Comments to P. Henry, Referee #3

#This manuscript presents an interesting new hypothesis explaining gravity anomalies in the Sea of Marmara area: the presence of high density bodies within the crust along the North Anatolian fault zone. However, the manuscript does not yet provide a fully convincing demonstration that the presence of these bodies is required by the available data. Owing to the non-uniqueness of gravity inversion solutions, and to the limitations of the currently available constraints from seismology, the gravity modeling alone cannot prove the existence of the high density bodies. Data may also be fit (at least at wavelengths of more than about 30 km) considering relatively small variations of Moho depth that remain compatible with constraints from seismology. The presence of high density bodies, is, however, a sound hypothesis, which can be further supported by considering the geological and geophysical contexts.

We have carried out, as already stated above, more detailed sensitivity studies and have revised the models and interpretations (see answers to editors and reviewers #1 and #2)

#Geological knowledge on the Sea of Marmara area is already integrated in the discussion, but two important points are missing: (1) Ates et al. (1999, 2003, 2008) found magnetic anomalies in the Sea of Marmara area, which they related to the presence of magnetic bodies along the North Anatolian Fault zone. The largest one coincides with the eastern dense body infered in this study. (2) The North Anatolian fault zone follows more or less an ophiolitic suture, and this could explain at least in part the presence of dense and/or magnetic bodies along its track. Heterogeneities in the crust may thus not be a consequence of magmatic intrusions during a rifting event, but be a consequence of the convergent, and then transcurrent, tectonics during the Paleogene. This is already appearent in some of the cited references (e.g. Sengor et al., 2005) and more recent references also exist (e.g. Akbauram et al., 2016).

Thanks for pointing us to the additional publications. We have consulted those and in particular the work on magnetic anomalies was indeed important. We have complemented the discussion with respect to these findings (see page 14-15). In particular, the we added the following paragraph to the manuscript:

Page 15 line 3: “The mechanisms and timing of the emplacement of the high-density bodies are, however, difficult to determine. The modelled density indicates that the high-density bodies represent magmatic additions to the Marmara crust, potentially originating from larger depths that rose buoyantly into domains of local extension. Magnetic anomalies across the Sea of Marmara indicate positive anomalies along the MMF that may be interpreted as magnetic bodies along the fault (Ates et al., 1999; 2003; 2008). In particular, the locations of the high-density bodies beneath the Çınarcık Basin correlate spatially with the maximum positive magnetic anomaly (Ates et al. 2008) which indicates that some mafic lithology is present there below the non-magnetic sediments.”

#My conclusion would be that the gravity anomaly in the Eastern Sea of Marmara is at least in part caused by a mafic/ultramafic sliver in the crust, but it is still unclear to me whether a large high density body is present beneath Tekirdag Basin. I fully agree with the authors that these bodies could be a possible factor controling strain localization within the North Anatolian shear zone and that they predate the Pio-Quaternary transtensional tectonics, but I am not convinced they were emplaced as magnatic intrusions within the continental crust.

Concerning this comment, we agree that the high-density bodies could also represent inherited structures. However, the spatial correlation between the position of these bodies and the thickness maxima in the syn-kinematic sediment distribution is also evident. We have therefore decided to keep the two alternative interpretation scenarios.

#Regarding the discussion with Reviewer #2, I would like to confirm that the Sandwell/TOPEX gravity model has good consistency with the marine data that were collected during Marsitecruise (both used in Kende et al., 2015), and that the Eigen- 6C4 anomaly map used here seems less consistent with these marine data. I would like to encourage the authors to go on with their suggestion to compare models fitting Topex and Eigen-6C4 gravity anomalies. I would be happy to provide the gravity data used in Kende et al. to the authors (hence, do not request to stay anonymous). Ideally, a magnetic model could be added.

This provision of the data was essential for improving our manuscript and this way of receiving feedback is what authors ideally would wish for. As detailed in the comments to the other reviewers we have carefully carried out the comparison suggested by the reviewer and our work has greatly profited.

We agree that a magnetic model would be ideally complementing this work, but as no robust information on magnetic susceptibilities was available to us, we decided to postpone this to future work.

#References:

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Ates, A., Kayiran, T., & Sincer, I. (2003). Structural interpretation of the Marmara region, NW Turkey, from aeromagnetic, seismic and gravity data. Tectonophysics, 367, 41–99. https://doi.org/10.1016/S0040-1951(03)00044-1

Ates, A., Kearey, P., & Tufan, S. (1999). New gravity and magnetic anomaly maps of Turkey. Geophysical Journal International, 136(2), 499–502. https://doi.org/10.1046/j.1365-246X.1999.00732.x

Ates, A., Bilim, F., Buyuksarac, A., & Bektas, Ö. (2008). A tectonic interpretation of the Marmara Sea, NW Turkey from geophysical data. Earth, Planets and Space, 60(3), 169–177. https://doi.org/10.1186/BF03352780

All references were considered and integrated in our discussion.