



Success and failure of Phanerozoic reef production: a new approach

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The fossil record of reefs is biased by incomplete preservation and heterogeneous sampling, which are driven by geological and socio-economic factors. Biases might be sufficiently strong to mask ancient reef booms and bursts, so that the underlying environmental and biological triggers are obscured. Although a number of biases can be adjusted for, there remain many uncertainties in the reconstruction of absolute variations of Phanerozoic reef production.

Relative changes of reef proliferation can be reconstructed with much greater accuracy. I have used collection counts from the Paleobiology Database to assess the general sampling intensity of shallow marine environments and compared these data with the Phanerozoic record of metazoan reefs, as stored in the PaleoReefs database.

The good correlation between changes of reef abundance and changes of collection counts confirms that the reef record partly mirrors sampling/preservation and sea-level fluctuations. An analysis of residuals identifies just four significant episodes of metazoan reef proliferation: Late Devonian (Frasnian), Late Triassic (Norian-Rhaetian), Late Jurassic (Oxfordian-Kimmeridgian), and Neogene. Times of reef proliferation were short-lived on geological time scales and expansions were as rapid as declines. The pattern of substantial collapse often following substantial expansions may indicate that reefs are prone to self-organized criticality, just as many complex ecosystems. If this is true, the paradigm of reefs as passive tracers of global change should be revisited.