PP51B MCC: Level 2 Friday 0830h

Paleoproductivity, Proxies, and Preservation: Records of Neogene Evolution of the Oceans I Posters

(joint with B, OS)

Presiding: **K Billups,** College of Marine Studies, University of Delaware**; M Arnaboldi,** University of Michigan

PP51B-0922 0830h POSTER

Northwestern Subarctic Pacific Paleoproductivity Fluctuations : a Strong Link With Climate Variability During the Early-Mid-Neogene.

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Deep-sea records of biogenic opal accumulation and bulk sediment as well as diatom-bound $^{15}N/^{14}N$ indicate that the subarctic North Pacific underwent drastic productivity fluctuations closely related to major climatic transitions in the late Cenozoic. In the northwestern Subarctic Pacific (ODP sites 882/883) warm intervals are characterized by massive biogenic opal deposition and relatively low nitrate utilization. On the other hand, cold periods show reduced opal export production together with more complete nitrate consumption. Once high-opal, nutrient-rich environments developed in the mid-Cenozoic, there is evidence that the greatest polar overturning actually occurred during somewhat warmer intervals in the late Oligocene, and during the Middle Miocene climatic optimum. In these intervals, higher opal content and lower sedimentary $\delta^{15}N$ seem to indicate a correlation between warm climate and enhanced surface-water nutrient concentrations. The correlation between global temperature and biogenic opal accumulation is also documented across the abrupt 2.7 Myr transition from Pliocene warmth towards widespread Northern Hemisphere Glaciation, as well as across subsequent glacial/interglacial transitions. This consistent pattern over different time scales suggests that climate has been affected by the tendency for polar overturning during warm intervals and polar stratification during cold periods. Reduced stratification would have represented a leak in the biological pump, releasing deep-sequestered carbon dioxide back into the atmosphere.

PP51B-0923 0830h POSTER

A Closer Look at the Late Miocene-Early Pliocene Biogenic Bloom".

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A late Miocene-early Pliocene increase in marine biological productivity has been recorded in equatorial upwelling areas of the Indo-Pacific Ocean as well as in the Benguela coastal upwelling area. Before proposing possible causes of the biogenic bloom, we ask two questions: 1) was the biogenic bloom a global event? 2) was the onset of the biogenic bloom simultaneous in different areas? Here we present productivity reconstructions from 3 Atlantic Ocean ODP sites that lie outside of upwelling influence: Site 982 (subpolar North Atlantic); Site 925 (western tropical Atlantic), and Site 1088 (subantarctic South Atlantic). To reconstruct paleoproductivity we use a multiproxy approach based on benthic foraminiferal accumulation rates (and thus derived paleoproductivity after Herguera, 2000), Uvigerina counts, and mass accumulation rates of bulk carbonate and planktic foraminifera. Our results indicate a three-fold increase in paleoproductivity during the late Miocene/early Pliocene climate transition. The timing, however, of productivity maxima differs among the sites. At subantarctic site 1088 productivity increases rapidly at 7.5 Ma reaches a maximum between 7.5 and 6.6 Ma and decreases again 6.6 Ma. At tropical Atlantic site 925 our reconstructions indicate an increase at 7 Ma, a peak at 6.8-6.5 Ma and a decrease toward 6 Ma. At subpolar site 982, productivity increases gradually from 9 Ma to 5.4 Ma, rapidly at 5.4 Ma, and then decreases gradually again between 5 and 4 Ma. Only at sites 1088 and 925 can we observe an association between paleoproductivity maxima and decreasing benthic foraminiferal 13C values during the late Miocene 13C shift. These results suggest that placing the paleoproductivity events into a context of oceanic nutrient levels linked to changes in external (e.g., weathering and gateways) boundary conditions and internal (e.g., ocean circulation) boundary conditions will be complex.

