

Interactive comment on “What makes seep carbonates ignore self-sealing and grow vertically? The role of burrowing decapod crustaceans” by Jean-Philippe Blouet et al.

Anonymous Referee #2

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General comments: The manuscript describes a Jurassic seep carbonate body cropping out in the Aurel area (SE France basin) and focuses particularly on the control exerted by the bioturbation on the vertical growth of the carbonate body. Authors interpret that intense burrowing by callianassid-type shrimps in the central part of the seep enhanced vertical permeability during a long time, which avoided the self-sealing process in the seep deposits and allowed the vertical aggradation of the carbonate body. This work contributes to a better understand on the sedimentation in seep environments and particularly on the formation of high aggrading carbonate bodies. I find this work interesting and it adds to the knowledge about seep-related processes and products. Therefore, I recommend its publication after moderate to major revision. In

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the manuscript, I find particularly well described, interpreted and discussed the sedimentary facies architecture and C isotopes. Nevertheless, I have two major general comments about the origin of the tubular structures and burrowing. 1. Origin of tubular structures: It is presented the tubular structures within the seep carbonates as biogenic, e.g. trace fossils, but a discussion about other possible origins (abiogenic gas conduits) is missing. In this regard, abiogenic conduits have been well documented in the literature, both in present-day and ancient seeps, and some of their complex networks resemble that of the Aurel pseudobioherm. In addition, I find the interpretation as burrows should be supported on more data or evidences (the only macroscopic sample presented correspond to a single 11 cm-long rock fragment) and then a discussion on the origin would be relevant. 2. Burrowing: Burrows are classified in three size categories (large, medium and small) each of which is interpreted (based on cross-cutting relationships) as formed in three consecutive phases at progressively deeper tiers. However, manuscript's Figure 8 shows that large burrow (Ba) contains centered medium burrows (B1-B3) and they present a parallel and no cross-cutting relationship. It seems, at least from that figure, that medium burrows are actually cement-filled holes of the large burrow and not different burrows. Nor do the figures show a clear cross-cutting relationship between small and larger burrows. I think that this is a key point to interpret the temporal and spatial (depth) distribution of the burrows and, therefore, cross-cutting relationships among burrows should be better illustrated or with more figures (they could be in the "supplementary material").

Specific comments: Lines 201: Show the three units in Figure 3. Line 280. It is not clear in Fig. 8 that medium burrows cut through large burrows. Line 289. Indicate figure (Fig. 8?). t3 in Figure 8 is too small to observe concentric bioclast orientation. Lines 313-315: Add reference. Line 324. Smooth wall character does not indicate that it be Trypanites but other criteria as cut bioclasts, etc. Line 335-336. Why does homogeneous micrite-rich fabric reflects high bioturbation if there is no evidence of burrowing? Why sediment homogenization or mixing could not be due to other process, as for example gas bubble ascending? Line 354: Description of microfacies and diagenesis

(section 4.5) is organized in tiers 1, 2, and 3, but these tiers are interpretative, and interpretations should be located in the discussion. Therefore, I recommend to delete them from that section. Moreover, description of carbonate phases would be more understandable if they will be presented following cement stratigraphy. In general, I miss comparison with and references to other papers on seep carbonates and particularly on paragenetic sequences. Line 356: What was bioturbated, the original marl or the later micrite carbonate? Line 397. It is used in this line and through the text “syndimentary cements” (also “sedimentary cements”) to indicate early diagenetic cements. I would be better to use always “early diagenetic cements” in contrast to “late diagenetic cements”. Line 495: Most D18O values (table in Appendix I and Fig. 13A) corresponding to saddle dolomites are about -1 to -2 per mil. These values are very strange, are higher than reference sediments and early diagenetic cements, and they are not compatible with hot fluids (>60-80°C) from which saddle dolomites precipitate. Common D18O values for saddle dolomites documented in the literature are around -6 per mil or lower. It needs some discussion. Line 575: “sediment-cement alternations” change by “sediment-cement sequences”. Always use the same terminology for the same things. Line 593: Add reference to Fig.3 (“...A and B; Fig.3”). Line 597: It is mentioned the downward growth of concretionary crusts. However, it is not clear whether this interpretation corresponds only to layers A and B or to the entire pseudobioherm. It should be state more explicitly. Line 605: It is mentioned that the axis of vertically stacked carbonates shows two lateral shifts coinciding with marker beds A and B. Then, these shifts are interpreted that hydrocarbon-charged fluids migrated upslope. However, Fig. 3B suggests that the axis of the PBH migrated in opposite directions, first westward and then eastward. How can this apparent contradiction be explained? What was the regional and/or local paleoslope orientation at Middle Callovian times? Line 608: Change “chemosymbiotic microbial communities” by “chemosynthetic microbial communities”. Figure 8: The legend of this figure is fragmentary and very complex with a lot of symbols, colors (not easily identifiable), etc. It should be a single and simpler legend.

Technical corrections: - Omit blank spaces front and back “/” and “-“symbols. Revise throughout the document. - Omit blank spaces between number and °C symbol. Revise throughout the document. - Omit blank space between number and per mil and per cent symbols. Revise throughout the document. - Insert blank space between two words. In many places of the text, blank spaces between words are missing. Revise throughout the document.

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