plot within the modern surface domain at temperatures of 12°C. However, the phyllosilicate data points plot well outside their respective MSDs, suggesting the phyllosilicate δ D values of these Triassic samples have likely been altered by proton-diffusion.

PP52A-0330 1330h POSTER

Stable Isotopes in Precipitation in the Canadian Rockies: Implications for Meteorological Controls on Annual Snowpack

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Fresh snow and rainwater samples were collected in February, March, and August 2002 at elevational transects extending from 1800 to 2900 m in the Haig Icefield region, southern Canadian Rockies. The Haig Icefield straddles the continental divide and its principal outlets drain into eastern and northern slopes of the Upper Kananaskis, French, and Robertson valleys. Both eastern and northern drainages are considered to be lee slopes with respect to the prevailing westerlies that bring moist Pacific air masses into the region. Snow and rain samples were analyzed for oxygen and hydrogen isotopes as a function of altitude, revealing opposite elevation-depletion relationships in different precipitation events. We interpret the results in relation to synoptic meteorological conditions during each event. Different synoptic systems have distinct isotopic signatures in the region. Snow samples were also collected from snowpits at three different sites, providing a stratigraphic record of isotopic content through winter 2001/2002. Isotopic variability allows us to assess the synoptic controls on seasonal snowpack in the region. This offers a promising avenue for improved understanding of moisture supply and its sensitivity to interannual variations in weather system frequency.

PP52B MCC: 131 Friday 1330h

Advances in the Development and Application of Paleoproxies II *(joint with A, H, OS, GC)*

Presiding: **G Klinkhammer,** Oregon State University**; P K Swart,** University of Miami

PP52B-01 1330h

Temperature-Dependent Ca Isotope Fractionation in Calcitic Phyto- and Zooplankton (*Emiliania huxleyi* and *Orbulina universa*)

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Coccolithophores are important primary producers and are responsible for approximately half of the global carbonate precipitation. Their first occurrence dates back to the Triassic, thus, providing the potential to record long-term changes in ocean chemistry.

Here we report results of δ^{44}Ca analysis of the coccolithophorid *Emiliania huxleyi* grown in mono-specific cultures at temperatures ranging between 5 and 20°C. The temperature-dependence of Ca isotope fractionation in *E. huxleyi* is 0.042 $\pm$ 0.005$^o/_{oo}$ /°C which is similar to the planktic foraminifera *O. universa* (0.019 $\pm$ 0.002$^o/_{oo}$/°C) (Gussone et al. 2002). The observed Ca isotope fractionation ($\epsilon_{calcite-fluid}$=-1.1$^o/_{oo}$, 15°C) is in general agreement with a previously published value of cultured *E. huxleyi* at 16°C (DeLaRocha and DePaolo 2000). In contrast, Quarternary coccolith oozes show considerably lighter δ^{44}Ca values ($\epsilon_{calcite-fluid}$ =-1.9 to -2.6 $^o/_{oo}$) (Zhu and McDougall 1998). The origin of this discrepancy is not yet clear. It may be due to culturing artifacts, diagenetic alteration or species-dependent Ca isotope fractionation.

The fractionation of Ca isotopes in calcite is similar in *E. huxleyi*, *O. universa* and sclerosponges (*Spirastrella* (*Acanthochaetetes*) *wellsi*). In contrast, Ca isotopes in inorganic aragonite and aragonitic sclerosponges (*Ceratoporella nicholsoni, Astrosclera willeyana, Vaceletia sp.*) are more strongly fractionated ($\epsilon_{aragonite-fluid}$ =-1.7$^o/_{oo}$, 15°C). These observations indicate that kinetic Ca isotope fractionation during calcium carbonate precipitation depends *inter alia* on the skeleton mineralogy of marine organisms. The latter effect has to be explained by a model of kinetic isotope fractionation taking the specific mineralogical differences between calcite and aragonite into account.

