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IMPACT OF THE BEHAVIOUR OF THE EARTH'S INTERIOR UPON THE EVOLUTION OF THE EARTH'S ATMOSPHERE AND THE RISE OF OXYGEN

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At IUGG95 I outlined a new history of the Earth's internal evolution. That history can now be elaborated and its impact upon evolution of the atmosphere outlined. The story begins in the later stages of planetary accretion, with magmatic FeO being reduced by the nebular atmosphere to Fe and 'subducted' to form the core. Some of the huge amount of water thus produced (several 100 V_{ocean}) gave the early Earth a wet mantle with a low viscosity well able to convect away the great heat. Throughout the Archaean, a low-pH ocean (topped by a shallow oxygenated water layer beneath a dense CO2+N atmosphere) accumulated Fe++ in solution. At ~2.8Ga the ocean floor began to deepen, marking declining MOR height and mantle heat, and foreshadowing the 2.45-2.2 Ga 'hiatus' in mantle overturn seen as a gap in orogenic granitoid dates. Deepening ocean basins exposed the cratons to massive weathering. This lowered CO2 and resulted in the Earth's first glaciation at 2.65Ga, followed at 2.35Ga by the Huronian glaciation during the 4km+ lowering of sea-level by the hiatus proper. During the hiatus the supply of reducing gases from MORs was shut off and oxygenic life was at last enabled to begin to win its battle against the Earth's reducing power. This resulted in deposition of uniquely vast amounts of banded ironstone formation during the 2.45-2.2Ga interval. Carbonates with a major positive excursion in delta13C at 2.2Ga mark the florescence of oxgenic life presented with non-acid shallow seas over planated cratons as renewed MOR activity raised sea-level. Thus both the lowering of CO2 in the Earth's atmosphere and the rise of oxygen stem from changes in the Earth's internal behaviour, not from biological innovation.