Joint EPS/ Astronomy Colloquium

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The interaction of photosynthesis with the crust and mantle and the effect of the moon-forming impact on the current Earth

Photosynthesis evolved before 3.8 billion years ago. Rocks of that age include metamorphosed black shales with pyrite showing that sulfur based and iron based photosynthesis existed. A complete carbon cycle existed on land and at sea. The land biota needed FeO to dump oxygen. A consortium with efficient weathering evolved to obtain the FeO from exposed rocks. Weathering in turn led to widespread continents with Fe-poor sediments and Fe-poor granites. The presence of these rock types provided selective pressure to vent oxygen directly and the advent of cyanobacteria. The mantle as well as the crust sequesters biological information. The Earth became habitable after the moon-forming impact once its interior was cold enough for carbonate to subduct in very C-rich domains in the upper oceanic crust. This process continues today causing mantle carbon to exist within highly concentrated domains. The chemical and isotopic character of these domains survives subduction and even partial melting of kimberlites and their freezing within the lithosphere. The build up of oxygen in the Earth's atmosphere is evident in U/Th of zircons in kimberlites. Subduction of carbonate 4.26 billion years ago and its emplacement with the continental lithosphere at 3.6 billion years ago is indicated by study of a 1.48 suite of alkalic rocks in India.