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Zhu, P. and McDougall, J.D. Geochimica et Cosmochimica Acta **62**, 1691-1698, 1998

PP52B-02 1345h INVITED

Paleoproxies: Heavy Stable Isotope Perspectives

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Recent advances in isotope ratio mass spectrometry, namely multiple collector ICP-MS and refined TIMS techniques, will significantly enhance the ability to measure heavy stable isotope fractionation, which will lead to the development of a wide array of process-identifying (bio)-geochemical tools. Thus far research in this area is not easily assessable to scientists outside the isotope field. This is due to the fact that analyzing heavy stable isotopes does not provide routine numbers which are per se true (the preciser the truer) but is still a highly experimental field. On the other hand resolving earth science problems requires specialists familiar with the environment being studied. So what is in there for paleoceanographers?

In a first order approach, relating isotope variations to physical processes is straightforward. A prominent example are oxygen isotope variations with temperature. The total geological signal is of course far more complicated. At low temperatures, heavy stable isotopes variations have been reported for e.g. Ca, Cr, Fe, Cu, Zn, Mo and Tl. Fractionation mechanisms and physical parameters responsible for the observed variations are not yet resolved for most elements. Significant equilibrium isotope fractionation is expected from redox reactions of transition metals. However a difference in coordination number between two coexisting speciations of an element in the same oxidation state can also cause fractionation. Protonation of dissolved Mo is one case currently discussed. For paleoceanography studies, a principal distinction between transition metals essential for life (V to Zn plus Mo) or not will be helpful. In case of the former group, distinction between biogenic and abiogenic isotope fractionation will remain an important issue. For example, abiotic Fe redox reactions result in isotope fractionations indistinguishable in direction and magnitude from microbial effects. Only a combination of different stable isotope systems bears the potential to solve this problem for a given set of samples and thus to model the ocean system more accurately in different scales.

Besides all complications some important applications of heavy stable isotopes as paleoproxies already emerge. Pilot studies indicate that Mo isotopes may present a proxy for the extend of anoxic condition in past oceans. On a finer scale the same system appears to provide a measure of (bio)-chemical redox-changes related to diagenesis. The Ca isotope system may complement more classical sea surface temperature proxies in particular environments. Promising results exist for polar waters (N. pachy left), as well as indications on the seasonality under global greenhouse conditions 110-50 Ma ago. However, the heavily species dependent Ca isotope fractionation can not be interpreted by just adopting concepts and findings from the oxygen system. While a complication to the ease of use as SST proxy, this species dependence offers pathways to unravel different modes of bio-calcifications.

Given the complexity of the matter, collaboration of specialists of different fields will be needed to develop successful process-related hypotheses and diagnostic tools.

PP52B-03 1400h

Do geochemical and faunal estimates of upper-ocean temperature agree in the tropics? Yes and no.

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To test geochemical and faunal proxies for upper-ocean paleotemperatures, we developed a uniform data set of multiple proxies in a core from the equatorial cold tongue in the eastern tropical Pacific over the past 25,000 years. The proxies are Mg/Ca on surface-dwelling G. ruber (using the time-resolved sequential leach procedure of Haley and Klinkhammer, 2002, and Benway et al., 2002, and the temperature calibration of Dekens et al., 2002), the alkenone index Uk'37 (using the temperature calibration of Prahl et al., 1988), traditional faunal transfer functions based on radiolarians (Pisias et al., 1997), and a revised faunal transfer function method for foraminifera (Mix et al., 1999). To first approximation, all the methods agree within their calibration uncertainties that temperatures in the eastern Pacific cold tongue varied by 3-5 degrees C from glacial-to-interglacial time. In detail, however, the methods disagree. For example, the two geochemical methods bracket the range of total change, with largest changes in Mg/Ca (6 degrees) and smallest changes in Uk'37 (3 degrees). The radiolarian and Uk'37 indices stay relatively cold through the deglaciation and warm in the early Holocene, whereas the foraminiferal and Mg/Ca indices document warming relatively early following the Last Glacial Maximum. The differences in timing of changes occurs over a 1 meter interval of the core, and thus are not an artifact of differential bioturbation. We explore the potential causes of offsets between the indices, based on the ecological preferences of the carrier particles and other possible effects.

PP52B-04 1415h

Sr/Ca in Coral Aragonite: Is Night Carbonate a Good Indicator of Sea Surface Temperatures?

