

Major change in Earth's internal behaviour, 2.8-2.2Ga, with a chain of global consequences leading to the rise of atmospheric oxygen

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At ~2.3-2.2Ga atmospheric oxygen rose dramatically, but biological developments may not have been the fundamental cause. Multiple global evidence suggests that this date marks the completion of a major reorganization of the Earth's internal behaviour. I recognize the long-extant 2.45-2.2Ga gap in orogenic granitoid and greenstone zircon ages as a hiatus in mantle convection. Before this, mid-ocean ridge (MOR) crests, previously barely submerged, deepened markedly after 2.8Ga. So sea-level fell, exposing cratons to massive weathering, eventually unroofing ~10km from granitoids and lowering atmospheric CO₂, yielding global glaciations at 2.45-2.3Ga.

Collapse of MORs shut off their supply of reducing gases which, below a chemocline, had kept the oceanic pH down (~4.5?) and abundant Fe²⁺ in solution, which oxygenic life now precipitated as banded iron-formation.

When convection resumed after ~2.22Ga and sea-level rose over planated cratons, oxygenic life achieved its crucial florescence. On the evidence (1) and that presented at IUGG 2007 (see <<http://osmaston.org.uk>>) mantle convection is now of the 2-layer form, so its change-over from the whole-mantle form was potentially what underlay development of Earth's low-CO₂, oxygen-bearing atmosphere.

1. Osmaston, M. F. 2006 Global tectonic actions emanating from Arctic opening in the circumstances of a two-layer mantle and a thick-plate paradigm involving deep cratonic tectospheres: the Eureka (Eocene) compressive motion of Greenland and other examples. In *ICAM IV, Proc. Fourth International Conference on Arctic Margins, 2003, Dartmouth, NS, Canada* (ed. R. Scott & D. Thurston): US Dept. Interior, OCS Study MMS 2006-003, pp.105-124: Also published on: <http://www.mms.gov/alaska/icam>.