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Dr E I Hamilton

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Professor F.H.C. Crick
MRC Laboratory of Molecular Biology
Hills Road
Cambridge

23 AUG 1973

Dear Professor Crick

Could you please send me copies of your papers published with Orgel Icarus (v. 19, p. 341, 1973) and any others relating to the subject. Your proposal of Directed Panspermia is indeed interesting. Transfer of spores or microorganisms in or on meteorites should not be ruled out, although apart from radiation in space and heating within the earth's atmosphere, there remains the problem of destruction upon impact. However, meteorites of poor thermal conductance and the low temperatures such as those associated with carbonaceous chondrites would seem to provide suitable material for transfer over a period of 1×10^6 y.

I am interested in your thinking concerning correlations between elements present in terrestrial living organisms and classes of stars. I enclose a paper, crude as it may be, that illustrates inorganic relationships which exist between the chemical composition of man and crustal rocks. With the exception of H,C,O,N I believe that the correlations are real and illustrate that man does reflect the composition of his environment. It had been my hope to continue these general studies to cells and their constituents which would have included a consideration of enzymes; at this level of organisation preliminary studies suggest completely different elemental compositions. The specific nature of enzyme requirements for metal co-factors appear to centre around the transition elements; this may be real or simply because such elements are easy to study. I have tended to consider that an element such as Mo, in a particular chemical form, provides a unique structure which 'fits' an organic template and provides a minimum, but optimum source for energy transfer.

Through the process of evolution a natural selection would be made of those elements which are naturally present and which can be transferred through the food chain. We certainly know that if they are not available in the food chain morbidity occurs but is preceded by the utilisation of other similar elements which are not effective and are also associated with morbidity. In the protoearth Mo would be available from volcanic emanations and is utilised by microorganisms which themselves are part of a food chain. Two problems which concern me are :-

- (1) Crustal rocks contain $\sim 70\%$ SiO_2 but in spite of the ease of formation of silico-organic compounds, silicon is only a trace element in man. Recently it has been suggested that Si is an essential element for man, while for some types of plankton and plants it is a very important constituent.

Perhaps terrestrial organic evolution of man passed through a Si phase but the progressive survival rate of mutants was low and was replaced by other elements indicating a very high level of sophistication but dispersion from reliance on a few compounds in order to allow for environmental changes.

- (2) The problem of only one universal genetic code (base pairing and triplet coding) for all forms of life. The lack of variability seems opposed to organic evolution and would seem to present a weakness in future evolution if it should be affected by non-natural organic products. The problem of organic evolution allowing for natural products seems different than when confronted with man evolved products. Do you suggest that an early 'seeding' of the genetic code has controlled organic evolution rather than the genetic code being a product of organic evolution ?

It is generally assumed that there will always be a progressive advance in technology resulting in increased relative sophistication of civilisation, but it seems equally probable that the process may be reversed and alternative forms of 'life' may become dominant, i.e. a series of cyclic phenomena. The gap between our Pleistocene or Miocene ancestors and the present day is, of course, insignificant in relation to astronomic distances and time. However, within the very short space of time, high points of technological achievements in past civilisations always seem to be followed by destructive episodes. Perhaps the lack of different genetic codes prevents man from 'digesting' the products of his technological achievement, and as Sagan suggests, technological civilisations are self destructing.

Yours sincerely

Euc I. Hamilton

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