Geophysical Research Abstracts
Vol. 21, EGU2019-16380, 2019
EGU General Assembly 2019

The Porous Great Ocean Conveyor and Paleoclimate Signals of Deep-Sea Fans

Roger Flood
Stony Brook University, School of Marine and Atmospheric Sciences, Stony Brook, New York, United States (roger.flood@stonybrook.edu)

The overall circulation pattern of the worlds ocean has been described in terms of a Great Ocean Conveyor where waters sink at high latitudes and travel through ocean basins before eventually upwelling and returning to source areas. Because of respiration, oxygen levels decrease and nutrient levels increase in deep waters as they flow through ocean basin, and nutrient levels in the deep modern ocean, and through proxies in past oceans, have been used as indicators of how fast deep ocean currents flow. While this model appears to adequately describe the modern ocean when sea level is high, material fluxes to the deep sea along continental margins were considerably different during glacial periods when sea level was low since many rivers discharged onto narrow continental shelves and possibly into the heads of submarine canyons. Turbidity currents, formed directly as hyperpycnal flows or through slumping of rapidly-deposited sediment, flowed downslope to deposit organic-rich sediments on deep-sea fans on the continental rise. Turbidity currents are dilute sediment suspensions (at least 94% water) and the water entrained in turbidity currents is transported to deep water along with the sediment load. These entrained fluids will have different nutrient concentrations than the deep-sea waters. Also, the rapidly deposited, organic-rich sediments of the deep-sea fan may lead to high fluxes of dissolved nutrients into deep water. The localized injection of nutrients into deep water is inconsistent with the Great Ocean Conveyor model. Many large deep-sea fan systems are inactive during the modern sea-level high stand, but one exception is the Zaire/Congo deep-sea fan in the Angola Basin, eastern Equatorial Atlantic, which is active today. Published nutrient profiles from the Angola Basin show elevated dissolved phosphorus levels and other anomalies at about 4000 m that appear to be related to recent turbidity currents or turbidite deposits on the nearby Zaire/Congo Fan. However, the deep Angola Basin is somewhat isolated from the Great Ocean Conveyor which in the Atlantic is mainly west of the Mid Atlantic Ridge. The Amazon Fan in the western equatorial Atlantic is inactive in modern times but was active in glacial times when sea-level was low. Sediment cores suggest turbidity currents occurred every 3 to 5 years. The Amazon River is about 5 times larger than the Congo River in terms of discharge, so nutrients added to the deep Atlantic Ocean through Amazon Fan activity were likely to be significant and could be observable. Published maximum-glacial paleo-nutrient profiles in the western Atlantic, along the route of the Global Ocean Conveyor, show anomalies at 3000 to 4000 m depth near the Equator that may related to the active Amazon Fan. Deep-sea fans with similar localized turbidity-current activity and high sedimentation rates were active in many ocean basins during low sea level, and the local sources of nutrients and other materials to the deep sea need to be taken into account when interpreting paleo-oceanographic data in terms of ocean circulation.