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Interactive comment on "The abyssal giant pockmarks of the Black Bahama Escarpment: Relations between structures, fluids and carbonate physiography" *by* Thibault Cavailhes et al.

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The manuscript describes a series of ~circular depressions at the base of the Bahama Escarpment. These are curious features and their discovery may ultimately merit publication. However, the manuscript more closely resembles a first draft, rather than a polished work. As is, the existing draft is too poorly written to fully follow many of the arguments in detail. Part of may be attributed to the challenge of writing in a second language. I have made some suggestions as to how to begin to sharpen the wording, but it is an incomplete effort. There are also a number of science related points

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(also indicate below) that need to be considered before this could be recommended for publication.

Why are these depressions called pockmarks from the outset? What is actually observed are approximately circular depressions. The term 'pockmark' has evolved to imply that the depression was somehow physically excavated by seepage, not physical collapse. Moreover, it is not commonly been used in carbonate settings. The manuscript also refers to other similar depressions that have been previously been called plunge pools. This is yet another mechanism for surface erosion. If these depressions had instead been called "Sinkholes", this would also imply a causal relationship with dissolution and collapse. Using any of these three terms presupposes an interpretative origin. However, the text argues somewhat convincingly that subsurface dissolution and collapse, which would make a stronger case that these features are sinkholes. Thus, should remodel the paper to first outline what is seen, before presupposing their possible origin. However, when the observable facts are considered, it seems that observations indicate that it is as likely that they are dissolution/collapse features (i.e., sinkholes) and not pockmarks.

Another recommendation is that the manuscript be constrained to what is actually observed and presented in the data. For example, while there is no evidence about the nature of the potential fluids, there is a long section on platform scale circulation and chemical evolution and circulation of fluids within the entire Florida Bahama Platform. It is laced with partial errors and inaccurate referencing. However, all that is important for this manuscript is to say is that dense brines are known to occur and would provide a density head to move out in >4.5 km water depth in this area. Another section that needs to go is the timing of activity. Frankly, without any particular evidence it is absurd to be trying to relate these to things like Milankovich timescales (ii), changes in hydrostatic head associated with seafloor erosion (iii), with earthquake induced tides (iv), and earthquake induced circulation. Moreover, this is generally considered to be one of the more tectonically in active areas along the Atlantic margin (vi). Thus, this is

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only wild speculation.

Comments made while reading through the text:

Line 1: The name in the title and elsewhere for this morphologic feature is well established to be the Blake Bahama Escarpment, not the “Black Bahama Escarpment”.

Line 16: Do not need to make water depth negative.

Line 32: Why “Triggers” collapses? Can see why dissolution results in collapses, but not why it is a trigger. Wrong word?

Line 34: While later in the text the question of whether the depressions previously interpreted to be “plunge pools” are actually plunge pools is discussed, dissolution does not produce plunge pools.

Line 61: I think the features described in the Backshall paper are actually called dolines (i.e. sinkholes).

Lines 57-69: This section indicates that the term “pockmark” has been used to describe a wide variety of features. In some regards, the term has lost much of its significance, but think that it is most commonly used to describe depressions in clastic sediments, following from the classic reference: Hovland M, Judd AG (1988) Seabed Pockmarks and Seepages. Impact on Geology, Biology and the Marine Environment. Graham & Trotman, London.

Line 122: Change “is a post-rift feature mostly made of a” to “are underlain by”

Line 126: Again, the established name is the Blake Plateau, not the “Black Plateau”. Make a global change.

Lines 127-129: This is misleading, as noticeable structural deformation associated of the Cuban Orogeny does not extend through-out most of the Bahama Platform.

Line 138-139: Meaning of “never-the-less” is confusing. Is this implying a change in

the Pleistocene?

Line 151: Misleading. Such high temperatures are not associated with the fluids from the seeps at the base of the Florida Escarpment. These high temperatures were measured at depths in bore holes into the platform at a considerable distance away from the seeps.