PP51B-0924 0830h POSTER

Palaeoceanographic Variability of the Benguela Upwelling System Depending on the Northern Hemisphere Glaciation (NHG) - Indicated by Organic-Walled Dinoflagellates

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The causes and effects of the intensification of growth of the northern Hemisphere ice caps at around 3.2 and 2.74 Ma BP are still unclear. Possible causes are changes in the global ocean circulation and the global carbon cycle, which might have resulted from tectonic processes, solar insolation changes, or the interaction between both processes. The Benguela upwelling area forms a key area within the global ocean system. Here, warm and saline Indian Ocean waters enter the South Atlantic Ocean and are transported to the north. Variability of this inflow may thus result in changes in deep-water production in the North Atlantic, thereby influencing the global thermohaline circulation. Furthermore, the Benguela area is characterized by extremely high bioproductivity in surface waters as a result of year-round upwelling. Variations in the upwelling intensity might lead to changes in atmospheric ñCO2. To study the changes in the circulation and the upwelling intensity, within this region organic-walled dinoflagellate cysts from two high-resolution cores (ODP 1084 and1082) covering the time interval from 3.3 to 2.5 Ma BP were investigated. Due to their sensitiveness to ecological parameters, organic-walled dinoflagellates reflect oceanographic characteristics keenly. The analyses discover clear distribution differences of individual species, especially of those that are sensible or resistant against aerobic decay. The sensible species, (Protoperidinium and Echinidinium), have their highest abundance from 2.76 to 2.73 Ma BP, a time interval in which the resistant species show no significant changes in their abundance. This implies that during this time interval the oxygen was reduced in the deep- and porewater suggesting that the global ocean deepwater circulation was weakened. Comparing these results with the known intensification of the NHG at around 2.74 Ma BP leads to the speculation that the increasing of ice caps in the northern hemisphere is highly associated with a lessened deep-water production in this region. Furthermore, frequency analysis show a strong compatibility between several species and the solar insolation.

PP51B-0925 0830h POSTER

Trans-Mediterranean Paleoclimate Connections Evident From Carbon and Nitrogen Stable Isotope Patterns in Late Pliocene Sapropels

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Variations in the Earth's orbital parameters cause fluctuations in the global climate. In particular precession is important at low latitude locations, such as the Mediterranean Sea. Here 21 kyr periodic precessional forcing drives dramatic oceanographic and environmental changes over the whole region. Precessional minima coincide with intensifications of the monsoonal system. As a result, the Mediterranean area experiences enhanced seasonality, increased precipitation, and greater fluvial discharge. Primary productivity has cyclically increased at the sea surface while dysoxic/anoxic conditions has developed at the sea floor. Such perturbations of the Mediterranean system have resulted in the deposition of sapropels, dark layers of organic-carbon-rich sediment, since the late Miocene. Sapropels represent an exceptional natural laboratory for investigating the mechanisms and dynamics of paleoclimate and paleoceanographic cycles and their local impacts over an entire basin. Our study is focused on complete and continuous sequences containing two sapropels corresponding to insolation cycles 180 (1.851 Ma) and 178 (1.829 Ma) and intervening "normal" sediment from the Vrica Plio-Pleistocene type section and ODP Sites 964, 967, 969, 974, and 975. These locations represent a spectrum of different sub-basins, distances from land, proximities to fluvial input, influences of different water masses and differences in water depths. Sapropels appear to be consistently characterized by higher del13C and generally lower del15N values, suggesting a widespread pattern of higher marine productivity with a major contribution from nitrogen fixation during their deposition. The presence of the same isotopic patterns in hydrologically separated parts of the Mediterranean suggests a strong paleoclimatic connection between the major sub-basins. Furthermore, the nitrogen isotopic evidence for a switch from algal to bacterial modes of primary production implies strong trans-Mediterranean near-surface stratification during sapropel times.

PP51B-0926 0830h POSTER

Upwelling Dynamics and Nitrogen Cycling on the Namibian Shelf and Slope over the last two Climatic Cycles

