PP42A-0493 1330h POSTER

Nutrient Storage and Release in Sediments Drives Miocene Mediterranean Sapropel Formation

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Cyclic sedimentation observed throughout the Mediterranean during the late Miocene has been related to precessional forcing of ocean stratification. Individual couplets, typically 2 meter thick sequences of sapropels and marls, can be reliably traced from western Spain to Crete, and were formed in restricted marginal basins. Micropaleontological evidence indicates paradoxically that the organic carbon-rich sapropels were formed under low productivity conditions marked by surface water stratification and deep anoxia whereas the marls were formed under higher productivity conditions marked by upwelling, with highest productivity strata in the middle of the marls.

Here we present geochemical evidence, mainly from detailed phosphorus determinations and paleo-redox proxies, from several of these cycles that, coupled micropaleontological and sedimentological observations, point to a sediment-nutrient feedback as a key factor controlling observed productivity variations. During stratification, anoxic conditions in these basins cause the release of the limiting nutrient phosphorus from reducible phases in the sediments, and basin stagnation causes the buildup of these nutrients in the deep basin. Driven by precession-scale wind stress changes, subsequent upwelling of these phosphorus-laden waters drives high productivity conditions during marl formation, peaking in diatom mat formation. Exhaustion of the stored phosphorus results in lower productivity conditions and the return to marls, which grade back in to sapropels due to lower wind stresses and stagnation.

PP42A-0494 1330h POSTER

Paleoclimatic and Paleoceanographic Significance of the Cretaceous Black Shales: a Parallelism with the Neogene Mediterranean Sapropel

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High-resolution and multidisciplinary study was performed of the Cenomanian Antruiles section cropping out in the northeastern Dolomites, northern Italy, in order to characterize the cyclic alternations of organic carbon-rich and organic carbon-poor layers and to investigate their possible origin. This succession represents a spectacular example of pelagic cyclic sedimentation and consists of a varicolored sequence of bioturbated marly limestone and dark marls (black shales). Calcareous nannofossils, planktic Foraminifers, Calcium carbonate content and Oxygen and Carbon Stable Isotopes analyses were investigated in 69 samples from a 5 meters thick section consisting of 11 marlstone-limestone couplets. A high-resolution sampling (centimetric) has been made in order to point out possible rhythmic fluctuations in the calcareous plankton abundance and composition. The quantitative data suggest that these couplets originate during period of relatively low productivity, with stable water column condition favouring the occurrence and diversification of oligomesotrophic groups. In particular the deposition of marls correspond to time of relatively low productivity in comparison with the limestone. The deposition of marls occurred in conditions of stratified water column, related to a sluggish current circulation. This circulation induces dysaerobic/anaerobic conditions at the sea bottom, locally favouring the organic matter preservation in the marls. Our contribution aims to point analogies and differences between the Cretaceous black shales and the Neogene sapropels. Our preliminary data suggest that both mark a decrease in productivity. Furthermore, a relationship between the Cretaceous and Neogene species, although taxonomically different, is inferred using, when possible, the functional morphology criteria and on the basis of similar behaviour to the same paleoenvironmental chemical-physical parameters.

PP42A-0495 1330h POSTER

The mid-Cenomanian Event: the Prelude to the OAE 2

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Detailed bio- lithostratigraphic investigations of the Cenomanian pelagic limestones of the Scaglia Bianca Formation in the Umbria-Marche Basin, show that the Bonarelli Level, which is the regional sedimentary expression of the OAE 2, represents the climax of a 2 myr-long cycle of black shale deposition starting in the middle Cenomanian within the planktic foraminiferal Rotalipora cushmani zone (Coccioni et al., 1992). This long-term cycle starts with a prominent short-term event, here named mid-Cenomanian Event (MCE), which is associated with several changes in the biotic and abiotic records. In particular, a comparison of the available chemo- litho-, and biostratigraphic data from the Umbria-Marche Basin, allows to recognise that the MCE is defined by:

- a 0.7 positive shift in the carbon isotope values (Jenkins et al., 1994; Stoll & Schrag, 2000); - a reorganisation of planktic foraminiferal assemblages (Premoli Silva & Sliter, 1994, 1999); - a major change in benthic foraminifera (Coccioni et al. 1995); - a major turnover in the radiolarian assemblages (Erbacher et al., 1996).

Moreover, the MCE is slightly (400 kyr) preceeded by a short-term 0.5 negative excursion in the oxygen isotope record (Stoll & Schrag, 2000). The above mentioned changes in carbon and oxygen isotope values can be confidently correlated over different basins and oceans (Jenkins et al., 1994; Stoll & Schrag, 2000) and seems to occur in correspondence of a major sea level fall following the chronostratigraphy provided by Hardenbol et al. (1998). These lines of evidence concur to define the MCE as an outstanding event associated with large scale changes in the oceanic structure and paleoclimate. The MCE and the following cyclical deposition of organic-rich beds may serve as a good casestudy to better understand differences and similarities between Mesozoic black shales and Cenozoic sapropels, and related paleoceanographic changes controlled by orbital climate cycles.

References

Coccioni, R., Galeotti, S., and Ragni, D., 1992, Litho- and biostratigraphy of the Scaglia Bianca Formation (Late Albian-Late Cenomanian) in the Umbria-Marche Apennines (Italy): 6th Annual Meeting of IGCP Project 262 (Tethyan Cretaceous platform correlation) - "Cretaceous Facies in Orogenic Belts", Athens, 22-26 May 1992, p. 4. Coccioni, R., Galeotti, S., and Gravili, M., 1995, Latest Albian-early Turonian deepwater agglutinated foraminifera in the Bottaccione section (Gubbio, Italy) - Biostratigraphic and palaeoecology implications: Revista Espaola de Paleontologia, N?. Homenaje Al Dr. Guillermo Colom, p. 135-152. Erbacher, J., Thurow, J., and Little, R., 1996, Evolution patterns of radiolaria and organic matter variation: A new approach to identify sea-level changes in mid-Cretaceous pelagic environments: Geology, v. 24, p. 499-502. Jenkyns, H.C., Gale, A.S., and Corfield, R.M., 1994, Carbon and oxygen isotope stratigraphy of the English Chalk and Italian Scaglia and its paleoclimatic significance: Geological Magazine, v. 131, p. 1-34. Premoli Silva, I., and Sliter, W.V., 1994, Cretaceous planktonic foraminiferal biostratigraphy and evolutionary trends from the Bottaccione section, Gubbio, Italy: Palaeontographia Italica, v. 82, p. 1-89. Premoli Silva, I., and Sliter, W.V., 1994, Cretaceous paleoceanography: Evidence from planktonic foraminiferal evolution: Geological Society of America Special Paper 332, p. 301-328. Stoll, H.M., and Schrag, D.P., 2000, High-resolution stable isotope records from the Upper Cretaceous rocks of Italy and Spain: Glacial episodes in a greenhouse planet?: Geological Society of America Bulletin, v. 112, p. 308-319.

PP42B MC: Hall D Thursday 1330h

General Paleoceanography and Paleoclimatology Contributions IV

(joint with OS, GC)

Presiding: **H J Spero,** Department of Geology, University of California**; E E Martin,** University of Florida

PP42B-0496 1330h POSTER

A New Biomarker Proxy for Palaeo-pCO2 Reconstruction in Ancient Sediments

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The carbon isotopic composition of marine organic matter has commonly been used in chemostratigraphy or as a proxy for ancient pCO2 levels. Both of these goals require that the source of organic matter be well defined, and in the case of palaeo-pCO2 investigations, the organic matter must be derived ultimately from aquatic photoautotrophs. However, additional sources, including terrestrial biomass, heterotrophs, or bacteria, can also contribute to total organic carbon (TOC). In the past decade, numerous workers have attempted to refine organic carbon isotope records using the isotopic composition of individual compounds (biomarkers) rather than the TOC. The appeal of this approach is that by examining specific biomarkers, a signal diagnostic for photoautotrophic organisms can be obtained.

For compound-specific isotope analyses to be most effective, the compounds analysed must have a relatively specific source. Among the most commonly used biomarkers in palaeo-pCO2 investigations are alkenones, long-chain ketones derived exclusively from certain species of haptophyte algae. However, alkenones are absent in rocks older than the Jurassic and either absent or present in low abundances in rocks older than the Miocene. Thus, in older rocks, other biomarkers, including steranes (derived from eukaryotic sterols), phytane (presumably derived from chlorophyll), and n-alkanes (derived from algal macromolecules), are used. Unfortunately, these compounds can have alternative sources and become less reliable as isotopic proxies for photoautotrophs with increasing thermal maturity and complexity of the hydrocarbon distribution.

Here we propose the use of a maleimides (1H-pyrrole-2,5-diones) as a new biomarker class for evaluating past changes in photoautotroph carbon isotopic compositions. Maleimides have three key advantages over other biomarkers in ancient rocks. First, they are degradation products of chlorophyll and have no known alternative origins in marine sediments. Second, because of their unique structure, they can be readily isolated from other organic components facilitating the determination of accurate carbon isotope ratios. Finally, the pyrrole structure is relatively stable insuring that maleimides survive even in thermally mature rocks. We have applied the analysis of maleimides to investigations of sediments from the Kupferschiefer (Permian), Vena del Gesso (Messinian) and Livello Bonarelli (Cenomanian-Turonian boundary) formations. In all three cases, the carbon isotopic compositions of selected maleimides exhibit shifts predicted by either carbonate or other biomarker carbon isotope profiles.

PP42B-0497 1330h POSTER

Palaeoclimate Events as Recorded in the Seismostratigraphy of the Cape Basin

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The Benguela Current System represents one of the largest upwelling regions world wide. Due to its high sedimentation rates it represents an excellent climate

archive and offers the possibility to document modifications within the circulation system as well as the changing terrigenous component in the southern Cape Basin.