Lines 157 – 161: This discussion is mixing what is inferred or directly seen at the Blake Bahama Escarpment and the Florida Escarpment. This is inappropriate for both points i.) and ii.), as there is a nearly two km difference in water depths and in different water masses which has a large impact on carbonate dissolution potential. Moreover, they are in very different geological settings. However, there are directly measured corrosion rates associated with ambient waters at the base of the Florida Escarpment. Paull, C.K., Commeau, R.F., Curray, J.R., and Neumann, A.C., 1991, Seabed measurements of modern corrosion rates on the Florida Escarpment, Geo-Marine Letters, v. 11, p. 16-22. Perhaps the intention was to reference Paull and Dillon, 1980, as it at least as about the BBE? However, it still is not a correct statement, as it says that the observed widespread basal erosion was not entirely chemical.

Line 159: The classic Peterson, 1966 reference showing increased dissolion with depth in the Pacific is inappropriate as used in this sentence.

Line 159-161 – A paper that made direct observations about the impact of abyssal corrosion and currents at the base of the BBE is Land, L., Paull, C.K., and Spiess, F.N., 1999, Abyssal erosion and scarp retreat: Deep Tow observations of the Blake Escarpment and Blake Spur, Marine Geology, v. 160, p. 63-83.

Lines -161-162 - Meaning unclear. What similar evidence.

Lines 167 -169: Awkward, complicated sentence. Also, meaning of “motors” is unclear. Rephrase.

Lines 169-170: Meaning of “non-quantified proportion is related to:” unclear.

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Line 170: Rephrase as thermally driven circulation does not cause density gradients, rather density gradients induce circulation.

Lines 171-172: The inclusion of the role of magnesium in dolomite formation seems irrelevant to the mechanisms which stimulate flow. Cut it.

Lines 175-176: Kohout circulation is normally is what is described in (i) above. Question whether it is appropriate to call the salinity difference driven flows Kohout circulation.

Line 179: Specify low sea-level stands

Line 180 – “eases” or increases?.

Line 181 – Meaning of “structurally porous” is unclear.

Line 186: “New” – Why would be data collected on this cruise not be “new”.

Lines189: Spell out “HR” here as it is the first use. Also, suggest including something to support the meaning of high-resolution, as most authors claim their data is HR. For example, what frequencies were used, streamer length, and processing?

Line 191: Unclear what 35/35 means? Also, the “penetration” of up to 2.5 seconds seems excessive based on what is shown in figure 3.

Line 199: Suggest changing “current-day” to ‘present day’, as seafloor currents are relevant to this ms.

Lines 200-201: Suggest replacing “that has been as a transforming ocean- continent passive margin” with “along this passive continental margin”.

Lines 200-210 and elsewhere: The use of all these two and three letter abbreviations makes it much harder to read the manuscript. Consider spelling out all but the most use ones throughout the paper.

Line 204: “Eastern” should not be capitalized.

Lines 204-206: Wording awkward. Rephrase.

Line 212: Suggest cutting “exactly”

Line 221: How is it known these are contourites? By reference or perhaps appearance in the seismic profiles?

Line 234: Justify or cut “spectacularly”.

Line 237: These are only “giant features” if they are being described as “pockmarks”. However, other somewhat similar submarine depressions in carbonate strata which have been described as sinkholes (i.e., dissolution features) are much larger. Land, L., Paull, C.K., and Hobson, B., 1995, Genesis of a submarine sinkhole without subaerial exposure: Straits of Florida, Geology, v. 23, p. 949-951.

Line 241: Assume d (lower case escarpment) is the distance from the 4 km isobath?

Line 244: Cut “therefore”

Line 245: Change “is proposed” to “is discussed” or “is considered”

Line 248: Change “around 7 km southwards the pockmark 2” to “∼7 km south of the pockmark 2”.

Line 248-249: Suspect “north” should be changed to “northside”? However, this lineament is not particularly convincing. Is this important? If not cut.

Line 249: Second mention of the depression which apparently Mulder et al., 2019 interpreted to be plunge pools. At some point should indicate how those depressions differ. In particular, why they are not pockmarks or sinkholes?

