Dear Anonymous Reviewer,

Thank you for your discussion denotes on our "Comments on Polom et al., 2018). Your comments are so long that to comprehensive reply to it we need to write a new article. Therefore will reply briefly.

We relate to Dr. Polom et al. with sympathy, and our comments present scientific discussion deprived any personal claims to our opponents.

At first, we have to denote that the problem of salt layer presence in the Ghor Al-Haditha area is not of academician interest only, but is very important issue for the engineering and commercial development in the Dead Sea coastal plain of Jordan. Dr. Hazim El-Nasser, Minister of Water and Irrigation and Minister of Agriculture of Jordan, said that the Red Sea – Dead Sea channel is being retarded à cause of a great number of sinkholes appeared since 1980th and now proliferating along the Dead Sea shore both in Israel and Jordan. All types of the industrial activity may be affected by sinkholes problem: water resources, infrastructures, agriculture, tourism, etc. The mechanism of sinkhole formation has a great practical and even political meaning. We want to involve any scientists to the discussion about the salt layer presence in the Ghor Al-Haditha (Jordan).

1. Our "Comments" does not relate to entire article of Polom et al. (2018), but only to conclusion on the salt layer absence in the study area. Moreover, we try to understand "Why the modern seismic reflection method based on the S-wave technique did not detect reflections from the salt layer in the study area?" (Abstract). We analyze some details of the study layouts (Section 3), geological interpretation of materials (section 2 and Fig. 1), some inaccuracies in interpretation of the previous researches (Subsections 5.1, and 5.5) and cite Polom et al. (2018) conclusions with respect to his interpretation of obtained results (Section 4 and Subsection 5.4).

2. You are absolutely right that “Any geophysical technique has its resolution, potentiality and the possibility to obtain univocal interpretations or not depending of the available information and the consideration of the state of the art of the technique”. “Moreover, the potential interpretation depends also from the geological context where the research has been carried out. It is obvious that indirect characterizations are not enough to obtain interpretations about properties that are different from the analyzed. In this sense, the interpretation of the geophysical records is always intuitive, open to re-evaluation depending the available information and the contour conditions defined for the interpretation and conceptual model inferred from the expected geology from the area.”
3. In fact, our position converges with yours about the possibility multiple interpretations of geophysical data. We only invite to write it in the conclusion of discussed paper. On the other hand, application of the method requires its

calibration. That is why, before study of salt using the Seismic Refraction method, we analyzed the geological peculiarities of the region and potential capacity of the method to reveal buried salt and to perform calibration of seismic results with the boreholes (Ezersky, 2006). It was established that in the Dead Sea graben area: (1) hard rocks apart from the salt are absent, there are only loose sediments; (2) hence, the most reliable (statistically substantiated) minimum velocity criterion for the salt layer presence (based on the P-wave velocity only) can be accepted as Vp_{min}=2900 m/s. Vp values less of that characterize alluvial sediments, and Vp values higher of that – characterize salt. Hereafter, values of Vp=2900 m/s and more were used as a criterion of presence of salt layer. With such a criterion, we have interpreted the seismic results of El-Isa et al. (1995).

4. Anonymous Reviewer writes: "Moreover, I am not expert in geology from the study area, but I believe that the contact of a unit, mainly related to evaporites, do not require a lonely straight contact as included at the figure 2 from the reply. The levels can change laterally and the evaluation is being carried out from indirect data and regional correlation from something that do not outcrop. I believe that the interpretation from Ezersky et al. can be correct, but it does not decrease the interest of the original manuscript, as they pointed out the eventual controversy about such data, and the article just contextualize the geophysical data and try to interpret such data at the evaluated context". You are right that the data shown in Fig. 2 do not decrease the interest to the original manuscript. We want to underline one more, the article is interesting taking into account applied modern technique and new experience. We discuss in our "Comments" the salt presence only. In this aspect, if we accept the fact of the salt boundary presence, we have to agree that the study (Polom et al., 2018) was carried out mostly out of the salt area and it can explain why authors do not see the salt layer. The model of salt formation and its relation to faults (e.g., Ezersky and Frumkin, 2013) explain shape of the salt boundary. Besides this, salt presence was suspected by other scientists (e.g., Taqieddin et al. (2000), Knight (1993)).

5. We have to agree with the Anonymous Reviewer, that "authors are preparing an article about the geophysical data from the area, that was not referred in the references". Preparing our Comments, we presumed that our above mentioned paper (submitted to another Journal) will be accepted or published before our discussion in the Solid Earth. Unfortunately, it is still under consideration and we have to change this sentence in the text. Subsection 5.2. will be rewritten so:

"5.2. Thickness of salt layer

Second reason that would explain results of Polom et al. (2018) are the parameters of the salt layer calculated by authors of the present communication using the MASW method in combination with the forward modelling, like described in Ezersky et al., 2013, Fig. 6, herein). Our calculations show that a depth of the salt layer varies from 37 to 42 meters from the surface, and thickness of the salt layer is of 7-10 m. It corresponds with Polom et al. (2018) presumption on the absence of "a thick (> 2–10m) compacted salt layer formerly suggested to lie at 35–40m depth" (p.1079 in Polom et al.) in the Ghor Al-Haditha. Indeed, thin salt layer (2 – 10 m thick) can be transparent for seismic waves, but it does not exclude the sinkhole hazard" (yellow marked text is new corrected edition).

6. Finally, we want to discuss with the Anonymous Reviewer his conclusion that our Comments must not be published. We believe that the Anonymous Reviewer did

not understand the goal of our comments and he will change his opinion after our reply.

References

Ezersky, M.G., The Geophysical Properties of the Dead Sea Salt applied to sinkhole problem. *Journal of Applied Geophysics*, 58 (1): 45-58, 2006.

Ezersky, M., and Frumkin, A., Faults—dissolution front relations and the DS sinkholes problem. *Geomorphology*, 201: 35–44, 2013. doi: 10. 1016/j.geomorph.2013.06.002.

Ezersky, M.G., Bodet, L., Akkawi, E., Al-Zoubi, A., Camerlynck, C., Dhemaied, A., and Galibert, P-Y., Seismic Surface-wave prospecting methods for sinkhole hazard assessment along the Dead Sea shoreline. *Journal of Environmental and Engineering Geophysics*, 18 (4): 233-253. doi: 10.2113/JEEG18.4.233, 2013 (Joint Issue with Near Surface Geophysics).

Knight, D.J., Extension west of Lisan Peninsula sinkholes along access road. Report on site visit 9–10 January 1993, DJK/A110/ 92235B. The Arab Potash Company, Jordan (unpublished), 1993.

Polom, U., Alrshdan, H., Al-Halbouni, D., Holohan, E.P., Dahm, T. Sawarieh, A., Atallah, M.Y. and Krawczyk, C.M., Shear wave reflection seismic yields subsurface dissolution and subrosion patterns: application to the Ghor Al-Haditha sinkhole site, Dead Sea, Jordan. Solid Earth, **9**, 1079-1098, 2018. https://doi.org/10.5194/se-9-1079-2018

Taqieddin, S.A, Abderahman, N.S., and Atallah, M., Sinkhole hazards along the eastern Dead Sea shoreline area, Jordan: a geological and geotechnical consideration. Environmental geology 39 (11): 1237-1253, 2000.