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Interactive comment on "Responses of an abyssal meiobenthic community to short-term burial with crushed nodule particles in the South-East Pacific" *by* Lisa Mevenkamp et al.

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General comments:

Reviewers comment: This study explores a really challenging question, that of how deep sea meiofauna respond to mining operations. It is an increasingly vital question as we learn more about the diversity and importance of deep sea meiofauna and as deep sea mining operations expand. I applaud the authors efforts to tackle this problem and I think this study should be published but with some clarification and moderate revisions. My biggest issues with the article center around their methodology and interpretation of depositing nodule sediment onto existing sediment. First, there is no

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indication that I can see of where this nodule sediment came from? How far from the "regular" sediment on which it was deposited was it collected? Are these nearby habitats or hundreds of miles apart? Also, why did the authors choose to deposit nodule sediment alone when in their description of nodule mining practices it seems that there is removal of nodule sediment, disturbance of underlying or neighboring sediment, and deposition of nodule particles mixed with suspended sediment and redeposited. It seems the mining operations are after the nodule sediment in particular, so why would they ever redeposit it onto non-nodule sediment? Unless by accident? Please clarify where the nodule sediment came from and why its direct deposition onto non-nodule sediment was chosen as the primary methodology as this doesn't seem to mimic any aspect of the mining operations under question. Also, the authors mention (with citations) in the discussion that meiofauna does inhabit the nodule sediment, yet there seems to be no taking this into account when interpreting the behavior of the meiofauna upon burial. Was the nodule sediment sterilized? Was it presumed that the meiofauna washed out upon transport? It seems like the primary interpretation of the presence of meiofauna in the nodule sediment at the end of the study is that it was colonized from the buried sediment below due to upward movement, but couldn't there have been a meiofaunal community in the nodule sediment upon deposition? If you didn't remove the meiofauna or examine it beforehand, how do you know that meiofauna found in it afterward came from the buried sediment?

Authors reply: For the first remark (origin of the nodule particles), we have added a short paragraph in the Material and Method part on Page 4 Line 15: "To obtain the crushed nodule particles, several nodules from the experimental site were collected 2 days prior to the experiment. Upon retrieval, epifauna, if present, was removed from the nodules and nodules were thoroughly washed with fresh water to remove all sediment and fauna. Subsequently, nodules were put inside plastic bags and manually crushed with a hammer. The resulting nodule particles varied in size between 3 μm and 1 cm (Supplementary Figure S2). " Thus, the nodule particles originated from the same area and were treated on board prior to the use in the experiments. Because of the

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treatment on board (removal of sediment, keeping the particles in plastic bags without the addition of seawater) we are very sure to not have added any meiofauna to the sediment of our experiment. And if meiofauna was present inside the nodule crevices, we would have been able to distinguish them as their shape would appear damaged or dried out from the treatment prior to the experiment. The choice to use crushed nodule particles was partly determined by practical limitations of the experimental design but also to be able to clearly distinguish impacts from the nodule particles with their specific properties (different grain size and porosity, metal content) from the effects of sediment deposition. Especially with regard to metal uptake it was important to limit the study to one substrate instead of a mixture. But indeed, we agree with the reviewer that in a mining scenario, mixtures of sediment and nodule particles will be much more likely. To elucidate the potential source of nodule particles during mining operations a sentence was added in the Introduction on Page 2, Line 13: “Therefore, breakage and abrasion of nodule particles is likely to occur during a mining operation with heavy gear, for example during separation of nodules and sediment as part of the collection process or by the force of the water jet used for the collection of nodules.”

Specific comments:

Reviewers comment: Page 2, line 1: “70s” should be “1970’s”

Authors reply: adjusted as suggested

Reviewers comment: Page 2, line 17: Here is where you describe mining operations and what happens to nodule sediment and “regular” sediment. You even mention how a large scale mining operation “is expected to directly impact the nodule associated fauna” so then it seems confusing that you then proceed to assume there is no fauna there until you place it on other sediment in your study.

Authors reply: I believe this question relates to our answer to the first general comment. The added nodule substrate did not contain any undamaged meiofauna anymore. Furthermore, from own (unpublished) data we know that the densities of meiofaunal or-

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ganisms inhabiting crevices of the nodules from the North East Pacific are very low (ranging from 2 to 31 individuals) and, therefore, constitute only a small fraction (5 $\pm$ 5 %) of the densities of meiofauna inside the surrounding sediment.

Reviewers comment: Page 4, line 8: Please specify here where the crushed nodule substrate came from and how/if it was treated.

Authors reply: See reply to first general comment.

Reviewers comment: Page 7, line 1: Citations would be helpful for all of these diversity indices and to specify which Simpson index.

Authors reply: In our case the Simpson's Index of Diversity was used 1-D=1-$(\sum\_iN\_i(N\_i-1))/(N(N-1))$.

We changed "Shannon-Wiener, Pielou's evenness and Simpson)" to "Shannon-Wiener index using the natural logarithm (H'), Pielou's evenness (J') and Simpson's index of diversity (1-D))".

Reviewers comment: Page 13, line 10: Please clarify here why you think that all the meiofauna in the nodule sediment came from the lower layer ("adjusting their vertical position in the sediment").

Authors reply: The added substrate did not contain any meiofauna and most meiofaunal organisms, particularly nematodes, do not actively emerge from the sediment. Therefore, it is most likely that colonization of the new substrate was done from the underlying sediment rather than from the water column. This is also in line with the lower densities seen in the 0-2 cm layer of the underlying sediment suggesting that those organisms migrated into the added substrate.

Reviewers comment: Page 14, line 25: Here you mention a study that showed a decrease in nematode densities "attributed to limited upward migration directly after the disturb (as was seen in our experiment)..." but previously you had indicated that there was considerable vertical migration from the lower sediment. Please clarify this.

Authors reply: This part of the discussion was removed as a response to reviewer #1 who suggested that the two studies should not be directly compared due to their very different experimental approach.

Reviewers comment: Page 15, line 27: Here you indicate that your study found that the addition of crushed nodule substrate “changed the relative abundance of feeding types in the new surface layer...” yet you don’t seem to have examined the nematodes in the surface layer (nodules) before depositing it, so how can you know this?

Authors reply: Also this comment relates to our reply to the first, general comment. We do believe that the added substrate was void of meiofauna or that meiofauna would at least be very damaged due to the treatment of the nodules prior to the experiment.

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