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Sr/Ca in coral skeletons has potential as an indicator of past seawater conditions but exhibits geochemical heterogeneity on a small spatial scale (<100 μm) that does not reflect variations in sea surface temperature (SST) or chemistry. Skeletal Sr/Ca is affected by variations in skeletal calcification rate which may be dependent on the photosynthetic activity of the zooxanthellae in coral tissue. The skeleton deposited at night may be unaffected by these variations and may be a more reliable indicator of SST (Cohen *et al.* 2001).

We used secondary ion mass spectrometry with a 10 μm diameter analysis spot to construct records of Sr/Ca in a *Porites lobata* specimen from Lanakai, Oahu, Hawaii. Analyses were performed on sections cut perpendicular to the growth surface of the coral skeleton, spanning annual bands. Parallel tracks were analysed following fasciculi (composed of acicular crystals deposited during the day) and centres of calcification (composed of fusiform crystals deposited at night).

The Sr/Ca of the day and night material follow similar seasonal trends but are offset with night carbonate typically enriched by 0.3-0.4 mmol mol^{-1}. Both profiles are characterised by large Sr fluctuations of 0.4-0.5 mmol mol^{-1}, which are deposited approximately days apart and are superimposed on the general Sr seasonal trend. These fluctuations do not reflect variations in SST but may relate to daily variations in coral calcification or linear extension rate both of which can vary markedly during the day and night. We conclude that night carbonate **is** affected by kinetic processes and that there are similar challenges in reconstructing SST records from night carbonate as from day carbonate.

Cohen AL *et al.*, Kinetic control of skeletal Sr/Ca in a symbiotic coral: implications for the palaeotemperature proxy, Paleoceanography, 16, 20-26, 2001.

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PP52B-05 1430h

High-Resolution Cellulose Oxygen Isotope Records From Indonesian Trees

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Tropical paleoclimate records such as those derived from ice cores, lake sediments, and corals have yielded valuable insights into the Holocene history of the major modes of climate variability, in particular the El Niño/Southern Oscillation. However, because tropical trees generally lack visible, annual growth rings, their potential as recorders of climate variability has not been fully explored. To circumvent this difficulty, we made high-resolution oxygen isotopic measurements on cellulose extracted from tree samples from Indonesia. First, we examined teak samples, which are one of the rare tropical trees that display well-defined annual growth rings. The samples cover the period from 1800 to the present and show annual to bi-annual cycles, coherent with the visible rings. We use these samples to explore intra-site and intra-tree variability. Second, we measured $\delta^{18}O$ time series from three suar wood samples with no visible rings. The oxygen isotopic values are compared to radiocarbon-based age models and show a positive correlation between estimated growth rates and amplitude of the ^{18}O seasonal cycle, suggesting a common environmental forcing. Although the isotopic seasonal cycles are not always regular enough for perfect chronological control, they provide encouraging support for the use of high-resolution isotope records from tropical trees as proxies for multi-century reconstructions of climate variability.

PP52B-06 1445h

Calibration of Caribbean Sclerospognes to Their Ambient Environment: Indirect and Direct Methods

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Sclerosponges construct a concentrically banded aragonite skeleton, recording the ambient environment of their cryptic reef habitats over scales of hundreds of years. In an investigation of their use as high-resolution paleoclimate proxies, periodically stained sclerosponges collected from the northern coast of Jamaica are calibrated to their ambient environment using a variety of methods, both indirect and direct. One method of indirect calibration involves using cycles present in high resolution oxygen isotope data correlated with high-resolution Sr/Ca data. Because oxygen isotopes have been field calibrated to temperature, Sr/Ca can be calibrated to temperature via oxygen isotopes if both time series are assumed to reflect the full annual amplitude of the temperature signal. This method also assumes that a field calibration of oxygen isotopes in different sponges and locations is applicable to the intra-annual cycles of an individual sclerosponge. In a second method of indirect calibration, proximal corals with excellent time constraint are analyzed over the period during which the sclerosponges were stained. Because various proxies have been field calibrated in corals (i.e. oxygen isotopes to temperature and salinity; Sr/Ca, Mg/Ca, Ba/Ca, and U/Ca to temperature, carbon isotopes to photosynthesis and heterotrophy), relationships between sclerosponge skeletal chemistry and the environmental conditions inferred from the coral data can be resolved. Finally, attempts are made to directly calibrate stained segments of sclerosponges to real temperature and water chemistry data taken over a three year period from the caves in which the sclerosponges were growing. Direct calibration involves very fine sampling resolution from the top millimeter of the skeleton, which is achieved via LA-ICP and micro-milling techniques. Through three independent means of calibrating sclerosponges to their modern environment, questions of their use as high-resolution proxies over longer time scales can be addressed.