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The Benguela upwelling system is the world's most productive eastern boundary current. Whether local paleoproductivity was mainly supported by new or recycled nutrients is a tricky issue. Solving this question is, however, an essential prerequisite for estimates of the net CO2 pumping attributable to this upwelling through the past and, ultimately, for forecasts of the future climate changes. In this regard, the mechanisms that control the local nutrient budget and their variations with climate changes must be addressed. We interpret the $\delta^{15}N$ signals of three cores distributed from the upper to the lower continental slope of Namibia ($25^{o}6S$) as reflecting an interplay of changes in local nitrogen cycling and regional denitrification during the last 250 kyrs. Detrital grain-size distributions and SST records were used as proxies for wind stress and upwelling dynamics, respectively, and TOC and MAR Corg values as indicators of paleoproduction. The upper slope core displays a noisy $\delta^{15}N$ signal without obvious glacial-interglacial variability, whereas the lower slope cores display low $\delta^{15}N$ during cold periods and high $\delta^{15}N$ during climatic optima. This dissimilarity results from the segregation of the upwelling structure in two cells, decoupling nutrient dynamics of the shelf from those beyond the shelf-edge. We hypothesize that, for the coastal cell, denitrification and nutrient recycling change little over time, though regenerated production may be more intense during sea level high-stands. The coastal cell d15N seems insensitive to wind stress variations. Changes in nutrient availability in the shelf-edge cell waters, however, may be partly mediated by the strength and zonality of the wind, impacting off-shore productivity, though this cannot explain the full range of variability. Positive $\delta^{15}N$ peaks during full interglacial periods, namely stages 7.5, 5.5 and 1, are concurrent with $\delta^{15}N$ maxima from other upwelling systems adjoining OMZs. We suggest that, during full interglacial periods, some degree of water column denitrification occurs in the Benguela region: globally lower oxygen concentrations in intermediate waters at these times, possibly in combination with sporadic intrusions from a poleward, oxygen depleted undercurrent, led to suboxia in the OMZ.

PP51B-0927 0830h POSTER

Coccolith Carbonate Burial in the Open Ocean: Neogene Patterns

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Coccolithophorids, gold-brown algae, are prominent primary producers in the World's oceans. They produce calcite scales (coccoliths) that surround their cell, which represents a potential short-term CO_2 source to the environment. The burial of coccoliths into marine sediments acts as a long-term sink of carbon. In fact, sedimentary carbonates are the largest reservoir of carbon on Earth, and hence play a vital role in the global carbon cycle. The contribution by coccolithophorids to this long-term sink can be expressed by accumulation rates of fine fraction carbonate. In more detail, absolute abundances of coccoliths combined with species-specific carbonate weights can resolve which taxa are most effective contributors to deep-sea carbonate. Surprisingly little has been done to link biogenic calcium carbonate budgets in the geological past to the general evolutionary patterns of calcifying plankton. Coccolithophorids have evolved relatively rapidly since their first appearance in the Mesozoic. Their evolutionary patterns are characterized by several periods of increasing species diversity and subsequent decline, as well as changes in their coccolith size and morphology. An overall decrease in the coccolith sizes is recorded during the Neogene, with the disappearance of large coccoliths (>10 micron) since the Middle Miocene. Because larger coccoliths are generally more resistant to dissolution, this observation cannot be due to (selective) carbonate dissolution. Hence, it implies significant variability in the amount of coccolith carbonate effectively buried through time, and potentially drastic changes in coccolithophorid productivity in the open ocean, with consequences for the short-term effects of biocalcification. This study focuses on Neogene proportions and accumulation rates of coccolith carbonate in selected well-preserved DSDP and ODP Sites from the Atlantic, Pacific and Indian Oceans, at a 1-2 M.y. resolution. Ultimately, the aim is to understand the observed variability in the context of global climate change, ocean chemistry fluctuations and plankton evolution during the Neogene.

PP51B-0928 0830h POSTER

Identification of Dissolution Patterns in Nannofossil Assemblages: A High-Resolution Comparison of Synchronous Pliocene Records From Ceara Rise, ODP Leg 154

