

Interactive comment on “Origin of lipid biomarkers in mud volcanoes from the Alboran Sea, western Mediterranean” by C. López-Rodríguez et al.

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Dear Editor,

We would like to thank you for this review process as well as the two reviewers for their comments. Reviewer #1 does not suggest particular changes, while reviewer #2 provides some suggestions that have been considered in order to improve the final version of our manuscript.

Points raised by reviewer #2 have been addressed in this new version, following his suggestions. Detailed responses are given below. When minor changes have been addressed in full we listed the response as OK; responses to the other points include further details.

C9479

Sincerely, on behalf of all authors C. Lopez-Rodríguez

REVIEWER #2

Page 18857 Line 3: the sentence is wrongly written. Change “later undergone” for “later has undergone”.

Response: OK

Page 18857 Line 26: “Iberia” is wrongly written. Change this word for “Iberian”.

Response: OK

Page 18858 Line 2: In “Shale diapirs structures” the word “diapirs” is wrongly written. Change this word for “diapir”.

Response: OK

Page 18858 Line 6: the verb “contains” is wrongly written. Change this word for the form in plural “contain”.

Response: OK

Page 18858 Line 12: “Lopez-Rodríguez et al., 2013” does not appear in reference list.

Response: “López-Rodríguez et al., 2013” was changed in the text to “López-Rodríguez et al., 2014” and the completed reference included in the reference list as “López-Rodríguez et al: Fluid venting and methane seep activity in Carmen MV, West Alboran Basin, in preparation, 2014”.

Page 18858 Line 23: “The 900 kg box-corer had a round box of 30 cm internal diameter”. Please add the high of the box and some details on subsampling (as is done for the gravity core samples).

Response: we have included in the paragraph the height of the box-core and added some additional details about the subsampling of box-cores, as follows: “The 900 kg box-corer had a round box with an internal diameter of 30 cm and a height of 55 cm.

C9480

The recovered gravity cores were cut in 1 m sections, split open lengthwise and lithologically described. Box-cores were sub-sampled using pvc tubes of 50 cm length and 9 cm inner diameter which were pushed vertically in the sediment. Subsequently, these sampling tubes were split open lengthwise and lithologically described".

Page 18859 Line 21: What detector? (Surely GC-FID as mentioned for methane analyses)

Response: the detector used in GC was a flame ionization detector. It was included in the text as follows: "Gas Chromatography (GC) was performed with a Thermo Finnigan TRACE instrument equipped with a fused silica capillary column (CP Sil-5, 25m x 0.32 mm, $df = 0.12 \mu\text{m}$), with a flame ionization detector and helium as a carrier gas"

Page 18859 Line 22: not a 525 column. Insert blank.

Response: reviewer is correct; this error occurred due to Publisher's file conversion.

Page 18864 Line 8: delete "by"

Response: OK

Page 18865 Line 7: "Lower than that" instead "lower that"

Response: OK

Page 18865 Line 19: M defines molar concentration (molarity), i.e. moles per volume. Thus the dimension μML^{-1} seems not correct. Use $\mu\text{mol L}^{-1}$ or μM , both in this sentence as in general.

Response: Dimension $\mu\text{M L}^{-1}$ was replaced by the right one μM , in this paragraph as well as across the text as suggested by the reviewer.

Page 18866 Line 14: delete plants, following sentence not understandable

Response: OK

Page 18867 Line 6: lead (not lend)

C9481

Response: OK

Page 18867 Line 11: "than at the visually" not "than the visually"

Response: OK

Page 18867 Line 13: "be at 230 cm" instead "be 230 cm"

Response: OK

Page 18867 Line 25: This is not uncommon (as said twice), but rather an often encountered phenomenon indicating oil impregnations.

Response: The term "Uncommon" was deleted from the text. The sentence was completed deleted.

Page 18868 Line 16: "in other studies" instead "another"

Response: OK

Page 18868 Line 20: "signatures typical of hydrocarbon" instead "signatures of typical hydrocarbon"

Response: OK

Page 19 18869 Line 14/15: to be appeared?

