spores, alkenone abundance, pigments, Ba), surface water nutrient availability (organic nitrogen isotopes), nutrient source (diatom species abundance), land vegetation type (n-alkane abundance and carbon isotopes) and surface water pCO2 (alkenone and calcite carbon isotopes). Three conclusions have been drawn from this unique data set: 1. Surface water productivity is not associated directly with increased glacial upwelling. Peaks in productivity occur during early glaciation, and full glacial productivity is lower than the interglacial levels. It is suggested that this is caused by the antagonistic effects of upwelling intensity and nutrient supply from the Southern Ocean. 2. Surface water pCO2 is relatively insensitive to changes in upwelling and productivity, suggesting the Benguela current is continuous sink of atmospheric carbon dioxide throughout a glacial-interglacial cycle. 3. South West Africa vegetation co-varies with precession and is independent of glacial-interglacial cycles. We suggest that this is due to the strong influence of precession on the southward penetration of the ITCZ and thus moisture availability.

PP52C MCC: 3004 Friday 1600h

Effects of Sediment Dynamics on Marine Paleorecords II *(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

PP52C-01 1600h INVITED

Temporal and spatial changes in sedimentation along the margins of the North Atlantic

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The seafloor along both the eastern and western margins of the North Atlantic is dominated by features produced during times of lowered sealevel and modified during the Holocene. The most striking features are glacial outwash fans, giant landslides and canyoned margins with associated filled basins. The landslides occur in areas of high accumulation and can relocate hundreds to thousands of cubic kilometres of sediment in single erosive events. Off NW Africa up to 20% of sediment may be remobilized by landslides, with each event leaving a hiatus. Each of these hiatuses extends over an average area of 4800 km2 and represents removal of sediment layers several tens of meters thick and of several hundred thousand years duration. Evidence will be presented to show that the rate of redeposition is related to climate/sealevel change in some basins.

PP52C-02 1615h INVITED

Radiocarbon ages of marine biomarkers and co-occurring foraminifera: evidence for differential particle transport on continental margins

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Continental margins, with their typically high accumulation rates, are prime locations for high temporal resolution studies of past climate. One key assumption is that the sediments in these locations reflect past conditions in overlying ocean waters, and that co-occurring sediment constituents are coeval. We will present evidence based on radiocarbon dating of various sediment constituents from several continental margin sites that these assumptions are often not valid due to current-induced sorting of fine-grained and coarse-grained sediments. Marine organic biomarkers, which are often also used as proxies for past ocean conditions, can be up to several thousand years older than co-occurring foraminifera, which in turn provide age control in most paleoceanographic studies. The age offsets between the organic compounds and the coarse-grained foraminifera appear to be site-dependent and, at the same time, relatively constant over time at a given site. The offsets seem to be caused by a combination of resuspension, often caused by bottom currents, and preferential preservation of protected and refractory compounds. This observation has important implications for our understanding of sedimentary records, the paleoclimatic signals preserved in them, and organic carbon burial.

PP52C-03 1630h INVITED

Paleoclimate Variability Inferred From Size Distributions of Deep-Sea Sediments: A Comparison of Different Methods

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One of the outstanding problems of paleoclimate reconstruction from physico-chemical properties of terrigenous deep-sea sediments stems from the fact that most basin fills are mixtures of sediment populations derived from different sources and transported to the site of deposition by different mechanisms. Conventional approaches to paleoclimate reconstruction from deep-sea sediments do not distinguish between provenance and dispersal-related variations, and therefore often fail to recognize the true significance of variations in sediment properties.

Many attempts to extract paleo-environmental information from deep-sea sediments have focused on grain size, more specifically on the use of variations in univariate summary statistics of grain-size distributions (GSDs). This approach to characterization is unlikely to be successful because most deep-sea sediments are mixtures of different sediment types, as a consequence of time-averaging effect related to bioturbation and low accumulation rates. We present a conceptual model of spatio-temporal grain-size variation in terms of dynamic populations (DPs). Each DP results from a characteristic combination of production and transport mechanisms that corresponds to a distinct subpopulation in the data analyzed. The mathematical-statistical equivalent of the conceptual model may be solved by means of the end-member-modeling algorithm EMMA. The modeling results of a high- and low-latitude ocean basin are shown to illustrate the common degree of complexity of deep-sea grain-size records. The distinction between DPs related to selective dispersal of detritus from a single source, and DPs related to mixing of detritus from different sources is shown to be essential for successful paleoclimate interpretation. The case study of the North Atlantic is discussed in more detail to illustrate the latter.