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Nannofossil assemblages in sediment samples are being increasingly used as paleoceanographic proxies of surface water conditions. However, these records can be scrambled by a number of taphonomic factors since fossil nannoplankton assemblages are controlled not only the initial production of the plankton in the surface waters but also dissolution throughout the water column and on the seafloor. An assessment of the relative contributions of these controls is therefore necessary for reliable use of nannofossil population abundance data, in particular in the critical early stages when assemblages are still sufficiently diverse to make assemblage analysis for paleoceanography attractive, but when nonetheless relative abundances of species may have been significantly skewed. This study demonstrates that even where nannofossil preservation is qualitatively good to very good, there can be significant distortion by dissolution in the composition of nannofossil assemblages and temporal assemblage patterns. However, a comparison of synchronous well-preserved Pliocene nannofossil and non-nannofossil records from Ceara Rise Site 929 (4397 m depth) with Site 926 (3598 m depth), shows that nannofossil abundance patterns that have been controlled primarily by the original production of the individual taxa can be clearly differentiated from those patterns that have experienced significant subsequent dissolution overprinting. This overprinting can be detected by the number of co-varying relationships within the nannofossil taxa, the taxa that form those co-varying relationships, the coupling of dissolution indices with each other and with nannofossil abundances, and the loss or reduction of dissolution-susceptible taxa. Furthermore, by the unique comparison of absolute nannofossil abundance variations at the two sites (achieved by normalising nannofossil to terrigenous abundances), the dissolution signal present at Site 929 can be isolated from the original productivity signal.

PP51B-0929 0830h POSTER

Cenozoic pelagic Sr/Ca records: Exploring a link to paleoproductivity

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Recent studies have revealed that Sr/Ca ratios of surface ocean carbonate producers are affected by productivity. In this study we explore a link between published bulk carbonate (primarily coccoliths) and planktonic foraminiferal Sr/Ca records and large-scale variations in paleoproductivity over the course of the Cenozoic. We constrain seawater Sr/Ca changes with benthic foraminiferal Sr/Ca records constructed from a number of sites from the Atlantic and Southern Ocean. In agreement with Lear et al. (2003) inferred seawater ratios vary little over the Cenozoic until the early Pliocene when ratios begin to rise steeply toward the present. Using the benthic foraminiferal-derived Sr/Ca seawater curve, we calculate the partitioning coefficient of Sr for bulk carbonate and planktonic foraminiferal Sr/Ca records. We show that over the past 50 myr, there have been two broad periods of enhanced partitioning of Sr relative to today, the Oligocene and the mid to late Miocene/Pliocene. Because these are two intervals for which we can cite evidence for a relative rise in oceanic nutrient levels, we believe that the Sr/Ca ratios of bulk carbonate and planktonic foraminiferal tests reflects the effects of oceanic nutrient levels on Sr uptake during hard part formation. Within the limits of the inferred seawater Sr/Ca record, the results of this study contribute a geologic perspective to recent laboratory and field studies that have raised the possibility that Sr incorporation into biogenic calcite is controlled by biogeochemical processes.

PP51B-0930 0830h POSTER

Investigating the Paleoceanographic Significance of Li/Ca in Foraminifera

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Lithium exhibits conservative behavior in the ocean and has a constant concentration and isotopic composition throughout the world oceans. Given our current understanding of lithium and calcium systematics (i.e., residence time of Li/Ca over 1Ma), it is anticipated that seawater Li/Ca ratios, and subsequent lithium incorporation in foraminiferal tests would not change over glacial-interglacial timescales. However, recent results suggest that foraminiferal Li/Ca may be an expression of changes in the incorporation behavior of the foraminifera due to environmental changes associated with glaciation and can potentially be applied as a proxy for seawater carbonate ion concentration across glacial-interglacial time cycles. To further investigate this supposition, high precision Li/Ca ratios were measured in the planktonic foraminifer Globigerinoides sacculifer over a full glacial-interglacial cycle (100ka) from Pacific Ocean core RC17-177. Li/Ca varies with $\delta^{18}O$ showing an increase of 37 percent from the Holocene to the last glacial maximum. These results will be complemented with foraminiferal lithium isotopic data currently in progress. If foraminiferal Li/Ca proves to be dominantly controlled by calcification rate as a function of seawater carbonate ion concentration, then Li/Ca may act as a proxy of past atmospheric CO2.