As part of ODP Leg 175, three sites (Site 1085, 1086, 1087) were drilled in the southern part of the Cape Basin. Significant events as incursions of warm or cold waters (from Indian Ocean or Antarctica respectively), climate changes and slumpings are recorded in the deposited material. The sedimentary properties are expected to be reflected in the signal structure of seismic data from this area. Aim is the extrapolation of informations from the sites spatially by associating the results via synthetic seismograms to the seismic profiles.

In this contribution we represent a seismostratigraphy of the southern Cape Basin in view of three selected significant events: The first topic is the considerable increase in upwelling within the Benguela Current System (BCS) in late Miocene (about 5.7 Ma), reflected in the seismic profiles by a change in reflection pattern from weak signals of continous layers to a chaotic transparent style. The layers show an increase in thickness towards the shelf and are disturbed by slide scarps. The position of the scarps show a landwards shift with increasing age. The second point is the onset of glaciation of northern hemisphere about 3.2 Ma. In the seismic sections it accords to a change of reflection pattern from a more chaotic and transparent style to continous reflectors with strong amplitudes running parallel to the seafloor. Additionally, the strongest of them corresponds to the abrupt cooling in late Pliocene (1.9-2.1 Ma) which is accompanied by an intensification of upwelling and increase in productivity. The time range accords also to the transition of lithostratigraphic unit IB to IA. A third item is the enhanced input of terrigenous matter in late Miocene- early Pliocene which can be traced and mapped in the seismic reflections.

PP42B-0498 1330h POSTER

Low late Pliocene sedimentary δ^{15}N from a 10 site survey

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Comparison of sediment samples from 10 ODP sites in the Pacific, Atlantic and Indian Oceans reveals a widespread change in the δ^{15}N of sedimentary organic matter between late Pliocene and Holocene times. Late Pliocene δ^{15}N values from the Pacific, Indian and southwestern Atlantic are 2.3 $^{o}/_{oo}$lower than their modern counterparts while sites in the north and tropical Atlantic show no difference. These results pose interesting questions for the paleoceanographic community and for extending the use of δ^{15}N as a paleoceanographic proxy back in time. The lower late Pliocene values may reflect reduced rates of denitrification and a lower δ^{15}N of nitrate in the ocean. Alternatively, the modern balance between nitrogen fixation and denitrification, inputs and outputs of nitrate, may not have existed during this period of warmer-than-modern seasurface temperatures. Lesser rates of denitrification and/or enhanced rates of fixation, the main sink and source, respectively, would generate higher nitrate concentrations, increasing export production and the draw down of atmospheric CO_2. The lower δ^{15}N values may therefore indicate a fundamental change in the marine N cycle that is of interest to paleoclimate studies It is also possible that these low δ^{15}N values may reflect a post-burial diagenetic change. High resolution records from the late Pliocene show systematic relations between δ^{15}N and other paleoceanographic parameters, suggesting that the short term variability is real. If there is a slow, continuous decrease in δ^{15}N values due to diagenesis then absolute values of δ^{15}N from bulk sedimentary organic matter can not be evaluated with respect to modern baseline values.

PP42B-0499 1330h POSTER

Structure of the Last Glacial Maximum in New Zealand -Terrestrial and Marine Evidence from Southern mid-latitudes

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The global structure of the Last Glacial Maximum (LGM) and its termination is a challenging problem of modern paleoclimatology. The current scenarios about the timing of the peak of the last glaciation as well as the subsequent warming remain controversial. We attempt to improve the understanding of this topic by reconstructing continental paleoglaciations and their decay phase. We date moraines to obtain information about the timing and amplitude of the glacial maxima and investigate marine sediment cores for the meltwater pulse connected to the termination of the glacial event. New Zealand represents a highly interesting site for this approach due to its geographic position and its outstanding glacial geology. As a small islands in mid Southern latitudes close to Antarctica, glacial records from New Zealands Southern Alps can be directly crosschecked with other mid-latitude sites in both Hemispheres, as well as compared to the glacial record and the ice-core data from adjacent Antarctica. Further, the glacial record of the Southern Alps is uniquely well preserved.

The center of the presented study is the investigation of the moraine suite at Lake Pukaki, on the dry Eastern side of the Southern Alps, which are presumbably deposited by glacial advances during the LGM. We focus on the two extremes of this LGM moraine set, i.e. (i) the moraine belonging to the most extensive LGM advance, and (ii) the moraine directly bordering Lake Pukaki, representing the last glacial stage before the abrupt, lake-forming collapse of the LGM. We apply the method of Surface Exposure Dating of erratics on top of these moraines using in-situ cosmogenic Be-10, Al-26, and Ne-21. First data indicate, that the two brackets of this moraine sequence can be resolved. The preliminary age for moraine (i) is 26.5 +/- 4 kyrs, the age for moraine (ii) is 15.5 +/- 2.5 kyrs. We are thus able to date the peak of the LGM together with the last glacial event before its catastrophic collapse.

In order to more accurately constrain the timing of glacial events relative to ocean and climate reorganizations we directly compare the terrestrial and marine glacial records, i.e. for the first time compare the moraine ages to high resolution climate records in rapidly accumulating marine sediment cores from East of New Zealand. These sediment cores are influenced by river outwash from the fluvial system draining the Southern Alp foreland, and thus record evidence of the collapsing ice masses. This independent cross-check of terrestrial and marine records does not only increase reliability, but also the precision of the data, as the sediment cores are C-14 dated. The first marine data together with more data from the Lake Pukaki terminal moraines and the respective lateral moraine set will be presented at the conference.

PP42B-0500 1330h POSTER

Spectral Analysis of Reconstructed Summer Temperature Variations

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Annual average summer temperature variations can be reconstructed using dendrochronology methods (analysis of tree rings). We perform spectral analysis of temperature series reconstructed for the last 3000-4000 years and for various geographical locations both in the northern and southern hemispheres. Spectral properties of these data series were calculated using wavelet decomposition and methods of higher order spectral analysis. The obtained spectral features are compared with the known solar periodicities. No evident correlation between the reconstruted temperature and the 11 year solar cycle is found.

PP42B-0501 1330h POSTER

Evidence that delayed subbottom temperature response to end-Glacial warming postponed hydrate dissociation and mass wasting until the early and mid-Holocene along Nordic Basin margins

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Incorporating both late/post-Glacial bottom-water warming and eustatic sealevel rise into a MH (methane hydrate) stability model explains why at least some major submarine landslides (e.g., the Storegga Slide, Norwegian margin) may have been triggered by MH dissociation during the early or middle Holocene, not during the lowest sealevels of the LGM (Last Glacial Maximum, 18-20 ka). In the case of the giant Storegga slide on the Norwegian margin, failure (8.15 ka; Haflidason, H., H. P. Sejrup, P. Bryn, and P. Lien, The Storegga Slide; Chronology and Flow Mechanism, EUG XI Abstracts, p. 740, 2001) may have been initiated either below the upper slope or under the shelf (for fresh porewater, especially with 1 or 2 % admixed ethane). The stability relations show that MH could have formed AFTER the low sealevels of the LGM, but BEFORE significant warming at MH levels. At water depths below ca. 800m, persistent low bottom water temperatures in the Nordic Seas allowed the sea level rise to thicken the MH stability zone over time, ruling out deepwater Holocene initiation of failure. However, mass wasting on the upper continental slope may have been triggered in many mid to high-latitude seas where the effect of post-Glacial ocean warming overcame the MH-stabilizing effects of eustat

PP42B-0502 1330h POSTER

Porewater geochemical evidence for fluid flow in Miocene Peri-platform Sediments of the Marion Plateau, Leg 194 Ocean Drilling Program

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One of the goals of studying the Marion Plateau was to use the sediments and pore fluids recovered to investigate fluid circulation in ancient carbonate platforms of the plateau. The extensive dolomitization found in both platforms is itself indirect evidence for past fluid circulation in the platform. But when and how fluids may have circulated and the nature of the fluids, whether they were normal seawater or hypo- or hypersaline, are open questions. Although sampling of porewaters from within platform MP3 was simply not possible, samples taken from sediments above and below the adjacent peri-platform facies provide evidence that seawater continues to circulate through a these sediments even though they are overlain by 200 m of hemi-pelagic deposits.

Site 1198 drilled to basement 5 km southeast of the margin of Miocene platform MP3. For most of the porewater constituents, nearly symmetrical, arcuate porewater profiles are found in the upper 200 mbsf, the hemipelagic sediments of seismic Megasequence D. From essentially seawater values near the sediment surface, concentrations either increase or decrease in the interval from 0 to 100 mbsf. In the interval from 100 to 200 mbsf, the trends of the upper 100 mbsf reverse, and concentrations return to values close to those of normal seawater. This pattern is found for alkalinity, sulfate, ammonium, strontium, potassium, and magnesium. Pore water samples could not be recovered from most of the peri-platform sediments of seismic Megasequence C. However, at the base of this sequence the porewater concentrations of most dissolved species are also close to seawater values. Concentration changes typical of pelagic sediments are seen in the deepest sediments of seismic Megasequence B.

The shapes of the porewater profiles in the upper 100 mbsf are not atypical for pelagic sediments. But the changes in concentration seen in the interval between 100 and 200 mbsf are quite unusual. They are most easily explained by relatively constant reaction rates, with diffusion acting upon both the upper and lower bounds of this sediment package. The near-seawater concentrations at the upper and lower bounds of seismic Megasequence C implies that the fluid within the peri-platform sediments is close to seawater in composition, and suggests active circulation of seawater through the sediments of seismic Megasequence C, between 200 and 350 mbsf. Neither the mechanism nor direction of fluid flow can be determined. Based on the seismic profiles of the Marion Plateau, sequence C is not exposed on the seafloor and thus has no direct connection to seawater. The unit is in contact with the MP2/MP3 platform, and a hydraulic connection between the platform and the peri-platform sediments of seismic Megasequence C seems likely. Thus one possible explanation for the observed evidence for seawater circulation in Megasequence C is that it is coupled with active circulation of seawater within the platform.

