

Interactive comment on “The Bortoluzzi Mud Volcano (Ionian Sea, Italy) and its potential for tracking the seismic cycle of active faults” by Marco Cuffaro et al.

Anonymous Referee #1

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The manuscript ‘The Bortoluzzi Mud Volcano (Ionian Sea, Italy) and its potential for tracking the seismic cycle of active faults’ presents a multi-parameter dataset of a mud volcano in the Ionian Sea. The authors consider this mud volcano as a promising location for installing a cabled multiparametric station in order to study the relationship between the seismic cycle of underlying active faults and fluid expulsion. The data set is definitely interesting and interpretations seems to be sound (though not always easy to verify based on the presented data, see below); hence, I principally support publication of the manuscript but suggest major modifications, especially concerning the structure of the manuscript and the data presentation. In addition, the authors should elaborate more on the general significance of their study, or rather demonstrate

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more clearly, why the BMV is representative and best suited for the suggested investigations. I am not an expert on geochemistry and cannot comment this section of the manuscript.

General comments: 1) I strongly suggest to change the structure of the manuscript. Separate 'Material and Methods' from the 'Results'. In addition, you mix results and discussion quite a bit. Introduce the methods first and then summarize the results. You state that you have a multi-parameter data set. Make use of this opportunity and try to combine the data sets already during presentation of the results. Morphology and subsurface features (seismic data) can be combined. The second major type of data are the geochemical data. The integrated presentation of the data would be the perfect basis for the discussion. The main points of the discussion should then be the (1) Origin and Activity, and (2) the potential to use the BMV as location to investigate the relationship between the seismic cycle of underlying active faults and fluid expulsion.

2) It remains unclear why you selected the BMV for the investigations. How does it compare or differ to other mud volcanoes in this area. Mud volcanoes in the area haven been investigated before. Not much information is given on previous investigations of mud volcanoes in the Ionian Sea.

3) This previous point is closely related to the general relevance of your investigation. What is special compared to previous study? How does your investigation contribute to the general understanding of mud volcanos? Why is the BMV more than a case study?

4) The conclusions are mainly a list of your most important results, which are already listed in the abstract. A conclusion should tell the reader what she can or he could do with the newly acquired knowledge. Answer the question "So what?".

5) Several of your statements cannot be verified based on the presented figures. I am aware that you cannot show every detail but some enlargements/details in order to support your statements would be useful (see specific comments)

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6) The geochemical analyses of the BMV is based on one cast above the BMV. I am not a geochemist but I wonder how representative this cast is?

7) Annotations of several figures are very small and difficult to read.

8) Avoid extensive referencing. References are always a selection; you cannot mention all, especially for a topic, where quite a lot of work has already been published. I suggest not using more than three references for one statement.

9) I am not a native English speaker but I have the impression that some (little) language polishing is needed. I have not made any specific comments on this point.

Specific comments:

Page 1, Line 14/15: Conclusions are drawn . . . Give specific conclusions. Do not only announce them.

Page 2, Line 5/6. This is an example for extensive referencing.

Page 2, Lines 8/9: Another example for excessive referencing. Not mentioned any more in the following. Check for the entire text.

Page 2, 14/15: 27 Mt methane a-1 . . . Is this the only estimate? I assume that estimates cover a wide range of numbers.

Page 2, Line 15/16. Calabrian arc is not marked on Fig. 1.

Page 2, Line 29/30: It seems that you do not use the OBS/OBH data in the manuscript. Why do you mention them here? Alternatively, why do you not use them for the manuscript?

Page 3, Line 4/5: Be more specific. Name some of the potential precursors.

Page 3, Line 26: Mark Aeolian Islands on Fig. 1

Page 3, Line 31: Mark escarpments on Figure 1. If the figure is getting too crowded, an additional figure showing all the locations mentioned in the text may be useful.

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Page 5, Lines 6-13: You mentioned OBS/OBH deployments in the introduction. Why are these data not included? Local seismicity would be interesting. Or, are they still on the sea floor?

Page 5, Line 15. What is the extend of the BMV area? Is it the area shown on Fig. 1? Clarify.