Lines 252-253: Suggest changing “than 2, 4, 6, and 7. We so call these pockmarks, inner pockmarks” to “. . . so call these inner pockmarks”.

Line 253: Cut “comprise”

Line 255: Suggest changing “within” to “near”

Line 260: Redundant with lines 256-257.

Line 266: This heading does not seem to be a good fit to what is in this section? Consider renaming it.

Line 268: Cut “geological”

Lines 268-279: Wordy- cut down.

Line 272: Change “consistently” to “consistent”

Line 286: Suggest cutting “signal”

Lines 287-290: Very complicated sentence. Reword. Is “brittle-stylized” a term other workers have used? If so reference it.

Line 291: The word should be “diffuse” rather than “diffusive”. However, the conical area of high amplitude reflections between 6.4 and 7.0 sec TWT do not seem to be diffuse. Instead they show nearly horizontal layers suggesting they are associated with fill within a hole.

Lines 292-294: Meaning of sentence is unclear? What does the depth of the water tell one about the subsurface processes?

Line 299: Are the reflection amplitudes here anomalously strong? Frankly, it does not look like the reflections in this buried conical filled looking feature is distinctly stronger than the laterally continuous horizons further to the east? Moreover, is there a phase reversal associated with the strong reflector that marks the top of the filled conical depression? If this depression is cut into cemented early Cretaceous or even Jurassic limestones, they might not produce identifiable laterally continuous reflections. Also worry that the squiggly reflectors near the base of the escarpment identified as high amplitude anomalies in 4b, 4c, and 4f are over interpreted. Are they out of the plan reflections coming off the edge of the platform? Drawing faults separating them is purely interpretation.

Line 302-303: While it seems reasonable that these may be contourites, is it actually known? For example, have they been sampled? If not, build a case as to why they are being interpreted as being contourites.

Line 303-304: “This depression is bounded by at least four anthithetic curved normal faults and shows a chaotic/disorganized facies in its center.” These are not at all clear in figure 3c? Fear that this is over interpreted in the line drawing of figure 4c. Moreover, does this fit under the heading of Contourites?

Line 307: What is the vertical exaggeration?

Line 308-311: Why is this not shown? This needs to be supported with an image of the purported plume and a description. Moreover, the wording of the whole paragraph is weak. Why is it important to state the time it was seen when there is no way to figure out where the purported plume was located? Even less useful is to state a specific time when nothing was seen.

Lines 314-324: Redundant - This has all been said before.

Lines 326-328: While there are two lines on figure 5C, it is not clear what data they are fitted to? The header indicates that this a quantitative section. Not described in the figure caption.

Line 333: By inspection, this looks like a nominal correlation. Give the r-squared value.

Line 341-348: Except for describing these depressions as pockmarks, no data has been presented that explicitly indicates these are fluid escape features.

Line 349: Here the “shape” of the BBE is mentioned. While some reference to steepening of the BBE has been made, how the sustained high slopes on the face of the escarpment above should be added to the Introduction. Thus, basal erosion is one way to steepen the slope and makes this some of the boldest topography on Earth.

Line 365: Cut “genetic”.

Line 367: Suggest changing “located” into “cut”

Lines 367-368: Suggest changing “Thanks to the high quality of the acquired data, we here” to simply “We”.

Lines 368-369: Apparently an attempt to link the high-amplitude seismic anomalies to “fluids” is being suggested. While not stated, the inferred fluid is gaseous gas. However, nowhere previously in the text has such a link been explicitly developed.

Line 369: While figure 3a, shows a box that outlines what is supposed to covers the conical filled feature with higher amplitudes, figure 3c does not extend to this depth.

Line 380: Replace “coherent” with “consistent”.

Lines 380-381: Previous sentence has the fluids rising (“pop up”) while draining suggests they sink.

Lines 384-385: What is a “plug scale”?