PP42B-0503 1330h POSTER

Terrestrial Runoff Into the Great Barrier Reef: Direct Evidence From the Coral Record for Major Increases in Anthropogenic Fluxes

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Inshore regions of the central and northern Great Barrier Reef (GBR) are regularly impacted by runoff from large rivers. The river flows are highly episodic, being associated with cyclones or occasionally intense monsoonal depressions. During these high intensity rainfall events, there can be massive discharges of freshwater and suspended sediments into the GBR lagoon. It is shown here how long-lived (300-400 year old) corals from the inshore region of the Great Barrier Reef of Australia provide a unique long-term quantitative record of suspended sediment loads delivered to the GBR by river flood plumes. *Porites* corals from the inshore Pandora and Havannah Reefs, experience episodic discharge of freshwater flood plumes from the Burdekin River. Barium acts as a monitor for suspended sediment as it is desorbed from suspended particles as the freshwater flood plumes enter the marine environment. Ba/Ca ratios in coral cores therefore provide a proxy of long-term changes in suspended sediment loads, which are entering inshore coral reefs prior to and following European settlement.

The Ba/Ca systematics in the coral core analyzed in this study reveal two distinctive patterns. For the period prior to European settlement, there is only limited evidence for flood-plume related suspended sediment fluxes entering the inner GBR, although this period is mainly dominated by droughts. From 1800 to 1860, which includes major flood events in the years, 1801, 1811, 1817, 1819 and 1831, the coral fluorescent flood-bands still do not exhibit any Ba peaks. Immediately following European settlement, in the 1860s, there is a dramatic change in the Ba/Ca ratios of the coral core. For example in the 1870 flood-band there is a large Ba/Ca spike, indicative of a significant increase in suspended load being delivered to the inner GBR. This is coincident with the first grazing activities by European settlers in the Burdekin catchment. It is hypothesized that the initial spike in Ba/Ca is a result of disturbance by grazing of hoofed animals (initially sheep and later cattle) on the highly fragile riverbanks. Thereafter (i.e. post 1870) during all subsequent flood plume events, the Ba/Ca peaks are present in approximate proportion to the volume of the river discharge, modulated by land-use intensity and climate changes, principally droughts.

PP42B-0504 1330h POSTER

The Holocene History of the White Sands Dune Field and the influences of Climate on Eolian Deflation and Playa Lakes

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White Sands National Monument is the largest gypsum dune field in the world. The dunes have formed downwind of a 20-m-deep, 19-km-wide deflation basin containing large playa lakes. Today, the gypsum sand is derived from the edge of the deflation basin, next to the dune field, rather than the alkali flat and playa lakes where gypsum crystals are forming. Three erosional shorelines mark wetter episodes when playa lakes formed in the deflation basin. The youngest shoreline is forming today around Lake Lucero playa. The oldest shoreline, termed L1 is degraded and probably formed at the Pleistocene-Holocene transition. Deflation from the L1 to the L2 shoreline cut through Pleistocene bedded evaporites and probably marks initiation of the dune field. This event was before 5,840 years BP, based on radiocarbon in a lake dammed by the dunes. This reinforces an evolving consensus that episodes of deflation have characterized desert basins in the southwestern United States. Regional deflation events have been dated at 7,000 years and 4,000 years BP. The shorelines in the deflation basin imply that the White Sands dune field was created in short episodes and the modern dune field may not represent conditions active during expansion of the dune sea.

URL: http://www.geo.utep.edu/Faculty_Staff/langford.html

PP42B-0505 1330h POSTER

Depositional Environment of Syn-rift Sediments on the Iberia Margin

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Faunal assemblages of ostracods and benthic foraminifera recovered from Lower Cretaceous sediments at ODP Leg 173 Site1069 on the Iberia Margin represent deposition in an open marine outer shelf to upper slope environment.

The benthic foraminiferal assemblages recorded are considered to comprise relatively few autochthonous deeper water forms. This relative paucity of the assemblages considered to be in situ is considered due to dilution by the downslope mass movement of older material.

The presence in the samples of abundant calcareous benthic foraminifers is considered to be due to the reworking of Upper Jurassic or ?lowermost Cretaceous material from nearby tilted blocks. The moderately high diversity of these allochthonous assemblages includes species that are not considered to have inhabited the same environmental niches. For example spirillinids are thought to be indicative of relatively shallow (<100m) habitats and extant spirillinids are found within the photic zone with some epiphytic species living on grasses in very shallow water. Conversely the abundance of species within the same assemblages of allochthonous forms, but thought to have inhabited deeper water niches, supports the suggestion here that the faunas are allochthonous and mixed, having been derived from different horizons deposited during the shallowing of the Lusitanian Basin during the Late Jurassic.

Although the calcareous benthic foraminfers are all moderately well preserved, and the assemblages moderately diverse, suggesting that they have not been transported far, the individuals are all of a relatively small and similar size which suggests some degree of sorting.

These allochthonous calcareous benthic assemblages from ODP Leg 173 are similar in characteristic components to Jurassic assemblages recorded from DSDP Leg 11, from DSDP Leg 41, from DSDP Leg 76, ODP Leg 149 and from onshore Portugal.

Ostracods are rare in the samples analysed. All specimens are juveniles and although reasonably well preserved some carapaces are crushed. Assemblages consisting solely of juveniles are unusual and evidence from studies of modern depositional environments indicates that they occur in outer shelf - upper slope situations as a result of transport offshore of the fine-grained, suspended particulate fraction.

PP42B-0506 1330h POSTER

^{10}Be Dating of the Last Retreat of the Southern Margin of the Scandinavian Ice Sheet: Preliminary Results

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Prominent moraines crossing the Baltic region mark the late Pleistocene maximum extent and recessional phases of the southern margin of the Late Pleistocene Scandinavian Ice Sheet (SIS). The presence of five main moraines between the advance during the Last Glacial Maximum (LGM) and the Younger-Dryas Salpausselkä Moraines in southern Finland dated at 11.6 $\pm$0.5 ^{10}Be ka suggest a strong millennial-scale signal for this sector of the ice sheet. However, dating control constraining the age of the LGM and retreat phases of the southern SIS margin in this region is all but lacking. We have sampled boulders for surface exposure dating (^{10}Be) from moraines along a broad south-to-north transect spanning Poland, Lithuania, Latvia, Belarus, Estonia, and Finland. Here we report ^{10}Be concentrations on 16 boulders measured by AMS at the Centre de Spectrométrie Nucléaire et de Spectrométrie de Masse. We used a production rate of 5.1 $\pm 0.3 atoms g^{-1}$ yr^{-1} scaled for latitude and altitude according to Lal's factors. No corrections for sample thickness, snow cover nor erosion have been applied. One boulder from the Gruda Moraine representing the last glacial maximum in Lithuania was dated at 17.2 $\pm$1.4 ^{10}Be ka. Seven samples from the Pomeranian Moraine in Poland have a weighted mean age of 16.6 $\pm$0.7 ^{10}Be ka. Two samples from the Middle Lithuanian Moraine in Lithuania have a weighted mean age of 15.4 $\pm$0.8 ^{10}Be ka, and five samples from the North Lithuanian Moraine in Latvia date to 14.1 $\pm$0.7 ^{10}Be ka. A single boulder on the Pandivere Moraine was dated at 14.6 $\pm$1.3 ^{10}Be ka. We are processing an additional 144 samples for 10Be dating that will further refine this chronology.

PP42B-0507 1330h POSTER

Rapid Isotope Profiling of Speleothem by He Flow-through Laser Ablation: Insight Into Abrupt Climate Fluctuations From A new Exceptionally High Resolution Holocene δ^{18}O Record From SW Ireland

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Stable isotope analysis of carbonates at high spatial resolution is normally achieved either by microdrilling or by laser sampling, although the latter has not been widely employed, despite early promise, due to higher analytical errors particularly for oxygen isotopes. Laser ablation using a sample chamber continuously swept by He can be shown to significantly improve the accuracy and precision of carbon and oxygen isotope data, with the advantage of the rapid analysis times inherent with He flow-through technology. An automated He flow through laser-ablation system has been used to obtain continuous high resolution isotope profiles along growth axes of speleothem at a resolution of 250 microns or better. The system uses a 25W CO_2 laser heat source with a continuous helium flow sample chamber on line to a conventional gas chromatograph-isotope ratio monitoring system (Micromass Optima - Isochrome). In-situ analysis of Carrara Marble yield δ^{13}C and δ^{18}O values reproducible to better than $\pm 0.1^{o}/_{oo}$.

A new high resolution isotope record comprising 1640 analyses has been obtained on a well dated 465 mm Holocene Stalagmite (CC3). For the latter part of the Holocene each analysis represents 10-22 years, but for the period prior to 5,300 years where speleothem growth rates were higher, resolution is sub-decadal. The new data accurately reproduce the first-order variation obtained by drill-sampling with δ^{18}O varying from -11.65 to -0.82$^{o}/_{oo}$, but with most data varying by $\pm$1.75 around a mean value of -3.26$^{o}/_{oo}$. Historically cooler periods are associated with lower δ^{18}O but the new profile also reveals short lived high amplitude ($>3^{o}/_{oo}$) isotope shifts. One of these events exhibits an extremely large shift of c.8$^{o}/_{oo}$over 1mm of calcite dated to between 8445 and 8400 calendar years BP. This high amplitude event is superimposed on a 350 year old episode of lowered δ^{18}O that commenced at 8470 years BP but is too large to attribute solely to cooling and may reflect change in the isotopic composition of N. Atlantic surface waters consistent with catastrophic release of Laurentide ice sheet melt waters.

