the Troodos Ophiolite: Evidence from Broadband Seismology

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Cyprus lies on the Anatolian Plate to the north of the subducting African Plate. The Troodos Ophiolite provides an example of a complete ophiolite sequence from mantle harzburgites to pillow lavas. A central question concerns the depth to the base of the ophiolite and the lateral extent of the ophiolite at depth. Utilising a new network of broadband seismograph stations located across Cyprus, analysis of receiver functions and surface wave dispersion are used concurrently to provide insight into Cyprus' crustal architecture. Receiver function H-K stacking is used to determine Moho depth and bulk Vp/Vs ratio beneath each station. However, results indicate that H-K stacking fails systematically across Cyprus and as such, is not a reliable technique to analyse crustal structure in Cyprus. The failure of the H-K stacking technique implies that the Moho in Cyprus is not a sharp velocity discontinuity, perhaps influenced by the subducting African Plate. It may also indicate the presence of complex upper-crustal structure associated with the Troodos Ophiolite. Thus, local earthquake fundamental mode Rayleigh wave analysis is used to constrain crustal shear velocity structure. Dispersion curves are picked for each event-station pair and inverted for group velocity across the eastern Mediterranean. The Troodos ophiolite is identified as a high shear velocity anomaly, confined to the upper crust. Below this high velocity anomaly, relatively homogeneous group velocities across the island are interpreted as the pre-existing crust onto which the Troodos Ophiolite was obducted. To allow interpretations of shear wave velocity with depth, joint inversions of surface wave and receiver functions are performed. These confirm that the Troodos ophiolite exists as a high velocity package in the uppermost crust (6 - 10 km) with a gradational Moho at $\sim$25 - 30 km depth.