Biogeosciences Discussions, 3, S78–S80, 2006
www.biogeosciences.net/bgd/3/S78/
European Geosciences Union

Biogeosciences Discussions

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

M. Storrie-Lombardi

mike@kinohi.org

Received and published: 23 March 2006

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

Comments by M. C. Storrie-Lombardi, M.D.

It is probably true that in our search for evidence of extraterrestrial life we should adopt in exobiology a metabolic version of Koch's postulates for disease. Instead of requiring (1) the presence of an organism in every case of a disease, (2) isolation of the organism, and (3) production of the disease when the organism is introduced to a healthy host we could insist that (1) we find an extant or fossil organism each time we see a specific geological alteration in a mineral matrix, (2) we isolate extant organisms, (3) we introduce them to an unaltered mineral matrix and watch for the appearance of the expected biotic alteration. Such 'proof of life' has so far eluded us.

The paper under discussion does not claim to have identified and isolated extant microorganisms. Instead this a classical microbial fossil identification effort that must rely on correlational evidence or 'guilt by association'. Fortunately, the author can bring to the discussion two types of data: morphological and chemical. Co-registration of structural and chemical data have become a fundamental component of exobiology research over the past decade and are instructive here. The paper demonstrates that the filamentous structures and the surrounding matrix share many similarities in elemental abundance distribution and some startling differences. One of the implications is that at some point in their history the filaments and matrix shared a common geochemical evolution. Part of the debate is over where and when the shared events occurred. Are these filaments (1) organisms that invaded the sample after arrival on Earth and experienced subsequent mineralization, (2) biotic forms long co-resident with the matrix on its off-world parent body, or (3) abiotic forms arising from an ancient self-organizing geochemical process?

The forensic chain of evidence for Orgueil is quite good and would appear to rule out contamination even though this is Earth, a planet driven by biology that stands ready to contaminate anything in a matter of minutes. Nevertheless, for a prokaryote or eukarote to grow from one or a few organisms to the clusters shown by the author (clusters more characteristic of an extended mat community) requires the presence of considerable quantities of liquid water. The fundamental Orgueil mineral matrix is quite friable. Application of small amounts of water to the material results in complete dissolution of the underlying structure, and, in a 1-G gravitational environment, the matrix would turn to slush. That is not what we see on the electron micrographs presented, nor is it the description of Orgueil from multiple investigators.

If these forms are then to be considered hitchhikers arriving with the meteorite we are faced with option 2 or 3, a choice reminiscent of the childhood question: animal, vegetable, or mineral? If the matrix were from Earth, the most likely guess would be "animal" or "vegetable". But it is not from Earth and we still live in a statistical universe

BGD

3, S78–S80, 2006

containing only one planetary body meeting all of Koch's postulates for proof of life. Since we believe that forms created by geochemical self-organization are the result of a simpler process than forms arising from biology, we have repeatedly invoked Occam's razor to predict that forms such as those shown in this paper are more likely the result of abiotic activity. Therefore, we must ask the obvious question: if these are not biological structures, what is a comparable example created by a geochemical process here on Earth? If the journal readership could provide tenable photographic candidates of such geological forms and co-registered chemical data, it would be a significant contribution to the exobiology literature.

Our visual and auditory pattern recognition skills are based entirely on our own personal, experiential data and our observational skills. It is quite clear that some of us have perfect auditory pitch and some of us in the scientific community are tone deaf. Some of us have good visual recognition skills and spend a lifetime looking at images, while others are "visually challenged" and much more comfortable with multivariate numerical data. Extended debates based on "expert opinion" and "personal experience" were the rule in medicine many years ago, but have long since given way to a process where the initial prescient observations of a gifted clinician are then confirmed or rejected by statistical integration of imaging and chemical data sets. It is quite feasible to merge the two worlds of expert opinion, images, chemistry and predictive statistics in exobiology if we can accumulate a sufficient data set of images with co-registered chemical data to actually do some interesting mathematics. But no amount of skill in single experts will be useful in the face of inadequate datasets. Once this paper has been modified as outlined in the previous comments and responses, I would hope its publication stimulates a far-reaching discussion and data exchange sufficient to let us discuss the merits of future imaging and chemical data using the statistical tools this subject deserves.

Interactive comment on Biogeosciences Discussions, 3, 23, 2006.