Carboniferous To Triassic Carbonate And Chert Factories Along NW Pangea Controlled By Global Thermohaline Circulation

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ABSTRACT

A significant global event occurred at about the Sakmarian-Artinksian boundary that triggered a vigorous pattern of thermohaline circulation along the northwest margin of Pangea. This event followed the thawing of Gondwana ice-sheets in the southern hemisphere and coincides with maximum flooding on global scale, cessation of cyclothem sedimentation and onset of widespread biogenic silica preservation (Permian Chert Event). Seasonal thawing of northern sea ice, the presumed engine of thermohaline circulation, led to the influx and circulation of dense, hypersaline cold water in the deep Panthalassan Ocean parallel to the northwest margin of Pangea, displacing nutrients- (phosphorus, iron, nitrogen, etc.) and silica-rich water in its path and forcing it along the oceanic margins via upwelling. Lighter melt water was also carried southward all along northwest Pangea through Coriolis forcing. This led to the contraction and ultimate disappearance of prolific warm-water carbonate factories and their replacement by biologically impoverished cool- to cold-water carbonate factories. This also led to the expansion of siliceous factories and preservation of their sedimentary products as bedded spiculitic chert, associated with unusually large phosphate and glauconite deposits. The areas favourable to siliceous sedimentation and preservation expanded both landward and southward during the Guadalupian and this process reached its zenith during the Lopingian, at which time not only northwest Pangea but many warmer areas of Panthalassa and the Tethys became the loci of sponge and radiolarian siliceous sedimentation.

A major event occurred during latest Permian time which led to the collapse of thermohaline circulation. Presumably rapid global warming and equally rapid thawing of northern sea ice destroyed a palaeoceanographic setting that had promoted the growth and preservation of biogenic siliceous sediments for nearly 30 Ma. Complete thawing of northern sea ice would have ended thermohaline circulation and led to warm and sluggish oceanic conditions inimical to the production, accumulation and preservation of biogenic silica. These conditions lasted between eight to ten million years (Early Triassic Chert Gap), during which several families of silica-secreting organisms became extinct, while others took refuge under more favourable conditions, before staging a come back during Anisian time (early Middle Triassic).