

Reviewer comments:

Thank you for asking me to review this interesting paper! It covers a very interesting subject matter that seems quite difficult to unpick and the authors have made a good (and convincing) attempt to understand these potential fossil poops!

The figures are well made and easy to interpret. The paper seems well referenced (although please note I am not a coprologist). The methods are well described and appropriate – using an interesting method to do some comparative morphological work with extant animal faeces, and I think the findings shown in this paper are sound and sensible. The paper is fairly easy to read, although I think that some minor revisions to the abstract and introduction would greatly help the reader. I would have also liked a little more investigation into the potential diagenetic routes for faeces to become siderite, but I do understand that maybe outside of the scope of the paper.

I have one concern pertaining an aspect of the paper which I did not understand well. This maybe my fault, but I was not clear whether there are lots of siderite concretions found in this deposit which do not look like the morphotypes identified by the authors (see my comments RE: line 385). This is concerning and I would like to see how this addressed, because, at the moment it undermines the findings of the paper.

If this can be addressed then I would recommend this fun and fascinating paper for publication.

I have made a few detailed comments below.

All the best,

Dr Thomas Clements

Line 21: The structure of the abstract introduction is a little hard to follow – I think this could be easily rectified by rearranging the sentences to show the context matter as the primary focus of the introduction thusly:

Excrement-shaped ferruginous masses have been recovered from the Miocene of Turów mine in south-western Poland. These siderite masses have been the subject of much controversy, having been interpreted either as being coprolites, cololithes or pseudofossils created by mechanical deformation of plastic sediment. Here we present the results of mineralogical, geochemical, petrographic and microtomographical analyses.....

Line 40: This introduction suffers similarly as the abstract, where the first mention of the studied location or it's age is nearly 30 lines into the introduction. To help the reader, I suggest that a sentence at the start of the introduction can guide the reader about the topic covered in this paper. For example: *Ferruginous masses that are excrement shaped have been recovered from the Miocene of Turów mine in south-western Poland, however, a detailed study of these masses has not been undertaken and it is unclear if they are biological or geological in origin.*

Line 47: *This is not surprising because faeces of herbivorous tetrapods are commonly composed of a large quantity of undigested plant residues attracting microbial decomposition.*

this statement is inaccurate when coupled with the next sentence. Both herbivorous and carnivorous faeces will attract microbial decomposition – it is the lack of the mineral supply (i.e. calcium phosphate) that the is the limiting factor here - as you say in the next sentence. It is also important to note here that the phosphate is a mineral source that allows for mineralisation processes to occur. I would remove this sentence, and expand on the next sentence to say something to the effect:

This is not surprising because the calcium phosphate derived from undigested bones in the faeces of carnivores acts as important source of permineralizing agent which is often not present in the faeces of herbivorous tetrapods.

Line 55: 'multi-decimetre-long' is both specific and non-specific. Can this be clarified without using the term decimetre (which is not a standard use SI unit)?

Line 80: activity of what? Tectonic activity?

Line 98: I think that it would be useful to define limnotelmatic for non-geologists here.

Line 119: burrows of sediment eating fauna? Inverts, verts? Terrestrial? Could the authors be more specific here?

Line 131: Table 1 caption. Please clarify: adjacent geographical areas to the Turów mine?

Line 139: I do not think it is appropriate for reviewers to correct English and I apologise for doing so but the expression is 'on the other hand'. This makes very little difference to the meaning of what you have, but I just wanted to point it out.

Line 142: This is just a submission error but 'invertebrate sand vertebrates' made me laugh.

Line 155: can you expand on how/why these were samples were selected? This feeds into my concern regarding line 385. Please clarify.

Line 156: was the fossil found *insitu*? This should be made a little clearer. Also, what does 'documented macroscopically' mean?

Line 285: Length is spelt incorrectly.

Line 244: 'the' is not required in front of each animal name

Line 252: could these tables be combined?

Line 275: sausage-shaped has a technical term which could be included if you wish: allantoid

Line 385: I would like some clarification regarding this sentence – are the authors saying that there are lots of types of concretions in the formation – in particular, siderite concretions that don't all look like the masses discussed here? This would be highly

problematic and would lend weight to the idea of a non-biological origin. I worry that if this is the case and the authors have only selected concretions to investigate that look morphologically similar to faeces and discarded the others without comparative investigation, this demonstrates a confirmation bias. Has there been investigation of the non-faeces looking concretions? Do they contain any similar structures? Some clarity here would be very useful.

Line 392: I don't understand why a limited quantity of the specimens would mean they are biotic in origin?

Line 396: Spencer (1993)...what an odd and specific argument...

Line 403: it *is* a product of diagenesis if your evidence is correct

Line 406: altered is the past tense of alter not alternated.

Line 410: But you say that they might have been produced by snakes – so not herbivores? I don't think this sentence is necessary – and conflicts with what you say later about dissolving the hair of prey. Furthermore, digested and decaying plant and organic matter can and often does have phosphates in it, but if the diagenetic processes (especially in association with lignite deposits) means that siderite forms, then you would not see phosphates in the coprolites.

Line 471: see line 392 comment.

Figure 1: Aspects of this figure appear to be copied from Kasiński et al. 2015 and so it should be cited here.

Figure 2: scale cut off(?) for N