Response: "to be appeared" has been replaced by "to be reached"

Page 18869 Line 20: showed?

Response: the sentence "as is showed by multichannel seismic profiles from the West Alboran Basin" has been changed by "as indicated by seismic data"

Page 18870 Line 10: change "methanotrophs archaea" for the correct "methanotrophic archaea"

Response: OK

C9482

Page 18870 Line 11-13: crude sentence, rework.

Response: This sentence was rewritten. The lower activity of Kalinin MV (compared with Perejil MV) was explained using the archaeal lipid biomarkers given in table 2 as well as GDGTs-based ratios. No more details were given since no pore water data for Kalinin were available to explain if this structure has been active recently, as it is the case for Perejil MV. We consider that a deeper discussion of the AOM activity of Kalinin was not appropriate without further sulphate or methane data. However, the current dormant state of Kalinin MV is discussed based on the presence of a thick hemipelagic sediment drape in section 5.5.MV dynamics.

Consequently, the sentence has been rewritten as:

“However, some differences in GDGTs-based ratios and also in archaeal lipid biomarkers (mainly in crocetane contents; Table 2) indicate lower rate of anaerobic oxidation of methane (AOM) at Kalinin MV compared with Perejil MV (Table 2). In Perejil MV crater, the finding of authigenic pyrite in the mud breccia suggests that recent methane fluxes and concordant sulfate reducing processes occur at this site.”

Page 18871 Line 6: “interval” must be written in plural; “intervals”

Response: OK

Page 18871 Line 11: “biomarker” must be written in plural; “biomarkers”

Response: OK

Page 18871 Line 13: “reflect” rather than “reflects”

Response: OK

Page 18871 Line 23: “indicated” instead of “indicate”

Response: OK

Page 18872 Line 8: is (not are)

C9483

Response: OK

Page 18872 Line 13: rework paragraph.

Response: The paragraph has been modified as suggested. It has been divided in two parts; the first one compares nearby sampling sites located in the crater of Perejil MV. Thus, we have compared the hydrocarbon gas data provided by Blinova et al., 2011 with the data reported in this study. The comparison not only supports differences in methane concentrations between sites but also between samples taken in different years (Blinova et al., 2011 gas samples were taken in 2008, whereas the gas samples studied here were obtained in 2010). Both cases are used as examples to prove the high seeping variability that Perejil MV shows, both in space and in time. The second part is focused on empathising the applicability of AOM-related biomarkers to discern the current activity of Perejil MV and to further support this structure as the most active MV in the northern MV field.

The new text includes: “Differences exist in the methane concentrations at Perejil MV that are reported here and those reported by Blinova et al. (2011) from neighboring sampling sites, which can be explained due to the dissimilar hydrocarbon contents of seeps via contiguous conduits within the volcano. Alternatively, such differences may result from changes in the composition and activity of seepages through time. However, further analyses and in situ MV-monitoring are needed to clearly discriminate between both options.

Furthermore, the presence of AOM-related biomarkers confirms that AOM-activity at Perejil MV is relatively recent (Fig.5, Table 4). Also the absence of a hemipelagic drape supports that core RL31CG, recovered from the crater of the Perejil MV, sampled a recent mud-flow event that may occurred only some years ago. On the basis of all these findings we consider Perejil MV the currently most active MV at the northern margin of the West Alboran Basin”

Page 18873 Line 1: “biomarker” rather than “biomarkers”

C9484

Response: OK

Page 18873 Line 8: “variation of some” instead of “variation some”

Response: OK

Page 18873 Line 16/17: the co-occurrence of ANME 1 and 2 is no requisite to indicate AOM; there are AOM sites with exclusively ANME-2 or ANME-1.

Response: We have modified the sentences as follows: “At Perejil MV, the presence of these AOM-related biomarkers indicates that active AOM is occurring at this structure. Additionally, the specific AOM-related biomarkers found at this MV have proved the co-occurrence of ANME-2 over ANME-1 group.”

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