

Evidence for Global Biomass Expansion in the Late Archean, Hamersley Basin, WA

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There is a growing body of evidence to suggest that the earth's atmosphere and biosphere have evolved in parallel with the supercontinent cycle [1]. That is, the endogenic energy of the planet (in the form of plate tectonics) has played a major role in driving the biosphere to greater complexity. There were two significant stages in earth history when atmospheric oxygen levels rose significantly and the biosphere expanded rapidly. The most recent of these biospheric expansions (c. 1.0 to 0.5 Ga) has been studied in considerable detail. The earlier event (c. 3.0 to 2.2 Ga), has received little attention.

Evidence of the existence of a biosphere before 3.0 Ga is limited, partly as a result of preservation, but also because the biomass was small. Concretions, the mineralogical expression of microbial activity during the diagenesis of sediments, are abundant in late Archean and early Paleoproterozoic successions. They provide a sensitive barometer to biological activity in both the accumulating sediments and in the overlying water column and suggest a rapid increase in the global biomass. The environment within the accumulating sediments was relatively oxygen rich implying that oxygen was being released into the oceanic water column well before its appearance in the atmosphere at c.2.45 Ga. Sulfate reducing and methanogenic microbial life appear to have been active and abundant.

The fact that the biosphere increased dramatically just after the first large continental masses began to form and as the earliest intracratonic basins began to subside is unlikely to be coincidental [1]. The connection almost certainly relates to carbon burial but possibly also to the recycling of essential nutrients (notably P). The links between these events is significant as it suggests that for life to evolve in complexity and for the biomass to expand it must do so in concert with an evolving dynamic planet.

References

[1] Lindsay, J., Brasier, M. (2003). . In P.G. Eriksson, W. Altmann, D.R. Nelson, W.U. Mueller, O. Catuneau (Eds.), *The Precambrian Earth, 12, Tempos and Events*, Amsterdam, Elsevier, 388-403.