Variability in iceberg discharge and deep-ocean circulation in the North Atlantic during the last glacial period is inferred from the GSD and trace elemental composition of terrigenous sediments on Reykjanes Ridge. End-member modeling of the GSDs is used to unmix the signals of varying bottom-current speed and iceberg discharge. The GSD within the silt fraction appears to be influenced by both factors. We show that reconstructions of variations in bottom-current speed based on the raw grain-size data are opposite to inferences from the unmixed record. The discrepancy between the interpretations obtained by the conventional approach and EMMA highlights the danger of interpreting grain-size variation in terms of a single controlling factor without knowledge of the sources and dispersal mechanisms of the sediments.

PP52C-04 1645h

Comparisons of Radiocarbon Ages of Alkenones With Planktonic Foraminifera and Total Organic Carbon in Oceanic Surface Sediments

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To further evaluate the fidelity of alkenones as molecular stratigraphic markers, we have measured radiocarbon ages of alkenones as well as coexisting planktonic foraminifera and total organic carbon (TOC) in the surface sediments collected from a range of depositional settings (Gulf of Mexico, Arabian Sea, Indian Ocean, NE Pacific margin, NW Atlantic margin, Bermuda Rise, south Atlantic, etc.). Radiocarbon ages of alkenones are equivalent with those of planktonic foraminifera in sediments from the Arabian Sea, and Indian Ocean. However, at the other sites investigated alkenones are significantly older than those of the corresponding planktonic foraminifera. We ascribe these age differences to sedimentary processes influencing coarse-grained foraminifera and alkenones associated with fine-grained particles. The latter are more susceptible to resuspension, advection and redeposition by oceanic currents. Alkenone ages are, on average, younger than TOC ages at the study locations. The age difference appears to be greatest in coastal sediments, which could be explained by the contribution of old terrigenous organic matter.

PP52C-05 1700h

On the potential sedimentological origin of downcore variations of bulk sedimentary δ^{15}N

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ODP site 1144 is located less than ten kilometers from core site SONNE 17940 on the continental slope of the northern South China Sea (SCS). Despite their proximity, the sedimentary nitrogen isotope records are distinctly different at both sites, with glacial-interglacial variations of ca. 1 permil at site 17940, and up to 4 permil at site ODP1144. Here we explore the potential origin of these differences in the δ^{15}N records, focussing on three aspects of the variable sedimentology at both sites on glacial-interglacial timescales. 1) Based on major element contents (Si/Al and Zr/Al ratios), glacial sediments at site ODP1144 are significantly finer-grained than at site 17940. As evident from a suite of samples from the SCS, finer-grained sediments are associated with higher δ^{15}N values, thus contributing to the offset in the δ^{15}N records between both sites. 2) Sediments at site ODP1144 contain lower amounts of potassium, and, by inference, ammonium, which substitutes for potassium in K-bearing minerals. Given the low δ^{15}N of ammonium fixed in clay minerals this difference in mineralogy further contributes to lower glacial δ^{15}N values at site 17940 compared to ODP1144. 3) We will also be presenting radiocarbon dates of total organic carbon (TOC), in an attempt to elucidate the different origin and sedimentological history of TOC at both sites. Sediments found at both ODP1144 and 17940 originate from an area affected by eustatic sediment redistribution, gravity- and fluvially-driven sediment mobilization from the broad northern SCS continental shelf. Rare earth element analyses (Shao et al., 2001) indicate that a significant part of the detrital material at ODP1144 originates from Taiwan, transported through the Penghu channel to the coring site in the northern SCS, and is not representative of the vertical particle flux to the sea floor. Sediment redistribution therefore potentially affects downcore variations in bulk sedimentary δ^{15}N, and cautions the interpretation of a single downcore record with respect to local/regional δ^{15}N variations in the past, and indeed with respect to other sedimentary proxies.

PP52C-06 1715h

A Sub-Decadal Continental Margin Record of Little Ice Age-to-Modern Climate-Induced Changes in Sediment Delivery and Transport in the Gulf of Alaska

