History of the Earth and life

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To provoke this session of the Conference, and to formulate the study of origin and evolution of life, I present a working hypothesis for the history of the Earth and life, covering the whole Earth from the central core through the mantle, ocean-atmosphere and biosphere, to the magnetosphere. The following seven biggest events are proposed. (1) Birth of the Earth by the collsion-amalgamation of planetesimals and subsequent heavy extra-terrestrial bombardment at 4.55-4.56 Ga. (2) Initiation of plate tectonics, and resultant formation of continnetal crust and birth of life, presumably due to the formation of the ocean at 4.0Ga, as demonstrated by the surface records of the supra-crutal rocks in Isua, Greenland, and Acasta Gneiss, Canada. (3) Birth of a strong magnetosphere and initiation of photo-synthesis at 2.7Ga, as shown by the wide-spread occurrence of stromatolite and magnetic intensity variation with time, presumably by the mantle overturn. (4) Formation of first supercontinent at 1.9Ga. (5) Return of seawater into the mantle at 0.75Ga, deduced from the change of subduction zone geotherm with time. Return flow of seawater into the mantle decreased sea-level, and emerged a large landmass like today; the accumulation of terrigenous sediments prevented oxidation of organic matter. This increased the free oxygen in the atmosphere, which facilitated the proliferation of life. Released oxygen formed an ozone layer, which cut off ultra-violet rays, enabling life to move on land by 0.45 Ga. (6) Largest mass extinction at the P/T boundary (0.24-0.25 Ga). This may be related to the explosive volcanism by the breakup of Pangaea. The screened sunlight prevented the photo-synthesis and caused the super-anoxic events. (7) Birth of human-being and the initiation of science. At about 6 Ma, the African plume was activated extensively to change the climate of East Africa, enabling the appearance of ancestral human-beings.

The impact of sediment resuspension on mercury and methylmercury fate, transport and bioaccumulation is shallow estuaries

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Sediments could be a significant source to the overlying water column during resuspension events. The effect of resuspension on the cycling of Hg and methylmercury (MeHg) between the water column and the sediment during tidal resuspension was simulated using a mesocosms. A series of month-long experiments were with different levels of resuspension and with and without clams. WhileTSS was higher during resuspension, on a mass basis, MeHg concentrations decreased with increased TSS. The results suggest that Hg appeared strongly bound with little release during the resuspension events, while MeHg was actively accumulated in phytoplankton, and thus biota (zooplankton and clams) during the experiments. Overall, dissolved Hg and MeHg did not change in concert with changes in particulate load, suggesting that the dynamics between dissolved and particulate cannot be explained by an equilibrium partitioning. Finally, resuspension, by initially aerating the surface sediment and decreasing sediment acid-volatile sulfide (AVS) resulted in an initial increase in methylation rate but over time, as sediment AVS continued to decrease, methylation rate decreased. These results are consistent with the complex interaction between the amount of sulfide in sediments and its inhibitory role on Hg methylation. The biogeochemical dynamics as well as the bioaccumulation, fate and transport of Hg and MeHg during resuspension will be discussed.