

Leaking Earth: An ultimate trigger of the Cambrian explosion Leaking Earth: An ultimate trigger of the Cambrian explosion

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The Phanerozoic time began from the Cambrian explosion. Most of the ancestral life forms, more than at least 20 Phyla, appeared in a short time from 540-520Ma. Metazoans up to 35 Phyla appeared by the end of the Cambrian at 488Ma. Since then, animals and plants began to diversify extensively in association with environmental and geochemical diversifications. This is initiated by the global supply of nutrients. An abrupt increase of nutrient supply was caused by the emergence of huge landmass, because the amount of water in the mantle wedge must have increased from 1.0wt% to 6.5 wt%, if subduction zone geotherm began to cut the boundary of the stability field between clinocllore peridotite and antigorite peridotite during the cooling. This means the initiation of return-flow of seawater into mantle during the Neoproterozoic, so called Leaking Earth.

We envisage the following processes for the dawn of the Phanerozoic. (1) initiation of return-flow of seawater into mantle was caused by hydration of mantle wedge, (2) leading to the drop of sea-level. (3) Subsequently, the coast line moved oceanward to increase the size of landmass, (4) with the resultant birth of huge river systems to transport large volumes of sediments (5) which buried organic matter synthesized by photosynthesis by algae and cyanobacteria. (6) The burial of organic matter resulted in accumulating oxygen in atmosphere as back reaction to consume free oxygen in atmosphere is prevented. (7) High pO₂ began to be kept and finally diffused upwards to form the ozone layer. (8) Ozone layer shielded the ultraviolet radiation from Sun, thereby enabling plants and animals to invade the land. Firstly, cyanobacteria invaded in the swamp along the river to lake. It gradually evolved to algae, bryophytes and to Tracheophytes by late Devonian.

Initiation of return-flow of seawater into mantle began 4.0 b.y after the birth of planet with R (radius) = 6400km and only 3-5km thick ocean. It brought a golden era of life, accompanying global supply of nutrients continuously. The leaking Earth was the fate of cooling planet, Earth, covered by ocean. It is an ultimate trigger of the Cambrian explosion.