Solid Earth Discuss.,
https://doi.org/10.5194/se-2018-123-RC1, 2019

Solid Earth Discussions
Open Access
EGU

Interactive comment on "Ionian Abyssal Plain: A window into the Tethys oceanic lithosphere" *by* Anke Dannowski et al.

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Received and published: 11 January 2019

Manuscript n. se-2018-123 Title: Ionian Abyssal Plain: A window into the Tethys oceanic lithosphere by Anke Dannowski, Heidrun Kopp, Frauke Klingelhoefer, Dirk Klaeschen, Marc-André Gutscher, Anne Krabbenhoeft, David Dellong, Marzia Rovere, David Graindorge, Cord Papenberg, and Ingo Klaucke

This paper presents new results from the analysis of a seismic refraction and wide-angle reflection profile acquired in the abyssal plain of the Ionian Sea . Main results concern seismic velocity distribution and crustal structure of the lower plate in a relatively undeformed region, seaward of the converging plate boundary, whose nature (oceanic/thinned continental) is still debated. It is a good paper, which provides inter-

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esting new data. The manuscript is concise, well written and illustrated, and it deals with topics of relevance that could be of general interest to the readers of the journal. I have some general comments and specific issues, which should be addressed to improve the overall good quality of the manuscript.

- The Calabrian Arc is described as a classic subduction system, where the lithosphere is actively subducting underneath Eurasia. However, the geodynamic setting of this unique convergent plate boundary is far more complex. The subduction system is segmented along lithospheric faults accommodating slab tearing, plate divergence and incipient rifting processes, which appear oriented parallel to the convergence direction. Moreover, the study region is located were the slab is already detached, and thus the rate of underplating might have slow-down recently. The deep fragmentation of the subduction system close to the study region, occurs along lithospheric faults, which were described as related to Mesozoic inherited discontinuities in the Tethys lithosphere (i.e. fracture zones) and are presently driving neotectonics. I suggest to discuss this complexity in the frame of the results of this new study.

- It has been recently proposed that lithospheric faults segmenting the subduction system trigger serpentinite diapirism, which brings to the surface mantle derived rocks, representing a tectonic window into the Tethyan mantle. These findings are not discussed at all in this manuscript, but I think they are relevant because strictly related to the nature and structure of the lower plate, one of the main subjects of this paper. If serpentinites are inherited from the Tethyan ocean, they are Mesozoic in age, and could have developed along fractures located near the boundary between the oceanic crust and the adjacent thinned continental crust as suggested by Polonia et al. (2017). The widespread presence of serpentinites suggests that the Tethyan Ocean, was not a magma-rich basin; serpentinization may have occurred along the OCT or may represent the product of hydration of exhumed mantle. The Authors might take into consideration the occurrence of serpentinites, and check whether it fits their data or suggest alternative possibilities. This would help future researches in this area.

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- This comment brings me to the next issue dealing with uncertainties. Gravity modelling is very dependent on the forward modelling approach and parameters, and usually does not provide firm evidence to discriminate gabbros from mantle-derived lithologies, and it has been unable to provide solid evidence to unambiguously discriminate mantle lithologies at depth from other combinations of mafic and ultramafic rocks. (e.g., Escartin & Cannat, 1999; Dunn et al., 2007). Velocities are the strongest evidence pointing for an oceanic crust. However, I would suggest to include in the discussion as a reference, two additional velocity profiles to be compared with presented refraction data: exhumed mantle like in the Tyrrhenian Sea (Prada et al., 2014) and exhumed lower crust. High Vp/Vs data close to the study region should also be considered and discussed (D'Alessandro et al., 2016). Exhumed mantle does not probably fit the velocity profile reconstructed using the newly acquired data, but discussing this occurrence would eventually strengthen the conclusions. On the other hand, I am not sure that the velocity profile of an exhumed lower crust can be discharged.

- Finally, in the geology background the Authors state that, if the Ionian lithosphere has a Tethyan affinity, its oceanic nature would support the hypothesis that the Adria microplate and the Ionian Sea, belong to a rigid promontory of Africa. However, thrust faulting and inversion structures in the abyssal plain (as described by Gallais et al., 2011 and in this manuscript) and below the accretionary wedge (Bortoluzzi et al., 2017) contradict such a 'rigid' connection to Africa. The Authors should discuss this apparent contradiction and suggest likely scenarios for tectonic inversion and basement involved tectonics in the oceanic lithosphere as evidenced in the multichannel seismic lines.

More specific comments are included in the annotated pdf.

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Please also note the supplement to this comment:
https://www.solid-earth-discuss.net/se-2018-123/se-2018-123-RC1-supplement.pdf

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2018-123, 2018.

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