PP51B-0931 0830h POSTER

Significance of Dust Inputs and Arc Fluxes for the Nd and Hf Budgets in the North Pacific

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Neodymium and Hf isotope time-series from Neogene ferromanganese crusts in the Pacific Ocean indicate a long-term balance of these radiogenic isotopes over the entire Pacific basin. The two main factors controlling this balance have been (i) advection of water masses from the Southern Ocean and (ii) erosion and supply of Nd and Hf from young circum-Pacific island arcs. It has, however, been suggested that Asian dust is of major importance for the Nd (and Hf) budget of the North Pacific. Looking back into the past there was an order of magnitude increase in dust flux to the North Pacific at about 3.5 Ma. The timing of this increase in dust flux coincides with a slight decrease in Nd and Hf isotope ratios in ferromanganese crust records from the equatorial and North Pacific, which renders it possible that the release of Nd and Hf from dust particles had some effect on the seawater budget, at least over the past 3.5 Myr. In order to evaluate the importance of Nd and Hf fluxes from different sources to the North Pacific, a simple box model was developed. Assuming steady state, a self-consistent model is presented, in which the fluxes and isotope compositions into and out of North Pacific seawater are balanced. The modelled fraction of dust dissolving in the North Pacific is less than 3 % and the total dust-derived Nd contributes less than 13 % to the dissolved Nd budget of the North Pacific. Prior to the ten-fold increase in dust flux the effect of dissolved dust on the deep water isotope composition must have been negligible for Nd. Despite large uncertainties we obtained similar results for the Hf budget (less than 2.4 % dust is being dissolved; maximal contribution of dust to the Hf budget of 23 %). The results for the Nd budget are considered robust because, forced by the isotopic results derived from the ferromanganese crusts, variations of the frame parameters within realistic ranges only lead to minor changes in the results. The box model also provides an estimate of the flux of arc-derived Nd (and Hf). Assuming ϵ_{Nd} for the radiogenic arc-endmember to be +5, the arc-derived flux of Nd cannot have been less than 4 x 10^8 g/yr in order to meet the requirement to balance the isotopic composition of advected Nd. The results of the model strongly support the view that island arcs have been a very important input source for the Nd (and Hf) budget of the Pacific. Concerning the input mechanisms for arc-derived Nd and Hf it is suggested that either small riverine systems or exchange processes between particles and seawater at the ocean margins or a combination of both have been responsible for supplying these elements to Pacific deep water.

PP51B-0932 0830h POSTER

The Link Between Eolian Flux, Paleoproductivity, Microfossil Preservation, and the Global Climate

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Most of the terrigenous material that reaches the abyssal mid-latitude western North Pacific Ocean is wind-transported because the abyssal plains are isolated from the Asian continental margin by submarine trenches. Eolian flux is favored by continental aridification and by an increase in wind strength- i.e. by geologic changes like Himalayan uplift as well as by astronomic (Milankovitch) parameters that promote glaciation. Our data from several ODP sites show that phytoplankton blooms (inferred from dinoflagellate cyst concentrations) were driven by enhanced eolian flux of limiting nutrients (inferred from the concentration of pollen and embryophyte spores) during the late Cenozoic. The increased particle sinking rate- a nonlinear function of terrigenous and biogenic particle flux- resulted in rapid sedimentation in the abyssal western North Pacific Ocean over short intervals 5, 3.5, 3, 2.5, 1.6. 0.8, and 0.4 Ma. Carbon burial was enhanced as the rapid sedimentation of fine particles protected oxidation-susceptible organic-walled microfossils (palynomorphs) like "round-brown" protoperidiniacean dinoflagellate cysts from oxidation and highly soluble calcareous planktonic foraminifera from dissolution. Based on the ages of enhanced burial events and on first-order calculations of organic and inorganic carbon in these palynomorph-rich calcareous sediments, we suggest that the sequestration of CO2 over a large area of the abyssal Pacific Ocean may have weakened the greenhouse effect sufficiently to explain the sudden cooling events in the Plio-Pleistocene record.

PP51B-0933 0830h POSTER

Chemical Identification of Source Regions in the Operationally-Defined Eolian Dust Component of Central Pacific Sediment