URL: http://www.gl.rhul.ac.uk/silab

PP42B-0508 1330h POSTER

Evidence From the Nebraska Sand Hills for a Significant Late Holocene Drought on the Great Plains

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The agricultural productivity and aquifers of the Great Plains are major world resources, but the climate of the region is highly variable and prone to episodes of drought. Climate records of the last 100 years do not reveal the full range of variability. Radiocarbon dating

of soils buried by eolian sand and optical dates on eolian sand both provide evidence that dunes were mobilized by the wind one or more times during the last 1000 years in the Nebraska Sand Hills. The spatial and temporal significance of these mobilizations is not easily determined. Do they represent brief, localized episodes of sand transport associated with 1930's type droughts, or might they reflect synchronous, longer-lived regional arid episodes? Uncertainties of the calibrated radiocarbon ages on these young paleosols are typically 200-300 years (2 sigma). The paleosolsare rarely traceable more than 100 m due to erosion or limited exposures.For the Nebraska Sand Hills, paleoclimatic inferences based on paleosols alone are equivocal. However, interdune peatlands (fens) with a subsurface sand layer of wind-blown origin present in their upper meter have been mapped at 24 localities over about 15,000 square km in the north-central Sand Hills.Core transects in three fens, 75 km apart, show that sand sheets and small dunes extended over a significant portion of the interdunes. We argue that extended drought conditions are needed to reduce dune-stabilizing vegetation and cause groundwater declines sufficient to "shut down" the fens, enabling sand sheets and small dunes to move over the interdune valley. 80 calibrated radiocarbon dates on plant seeds immediately below and above the sand layers from the three fens indicate sand was blown over the peat beginning about 900 years ago. Conditions favorable for peat formation did not return for at least 50 to 100 years.

PP42B-0509 1330h POSTER

Spatial Distribution of Living Coccolithophores in the Southern Adriatic Sea During Late Autumn,2000.

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Water samples for coccolithophorid analyses were collected during the cruise on N/O Italica in the Southern Adriatic Sea in October 2000, from the Albanian slope to the Italian shoreline. The investigated area on the Albanian slope includes the shoreline of Gulf of the Drin to the north of the Corf island and on the Italian shoreline from the Gulf of Manfredonia to the Capo Santa Maria di Leuca and the southern part of the Otranto Channel.

The aim of this work is to understand the ecology of coccolithophorids, one of the major contributors to the carbonate sediment in the Mediterranean Sea, studying their spatial and vertical distribution, species diversity and productivity and try to determinate the relationship of this phytoplankton group with environmental parameters. Sampling was done along several transects from east to west coast (86 stations, 300 water samples). The sampling depths were planned to obtain a regular sample grid. The sampling was finer in the upper photic zone and coarser at depths where both a lower coccolithophorid concentration and species diversity have been observed. For each sampling depth the sea water was filtered on board, on Millipore acetate cellulose filters and immediately oven-dried and stored in petri-dishes. Quantitative and qualitative analyses have been performed on LM and SEM microscope.

Here we report the results of 42 selected stations collected at 0m and 10m and of a transect in the southern part of the Otranto Channel. The absolute abundance of total nannoplankton varied between less than several hundreds to 1.7E05 cells/l (station 8). These values are consistent with previous studies in the eastern Mediterranean Sea (1.4E04 cells/l, Knappertbusch, 1993). The distribution and composition of the living coccolithophore communities in the Southern Adriatic Sea can be related to the environmental conditions of surface waters. 60 species have been identified at SEM. The assemblage is mainly dominated by E. huxleyi, and by less abundant Rhabdosphaera spp., Syracophaera spp. and holococcolithophorids. Florisphaera profunda, known as deep-living species, is only present in samples from Santa Maria di Leuca transect below the 100m of depth.

PP42B-0510 1330h POSTER

Late Pleistocene Palaeoclimate Record from Palaeolake Lisan, Israel

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Lake Lisan, precursor of the Dead Sea, occupied an elongated narrow depression within the Dead Sea rift valley between 70-15 ka. This region, located at the transition between the Arabian Desert and the Mediterranean climatic zones, is a potential site to study the climatic variations in the Near East (Heim et al. 1997).

The Lisan Formation is defined as beginning with the lower member that comprises detrital-aragonite laminae. It is overlain by a middle member that contains abundant sand and clay layers. The upper member mainly comprises aragonite-detrital laminae and is also known as the White Cliff member (Schramm et al. 2000). The results of various studies including chronology, mineralogy, laminae counting and measurement on the polished thin sections of the entire White Cliff member will be presented.

The white laminae are composed of authigenic aragonite, possibly the annual summer precipitate of Lake Lisan. The detrital material consists of fine-grained calcite, dolomite, aragonite, quartz, unaltered plagioclase and clays resulting from flood inputs into the lake during winter rains. While occasional euhedral, clear gypsum crystals are present, the bulk of gypsum is of diagenetic origin, occasionally with inclusions of primary detrital sediment. The absence of laminar gypsum is indicative that during this period the density stratification was intact and there was no large scale exchange between the two water masses. The abundance of aragonite is more than twice that of clastics, pointing to a dominance of chemical precipitation and the saline nature of the lake during this period. The deposition of White Cliff Member ceased around 15 ka due to a major drop in lake level that caused widespread deposition of gypsum.

The correlation of our data with N. Africa and Asia and its implications for regional precipitation regimes will be presented.

References:

1. Schramm, A., Stein, M. and Goldstein, S.L. (2000). Earth and Planetary Science Letters 175, pp: 27-40.

2. Heim, C., Nowaczyk, N.R. and Negendank, J.F.W. (1997). Naturwissenchaften 84, pp: 398-401.

PP42B-0511 1330h POSTER

Dating Neogene Eolian Deposits by Ichthyolith Sr Isotope Stratigraphy

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Comparison of the $^{87}Sr/^{86}Sr$ isotopic ratio of fossil fish teeth (ichthyoliths) with the global seawater Sr curve should provide a highly accurate method for dating pelagic clay cores. This is potentially useful for deep sea red clay cores that are rich in ichthyolith material but barren of other fossils. The strontium component of the fish teeth is assumed to have grown in isotopic equilibrium with seawater. However, acquiring consistent, reproducible results from Sr isotopic analysis of ichytholiths has posed many problems in the past. These difficulties have been variably ascribed to 1) contamination from authigenic ferromanganese oxyhydroxide coatings, 2) Sr exchange during burial diagenesis, and 3) laboratory contamination from cleaning reagents. We have developed a rapid, efficient, low-blank method for removing authigenic Fe-Mn oxyhydroxide coatings and other potential contaminants including clays, organics, carbonate, opal and zeolites from all surfaces and internal cavities of ichthyoliths, as verified by SEM imagery. To test our method, we produced improved age-depth profiles for R/V Ewing cores 9709 PC01 and PC07 from the north central Pacific Ocean (see companion abstract by Johnson et al.). Average uncertainties in our dataset from age assignments using the Sr isotope LOWESS fit of McArthur et al. (2001) vary from $<\pm 1$ m.y. for the 15 Ma to 40 Ma interval to $\pm$1-2 m.y. for the 0-15 Ma interval. Currently, we are limited by our blank in analyzing the smallest samples (<100 micron size fraction), but are working on an ultra low blank method that will eventually allow us to analyze very small individual teeth. At present, we can analyze single teeth if they are in the 50-100 microgram mass range, translating to 50-100 nanogram loads on mass spectrometer filaments. This Sr isotope-based chronology should provide a precise time scale for the pelagic clay sections and marine wind blown dust records we have been studying, and represents a significant improvement over previous efforts to date the red-clay record.

PP42B-0512 1330h POSTER

Improved Age-Depth Profiles for Neogene Red Clay Cores from the Subtropical North Pacific Ocean

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We are generating a series of age-depth curves for deep-sea red clay cores that were collected by the R/V Ewing in 1997 along a north-south transect in the north east Pacific Ocean. Many of these cores are not datable by conventional biostratigraphic methods. Although lacking in other fossils, ichthyoliths (phosphatic fish teeth) are abundant throughout most of these cores. Using Sr isotope stratigraphy (see companion abstract by Gleason et al.), we have produced age-depth profiles for two of these cores. PC-07 was recovered at 8.8° N, 135.4° W. Red clays are abundant in the uppermost portion (top ~350 cm) of this 16 m core. Lower in the core, silicious clays and carbonate-rich intervals occur. This lower section includes datable nannofossils, allowing some cross-calibration with the Sr isotope method. Our data suggests a very good correlation between the nannofossil biostratigraphy and the Sr isotope technique employed here. The age-depth curve for PC-07 indicates two distinct sedimentation rates for this site. From 1500 cm to approximately 350 cm (early to mid Miocene) there is a relatively high sedimentation rate of ~2.4 mm/ky. The rate appears to decrease abruptly around 350 cm (~13 Ma). The average sedimentation rate for the red clay interval (mid Miocene to present) is an order of magnitude lower (~0.25 mm/ky), reflecting northward movement of the site away from the equatorial high productivity zone. Further data may indicate whether hiatuses occur in this core. PC-01 (32.5° N, 141.2° W) is entirely composed of barren red clay. The age-depth curve for this core indicates an average sedimentation rate of 0.4 mm/ky spanning from the early Miocene (24 Ma) to the present. No hiatuses greater than 4 Ma were identified. Using Sr isotope stratigraphy, the geochemistry and continental unroofing records of the eolian deposits in these cores can potentially be used to reconstruct zonal wind patterns back to the middle Eocene.

PP42B-0513 1330h POSTER

Oxygen and carbon isotopes in terrestrial mollusk shells. From modern to fossil values, climatic impact on the mollusk diet.

