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Crustal Thickness and the Distribution of Oceanic Lithosphere in the Western Mediterranean from Gravity Inversion

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Gravity inversion has been used to map Moho depth, crustal thickness and continental lithosphere thinning for the western Mediterranean in order to determine the distribution of oceanic and continental lithosphere and the location of the ocean-continent transition. Data used in the gravity inversion are bathymetry, free-air gravity, sediment thickness and age isochrons, where available, from Smith and Sandwell (2009), Sandwell and Smith (2009), Laske and Masters (1997) and Muller et al (2008) respectively. The gravity inversion method, which is carried out in the 3D spectral domain and predicts Moho depth, incorporates a lithosphere thermal gravity anomaly correction because of the elevated geothermal gradient within oceanic and rifted continental margin lithosphere (Chappell & Kusznir 2008). Gravity inversion results are dependent on the age of the oceanic lithosphere and continental break-up; the lithosphere thermal gravity anomaly correction is dependent on the lithosphere thermal re-equilibration time. Gravity inversion sensitivities to break-up ages of 30Ma, 20Ma and 5Ma have been examined, for the western Mediterranean corresponding to break-up ages in the North Balearic Basin and Gulf of Lion, in the South Balearic and Ligurian Basins, and in the Tyrrhenian Basin. The resulting maps of Moho depth, crustal basement thickness and continental lithosphere thinning from gravity inversion predict the distribution of oceanic and thinned continental crust within these basins. Gravity inversion results suggest that a reference Moho depth of 45km is required in order to predict crustal thicknesses consistent with oceanic crust in the Balearic Basins and the Tyrrhenian Sea. The high reference Moho depth (45km or greater) required by the gravity inversion to predict sensible oceanic crustal thicknesses suggests that the western Mediterranean region is subjected to regional mantle dynamic subsidence. This is consistent with mantle dynamic topography predictions by Mueller et al (2008). Maps of Moho depth, crustal basement thickness and continental lithosphere thinning have been corrected for regional variations in mantle dynamic topography.