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Water-mass evolution during the Cenomanian and Turonian from the proto-Tethys and Western Interior Seaway.

James Eldrett (1), Paul Dodsworth (2), and Steven Bergman (3)

(1) Shell Global Solutions International, Rijswijk, Netherlands (james.eldrett@shell.com), (2) StrataSolve Ltd, Warrington, United Kingdom (dodsworth@stratasolve.com), (3) Shell International Exploration and Production Inc, Houston, USA (Steven.Bergman@shell.com)

The Cenomanian and Turonian Stages were characterized by sustained global greenhouse climate conditions, emplacement of several Large Igneous Provinces (LIPs), oceanic anoxic events (OAE), and major global perturbations in the carbon cycle. Here we present detailed palynological and geochemical data from cores located along a North-South transect from the Western Interior Seaway (WIS) to the western proto-Tethys (Demerara Rise). Our integrated dataset demonstrates the northward flow of an anoxic Tethyan water-mass into the WIS during the early-middle Cenomanian; followed by a major re-organisation during the latest Cenomanian- Turonian as a full connection with the Arctic- Boreal water-mass was established during peak transgression, resulting in the de-stratification of the water column and improved oxygenation throughout the WIS and as far south as the Demerara Rise. These data suggest that the recorded decline in redox-sensitive trace metals reflect a genuine ventilation event and not a reduction in the trace metal global inventories. These long term trends in water-mass evolution are tentatively linked to third order eustatic transgression-regression cycles driven by regional tectonic and/or mantle plume-lithosphere dynamics associated with the emplacement of LIPs during this time. On shorter timescales (4th, 5th order) there is no evidence for global eustacy in the Greenhouse Cenomanian - Turonian with most of the bed-scale variations controlled by Milankovitch-driven variations in marine carbonate, siliceous, organic matter productivities and orbital influences on ocean-atmosphere-climate dynamics.