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Stable isotope studies on fossil material as well as on sediment have been very successful these past years indicating such method a very promising Quaternary paleonvironmental index for continental studies. Although most of the studies on fossil material was related to modern material collected near the fossil record, no precise analysis of the impact of the diet and precipitation was carried out in order to justify the previous assumptions. Here we present the results of two sets of analysis from terrestrial mollusk shells, a particularly good climate indicator. On one hand, individuals from hatched eggs of raised Helix aspersa were fed with different plants characteristic of the two main photosynthetic pathways (C3 and C4), and waters of different isotopic values. The shells were analyzed in order to observe the impact of the food diet and of the

precipitation on the isotope content of the shell carbonate. On the other hand, the study of fossil shells (Vertigo modesta) from the loess series of the Great Plains, an area where shifts in photosynthetic pathways where detected during the last isotopic stage 2 (24,000-12,000 yr B.P.), is carried out. The interpretation of the results is based on those of the study of modern shells

PP42B-0514 1330h POSTER

Middle Miocene monsoon seasonality inferred from Thai rhino-teeth stable isotopes

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The present climate of Thailand is controlled by the Southeast Asian Monsoon system. Although modeling paleoclimatic fluctuations in monsoon variability has improved, records of past climate changes are crucial to observe the first occurrence or intensification of the monsoon wind system. Different time spans have been suggested from 30 Ma (Ramstein et al. 1997; Fluteau et al. 1999) in the Indochina area to the end of the Miocene (8-6 Ma)(Quade et al. 1989; Kroon et al. 1991; Cerling et al. 1993)in the Himalayan area due to different hypotheses such as (i) Paratethys ocean shrinkage (Ramstein et al. 1997; Fluteau et al. 1999, (ii) Himalayan and Tibetan plateau uplift(Kutzbach et al. 1989; Ruddiman & Kutzbach 1989; Prell & Kutzbach 1989) and (iii) chemical weathering and atmospheric [CO_2](Prell & Kutzbach 1989; Raymo & Ruddiman 1992). Here we reconstruct middle Miocene seasonality in precipitation using high-resolution $\delta^{18}O$ and $\delta^{13}C$ records from $CaCO_3$ of rhinocerotid tooth enamel in Thailand. $\delta^{18}O$ of mammal tooth enamel, precipitated under constant body temperature, is a powerful precipitation/evaporation proxy, since temperature corrections are unnecessary. The results show that middle Miocene seasonality in rainfall was similar to today, although the amount of precipitation was higher, which is in agreement with atmospheric circulation models (Fluteau et al. 1999).

References

Cerling, T. E., Wang, Y. & Quade, J. Expansion of C4 ecosystems as an indicator of global ecological change in the late miocene. Nature 361, 344-345 (1993). Fluteau, F., Ramstein, G. & Besse, J. Simulating the evolution of the Asian and African monsoons during the 30 Myr using an atmospheric general circulation model. J. Geophys. Res. 104, 11995-12018 (1999). Kroon, D., Steens, T. & Troelstra, S. R. Onset of monsoonal related upwelling in the western Arabian Sea as revealed by planktonic foraminifers. Proc. Ocean. Drill. Program Sci. Results 117, 257-263 (1991). Kutzbach, J. E., Guetter, P. J., Ruddiman, W. F. & Prell, W. L. Sensitivity of climatic uplift in southern Asia and in American West: Numerical experiments. J. Geophys. Res. 94, 18393-18407 (1989). Prell, W. L. & Kutzbach, J. E. Sensitivity of the Indian monsoon to forcing parameters and implications for its evolution. Nature 360, 647-652 (1992). Quade, J., Cerling, T. E. & Bowman, J. R. Development of asian monsoon revealed by marked ecological shift during the latest miocene in northern pakistan. Nature 342, 163-166 (1989). Ramstein, G., Fluteau, F., Besse, J. & Joussaume, S. Effect of orogeny, plate motion and land sea distribution on Eurasian climate over the past 30 million years. Nature 386, 788-795 (1997). Raymo, M. E. & Ruddiman, W. F. Tectonic forcing of late Cenozoic climate. Nature 359, 117-122 (1992). Ruddiman, W. F. & Kutzbach, J. E. Forcing on the late Cenozoic uplift northern hemisphere climate by plateau uplift in southern Asia and the American West. J. Geophys. Res. 94, 18409-18427 (1989).

PP42B-0515 1330h POSTER

Late Quaternary History of River Discharge and Glaciation in the Southern Kara Sea, Arctic Ocean: Preliminary Results

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Within the framework of the joint German-Russian project on "The Nature of Continental Run-Off from the Siberian Rivers and its Behavior in the Adjacent Arctic Basin (Siberian River Run-Off-SIRRO)", a multidisciplinary expedition with RV "Akademik Boris Petrov" was carried out in the Ob and Yenisei estuaries and the southern Kara Sea in August-September 2001. From the geological point of view, the variability of river discharge in relationship to climate change and the reconstruction of extent and history of glaciation in the southern Kara Sea during Late Quaternary times are major foci of interest. To reach these goals, an intensive sediment ecosounding (2-12 kHz) survey and sediment coring program has been performed. Based on profiling and sediment core data, the following preliminary statements can be given: (1) The extent of the eastern margin of the Barents Sea LGM Ice Sheet between 74 and 78°N can be mapped in detail. Different types of glacial to nonglacial facies can be distinguished. This ice barrier should have strongly influenced river discharge, diverted towards the NE probably into the Voronin Trough. (2) The local LGM (?) ice sheet on Taymyr Peninsula seems to be not connected with the Barents Sea Ice Sheet. (3) Siberian river discharge reached maximum values during the last deglaciation and displays distinct (cyclic) variability during Holocene times. Further detailed evaluation of the sediment echograph profiles as well as detailed sedimentological studies and AMS 14C datings will follow to support these ideas.

PP42B-0516 1330h POSTER

Multiproxy Evidence for Long-term Changes in Summer and Winter Monsoon Dynamics on the Chinese Loess Plateau

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We have assembled a multiproxy database from a 170-m thick loess/paleosol section near Jiadoao, Shaanxi Province, China. The database includes information about environmental magnetic properties, pedogenic and total iron concentrations, color indices, particle size distribution, carbonate content, and stable isotope ratios. These data from Jiaodao section, which is only 50 km north of the classic Luochuan section, provide excellent insight into the dynamics of the summer and winter monsoons over the past 2.6 Ma. Several paleoclimate proxies imply a long-term decrease in temperature accompanied with a gradual increase in winter monsoon strength from 2.6 Ma to present. These trends are similar to the long-term increase in oxygen isotope values seen in the marine record. In addition, for the interval after 0.65 ka, some proxies, such as magnetic properties and depth of decalcification, indicate a significant increase in summer monsoon precipitation during soil-forming (interglacial) periods while other proxies, such as particle size, show an increase in winter monsoon strength during depositional (glacial) episodes. Our multiproxy approach contributes significantly to the understanding of long-term changes in Asian monsoon dynamics and provides a terrestrial insight into the nature of a mid-Pleistocene climate shift.

PP42B-0517 1330h POSTER

Stable Isotope Analysis of a 12 M.Y. Record of Soil Carbonates in the Southern Rio Grande Rift

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A core collected in Trans-Pecos, Texas has been dated by paleomagnetic techniques and records almost continuous deposition between 12.5 million years ago and 350,000 years ago. The core was deposited in the floodplain of small arid stream over most of this time and the invariant depositional environment and continuous record make this core uniquely suitable for stable isotope analysis of soil carbonates. We have collected samples from over 90 soils, extending back as far as 10 million years. These soils record the uplift associated with formation of the Rio Grande rift, which occurred between 15 million years ago and the present, as well as the establishment of the Chihuahuan Desert and the gradual drying of the southwestern United States. The core also documents climatic changes over the last 12 million years in a tectonically and ecologically important region of the world. Because the depositional setting of the core was similar over such a long time and the setting is a closed basin, factors such as changing sediment sources and other depositional factors can be discounted.

PP42B-0518 1330h POSTER

Developing a Geophysical Approach to the Study of Climatic Change Markers in Quaternary Formations of the Fresnal Valley, North Chihuahuan Desert, Mexico

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In the context of an ongoing multidisciplinary investigation of the El Fresnal valley, Chihuahua (31°05'N and 107°30W), a multi-method geophysical survey program has been initiated. Its initial objective is the establishment of the best approach to assess and complement the geomorphological and geological study of the deposits characteristic of varying climatic conditions. The valley is a N-S oriented half-graben/tilted-block system with a playa-lake on the basin floor, and bordered by piedmonts classified as alluvial fans. Fan development appears to coincide with a proposed late Quaternary climatic shift that may have increased sediment flux. Three alluvial fans located on the footwall slopes were formed during this time and are consistent with the main climatic changes registered in the paleolake stratigraphy of Northern Mexico and the American Southwest. These alluvial fans consist mainly of debris flow deposits formed by flash floods probably triggered by a change from relatively moist to arid conditions.

To investigate these formations, a combination of standard electrical resistivity sounding, 2-D resistivity imaging and ground penetrating radar is used. Most of the survey lines are confined to a long traverse crossing

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the basin from East to West, roughly perpendicular to the structural axis. The two main challenges encountered are the difficulty of access and the high electrical conductivities found at very shallow depths in most areas. The worst affected method is GPR, which will most likely prove of limited use except for very detailed work. Electrical surveys yield more useful results and allow the main units of the fan deposits to be resolved. At this point the best geophysical approach seems to be a combination of fast, relatively deep vertical soundings for determining the overall geoelectrical structure and high-resolution 2-D imaging profiles that provide information on lateral variations.

PP42B-0519 1330h POSTER

Investigating the climate sensitivity of Stratospheric Injections of Large Amounts of S-bearing Gases.

