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Interactive comment on "Comets, carbonaceous meteorites, and the origin of the biosphere" *by* R. B. Hoover

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This manuscript argues that evidence of microbial, more specifically cyanobacterial, life is present in comets and/or meteorites possibly derived from those planetary bodies. This is supported by the theoretical consideration of liquid water pockets or pools of melt water, which would allow microbial life to thrive. Further evidence is provided by scanning electron microscopy imagery of carbonaceous meteorites, which revealed structures that were "interpreted as indigenous microfossils". As conclusion, (cyanobacterial) life can be expected widespread in the Universe and the endogenous origin of life on Earth in the primitive oceans of early Earth may have to be reconsidered.

The author expends quite some effort on discussing current knowledge and previous research such that the above conclusion could be drawn, yet omitting consideration

of studies that may point in a different direction. Some evidence presented in the text is interpreted by the author without citing sources of interpretation or presenting scientific evidence that would support the authors own interpretation. For example, Fig. 1 confronts the reader with the possibility of cyanobacteria from an ice core extracted in a core depth of over 3.5 km. This certainly is a possibility, yet it is not known to be the preferred habitat for this group of organisms. No discussion is presented as to why the interested reader should trust this interpretation, particularly when considering the possibility that dust fibres would show similar morphologies and size ranges.

Evidence of an “exotic microorganisms” is presented in Fig. 2 of this manuscript. This structure shows all features characteristic of a mineral grain, on the other hand lacks characteristics of microorganisms (such characteristics have been published elsewhere multiple times). Considering shape and composition, a valid alternative interpretation is that this is an exotic mineral. There is no discussion as to how the observed Au and U was “bioaccumulated” and in what form it may be present in the microbe. C, O and P are not exclusively of biogenic origin on planet Earth, yet no discussion is presented on why the reader should trust that this is indeed an “exotic microorganism”.

The author makes logic leaps, unsupported by hard data. On page 38 lines 15 - 20, for example, it is stated that Hoover at al. (1986, 2001 etc) suggested that pockets and pools of melt water beneath a comet crust could sustain pressures sufficiently high to allow the existence of liquid water for periods of time to allow growth of microorganisms and the formation of microbial mats. It is a major leap from the possibility of liquid water in cometary nuclei to the formation of microbial biofilms. The possibility for suitable environmental conditions not necessarily implies the consequence of biofilms formation; maybe on Earth, but not in the core of a comet. Such major claims must by all means be presented with and supported by solid data and/or serious discussion. The author attempts this by quoting himself (mostly non-peer-reviewed publications) and his interpretation of filamentous structures as microbial fossils indigenous to the extraterrestrial material, leading to the consequence of panspermia for the origin of life.

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The author further does not consider recent studies that discuss the issues associated with meteorite contamination. These studies, in all cases, used sterile conditions and described microorganisms (including fungi) growing e.g. on Martian meteorite ALH84001 or the Murchison meteorite, many microorganisms were identified, as terrestrial contaminants. Small cracks and fissures in meteoritic material have been shown to be sufficient for infiltration of contaminating microbes, some closely resembling what is presented as extraterrestrial fossils here, not mentioning any other possibility. In Figs. 5 and 6 the author presents evidence of fossilized extraterrestrial filaments preserved by magnesium sulphate. A long discussion is presented as to why this can only be extraterrestrial microbial filaments preserved by magnesium sulphate, yet, although the author mentions the mineral epsomite, there is no consideration of the fact that this specific mineral is not known for forming large minerals, but much rather to form almost cotton-like fibres. If magnesium sulphate is everywhere in this meteorite, why not consider this a possible interpretation for the observed structures? Further considering the high water solubility of epsomite, a discussion on the stability in the sample would seem adequate.

There is a significant discrepancy between the drawn conclusions of this manuscript and the presented “hard data”. What I find furthermore highly problematic is the fact that a large number of citations are Proc. SPIE. It is important to consider that these publications have not undergone a rigid peer-review process. This is essential in support of the conclusions of the work, particularly when the majority of papers cited to support the interpretations presented here are in fact Proc. SPIE citations mostly by the author himself and/or (co-)edited by the author.

For exo-/astrobiology to remain a credible research field and strengthen its value in the science community, it is paramount to support major claims as the ones presented here by serious evidence and discussion. The evidence provided is not satisfying nor is it convincing, the discussion is incomplete, not considering all relevant aspects of existing research and appears biased when looking at the list of supporting references.

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This is an absolute requirement when presenting research of potentially high scientific impact and is a prerequisite for “good scientific practice”.

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