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Studying the terrigenous component of marine sediment gathered during ODP Leg 199 (Paleogene Equatorial Transect) will help unravel the paleoceanographic evolution of the central equatorial Pacific Ocean. For example, grain size and mineralogic data from the operationally defined eolian dust (ODED) component of marine sediment in the Pacific have commonly been used to assess changes in wind intensity and continental aridity. Assuming this eolian component is representing the weathering products of the upper continental crust, geochemical studies of Th, Sc, and REE distributions (e.g., Olivarez et al., 1991; Weber et al. 1996) have suggested the presence of two endmember components in ODED: the upper continental crust itself (the eolian-transported weathering products) as well as ocean crust (primarily volcanogenic material). Expanding upon these studies, we are examining the complete geochemical composition (major, trace, and REE concentrations) of the extracted eolian component as well as of bulk sediment from ODP Site 1215 (26N, 147.9W, 5396 m water depth) in the sub-tropical central Pacific. While the bulk sediment composition primarily reflects changes in lithology, the extracted "eolian" component reflects the presence of an Asian loess source as well as an undifferentiated volcanogenic component, consistent with previous North Pacific studies. Further application of additional geochemical discrimination strategies, based on REE, Al, Ti, Nb, and Sc relative abundances, indicate the importance of a number of varying terrigenous sources, such as Asian loess, western Pacific arc material, and potentially South American volcanics. Additionally, the complete chemical characterization of the extracted component allows for the development of criteria by which the efficacy of the extraction procedure may be assessed on a sample-by-sample basis.

PP51C MCC: Level 2 Friday 0830h

Effects of Sediment Dynamics on Marine Paleorecords I Posters *(joint with B, OS)*

Presiding: **A Pearson,** Harvard University**; T I Eglinton,** Woods Hole Oceanographic Institution**; T Wagner,** Woods Hole Oceanographic Institution**; L Giosan,** Woods Hole Oceanographic Insitution

PP51C-0934 0830h POSTER

Differential sorting, delivery and preservation of organic matter along the Washington margin, USA

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The quantity of organic matter preserved along the Washington margin (USA) is correlated with mineral specific surface area and this organic matter is present in core top (upper 20 cm) sediments as aggregated organo-mineral complexes. Previous studies have illustrated that certain organic components delivered to the shelf (e.g. diploptene, angiosperm-derived lignins) are preferentially transported offshore while other organic matter is effectively preserved along the upper margin (e.g cutins). Using size and density fractionation techniques, we isolated organo-clay aggregates and investigated their organic matter form and content using a combination of synoptic (e.g. X-ray photoelectron spectroscopy) and compound-specific analyses (e.g. amino acid analyses). Every sediment sample, from sand-rich shelf sediments to low organic content deep slope sediments, contains a highly degraded' component of organic matter. Sorting, transport and delivery of this degraded' organic matter from the shelf to the deep slope can account for all the burial of organic matter deeper than 200 meters water depth. Molecular mass balances suggest that, at best, 50 percent of the shelf-derived organic matter is replaced with organic matter derived from the local vertical rain. These estimates strengthen the view that winnowing and transport of organic matter is an important process that delivers near-shore-derived organic molecules that can be used as paleoindicators to deep sediments.

PP51C-0935 0830h POSTER

Reconstruction of Past Changes in the Strength of the Thermohaline Circulation Based on Magnetic Proxies From North Atlantic

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Precise documentation of past variations in the strength of thermohaline circulation (THC) is critical for the understanding of the mechanisms and dynamics of changes in climate and carbon cycle. Here we present a record of changes in the strength of the North Atlantic bottom current obtained from a mineral magnetic study of high accumulation rate cores distributed along the path of the different branches of the North Atlantic Deep Water (NADW). In these cores the magnetic material is low Ti-magnetite with very uniform grainsize. It originates from a single common source (the Nordic basaltic province) and is transported to the site of deposition by the bottom current. The amount of the magnetic mineral in the sediment is measured by the Anhysteretic Remanent Magnetization (ARM). The average value of ARM decreases along the path of the NADW, illustrating progressive deposition. In addition, ARM exhibits short-term variations which correlate with rapid climatic changes revealed by oxygen isotopes studies and with the changes in the temperature over Greenland. Their normalized amplitude is virtually identical in all cores. Therefore, these changes arise from fast changes in the efficiency of transport, i.e. in the strength of the NADW. With the assumption that ARM is linearly related to the strength of the bottom circulation, we have obtained a proxy record for relative changes in the strength of the NADW, using a stack of the normalized ARM records, representative of the entire area from which the cores originate. A tentative record of the absolute changes of NADW was then obtained by adjusting the normalized ARM stack to a schematic profile suggested by previous studies in which the record has unit value down to 11 kyr, then decreases linearly to reach the value of 0.66 at 18 kyr. The resulting record documents a reduction of the circulation to about 40% of the modern value during Heinrich events, consistent, within present uncertainties, with the few available data obtained from cores located along the NADW path and with some model reconstructions. The record also suggest that the NADW was comparable to today during interstadials, which is consistent with published d13C data. Holocene data from the Gardar Drift showing a progressive decrease of the bottom current strength during the Holocene period will be also presented and discussed.