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The Chicxulub impact structure (Yucatan, Mexico) was produced 65 Ma, in coincidence with the large Cretaceous-Tertiary mass extinctions. The presence of massive evaporitic (S-rich) deposits at the impact location suggests the possibility that a long-lasting strong and abrupt climate shift was generated by the release of large amounts of S-bearing gases in the upper stratosphere. This work is aimed at assessing the climate sensitivity of stratospheric sulfate aerosols produced by the reaction of impact-released S-bearing gases and water vapor. Although the effect is reminiscent of the climate change produced by large volcanic eruptions, the impact-related climate shift is bound to be much larger than any volcanic one because the amount of impact-produced S-bearinggases is orders of magnitude larger than any known volcanic eruption.

This study is carried out with SCCM, the single column model ofthe National Center for Atmospheric Research (NCAR), modified to include a Sulfate Aerosol Model, which was developed specifically for this work. SCCM is equivalent to a grid column of the more complete NCAR's global climate model where the performance of the parameterized physics for the column is evaluated in isolation from the rest of the large-scale model. While lacking the more complete feedback mechanisms available to an atmospheric column imbedded in a global model, it provides an inexpensive first look at the response of the system to the forcing introduced by a particular parameterization.

As expected, the presence of S-bearing gases and in particular of sulfate aerosols (strong LW absorbers) in the upper atmospheric layer of the model produces a significant change in the atmospheric radiation fluxes. This results in a strong heating of the stratosphere (due to the presence of gases and aerosols) accompanied by a strong cooling at the Earth's surface. Compared to a Pinatubo-type eruption, the model estimates that in the uppermost layer the temperature increases by (at least) several tens of degrees, more than an order of magnitude that associated with Pinatubo. At the surface the impact-produced cooling is around few degrees, again about an order of magnitude that associated with Pinatubo.

PP42B-0520 1330h POSTER

Arctic Influences: Causal Mechanisms and Climate Dynamics of the Warm Early Paleogene

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Paleoclimate researchers recognize the Early Paleogene as a particularly warm interval in Earths history. Paleogene proxy climate indicators suggest warm polar and mid-latitude continental interior temperatures, and a reduced latitudinal temperature gradient. Most researchers believe that Early Paleogene climate was driven by forcing fields that act globally (e.g. greenhouse gases). However, modeling work based on the influence of global forcing fields has failed to reproduce the warm Paleogene climate indicated by proxy data. Quite possibly, an ameliorating influence acting directly at the poles, rather than over the entire globe, would more effectively warm high latitudes, provide an additional heat source to mid-latitude continental interiors, and reduce the latitudinal temperature gradient. We present a hypothesis based on the positive phase of the modern Arctic Oscillation as one possible high-latitude influence. In short, that prolonged low pressure over the Arctic Ocean would have warmed mid-latitude continental interiors and drastically reduced the Arctic Oceans ice cover, thus producing conditions consistent with proxy climate indicators for the Paleogene greenhouse interval.

PP42B-0521 1330h POSTER

Constraining PCO2 Levels in the Early-Middle Paleogene

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Inconsistencies among paleo-pCO2 estimates have added considerable difficulty to the reconstruction of past climates. This study uses the National Center for Atmospheric Research (NCAR) Climate System Model (CSM) with a slab ocean and Eocene geography in an attempt to constrain atmospheric pCO2 levels during the early-middle Paleogene (50-60 Ma), a time period which proxy records suggest was the warmest of the Cenozoic. We test the sensitivity of the modeled climate to three levels of CO2: 500, 1000, and 2000 ppm. Our results strongly suggest that a high CO2 level (1000-2000 ppm) was more likely for the late Paleocene and early Eocene than a low CO2 level (500 ppm). With increasing CO2, the greatest warming occurs at wintertime polar and high latitude continental regions. Wintertime northern hemispheric polar temperatures are ∼20 degrees C warmer in the 2000 ppm case than in the 500 ppm case, while tropical temperatures are only 3-4 degrees C warmer in the 2000 ppm case. The 2000 ppm scenario is the only case to produce mean annual and cold month mean temperatures at mid-latitudes and high latitude coastal regions that would be tolerable for early Eocene flora.

PP42B-0522 1330h POSTER

A Methane-rich Proterozoic Atmosphere: Possible Link to the Neoproterozoic Snowball Earth Glaciations

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An enhanced atmospheric greenhouse effect is required throughout Archean and Proterozoic to offset reduced solar luminosity. In the anoxic Archean atmosphere CH4 could have been an important greenhouse gas because of the decreased levels of the primary oxidants - OH, O and H_2O_2. However, after the major transition of the atmospheric oxidation state at 2.0-2.3 Gyr, the photochemical lifetimes of reduced atmospheric gases (like methane) should have been much shorter. Therefore, a common view of the Proterozoic climate suggests that CO_2 was the major greenhouse gas (along with H_2O) and that atmospheric CH4 concentrations were low.

Here we argue that substantial methane levels could have been present in the Proterozoic atmosphere if O_2 levels were somewhat lower than today. In agreement with earlier calculations, our 1-D photochemical model shows that the atmospheric methane mixing ratio is a highly nonlinear function of the surface methane flux. In our model, a factor of 10 increase in the methane flux results in a 60-fold increase of the surface methane concentration. 1-D climate calculations show that such a high methane abundance would keep the mean global surface temperature at ∼296 K under reduced solar luminosity conditions (∼17 % decreased solar luminosity at 2.3 Gyr ago), even if CO2 was present only at todays level.

Here we propose several reasons why the net methane flux could have been indeed substantially higher in the Proterozoic, compared to the present day. In the modern ecosystem, 99.9 % of methane, produced by methanogens, is being consumed by methanotrophic bacteria. These bacteria would presumably consume much less methane if O_2 levels were lower. Moreover, in the present day sulfate-rich ocean methanogens living in sediments are outcompeted by sulfate reducers and forced to live in the nutrient-poor environments. Methane is also consumed in marine sediments by anaerobic methanotrophs living in consortium with sulfate reducing bacteria. In an anoxic, sulfate-poor Proterozoic ocean net production of methane could have been substantially higher.

Towards, the end of the Proterozoic, oceanic sulfate abundances began to increase, as indicated by measurements of trace sulfate minerals in carbonates. The corresponding increase in the abundance of sulfate-reducing bacteria should have led to a decrease in methane production, by the arguments given above We propose that the Neoproterozoic Snowball Earth episodes at 750 Ma and 600 Ma may have been triggered by a rise in sulfate and/or O_2 and a corresponding decrease in atmospheric CH_4.

PP42B-0523 1330h POSTER

Oceanic gateways as a critical factor in initiating pre-Mesozoic glaciations

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An outstanding question in the earth sciences is the fundamental reason for the initiation and the demise of large continental glaciations, referred to as icehouse periods in Earth history. In this paper, we propose a unifying explanation for the four main icehouse periods during the past 620 million years). These glaciations occurred at: (1) 34-0 Ma (earliest Oligocene to Present; (2) 354-269 Ma (early Carboniferous to early Permian), (3) 444-443 Ma (late Ordovician Hirnantian stage of the Ashgill), and (4) at about 620-600 Ma in the Vendian (the snowball Earth). The duration of the youngest two glaciations is measured in tens of million years, whereas the Ordovician glaciation was anomalous in that, although very intense compared with the Neogene glaciations, it lasted less than a million years, and occurred during what is believed to be an essentially greenhouse period in Earth history. The duration of the Vendian glaciation is uncertain, but is probably in the order of twenty million years. Despite these differences in their duration, we propose that all these glaciations were initiated and terminated as a result of plate-tectonic processes. These placed continents in polar latitudes or removed them to lower latitudes, created the necessary topography, and opened and closed oceanic gateways essential for inducing the oceanic circulation needed for widespread ice formation. As is the case for Neogene glaciations, oceanic gateways are considered to be critical for the initiation of these three pre-Mesozoic glaciations.

PP42B-0524 1330h POSTER

High Frequency Climate Cycles From an Extreme Climate Event Record (Mid-Cretaceous)

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Potential for recognition of decadal to millennial cycles in a Greenhouse environment exists within Cenomanian/Turonian transgressive laminated sediments of the Tarfaya Basin (S. Morocco). Age control is based on a Milankovitch stratigraphy using pronounced 40 ka obliquity cycles, which we attribute to variations in trade-wind induced upwelling intensity. In this open-marine, anoxic basin, sedimentation rates were around 10 cm/ka. Despite the distinct lamination in many intervals, there is no sedimentary indication for the presence of varves. Lamination is due to orientation of particles, and not necessarily due to changes in sediment composition and particle size on an annual scale (0.05-0.2 mm). We attribute this to negligible fluxes from an arid hinterland during the non-upwelling season, which inhibit the formation of typical varves. However, all sediment components show distinct variations at millimeter to meter scales: sediment colour, organic carbon, carbonate and biogenic silica content, trace elements, concentrations of foraminifera and eolian dust, and abundances of various nannofossil species. The most prominent nanno species is *Eprolithus floralis*, which is considered as indicative of cold waters and/or high latitudes. Exceptionally high abundances of single

nanno species represent bloom periods, which are captured in faecal pellets highly abundant in darker intervals. Intervals with less distinct lamination are dominated by larger faecal pellets, higher carbonate content, discontinuous organic flasers, and a reduced porosity. The fine-scale variation in biogenic fluxes are indicative of changes in upwelling strength at interannual to millennial scales.

