Steranes constrain the ecological role of Ediacaran animals and protists

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The scarcity of early metazoan body fossils poses a great challenge for reconstructing the evolution and ecological role of early animals. Currently, the earliest animal fossils are thought to be represented by ~558 Million years (Ma) old *Dickinsonia* and ~555 Ma *Kimberella*, while the oldest diagnostic and undisputed sponge fossils are not found prior to the Cambrian period ~540 Ma ago [1, 2]. A stark contrast to molecular clock estimates of pre-Cryogenian animals renders animal-diagnostic fossil lipids (biomarkers) invaluable. The steranes 24-isopropylcholestane and 26-methylstigmastane were proposed to be diagnostic for demosponges and thus some of the earliest animals [3, 4]. According to the sponge biomarker hypothesis, demosponges would have attained ecological importance prior to the end of the last 'Snowball Earth' glaciations >635 Ma ago and played an important ecological role in the 100 Myr period bracketing the Cambrian explosion, which experienced severe ecological perturbations. But purported sponge biomarkers are difficult to reconcile with the body fossil record and the large fossil gap cannot simply be explained by unpreservable soft-bodied ancestors [5]. Instead, we find that unicellular eukaryotes with Neoproterozoic roots can also produce sponge-like biomarker signatures: planktonic protists such as Foraminifera or Radiolaria are the most likely sources of the ancient biomarkers [6]. We infer that predatory protists such as Rhizaria and Ciliates [7], not sponges, may have induced most Neoproterozic ecological perturbations such as the rise of algae. Higher export rates of large protists may have shifted respiration from the surface towards the sediments, allowing the oxygenation of marine habitats required for the subsequent ascent of macroscopic animals [8].

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