Geophysical Research Abstracts
Vol. 20, EGU2018-17698, 2018
EGU General Assembly 2018

Detachment faulting and mantle exhumation at fast opening rates in the Tyrrhenian Basin.

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We present seismic of the opening of the Tyrrhenian basin. Previous work with extensive wide-angle seismic data crossing the basin in 7 transects (collected in 2010 and 2015) provide P-wave velocity models that support the presence of oceanic-like magmatism after an abrupt breakup in a backarc spreading setting. However the magmatic phase stopped and was followed by a phase of mantle exhumation constrained by P and S wave velocity models, and groundtruth by an existing ODP drill samples. The wide-angle data indicates that mantle exhumation has occurred in several episodes through time and that mantle rocks floors most of the Vavilov and Marsilli sub-basins of the Tyrrhenian basin. We show that in the Vavilov basin mantle exhumation was largely accomplished by large-scale detachment faulting producing the well-know core-complex geometry, similar to structures described in slow & ultra-slow spreading centers. However, detailed stratigraphic information calibrated with drilling information provides accurate constrained rates of opening. The stratigraphy supports that mantle exhumation (after backarc seafloor-spreading stopped) opened at fast rates comparable to the East Pacific Rise, a mid ocean ridge where magmatism is robust, core complexes have not been observed, and mantle exhumation has not been described. We propose that small-scale pre-existing mantle heterogeneities may condition the deformation style, melt production and thus the architecture of the continent ocean transition at rifted continental margins.