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Reefs under global climate stress: a Paleozoic paradox from the Late Ordovician through Devonian

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The Mid-Paleozoic coral-sponge reef community flourished uninterruptedly in shallow tropical waters for ca. 100 million years (Katian 0.460- Frasnian 0.376 Ga), surviving the O/S Mass Extinction Events, but crashing at the F/F (Late Devonian) MEEs. Both mass extinctions are generally agreed to have been the result of multiple polar glaciations.
The Wenlock-Ludlow and Emsian-Givetian were marked by high atmospheric
CO2 concentrations at levels 12-24x the Recent, and tropical SSTs averaged 30ÂºC+. During the Emsian-Givetian, sealevel highstands drowned continental shelves, producing vast infracontinental sealanes and regional evaporite basins with strong tidal pulses and high salinities.
Middle Devonian GBR-sized tracts were at their maximal development, covering far greater carbonate platforms than the Holocene, reaching latitudes 50ÂºN+ and 45ÂºS. After the F/F MEE, reefs virtually disappeared for nearly 27 myr, with high generic losses of 80%+: all stromatoporoid reef builders vanished at the close of the Famennian, and during the Famennian rugose corals were virtually exclusively solitary forms. Glacial events produced MEEs at the O/S and F/F boundaries, confining reefs to lower latitudes such as during the Quaternary: global warming stimulated reef growth and coral diversity during the supergreenhouse, an apparent contradiction to the dire predictions for modern global warming. The advent of the first tropical Late Devonian rainforests stimulated icehouse O2 production, and changed continental
runoff: cold advective currents exacerbated P upwelling during the Famennian, lowering CaCO3 production by 90% in the tropics. There is no evidence for losses of low-Mg calcite corals and high Mg- calcite or aragonite stromatoporoids during the Devonian supergreenhouse, as postulated for the Holocene aragonitic scleractinians.