PP42B-0525 1330h POSTER

Geochemical Climate Transfer Functions from North American Soils and Application to Paleosols Across the Eocene-Oligocene Boundary

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The degree of chemical weathering in soils increases with mean annual precipitation and mean annual temperature. We have quantified these relationships using a database of major element chemical analyses of 126 North American soils. The most robust relationship found was between mean annual precipitation (P in mm) and the chemical index of alteration without potash (CIA-K):

$$P = 221.12e^{0.0197(CIA-K)}$$

with $R^2 = 0.72$. Another strong relationship was found between mean annual precipitation (P in mm) and the molecular ratio of bases/alumina (B):

$$P = -259.34Ln(B) + 759.05$$

with $R^2 = 0.66$. A Mollisol-specific relationship was found relating mean annual precipitation (P in mm) to the molar ratio of lime to alumina (C) as follows:

$$P = -130.93Ln(C) + 467.4$$

with $R^2 = 0.59$. Our data also showed that most Alfisols can be distinguished from Ultisols by a molecular weathering ratio of bases/alumina of less than 0.5 or by a chemical index of alteration without potash less than 80. Application of these data to a sequence of Eocene and Oligocene paleosols from central Oregon yielded refined paleoprecipitation estimates consistent with those from other pedogenic and paleobotanical transfer functions for paleoclimate.

PP42B-0526 1330h POSTER

Hydrologically Correct, Global Paleo-Digital Elevation Models (DEMs): a Maastrichtian (Late Cretaceous) Example

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The past surface relief of the Earth is an essential boundary condition for computer-based atmosphere and ocean modeling. It also provides the geographic context for understanding surface processes and biotic distributions and interactions. However, with increased model resolution and the addition of vegetation, soil (weathering) and chemical modules, there is now a need for more robust, detailed paleo-topographies and bathymetries that are fully integrated with the processes being modeled, especially the hydrological system (hydrologically correct). Here I present a new GIS-based, hydrologically correct, paleo-DEM for the Maastrichtian (Late Cretaceous).

This project was initiated in 1995 while the author was a graduate at the University of Chicago using the plate reconstructions of Rowley (1995, unpublished). The Maastrichtian paleogeography used in this study is one of a series of 27 global maps, representing the Cretaceous and Cenozoic, being compiled simultaneously to ensure continuity between each time interval. Each map is generated at a scale of 1:30 million in ArcView GIS and ArcInfo, using data from the authors own databases of lithologic, tectonic and fossil information, the lithologic databases of the Paleogeographic Atlas Project (The University of Chicago), a survey of published literature, and DSDP / ODP data. Interpretations of elevation are derived following the methods outlined in Ziegler et al (1985), an understanding of the tectonic regime and evolution of each geographic feature, and the age-depth relationship for the ocean.

The Maastrichtian has been completed first to provide the boundary conditions for a coupled atmosphere-ocean experiment. The hydrologically correct global DEM was derived using the elevation contours from the paleogeography and the suite of hydrological tools now available in ArcInfo GRID. The DEM has been constrained by defining areas of paleo-internal drainage, paleo-river mouths and known paleo-river courses. When integrated with the results of the coupled ocean-atmosphere model the result is a powerful tool for understanding surface processes and an important step towards the development of a fully evolving Earth Systems model.

Ziegler, A.M., D.B. Rowley, A.L. Lottes, D.L. Sahagian, M.L. Hulver, and T.C. Gierlowski, 1985. Paleogeographic interpretation: with an example from the Mid-Cretaceous. In: G.W. Wetherill et al. (eds.). Annual Review of Earth and Planetary Sciences 13: 385-425. Palo Alto, CA: Annual Reviews, Inc.

PP42B-0527 1330h POSTER

Carbon and Strontium Isotope Profile on Neoprotozoic III at Three Gorges, China, and Possible evidence for Post Marinoan Ice age

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Neoprotozoic III and Lower Cambrian strata of the Three Gorges in China have been well documented on stratigraphy and paleontology. The carbonate-rich strata of the Upper Neoprotozoic III occur above two tillite formations (Gucheng Formation and Nantou Formation), and they are divided into two formations. The lower of these, the Doushantuo Formation, contains black laminated dolostone and shaly dolostone. The overlying Dengying Formation is dominated by pink to light grey dolomite in the upper part and contains fossils of macroscopic algae (Vendotaenids), the middle part outcrops limestone and base outcrops dolostone. The Gucheng tillite Formation is covered by interglacial deposits of Datangpuo Formation that are overlain by Nantou tillite Formation. The Lower Cambrian strata are grey fossiliferous limestone with some interbedded black shale contains complex small fossils zone. Carbon and strontium isotopes were measured by standard methods on a section from the top of the Nantuo Formation to the Lower Cambrian. d13C rises to +4 5 from -4 within the lower part of Doushantou Formation, and then drops dramatically to -8 at the boundary of Doushantuo Formation and Dengying Formation. This is followed by a rapid rise to higher than 12 from -8 to +4 at the base of Dengying Formation. Stable values of +3 to +4 occur in the lower and middle part Dengying Formation, and are capped by a gradual drop from +2 to -3 at the top most part of Dengying Formation to the boundary of Cambrian as defined by complex small shall fossils. A short increase spans the boundary of Precambrian-Cambrian from -3 to 2. 87Sr/86Sr rises from 0.7075 at the base and middle part of Doushantuo Formation to 0.7095 at the boundary of Doushantuo-Dengying Formation boundary, and then falls to 0.7083 at the lower part of Dengying Formation. Gradually, it rises from 0.7082 to 0.7092 at the middle to upper part of the Formation. After falling back to 0.7087 near the top of the Dengying Formation, 87Sr/86Sr rises again at the boundary of Precambrian-Cambrian synchronously with d13C. The carbon and strontium isotope record of the section is strikingly similar to those from the Congo craton in Namibia, which also has two tillite formations, the Chuos tillite Formation at the base, Abenab subgroup dolostone at middle, and Ghaub tillite Formation at upper, and Maieberg Formation of dolostone overlies Ghaub Formation. The isotope curves can be correlated with each other, Doushantuo Formation to Abenab subgroup, and Dengying Formation to Maieberg Formation, respectively. Similar lithological aspects of Three Gorges section and Congo craton support this correlation too, where the lower part of the sections mainly outcrops dark and laminated dolostone in Doushantuo Formation and Abenab subgroup, with pink dolostone in the Dengying Formation and Maieberg Formation. This suggests correlation of the Nantuo tillite to the Chuos tillite. Strong fluctuations of d13C and higher 87Sr/86 around the top of the Doushantuo Formation, may suggest the Ghaub Formation tillite can be correlated to the boundary of Doushantuo Formation-Dengying Formation. As the existence of two tillite formations of Neoprotozoic III in the Three Gorges (Gucheng Formation and Nantuo Formation), the Ghaub Formation tillite in Namibia may represents the third local glacial deposits that are so called post Marinoan.

PP42B-0528 1330h POSTER

Paleoclimate Reconstruction From the d13C Organic and d13C Carbonate Proxies in Triassic Paleosols and Sediments, Ischigualasto Basin Argentina

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Stable carbon isotopes of organic matter and paleosol carbonate from the Triassic Ischigualasto Formation, Argentina are used as a proxy of paleoatmospheric pCO2 and d13CO2. Carbon and Oxygen isotope values were determined for over 100 Triassic pedogenic carbonate nodules and associated organic matter. The d13C of carbonate ranges from -3.29 per mil to -10.56 per mil. The d13C of organic matter ranges from -21.07 per mil to -24.24 per mil. The Hydrogen and Oxygen indices and TOC values indicate that the best preserved organic matter samples yield the most negative d13C values. Reconstructed pCO2 levels were around 1000 ppm V in the early to mid- Triassic and increased to around 2000 ppm V later in the Triassic. This maximum is followed by a fall in pCO2 in the late Triassic. This previously undocumented rapid change in paleo-CO2 levels likely accompanied the evolution of mammal-like reptiles to true dinosaurs as well as rapid climate change.

PP42B-0529 1330h POSTER

Ice Core Reconnaissance in Siberian Altai for Mid-Latitudes Paleo-Climatic and Environmental Reconstruction

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Investigations in Siberian Altai permits to expand our scope from Tibet, Himalayas, Tien Shan and Pamir to the area located at the northeastern edge of the Central Asia Mountain System. Altai forms a natural barrier to the northern and western air masses and therefore affords an opportunity to develop modern paleoclimate records relating to the westerly jet stream, the Siberian High and Pacific monsoon. Moreover, Altai alpine snowice accumulation areas are appropriative for studying air pollution dynamics at the center of Eurasia, eastward from the major Former USSR air pollutants in Kazakhstan, South Siberia and Ural Mountains. During the last century Altai Mountains became extremely contaminated region by heavy metal mining, metallurgy, nuclear test in Semipalatinsk polygon and Baikonur rocket site. Our first field reconnaissance on the West Belukha snow/firn plateau at the Central Altai was carried out in July 2001. Dispute of the large Alatai Mountains glaciation, the West Belukha Plateau (49°48' N, 86°32'E, 4000-4100 m a.s.l.) is only one suitable snow accumulation site in Altai to recover ice-core paleo-climatic and environmental records that is not affected by meltwater percolation. The objective of our first reconnaissance was to find an appropriate deep drilling site by radio-echo sounding survey, to recover shallow ice-core, to identify the annual snow accumulation rate, major ions, heavy metals, radio nuclides and oxygen isotopes level distribution. During 6 days of work on the Plateau, a 22 m shallow firn/ice core has been recovered by PICO hand auger at elevation 4050 m where the results of radio-echo sounding suggests about

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150 m ice thickness. In addition to the firn/ice core recovery, five 2.5 meter snow pits were sampled for physical statigraphy, major ions, trace element, and heavy metals analysis to assess spatial variability of the environmental impact in this region. Four automatic snow gauges were installed near proposed deep ice coring site for year around records. The seasonal accumulation at the drilling site was ranged from 250 to 300 ?? with density of 0.34 - 0.40 g cm-3. The ice-core stratigraphy analysis has shown that accumulation area seems to lie in the cold infiltration-recrystallization zone. Geochemical analysis of the shallow ice core, snow pit samples collecting during the 2001 field research will be discussed along with meteorological and synoptic data collected at the nearest to Belukha Plateau Akkem, (2050 m) and Kara -Tyurek (3600 ?) stations. A preliminary result has revealed that variability of elementary synoptic processes over the region impact on the amount of precipitation. North Atlantic Oscillation and West Pacific Oscillation indices have inverse associations with average amount of precipitation in Siberia where Altai is located.

