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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.

### PP51C-0936 0830h POSTER

### 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.

### PP51C-0937 0830h POSTER

### 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.

### PP51C-0938 0830h POSTER

### Provenance and Age of Sedimentary Particles Accumulating on the Bermuda Rise

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The Bermuda Rise has been a site of sustained paleoceanographic and sedimentological investigation due to its strategic location and the high sediment accumulation rates that characterize this drift deposit. Recently, we have established that fine-grained sediments which serve as the diluent entrain allochthonous organic matter and influence corresponding molecular proxy signatures. In an attempt to further understand the advective processes that lead to spatial and temporal offsets between molecular and microfossil records at this site, as well as their links to past climate variations, we examined in detail down-core molecular and bulk properties spanning the last glacial maximum to the present. We observe strong correspondence between age offsets and sedimentology, and these in turn are linked to known climate perturbations. Possible causes for these relationships are discussed in terms of sources and modes of delivery of fine-grained sediments to the Bermuda Rise, as well as implications for the application of multi-proxy records.

### PP51C-0939 0830h POSTER

## Beringian Sea Level and Marine Climate History: Investigations into Regional & Global Impacts

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Glacial-interglacial cycles have imposed on the Bering Strait region some of the most radical changes in paleogeography documented in the Northern Hemisphere. Only 20,000 years ago during the last glaciation when sea level was about 130 m below present, the Bering Land Bridge separated the deeper Bering Sea and North Pacific Ocean from the Arctic Ocean by more than 1000 kilometers of herb-dominated tundra. Missing from existing literature are studies of how the Bering and Chukchi seas participate in controlling Beringian and global climate. Fluctuations in sea level caused the rapid migration of shorelines changing gradients in temperature and moisture with considerable downwind effects based on regional terrestrial records. The greatest east-west heterogeneity across Beringia occurred during warm (flooded) or warming (partially flooded) periods of late Pleistocene summers, when the cool maritime influence bifurcated the relatively warm continental interior. Oceanographic changes were also radically influenced by changes in sea level across the Bering Straits that regulated the northward flow of Pacific waters into the Arctic Ocean and North Atlantic. Especially important in our collective research is an understanding of how the flow of water through the Bering Strait may have influenced documented changes in thermohaline circulation in the North Atlantic (e.g., Younger Dryas) by changing the flux of fresher Pacific water into the Arctic Ocean. On board the USCGC Healy in the summer of 2002, we collected from -2800m to -50 m water depth, a set of nearly 100 different marine cores measuring over 500 meters in total length. Some are up to 21 meters long, from -1300 m water depth, the longest cores taken in this part of the western Arctic. Specific cores appear to hold a high-resolution record of the deglacial and Holocene history in this region and a few of the cores likely contain sediments back to nearly 140,000 yrs BP. We also learned that the stratigraphic architecture of channel cut and fill across the Chukchi shelf is very complex with an outstanding record of repeated phases of sea level rise and fall. This complexity and related paleoceanographic implications will likely drive the direction of our future research. A series of related posters in this session highlight initial results from this ongoing project.

### PP51C-0940 0830h POSTER

## Climate Controlled Changes in Deep Ocean Flow: Examples From the Riiser Larsen Sea (Antarctica) and the Fram Strait (Arctic Ocean)

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Sediment cores from the northeastern Fram Strait (Arctic Ocean) and the western Riiser Larsen Sea (Antarctica) were investigated to reconstruct climate forced fluctuations of bottom currents. In terms of global water-mass circulation, the Arct ic Ocean plays a rather passive role with only very limited deep-water exchange through the Fram Strait. The cores investigated here are primarily influenced by the Yermak Slope Current (YSC), a water mass that is mainly composed of NSDW. Since NSDW is fo rmed in the Greenland Sea as a result of deep-water production, it is suggested that fluctuations in the speed of the YSC are linked to fluctuations in thermohaline overturn which in turn is strongly related to climate development. It turns out that cold events s uch as the Younger Dryas (12.7-11.5 kaBP) were periods of lower bottom-current speed whereas warmer periods suggest increased bottom-current activity. Holocene climate phases such as the cold "8,200 year Event" left clear traces in the record. In the Ri iser Larsen Sea that forms the easternmost part of the Weddell Gyre, deep-current controls are different. A large system of channels on the continental slope suggests that the channels are active pathways of either dense shelf waters or turbidity current s. Long sediment cores recovered from levees that flank the channels reveal carbonate-rich sediments with few IRD during the interglacials and carbonate-depleted sediments during the glacials in the sand f raction. High resolution granulometric data suggest that the channels were more active during interglacials than during glacials. In glacial climates surface-water bio-production in the RLS was low. Presumably a quasi-permanent ice cover prevailed that al so prevented the deposition of IRD. During interglacials conditions were like those of today with a very large sea-ice cover in winter and open water conditions in the austral summer. It can be assumed that dense water formation on the upper continental slope is reduced during the glacials and somewhat higher during interglacials.

