Solid Earth Discuss.,
https://doi.org/10.5194/se-2018-113-RC1, 2018

Solid Earth
Discussions

Interactive comment on "Crustal Density Model of the Sea of Marmara: Geophysical Data Integration and 3D Gravity Modelling" *by* Ershad Gholamrezaie et al.

M. Rodriguez (Referee)

rodriguez@geologie.ens.fr

Received and published: 30 October 2018

Review of the manuscript : 'Crustal density model of the Sea of Marmara : geophysical data integration and 3D Gravity Modelling' By Ershad Gholamrezaie et al. For Solid Earth This is a beautiful and thorough study about the crustal structure of the Marmara Sea with strong implications for the understanding of the geology of the area and the segmentation of the fault system. The study is clear, well written, with nice figures. The link with seismic and tomography studies makesyour 3D crustal model very convincing. I therefore recommend the publication in Solid Earth. However, I have a few minor comments, questions and suggestions.

Scientific comments: -The definition of the pre-kinematic and syn-kinematic sediments is a bit unclear and somehow difficult to relate to the complex geology of the area. What I do not understand is if this terminology refers to the timing of localization/propagation of the North Anatolian Fault, the opening of the Marmara Sea, or the onset of the Main Marmara Fault. . .or maybe all this stages together? I understand that the pre-kinematic sediments refers to the deposits older than Late Cretaceous, but there are also some tertiary sediments (Eocene) that were unrelated to the history of the North Anatolian Fault. Do you link these sediments with the pre or syn-kinematic history? You should dedicate a full paragraph where you explain clearly this terminology, and make a clear link with the geological episodes in this area. This terminology is sometimes confusing. -I have found the link with seismic profiles and tomography very convincing (especially the link with Becel et al. and Laigle et al.). . .Maybe you should add a figure summarizing what we have learned from these studies (i.e. a few cross sections). Some readers may not be familiar with these studies and find all the related sections difficult to follow. -One of the strongest result is the identification and mapping of the high density body, with a density $\sim$3. However I feel that the discussion about its origin is incomplete. You link these bodies to deep magmatic activity coeval with the activity of the North Anatolian Fault. . .but the mechanism at the origin of these high density bodies is unclear. Shear heating of the lower crust or the top of the lithospheric mantle? How can you be sure that the formation of these high density bodies is related to the activity of the North Anatolian Fault? What are the arguments? An alternative may be to consider these high density bodies reflects the intra-pontides suture zone. Parts of this suture zone has been mapped onland (see a synthesis in LePichon et al 2014), but the offshore mapping remains unclear. I wonder if what you identify may actually be some ophiolites or metamorphic rocks trapped along this suture zone. In terms of density, ophiolites are >3, some metamorphic rocks can reach the same density. For some insights about the intra-pontides suture zone, I suggest the following papers : Okay and Tüysüz, 1999; Robertson and Ustaömer, 2004. If the ophiolites/suture zone hypothesis is correct, then it means that structural inheritance strongly controls the

segmentation of the North Anatolian Fault in this area. It would also strongly emphasize some previous suggestions of Celal Sengör, who proposed that the localization of the North Anatolian Fault is strongly influenced by the intra-Pontides suture zone.

Detailed comments: -the title reads a bit long: I suggest something like '3D crustal density model of the Marmara Sea' -Geological setting : lateral escampe of Anatolia is not only the result of Arabia indentation, there is also a link with the retreat of the Hellenic trench, see Faccenna et al 2006 EPSL for an elegant synthesis -Geological setting: page3 Line 25. LePichon et al 2003 provide some observations suggesting the present-day context is pure strike slip, not transtensional (no oblique extensive stresses), except in the area of Cinarcik where the bend of the fault favors extension. . . -In the discussion, please compare better the improvements of your study with previous ones (Kende. . .etc. . .)

Comments related to the figures: -In the captions, please refer to the meaning of the abbreviations, it is sometimes boring to jump from one figure to another to find the significance. -In figure 8 : you should number the layers to ease the link with the text (for instance, when you refer to the third layer, the reader has to guess which one is it on the figure. . .) -As mentioned earlier, maybe adding some cross sections from previous works (Laigle et al 2008 especially) may help the understanding of your study for a broader audience

I hope you will find these comments helpful and constructive Best regards, Dr. Mathieu Rodriguez Ecole normale supérieure de Paris

Suggested References: Faccenna, C., Bellier, O., Martinod, J., Piromallo, C., Regard, V., 2006. Slab detachment beneath eastern Anatolia : a possible cause for the formation of the North Anatolian Fault. Earth and Planetary Science Letters 242, 85-97. Okay, A.I., Tüysüz, O., 1999. Tethyan sutures of northern Turkey. Geological Society of London, Special publications, 156, 475-515. Robertson, A.H.F., Ustaömer, T., 2004. Tectonic evolution of the intra Pontide suture zone in the Armutlu Peninsula, NW

Turkey. Tectonophysics 381, 175-209

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2018-113, 2018.