Lines 374-386: This is rambling. Can be shortened to two simple points- fractures increase permeability and this area can be inferred to have more fractures because of its structural setting.

Line 388: Cut “succinctly”. Not only is it irrelevant, it highlights that this text is not succinct.

Line 390: Unclear how do the depression depths differ?

Line 387: What is the diameter of the purported plunge pools?

Line 387-393: “Plunge pools” - This highlights the danger of using a process related term to describe a feature. Come out and clearly state that the features previously described as plunge pools, may not be plunge pools. However, the mechanism that is inferred here is suggesting that they are not pockmarks either, but sinkholes instead.

Line 391: Why is this only a “partial explanation”?

Lines 391-392: Unclear what “static emplacement into the canyon (through times)” means?

Lines 392-393: Why is the structural control necessarily needed? Also, “structurally-controlled” or a similar phrase is inserted in several places earlier as a modifier, where its appropriateness is in question.

Lines 395-396: The observation really is that these depressions can occur with or without a sediment cover, but are more common where it is absent. It does not necessarily mean that the sediment cover “did not inhibit” fluid escape, if there actually is fluid escape. Reword.

Line 396: Cut “piercing”.

Line 397: Replace “number” with either “density” or “frequency”.

Lines 399-403: Meaning unclear?

Line 402: Is it just contourites or any fine-grained sediment?

Line 402-406: Unclear what the shape implies about the bottom current?

Line 404: I believe that at these depths the seafloor in this location is covered by northward flowing Antarctic bottom water, not the North Atlantic Deep Water. Check it.

Lines 408-410: Unclear what type of sedimentary body might be related to the “the origin of the storage and release of fluids”?

Line 414: Sentence makes sense if “ones” is cut.

Line 416-417: First is there any indication of overpressure? If there is, a case for it has not been developed. However, if there was actually overpressure, is this statement about the size of the depression correct anyway? Moreover, if these are collapse structures, is there any reason to infer overpressure?

Lines 420-425: This calculation might estimate the depth of the horizon, but it is rather

disconnected to a credible argument that there is over pressure or not at this depth. Moreover, the high permeability of these carbonates especially if they are actually fractured as argued, makes it very doubtful this is an environment is susceptible for overpressured conditions.

Line 434: Do not have access to this paper now. However, question whether the Walles et al., 1993 reference states that the well encountered fresh water or that the well encountered strata that showed signs of fresh water diagenesis. These have rather different implications.

Line 436: Why would fresh water sink anyway? Why isn't it seawater that is the starting fluid which

Line 448-450: If this water is moving laterally through the platform why not just escape through conduits along the platform edge. Not clear there is a reason to develop overpressure that than causes it to be "episodically expelled upward though the hemipelagic cap.

Line 429-458: This is paragraph and figure 7 is a somewhat garbled and incomplete mix of pieces of the literature that are relevant to fluid evolution in the platform. However, it is not an accurate and systematic review of the processes. It has also strayed a long way from the existence and morphology of the depressions. Should simply be cut and focus on the things that can be observed in the data.

Line 461: In detail, the lack of water column acoustic anomalies does not actually mean that no fluid is coming out, it just implies that the fluid is not gaseous gas or in adequate concentrations to be detected.

Line 463-464: Of course fluids are present in these strata. The question is what the fluid is and whether gaseous gas was present. However, a convincing case that there in any significant quantities of gaseous gas has not been made in the manuscript.

Lines 460-499: This section seems to be almost entirely speculation.

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Lines 502-515: If one simply replaced the word “pockmarks” with topographic depressions, the essence of this part of the conclusions are generally supportable.

Line 517: Do not believe that this circulation is a proper use of Kohout convection.

Lines 516-526: This section of the conclusions would need some improvement. That a denser fluid is involved seems likely, but the description of its evolution is rather simplistic. However, you can simple reference work which suggests evolved dense fluids exist within the platform which may flow out in this area. However, that there are high pressures expelling fluids here is a big stretch. Also, the description that has been made suggests these are dissolution features, which in carbonate rocks are called sinkholes.

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