URL: http://www.icess.ucsb.edu/%7eaizen/aizen.html

PP42B-0530 1330h POSTER

The last Pluvial Highstand (Late Wisconsin, Tioga Age) in Panamint Valley, Southeast California

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A large late Wisconsin age lake has not been previously documented in Panamint Valley which contains a small north basin and a large south basin, both of which could have received overflow from the Owens River system via Searles Lake when the lake exceeded 1700' elevation. A 14C age on gastropod-bearing tufa indicates that the lake's surface elevation was near 512m (1680') at 22,600 ka +/-130 yr. This tufa deposit is about 2-3 meters thick and forms a fringing reef within a bedrock alcove about 1 km north of Water Canyon. The deposit appears to document a water body in the southern basin that would have been about 11 km wide, 52 km long and least 150m (500') deep with a volume around 4000 km3. Tentatively, the highest stand of the Tioga-age glacial lake' could have reached 1800-1820' based on the marginal-lacustrine gastropod assemblage Helisoma newberryi newberryi, Vorticifex solida (lacustrine indicator), and Stagnicola sp., found in a sandy (beach?) deposit 120' upslope from the 1680' tufa, but probably was not any higher (14C in progress). The lake does not appear to have breached the Wingate Pass spillway at 1977' into Death Valley during the last glacial.

Along the lower part of the Shepard Canyon fan, lacustrine silt is exposed at about 415m (1360') in a stream incision overlain by 1.5 to 2.0 meters of alluvial gravel. Tufa underlying the silt yielded a 14C age of 17,130ka +/- 100yr indicating a lake whose shoreline elevation was between 60 to 75 meters above the present valley floor. White chalky silt overlying the tufa at this locality yielded abundant Limnocythere sappaensis, an ostracode that lives within a wide range of total dissolved solids (TDS) in waters that are enriched or dominated by bicarbonate-carbonate and depleted in Ca. Its waters typically have an alk/Ca ratio of 7 or much higher. When this species is abundant and the only ostrocode present, the lake water commonly has a TDS of more than about 20,000 mg/L; in lakes with a much lower TDS other ostracodes are typically present. Thus, the abundance of L. sappaensis, combined with the absence of other ostrocodes, suggests an alkaline-saline lake.

A well-developed desert pavement with heavy varnish (Q3a and/or Q2 of Bull, 1999), occurs on the surface above 1.5 to 2.0 m of gravel that overlies the lacustrine silt and tufa dated at 17,130ka +/- 100yr. This pavement apparently postdates the last pluvial maxima and is very latest Pleistocene (or earliest Holocene). However, scattered, well-rounded cobbles that may be beach derived lie on or in Q2 pavement exposed 30-40 meters upslope from the lacustrine sediment outcrop.

The main body of the southern lake was nearly dry by 15,050 ka +/-80yr as indicated by the 14C age of root casts found in chalky silt at 357m (1170'), 11m above the present southern playa floor at the lowest part of the Revenue Canyon fan near the axial wash. The drying of Panamint Lake by about 15,050 ka approximately coincides with the time that overflow from Searles Lake is inferred to have ceased.

In the northern basin, tufa crops out at about 480m (1570') on the east side of Lake Hill; at the north end of Ash Hill, tufa occurs at about 1650-1700' and higher. The northern basin is isolated by a divide that reaches 1700' west of the Wildrose Horst. The northern lake, about 20 km long, 3-7 km wide, and 35-45 meters above the present valley floor, would have been mainly fed by a large watershed on the Darwin Plateau unless the northern and southern basins were connected.

PP42B-0531 1330h POSTER

Numerical Evidence for Abrupt Thermohaline Circulation Change at the Paleocene-Eocene Boundary Caused by Gradual Strengthening of the Hydrologic Cycle

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During the Paleocene-Eocene Thermal Maximum (PETM, 55 Ma), marine and terrestrial carbon isotope values exhibit a negative shift of at least 2.5 per mil (PDB), indicative of massive destabilization of marine methane hydrates, releasing 1100 gigatonnes of methane carbon. The cause of the hydrate destabilization is unknown but has been speculated to be warming due to a change from high-latitude to low-latitude deepwater formation. We present results from a numerical ocean model indicating that a sudden switch of deepwater formation from southern to northern high latitudes caused mid-depth and deep-ocean warming of 3-5 C. The thermohaline circulation switch is caused by a slow increase in the intensity of the atmospheric hydrologic cycle, as expected under increasing temperatures and consistent with PETM sedimentary evidence. Two mechanisms are indicted for thermal destabilization of methane hydrate. Deepened subduction prior to the THC switch causes warming of 1-4 C in limited areas at thermocline through upper intermediate depths, which could destabilize methane hydrates gradually and at progressively greater depths. Subduction warming is most pronounced in the Atlantic basins at 400-1400 m. The THC switch itself occurs abruptly, with up to 5 C warming resulting everywhere in the deep ocean. The magnitude and extent of the abrupt warming might have destabilized most (all?) remaining hydrate at the PETM.

PP42C MC: 120 Thursday 1330h

Paleoclimate and Paleoceanographic Records in the Mediterranean Sea II

(joint with OS)

Presiding: **P A Meyers,** Dept of Geological Sciences**; A Negri,** Universita di Ancona

PP42C-01 1330h

Sapropels and Black Shales - Peas in a Paleoceanographic Pod?

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Neogene-Quaternary sapropels of the Mediterranean Sea and Mesozoic black shales record episodes of extraordinary accumulation of organic matter in marine sediments, but do they record former scenarios that were the same except for their times of occurrence? Sapropels and black shales share many distinctive properties. Their organic carbon concentrations commonly exceed 20 per cent. They are rich in marine-derived organic matter, yet their C/N ratios are similarly elevated and mimic those of land-derived organic matter. The coupled presence of isorenieratene derivatives and low del15N values indicates that photic zone anoxia existed during their formation. Enrichments of redox sensitive metals show that anoxia also existed at the seafloor. Expanded sapropel and black shale sequences reveal that they contain similar annual laminations in which sunspot cycles can be identified. Finally, their depositional settings ranged from marine margins to the deepsea. Important differences also exist between sapropels and black shales. Foremost is that they are separated in time by more than 75 million years. Occurrences of sapropels are constrained to the Mediterranean Basin, whereas the distribution of black shales is global. Carbon isotope excursions exist in both sapropels and black shales, but they appear to record short-lived, local perturbations of the carbon cycle in the sapropels and long-term, global rearrangements in the black shales. Precessional cyclicity is strongly evident in sapropels. In contrast, sea-level cycles are strongly expressed in black shales, and their dominant orbital cycle is obliquity. These comparisons suggest that different combinations of paleoclimatic factors created similar paleoceanographic conditions during times when basin morphology was suitable for deposition of the organic-carbon-rich sapropels and black shales.

PP42C-02 1345h

Neodymium Isotope data for Foraminifera Indicates Increased Nile Outflow During Mediterranean Anoxic Events

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The environmental conditions leading to deep water anoxia in the Eastern Mediterranean during sapropel formation remain controversial. It is broadly accepted that sapropels are the result of either water column stagnation or increased export production, or both. Oxygen isotopes indicate reduced surface-water salinities during sapropel formation, which would have facilitated deep-water stagnation via convective stabilisation of the water column. A number of sources for the additional freshwater have been proposed, including glacial meltwater influx, increased outflow from European rivers, increased precipitation over the Mediterranean region as a whole, and increased Nile outflow due to intensification of the African monsoon. Oxygen isotopes by themselves cannot fully distinguish between these various possibilities. Though the exact mode of incorporation of neodymium (Nd) into foraminiferal tests remains a matter of debate, Nd isotopes in sedimentary planktonic foraminifera clearly record those in surface seawater and not any other part of the water column or the sediment[1,2]. Here we present Nd isotopic data for both the present-day Nile and for sedimentary foraminifera from ODP core 967, which demonstrate a significant increase in Nile outflow during the formation of sapropel S5.

Samples of Nile river water were collected from the Sudan in the dry season and analysed for neodymium isotope compositions. These analyses clearly show that the River Nile has both a very high neodymium concentration compared to the Mediterranean and a distinct $^{143}Nd/^{144}Nd$ ratio. ϵ_{Nd} (defined as $((^{143}Nd/^{144}Nd_{sample})/(^{143}Nd/^{144}Nd_{CHUR})-1)\times10^4$) for the main Nile around and below Khartoum is -3. In the wet season (sampling in progress), the Blue Nile (ϵ_{Nd} = +1) dominates over the White Nile (ϵ_{Nd} = -16) and the total Nile discharge is vastly greater, so that the annually-integrated ϵ_{Nd} of the main Nile should be even higher than -3. In contrast, the central Mediterranean has an ϵ_{Nd} value of about -10. There are as yet no data for the Nd isotopic composition of the Eastern Mediterranean, but owing to the influence of the River Nile this value might be expected to be around -6.

Foraminifera tests from specific horizons within sapropel S5 have been sampled and analysed for Nd isotopes. Preliminary data show a shift of 1.5-2 epsilon units from background Mediterranean values towards the Nile value within the sapropel. This shift compares to an analytical uncertainty for individual analyses of 0.15-0.2 epsilon units. No other postulated source of freshwater can produce such a shift and the data, therefore, point to a clear increase in Nile discharge at the time of sapropel S5 that was felt in the Levantine Basin.

[1] D.Vance, and K.W. Burton, Earth Planet. Sci. Lett. 173, 365-379 (1999). [2] D.Vance, G.M. Henderson, K.W. Burton and N.C. Slowey, J. Conf. Abs. 5, 1042, (2000).