Page 5, Line 15, 16. You explicitly state that the focal mechanisms are from earthquakes that are < 4.5 in magnitude. This implies that there are also larger earthquakes. What is about larger earthquakes?

Page 6, Lines 1-4. Processing details should be moved to the supplement or deleted, especially as the data have already been presented elsewhere (Bosman et al., 2015)

Page 6, Line 5/6: change to 'with a lateral resolution varying between 10 m for water depths shallower than 1000 m to 25 m at greater depth'.

Page 6, Lines 6-12: Delete. No need to include such details. You do not need to show that you know procedures for calibrating a multibeam system.

Page 6, Line 17, 18: This sentence reads very strange. First, you state that 22° is a maximum. Then you continue that it is even up to 28° . I assume that the 28° is related to the 35 km long escarpment. Maybe split to two sentences, though I am not sure what you mean. Suggestion: 'The upper part of the continental slope is characterized by a very steep slope (about 15°) that reaches a maximum of 22° . Even larger slope gradients of up to 28° are found along the NE-SW orientated main escarpments, which are up to 35 km long.

Page 6, Line 24/25. Difficult to follow. In your Fig. 4a, you show one rim. In this sentence, you mention two rims. This is confusing.

Page 6, Line 32 – Page 7, Line 11: More discussion. If you include the BMV in this discussion, you should mention the volume during the description. It also remains unclear if you calculate the volume of the BMV based on the given formula of if you use

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exact volumes based on your data.

Page 7, Line 17. I strongly suggest converting the TWT to depth and resolution in meters using a constant velocity of 1500 m/s.

Page 7, Line 27-30: I like that you have uninterpreted sections in the supplement. This give you the chance to add more interpretation to the interpreted sections. E.g., H1 is easy to identify at the location where you label H1. I find it difficult to trace H1 from these locations to the sides. In addition, erosion at H1 is difficult to see. Mark this clearly or show enlargements to support this statement.

Page 7, Line 31 to Page 8/Line 10: Similar comment as before. Mark lower and upper boundary more clearly. Mark features described in the text on the figures more clearly (Erosion, onlaps and so on). Make it easier for the reader to follow your description. In addition, I strongly suggest using depth/thickness of units in meters (possibly in addition to numbers in TWT).

Page 8, Lines 13 to 30: This is interpretation and I would suggest moving this to the discussion section. Sometimes, there are good reasons to leave this type of interpretation with the data description but the general structure of the chapters (methods, results, interpretation) is challenging the approach of an integrative interpretation of your multi-parameter data set.

Page 8, Lines 21-24: Do you have a preferred interpretation based on your data. Delete the figure numbers of the Evans et al. paper. It is sufficient just to reference the paper.

Page 9, Line 9. How sure can you be about the location of the core. Did you use a positioning system (e.g. USBL-System) during coring, or is it the surface location of the vessel? The chirp profiles show large lateral variability at the projected coring location. How sure can you be that you really penetrated the units imaged at the projected location of the core?

Page 9, Line 9 to 23: This is again mixing results and interpretation/discussion, even

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more than before. E.g., you describe the patchy/cloudy facies when discussing it. I strongly suggest to give a good description of the core first and discuss it afterwards (here or even better in the discussion section).

Page 9, Lines 26-31: Give the basic acquisition parameters (such as source frequency in order to estimate the resolution). You give very detailed information for the other systems but almost no information is given for the seismic system.

Page 10/11, Results: It is again a mixture between description and discussion.

Page 10. Line 13/14: The Ionia fault system is labelled from SP200 – 1400 on the CROP M-31 line (Fig. 10b), which contrasts the statement in the text (SP 1100 -1400) Clarify.

Page 10, Lines 24/25. Mark the flower structures. It is clear on the western side of the profile but not obvious for the eastern side.

Page 11, Lines 4-8. I do not think that I see the slightly transparent seismic reflection signal beneath the BMV. I may see some small amplitude variations but they seem to occur along the entire profile. In addition, I also see some areas with enhanced reflection amplitudes beneath the BMV (e.g. in the transparent unit directly beneath the seafloor reflector in Fig. 10e). Strong amplitudes also indicate rock/fluid indication. A better description and a better visualization is required in order to believe your statement (indication for fluid-rock interaction).

