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Adverse effects of heating in ancient tropical epeiric seas

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The enormous breadth and shallowness of most ancient epicontinental seas recorded in the stratigraphic record mean that there is an effective lack of modern analogues. Huge expanses remained within the photic zone. These seas were variably open to the ocean, and in some cases exchange was so reduced that salinity increased which, when unchecked, led to deposition of evaporites—a classic feature of many tropical examples. The onset of hypersalinity is commonly held to be recorded by the changeover from fossiliferous limestone to laminated dolomite as stenohaline faunal elements were extinguished. An overlooked effect of isolation of these seas, however, is the rise in temperature, which could have taken place well before hypersalinity came about. Invertebrate animals typically have strict thermal tolerances, meaning that even a small but permanent rise in water temperature would be deleterious to the tightly adapted fauna, rendering the sea essentially azoic and thereby mimicking the ecological effect of hypersalinity. Bottom albedo could also have decreased, if covered by a dark microbial mat, which would have radiated further heat to the water body.

Upper Ordovician Red River strata of subsurface southeastern Saskatchewan are composed of three limestone–dolomite–anhydrite sequences usually interpreted as "brining-upward" cycles. In the lowest cycle, bioturbated, highly fossiliferous limestone of the Yeoman Formation is abruptly succeeded in turn by laminated dolomite then by anhydrite of the Lake Alma Member of the Herald Formation. In one area, laminated dolomite of the basal Lake Alma passes laterally to metre-sized patch reefs. Unlike other reefs of this age, these biolithites are microbial and contain a sparse, low-diversity fauna of worm tubes, ostracodes, frondose bryozoans, stunted orthid and strophomenid brachiopods, along with rare tiny gastropods, foraminifers? and calcisponges?, plus burrows. The wealth of fossils comprising the typical Late

Ordovician biota is absent and thus is strongly indicative of ecologically stressed conditions—but it cannot be due to hypersalinity. Temperature increase is a reasonable explanation that accounts for the persistence of a restricted biota of stenohaline animals in a localized reefal setting before even these went extinct in this sea (Pratt & Haidl, 2007).