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An evolutionary story of Porifera: linkage between the most drastic climate change and the animal multicellularity

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Late Neoproterozoic is a period of climatic changes and animal evolution. It is still unknown whether there is a strong crucial link between the two events. However, one can believe the presence of the linkage if any biological evolution has progressed with biological effort to overcome the environmental tribulation. Recent advance in Neoproterozoic earth sciences leads to reliable discussion on this subject.

Currently well-accepted idea is that increased oxygen concentration induced the animal evolution. Here, the accumulated nutrients induced explosive photosynthesis immediately after the Marinoan snowball (635 Ma), and the raised oxygen supported collagen formation and animal respiration. However, traces of more primitive animals have been recently discovered from the period before.

Porifera (sponges) had likely evolved in Cryogenian soon after the Sturtian glaciation (720 Ma). For understanding its evolutionary process, the stratified ocean can be taken into account. Lack of the thermohaline circulation in a hyper-warming Earth and long-lasting production of ice-molten water induced stable stratification in the post-glacial ocean. Huge amount of organic matter was at least partly suspended at the density gradient and provided food for animals. Similar circumstances can be seen in habitat of the modern deep-sea coral reefs. In addition, this hypothesis fits the fact that the primitive multicellular animals are all filter feeders (Kano et al., 2011). Keyword for the evolution existed in food rather than oxygen.

The most primitive multicellular animal, a sponge, was likely originated from choanoflagellate. This filter-feeding protozoa is morphologically similar to the choanocytes of sponges, and genetically encoded for cell adhesion as preadaptation for multicellularity.

Kano, A. et al. (2011) The evolution of animal multicellularity stimulated by dissolved organic carbon in early Ediacaran ocean: DOXAM hypothesis. Island Arc, 20, 280-293.

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