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Bedform Evolution on Eirik Drift: HiRes MCS Evidence of North Atlantic Deep Water Variability Along the SW Greenland Margin

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The poleward flow of surface water in the North Atlantic transports heat to the northern North Atlantic, and leads to the export of deep, cold water towards the equator. While basinwide thermohaline circulation is ultimately controlled by global climate, bottom topography and Coriolis forces intensify or dissipate these currents on a regional scale. This gives rise to spatial and temporal variations in the distribution and intensity of ocean currents and significant variations in the rate and character of deep sea sedimentation which, if understood, can provide valuable insight into the history of this ocean circulation spanning millions of years. We report on results of a seismic survey of buried bedforms within a larger study of current-controlled sedimentation in the North Atlantic conducted aboard cruise 166-14 of the *R/V Knorr*. A series of at least six quasi-sinusoidal subbottom sediment buildups (averaging 1750 m long and 150 m high) are identified in a 15 x 35 km grid of high-resolution multichannel seismic reflection profiles in roughly 2500 m of water on the northwestern flank of Eirik Drift (150 km south of the southern tip of Greenland). Thickness changes within each buildup suggest that sedimentation rates varied by a factor of 3 over a distance of 3 km. In contrast to fields of sediment waves growing in unison across a large tract of seafloor, these features accumulated one at a time, each moving 1 to 3 km upslope of the one it replaced. We suggest these were the result of sediment fallout from the upslope edge of North Atlantic Deep Water (NADW) sweeping northwest along the Labrador Sea margin of Greenland. Long-standing intervals of sustained current-bedform interaction developed single sediment buildups, but periods of greater volume of NADW would overstep the existing bedform, and the depocenter would rapidly move upslope. The presence of a 40 to 60 m drape of sediment over the survey area chronicles a substantially different flow regime compared to that which formed the bedforms. Documenting the onset and termination of this flow pattern by drilling will provide a means to interpret fundamental modes and variations of the circulation of deep currents in the North Atlantic over the past several million years. These sequentially-formed, thick lenses of high-deposition-rate sediments provide an ideal location for collecting high resolution proxy data of climate change and its impact on ocean circulation.

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Quantification of the Changing Sedimentary Architecture of a Continental Margin Sediment Drift as a Result of the Mid Pleistocene Climate Transition (ODP Leg 194)

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The Marion Plateau (NE Australia margin) possibly provides an ideal setting to study continental margin paleoceanographic history. It is not significantly current scoured and is located at upper continental slope depths, freeing it from the influence of large sediment gravity flows. Atop the plateau, a hemipelagic sediment drift is perched and was drilled on Ocean Drilling Program Leg 194 (Site 1198). The lithologic record and other shipboard-acquired data sets (physical properties, downhole logging), as well as the site-survey seismic data all suggest that cyclicity dominates this sedimentary section, which encompasses the Mid Pleistocene Climate Transition (MPCT). The MPCT contains the transition from a 41 k.y. cycle (ice volume and temperature) to 100 k.y. cycle dominated world. An identical suite of quantitative analyses was conducted on two Pleistocene intervals of Hole 1198A. One interval was deposited prior to the MPCT, while the other was deposited subsequently. Variations in mass accumulation rates (MARs) of each component do not clearly correspond to oxygen isotope excursions, suggesting that processes other than eustatic sea level fluctuations affect sedimentation in this complex environment. Nonetheless, several relationships have been identified. In the 100 k.y. world, terrigenous MARs are highest during sea level trangression, while aragonite, high Mg calcite, and low Mg calcite MARs are highest during sea level highstand. Preliminary results suggest that the highest carbonate MARs occurred during sea level regression or low stand in the 41 k.y. world. Additionally, examination of shipboard color reflectance data indicates suborbital lithologic variability is present and increases during glacial episodes.

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Provenance and Age of Sedimentary Particles Accumulating on the Bermuda Rise

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