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Interactive comment on "Pore-water in marine sediments associated to gas hydrate dissociation offshore Lebu, Chile" *by* Carolina Cárcamo et al.

Anonymous Referee #2

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The manuscript on 'Pore-water in marine sediments associated to gas hydrate dissociation offshore Lebu, Chile, submitted by Carcamo et al., presents a sequence of observations/data and results relying on a multiproxy approach/investigation of a sediment core collected in a site located in the vicinity of a relief disposed along the Chilean margin. From the interpretation of bathymetric, sediment, geochemical and foraminifera data, in combination with a theoretical model, the authors intend to prove that the positive relief corresponds to mud growing related to gas hydrate dissociation.

General comments

While this manuscript intends to provide evidence supporting the assumption that the relief along the Chilean margin (as shown in Figure 2) is related to gas hydrate dissociation, the data presented essentially fails to do so. Data and information on pore water,

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sediment and foraminifera do not support the assumption that gas hydrate or methane emissions may actually explain the formation of such a relief. The main conclusions therefore seem to be rather far-fetched – at least in the current form of the manuscript. Several aspects, such as the use of forminifera to explain a relief, the integration of water samples data with sedimentological data, need further clarification and proper interpretation. Other open questions relate to the location of the sulphate-methane-transition zone (SMTZ); when was the relief actually formed (if really related to gas hydrate – note that the sediment core used to conclude on the presence of gas hydrate appears to be located (too) far off the relief to be really considered as a relevant and reliable indicator); are there any indications of a gas hydrate reservoir in the seismic data? Some of the aspects and open questions might benefit from further information in the methodology section of the manuscript. For example, there is a lack of information on the micropaleontological methods used and the exact origin of the results/data used in this study. For stable isotope measurements no errors are given, nor the standards used. There is also needed further information on the theoretical model used in this study. The references used in the discussion chapter should be updated with more recent and relevant publications. In its current form, this contribution has major shortcomings that would have to be addressed before any further re-consideration for publication in this journal. The topic, data presented, results and conclusions furthermore are actually quite far from the actual main scope of the HESS journal. The authors would have to do an additional substantial effort to have their contribution really target the audience of HESS. On the technical side, the manuscript also suffers from quite substantial shortcomings. There is quite a large amount of typing errors and poor English language that need to be improved. The quality of some figures (especially Figure 6) also needs to be improved.

Specific comments:

Line 44: when referring to biogenic and thermogenic methane gas, please note that thermogenic is also biogenic, as it stems from organic matter degradation. An alterna-

tive would be to use the term ‘microbial’ rather than ‘biogenic’.

Line 45: Conditions proper for gas hydrate formation need to be further explained in this part of the manuscript.

Lines 54-56: Note that the organisms listed here cannot be considered as biological indicators of fluid escape per se.

Lines 56-59: Please specify in which stable isotopes the pore water has been enriched.

Line 89: “located around a positive relief” is not clear. Please be more specific.

Lines 93-99: Please develop on how the water samples collected in the water column are related to sediment features?

Line 175: Foraminifera do not have gender (genus instead?).

Line 185-186: The data shown here does not support gas hydrate dissociation. The analysed core is located too far from the relief.

Line 188. In Fig. 5a there are not values up to 6‰

Lines 194-202. In this section statements are rather confusing and need to be reformulated.

Lines 203-208: Since methane is not metabolized by foraminifera, they cannot be used for discriminating between seeping and non-seeping sites.

Line 220: geothermal gradient to be expressed in 0C/km not km/0C.

Lines 240-247: From the current developments, it is not clear how grain size data fits into this paper and how it can serve sustaining the main hypothesis.

Lines 248-260: Similar comment than here above, but for seawater data.

Lines 261-264: It is not clear how the data used in this paper supports the main hypothesis (i.e. the observed relief is related to ‘fluid flux channelized by faults and fractures’.

Nor does the data provide evidence for gas hydrate dissociation.

Line 537: The term ‘co-isotope distribution’ is confusing. Rather use ‘stable isotopic composition’ instead.

Fig. 6. The pictures are rather blurry. Moreover, those are common species that should to be classified. The name of the genus is not enough.

Fig. 7. Seismic data would be needed to really assess this schematic profile.

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