Geophysical Research Abstracts
Vol. 18, EGU2016-11981-1, 2016
EGU General Assembly 2016

Holocene Sea Surface and Subsurface Water Mass Variability Reconstructed from Temperature and Sea-ice Proxies in Fram Strait

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In two high-resolution sediment cores from the West Spitsbergen continental margin we investigated planktic foraminiferal, biomarker and dinocyst proxy data in order to reconstruct surface and subsurface water mass variability during the Holocene. The two study sites are today influenced by northward flowing warm and saline Atlantic Water. Both foraminiferal and dinocyst (de Vernal et al., 2013) temperature reconstructions indicate a less-stratified, ice-free, nutrient-rich summer surface ocean with strong Atlantic Water advection between 10.6 and 8.5 cal ka BP, likely related to maximum July insolation during the early Holocene. Sea surface to subsurface water temperatures of up to 6°C prevailed until ca 5 cal ka BP. A weakened contribution of Atlantic Water is found when subsurface temperatures strongly decreased with minimum values between ca 4 and 3 cal ka BP. High planktic foraminifer shell fragmentation and increased oxygen isotope values of the subpolar planktic foraminifer species *Turborotalita quinqueloba* as well as increasing concentrations of the sea ice biomarker IP25 further indicate cool conditions. Indices associated with IP25 as well as dinocyst data suggest a sustained cooling and consequently sea-ice increase during the late Holocene. However, planktic foraminiferal data indicate a slight return of stronger subsurface influx of Atlantic Water since ca 3 cal ka BP. The observed decoupling of cooling surface and warming subsurface waters during the later Holocene might be attributed to a strong pycnocline layer separating cold sea-ice fed surface waters from enhanced subsurface Atlantic Water advection.

Reference:
de Vernal, A., Hillaire-Marcel, C., Rochon, A., Fréchette, B., Henry, M., Solignac, S., Bonnet, S., 2013. Dinocyst-based reconstructions of sea ice cover concentration during the Holocene in the Arctic Ocean, the northern North Atlantic Ocean and its adjacent seas. Quaternary Science Reviews 79, 111-121.