Page 11, Line 12 – Page 12, Line 10: Cannot judge this part. Seems to be quite long for me. Isotopic numbers are not superscript (in the entire text).

Page 12, Line 17. Change 'comparable' to 'similar'. Everything is comparable.

Page 12, Line 18, 19: This statement seems to be wrong. The Br content for GeoC2 is 0.990, and 1.04 in 500 and 1000 m depth for the BMV. This is less than 11° higher. The highest Bromine content is found in 200 m depth at BMV. This value is very unlikely to be related to the BMF because it is far above the BMV. How reliable is the statement, that

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the Brome content is really higher. Can you make this statement on one single cast?

Page 12, Line 23, 24. Not clear where you see the decrease in oxygen content. Be more specific.

Page 12, Line 27. 0.73 (not 0.71 as in the text) is given for the CO₂ content in the table.

Page 13, Line 7 to Line 18. Delete. This section is not containing relevant information.

Page 13, Line 20-26. As mentioned above, some parts of the result section would be located here much better. Otherwise, this section is just a repetition of the results. As mentioned above, the semi-transparent seismic facies is not evident for me.

Page 13, Line 17-19: As mentioned above. How representative is a single sample? I believe that higher CH₄ content is significant but convince the reader.

Page 13, Line 28. See comments concerning the semi-transparent facies above.

Page 15, Lines 17-20. Delete. No relevant information.

Page 15, Line 29. Mention how long before the earthquake the pore pressure changes have been measured.

Page 15, Line 22 - Page 16, Line 15. These are nice examples but this chapter reads as earthquake forecasting can easily be done by geochemical monitoring. Add a few sentences that the story is not that easy.

Page 16, Line 16-33: Principally, I agree but I am not convinced that the BMV is really the best place just because it is best characterized by the most extensive data set. I assume that there are some mud volcanoes with proven ongoing activity close by (escape of fluids, mud flows etc.). Why not using another mud volcano? What is special about the BMV?

Page 17, Lines 1-11: Delete here. Include in a rewritten conclusion.

Page 17, Conclusion. See general comments. Answer the question "So what?"

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Fig. 1: Nice figure with a lot of information. Try to add additional geographic locations and features mentioned in the text. Split to two figures if the figure is getting too crowded. I suggest deleting the earthquake locations from the figure because they are shown much better in Figure 2 and you only show the earthquakes in the area of Fig. 2. The grey dashed line (CA99-215 line) is very difficult to see.

Fig. 2: What is the difference between the solid and the blue dashed line? It seems for me that the dashed blue line is not needed.

Fig. 3: Figure should be larger. Add to figure caption 'Location of the maps is shown on Fig. 2a'.

Fig. 4: Figure should be larger. Annotations/Numbers are very small and difficult to read. Add distance scale to maps. Moat not labelled on the SE part of Profile a a'.

Fig. 4: Distance scale is missing on maps.

Fig. 5. Mark location of profile on Fig. 4. Add along track scale. Figure caption is confusing. It is not clear that 'absence' relates to both statements. Now it reads as the absence of amplitude anomalies indicates massive fluid escapes. Modify.

Fig. 6: Exponents are not in superscript for the volumes.

Fig7: See comments above. Add more interpretation and/or close-ups. Add absolute depth for the y-axis. I suggest using meters instead of TWT.

Fig. 8: Nice figure. Add absolute depth on Y-Axis. Would use meters instead of TWT.

Fig. 9: I have serious problems to correlate the enlargements of the core section with the photo of the entire core. E.g., section b should include the erosional contact. I can see a clear colour change at this interval in the image of the entire core but I cannot see this colour change or the erosional contact in the enlargement b. Enlargement b looks very homogenous for me. The same is the case for enlargement d, which also show clear colour changes. Some sedimentary layers seems to be down bended on the

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left-hand side of the image of the entire core, which is not visible on the enlargement. Annotations are very small and almost impossible to read.

Figure 10. Nice figure. See comments made above (especially concerning the slightly transparent seismic facies).

Fig. 11: OK

Fig. 12: Nice figure but not really discussed in the text. Discuss the outline of your monitoring tools in more detail.

Good luck with the revisions.

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2018-118>, 2018.

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