### PP51C-0941 0830h POSTER

## Changes in Benthic Foraminiferal Assemblages and Total Organic Carbon in Sediments at ODP Site 1058, Blake Outer Ridge During Marine Isotope Stages 11-12

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Marine isotope stages 11-12 (approximately 480 to 362 ka) comprise the most extreme climatic and hydrologic changes of the Late Pleistocene. During MIS 12, sea level was about 140m below present, and the production of NADW was severely reduced. In contrast, MIS 11 was probably the warmest and longest interglacial of the last 500 kyrs, characterized by sea level possibly 20m higher than today and a maximum in NADW production. In the western North Atlantic, the switch from one mode of circulation to the other appears to have been paralleled by a 3-4$^{\circ}$C change in bottom-water temperatures. We have examined benthic foraminiferal assemblages and organic carbon content in sediments from ODP Site 1058 (Blake Outer Ridge, 3000m water depth), spanning the MIS 11-12 time interval. Stable isotope data indicate that during MIS 11 Site 1058 was bathed by NADW, and by a water mass of southern origin during MIS 12. The organic carbon record is characterized by elevated values in the early part of MIS 11 and at the end of MIS 11. Benthic foraminiferal assemblages in these intervals show increased abundances of Bulimina, Uvigerina and Melonis, taxa usually indicative of stressed environments. The overall benthic foraminiferal record shows changes in relative abundances of the different taxa that are not related simply to glacial-interglacial changes. Instead, a more complex variability is evident, driven most probably by the interplay of different environmental factors, including changes in current strength and food supply, downslope transport, and lateral advection of material reworked from shallower areas.

### PP51C-0942 0830h POSTER

## Neodymium Isotopic Composition of Terrigeneous Sediment as a Monitor of Bottom- and Surface Currents: an Example From the Fram Strait

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A high resolution sediment core from the northeastern Fram Strait (Arctic Ocean) was investigated to reconstruct fluctuations of bottom- and surface currents related to climate change during the Late Quaternary. Neodymium isotopic compositions were determined for four different grain size fractions (<2 $\mu$m, 2-10 $\mu$m, 10-63 $\mu$m, >63 $\mu$m) of 17 samples covering the last 130 ka. These grain size fractions are assumed to monitor different transport mechanisms such as current transport and ice rafting. The neodymium isotopic composition of terrigeneous sediment is not affected by grain size variations or uptake of dissolved neodymium from sea water, and therefore reflects the isotopic composition of the source rock. This can be used to trace sediment pathways. The neodymium isotopic data indicate that sediments deposited at the core location are a mixture of material derived mainly from Spitsbergen and the Lena-, Ob-, and Yenisei Rivers (Siberia). Variations of the isotopic compositions with time reveal variable contibutions of the source areas as a result of changed oceanographic conditions. Only relatively small isotopic variations are found during MIS 3, 4, and 5, whereas major changes of the oceanographic conditions are indicated during the LGM and the early Holocene.

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# PP51D MCC: 3004 Friday 1020h

## Global, Hemispheric, and Regional Climate Signals During the Last Millennium II *(joint with A, H, C, GC)*

***Presiding:*** **C M Ammann,** National Center for Atmospheric Research**; P Naveau,** University of Colorado

### PP51D-01 1020h INVITED

## The 1810s as an ideal test of climate model skill in predictability

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One of the goals of paleo-research is to provide better constraints on our ability to understand the causes and consequences of climate change. The 1810s may represent an ideal case for such studies. It was the coldest decade of the last 300 years and climate models suggest that on the hemispheric scale the temperature changes were driven by a linear response to two very large eruptions in 1809 (Unknown) and 1815 (Tambora). Because the large scale can be simulated so well it is of interest to examine the regional response to such