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The Gulf of Alaska (GOA) margin is one of the few locations on Earth where orogenic processes, glacial climate, and continental margin sedimentation can be studied and quantitatively modeled in unison. Climatic changes control glacial dynamics, erosion, and sediment/meltwater fluxes to the ocean, and GOA margin strata appear to preserve a strong record of terrestrial climate (i.e., temperature and precipitation) as well as paleoceanographic signals on seasonal to tectonic time scales. In collaboration with the GOA-NEP GLOBEC program, gravity cores were collected at key sampling sites under the influence of the climatically sensitive Alaska Coastal Current (ACC). Chronologies for the past 400-y were established using Pb-210/Cs-137, coupled with paleo-and-environmental magnetism analyzed from u-channel samples at one-cm intervals. The sedimentary paleomagnetic record is correlated to the Sitka geomagnetic observatory record for the last century and extended using the Jackson et al. 400-yr global field model. Carbon and nitrogen stable isotopes, C/N ratios and opal concentrations were analyzed to determine OM source and paleoproductivity. Proximal to large sediment sources, high (>1 cm/y) sediment accumulation rates vary over decadal times scales and appear to be directly tied to the amount of coastal precipitation and the corresponding strength of the ACC. Distal shelf cores have sedimentation rates that vary over longer time scales and are 2-3 x higher during glacial melting from LIA maxima. High-resolution grain size analyses and core logging of bulk density and environmental magnetic parameters including magnetic susceptibility vary at LIA, pentadecadal, and decadal time scales and are strongly correlated with variability in regional precipitation as seen in the nearby Mt. Logan ice core record. Preliminary results suggest that the amount of freshwater discharge and corresponding strength of the ACC was substantially higher during the LIA.

URL: http://web.clas.ufl.edu/users/jaeger/goapaleo.htm

PP52C-07 1730h

Normalization for Sediment Redistribution Yields Entirely Different Biogenic Fluxes for the LGM to Present in the Eastern Equatorial Pacific.

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The Eastern Equatorial Pacific (EEP) plays a large role in global ocean biological productivity and the exchange of carbon dioxide between the oceans and atmosphere. Because of this, much effort has been directed to reconstructing productivity and biogenic fluxes on the glacial/interglacial timescale in this region. These reconstructions are based on both sediment accumulation rate and ratio (relative abundances of microfossil taxa, element conc. ratios) methods. Traditionally, the accumulation rate results have been used and interpreted to indicate increased biogenic fluxes during glacials. However, the ratio methods have indicated the reverse. We proposed that this conflict of methodologies was the result of processes at the seabed biasing the accumulation rate data. We have tested this hypothesis by 230-thorium normalization of sediment accumulation rates in 4 cores in the EEP. This normalization shows that sediment ponding (focusing) has resulted in excess accumulation (compared to water column flux) by a factor between 2 to 8 for the LGM in the cores we examined. This increased focusing during the glacial has been observed by others previously. We use a novel transfer function to reconstruct calcite fluxes using the normalized data and show that the resulting calcite flux profiles match well with independent ratio based organic carbon flux estimators; and that both fluxes were lower at the LGM compared to the Present. Thus, normalization for sediment transport resolves the discrepancy between methodologies, and shows that biogenic fluxes were opposite to traditional interpretations for the LGM to the Present.

PP52C-08 1745h

Influence of Multiple Sources and Processes on Continental Slope Sedimentation: New Climate Records off Martha's Vineyard (0-12 ka)

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Physical oceanographic conditions of the New England margin are among the most studied in the Atlantic. Deployment of a continuous profiler off Martha's Vineyard in 2001 (Station W) and planned augmentation with additional profilers, fixed moorings, and regular hydrographic cruises in 2004 will increase our knowledge of this region to an unprecedented level of detail. Paleoceanography of the region on the other hand is poorly characterized; few cores exist because the region has been considered to be strongly affected by mass sediment transport phenomena. We piggybacked a cruise to Station W in 2002 and collected 3.5 kHz echosounder profiles and two cores at 1600 m and 3100 m water depth. Echosounder data show that contourite deposition is common on the slope to a depth of at least 4000 m and that continuous deposition of contourites is likely to extend over several glacial cycles. Preliminary results show that sedimentation rates are between 10 and 30 cm/kyr. In the deeper core, we recovered a relatively thick brick-red layer, probably corresponding to the Younger Dryas, containing ice-rafted material originating from the Permo-Carboniferous red sandstones in the St. Lawrence estuary. Alkenone-based temperature records for the two cores show similar trends, but significant differences in SST might reflect local conditions in the slope waters. Oxygen isotopic composition of the planktonic foram N. pachyderma (right) measured at a coarse resolution show several maxima and minima. Detrital sand, mostly quartz, is persistently present in cores, with higher percentages in the shallower core, suggesting that transfer from the shelf should be considered in addition to ice-rafting. Indicators of current intensity/eddy kinetic energy, such as sortable silt and silt clay ratio, along with sand content, show significant sub-orbital changes.