Geophysical Research Abstracts
Vol. 19, EGU2017-18879, 2017
EGU General Assembly 2017

Continental breakup, back arc spreading and subsequent fast-rates of repeated mantle exhumation in the Tyrrhenian Basin

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We present active seismic data backed up by geological sampling that shows that rifting of Variscan lithosphere during the opening of the Tyrrhenian basin produced a sequence of events that casts some doubts on the classical interpretation of magma-poor rifted margins.
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 robust magmatism linked to an abrupt breakup and early backarc spreading. The magmatic phase stopped abruptly and was followed by a phase of mantle exhumation constrained by P and S wave velocity models, groundtruth by an existing ODP drill site.
The wide-angle data supports that mantle exhumation has occurred in several episodes through time and that tectonically-exhumed mantle floors most of the Vavilov and Marsilli sub-basins of the Tyrrhenian basin.
These areas of exhumed mantle have been soon after exhumation or event coeval to mantle exhumation been intruded by numerous basaltic diking events that currently form ridges and crop out at the seafloor in some locations where they have been sampled.
Each sequence of events of mantle exhumation and basaltic diking was followed by the construction of large basaltic volcanic edifice that form three distinct structures in the area: The Magnaghi, the Vavilov and Marsilli Seamounts
Extensive seismic stratigraphy with > 3000 km of 2D seismic lines across the entire basin calibrated by existing wells provides one of the most accurate kinematically constrained history of any rifted margin from the shelf to the deep basin. The stratigraphy supports that mantle exhumation (after backarc spreading) opened at fast rates comparable to the east Pacific Rise mid ocean ridge, where magmatism is robust and mantle exhumation has not been described.