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A wide-angle seismic survey of the Hecataeus Ridge, south of Cyprus: a microcontinental block from the African plate docked in a subduction zone?

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Cyprus lies at the southern edge of the Aegean-Anatolian microplate, caught in the convergence of Africa and Eurasia. Subduction of the African plate below Cyprus has probably ceased and this has been attributed to the docking in the subduction zone of the Eratosthenes Seamount microcontinental fragment on the northern edge of the African plate. In early 2010, on R.V. Maria S. Merian, we conducted a wide-angle seismic survey to test the hypothesis that the Hecataeus Ridge, another possible microcontinental block lying immediately offshore SE Cyprus, might be related to an earlier docking event. The upper crust of southern Cyprus is dominated by ophiolites, with seismic velocities of up to 7 km s-1. A wide angle seismic profile along Hecataeus Ridge was populated with 15 Canadian and German ocean-bottom seismographs at 5 km intervals and these recorded shots from a 6000 cu. in. air gun array, fired approximately every 100 m. Rough topography of the seabed has made picking of phases and their modelling a demanding task. Bandpass and coherency filtering have enabled us to pick phases out to around 80 km. Tomographic inversion of short-range first arrivals provided an initial model of the shallow sub-seabed structure. Forward modelling by ray-tracing, using the code of Zelt and Smith, was then used to model crustal structure down to depths of around 20 km, with occasional evidence of reflections from deeper boundaries (Moho?). Modelling results provide good control on P-wave velocities in the top 20 km and some indications of deeper events. There is no evidence of true velocities approaching 7 km/s in the top 20 km below the Ridge that might indicate the presence of ophiolitic rocks. Regional gravity and magnetic field data tend to support this proposition. We thus conclude that Hecataeus Ridge is not composed of characteristically ophiolitic, Cyprus (upper plate) crust, and it might well be derived from the African (lower) plate.