Enhanced Atlantic Merdional Overturning Circulation during pronounced interstadials

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An increase in the strength of the Atlantic Meridional Overturning Circulation (AMOC) is thought to have accompanied significant warming across the North Atlantic region at the onset of the Bølling-Allerød (B-A) interval around 14.6 kyr ago. Recent modelling results [1] suggest that Atlantic circulation during the B-A was enhanced even with respect to expectations for the Holocene mode of circulation. The transient 'overshoot' of the AMOC during the B-A can be explained predominantly by a convective temperature relaxation in the North Atlantic plus the advection of excess salt from the Tropics and the South Atlantic ('Stommel-feedback'). During the convective adjustment relatively warm and salty subsurface and deep waters in the North Atlantic rise to the surface where they lose their heat to the atmosphere. This leads to a fast densification of the surface waters and reinforces the generation of NADW. Prior to the Holocene cooler conditions over the North Atlantic could have made this mechanism particularly effective (as a consequence of increased sea ice cover and stronger ocean-atmosphere heat fluxes). We present new multi-proxy evidence from the South Atlantic that support this idea and suggest the same mechanism may have operated during Dansgaard-Oeschger event (D-O) 8 as well as the B-A. We propose that enhanced circulation within the Atlantic basin may be characteristic of the long-lived interstadials of the last glacial and deglacial periods.

[1] Knorr & Lohmann (2007) *Geochem. Geophys. Geosys*. **8**, doi:10.1029/2007GC001604.

Earth's geodynamic and redox evolution and the temporal distribution of Archean and Paleoproterozoic ore deposits

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The oldest preserved ore deposits are 3.45 to 3.2 Ga hydrothermal volcanic-hosted massive Cu-Zn sulfide deposits and porphyry Mo-Cu deposits. Although there is considerable evidence for mantle plume activity in the Paleo and Mesoarchean the oldest preserved komatiite-hosted Ni sulfide deposits are ~2.9 Ga, where reduced komatiite magmas interact with sulfide-rich submarine felsic volcanic rocks and sediments. With un-ambiguous evidence that plate tectonics and subduction had started by ~3.1 Ga and stable cratons formed by 2.9 Ga the oxygen fugacity of arc-related and crustal magmas was more complex with the first hydrothermal Au deposits (~2.9 Ga) and magmatic-hydrothermal Cu-Au deposits linked to subduction-related magmatism, and 2.85 Ga magmatic-hydrothermal Sn-W deposits linked to crustal melts. Differentiation of the continental crust also resulted in U-rich granitoids and detrital uraninite deposits between ~2.9 and 2.45 Ga. Peaks in ore deposit formation occurred during the ~2.72 to 2.66 Ga plume breakout event linked to formation of the first large stable continents. The oldest Iron Oxide Copper Gold (IOCG) deposits linked to continental alkaline magmas are ~2.66 Ga. Major high-grade Fe deposits are hosted by BIFs deposited between ~2.7 and 2.4 Ga before the rise of atmospheric oxygen with the first high-grade deposits forming at ~2.0 Ga when O levels were likely to have risen to about 10 percent of PAL. The first giant BIF-hosted Fe ore deposits, formed as a result of both hydrothermal and supergene processes during continental extension at about 2.0 Ga. The oldest Mn, SEDEX Pb-Zn, and hydrothermal U (unconformity-type and Olympic Dam IOCGs) deposits formed between ~2.0 and 1.5 Ga in continental basins after the significant rise of oxygen. While the ore deposit record may reflect the bias of preservation rather than global conditions it is consistent with links between ore deposits and the evolving Earth System and life, and may help resolve the complex record of redox proxies during the Meso and Neoarchean prior to the unambiguous rise of atmospheric oxygen in the Paleoproterozoic.