

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

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**Carbon isotopes document that at ~2.2Ga oxygen levels rose dramatically from a negligible level. It is arguable that without it we would not be here.**

**Previously (IUGG95, IUGG99, Goldschmidt 2000) I have outlined a new history of the Earth's internal evolution. Here I will briefly trace the early part, showing why, contrary to previous expectation, mantle convection had been so efficient that by 2.8Ga mid-ocean ridge (MOR) crests, previously (on sedimentary evidence) barely submerged, began to deepen markedly. This lowered sea-level, exposing cratons to massive weathering which lowered atmospheric CO<sub>2</sub>. The well-documented late Archaean acceleration of crustal addition to cratons, or, more precisely, of TTG-granitoid intrusion of greenstone belts, is also, paradoxically, evidence of waning mantle heat. Such wide-belt intrusion, grouped into quasi-coeval 'events', are seen as a form of post-subduction magmatism, marking interruptions of flat-slab subduction. On each occasion, the TTG derived from the subducted and reheated oceanic crust advected, to the surface, subducting-plate heat that would otherwise have been returned to the mantle heat budget.**

**This exacerbated the heat-budget problem, eventually precipitating a collapse of mantle convection 2.45-2.2Ga, an interval during which no greenstones or orogenic granitoids are known. This shut off the supply of reducing gases at MORs which, below a chemocline, had kept the oceanic pH down and abundant Fe<sup>2+</sup> in solution, enabling oxygenic life to precipitate it as banded iron-formation in unparalleled amounts. Related events in this interval are the global Huronian glaciation (2.35Ga) and mafic dyke swarms on every continent (2.45-2.3Ga), attributable to thermal shrinkage of the global lithosphere in the absence of MORs as take-up zones.**

**When convection resumed (patchily) at ~2.2Ga and sea-level rose over planated cratons, oxygenic life achieved its crucial florescence. Thus it appears that the Earth's internal behaviour, not biological innovation, was responsible for development of oxygen-consuming life forms and, ultimately, for our existence.**

**[text = 303 words]**

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