PP52B-07 1500h

Biologically Controlled Variations in Stable Isotope, Sr/Ca, Mg/Ca and U/Ca Ratios in Deep-Sea Corals

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Recently both Sr/Ca and Mg/Ca ratios in coral and foraminifera carbonate have been proposed as temperature proxies. While empirical calibrations of these new tracers have been impressive, there are still large differences between the biogenic temperature slopes and those found inorganically in the lab. Because they grow in constant seawater conditions without photosynthetic symbionts, modern deep-sea corals provide a natural laboratory for constraining calcifications effect on paleo proxies generally. We have made measurements of carbon and oxygen isotope ratios and Sr, Mg and U/Ca ratios in several specimens of Desmophyllum cristagalli. The stable isotopes show large variations ($12^o/_{oo}$ in carbon and $5^o/_{oo}$ in oxygen) that are strongly correlated both with each other and with the corals banding pattern. Our new isotope dilution ICP-MS data for Mg and Sr also show large variations. Mg/Ca ratios increase by about a factor of 3 in the newly precipitated aragonite, which is seen as a white band in transmitted light images. Within this same band Sr/Ca tends to decrease by about 10% but its pattern has more variability. Values for both of these cations in the more slowly precipitated dark bands are much closer to other data for biogenic distribution coefficients. U/Ca data are being collected by induced fission and are not yet available. Several different models have been proposed to explain small spatial scale variations in cation and stable isotope ratios. These generally fall into two categories, those based on transport of chemical species to the calcification medium and those based on fractionation effects at the solid/liquid interface. Our new Mg and Sr results tend to support the transport models.

PP52B-08 1535h INVITED

Osmium Isotopes as a Sediment Paleo-redox Proxy?

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Several recent studies have highlighted the potential of using authigenic Re enrichments in marine sediments, in conjunction with other trace metals, to constrain paleo-redox conditions. Specifically Re is strongly enriched in sediments deposited under reducing conditions. Interpreting the sedimentary records of authigenic Re enrichment is complicated by the fact that this metal can be readily mobilized upon reoxidation during early diagenesis, a phenomenon commonly referred to as "burn-down" (See Cruius and Thompson GCA 2000 and references therein). This diagenetic redistribution of Re limits the utility of the metal as an indicator of paleoredox conditions in marine sediments.

In this presentation we will review results of several published studies demonstrating that authigenic Os incorporated into reducing marine deposits is less mobile than Re during subsequent oxidation. This allows appreciable amount of Os to persist even in sediments that have experienced extensive oxidation. Furthermore we show that evidence of very high Re/Os ratios, characteristic of reducing depositional conditions, can be preserved in the form of unusually high $^{187}Os/^{188}Os$ ratios in these oxidized samples. These very high ratios are produced by in situ decay of ^{187}Re prior to burndown.

To illustrate the utility of this approach we will present new data from a South Atlantic DSDP core (Site 522). This record displays an excursion to unusually radiogenic $^{187}Os/^{188}Os$ during the initiation of the first major glaciation of the Oligocene. We interpret this excursion as evidence as a brief episode of reducing conditions in the South Atlantic. We have not recognized an analogous excursion in coeval Eocene-Oligocene Os records. Therefore we interpret this as a local phenomenon. Increased productivity driven by glacially enhanced nutrient delivery to the Southern Oceans may have played a causative role in generating this brief (less than 90 kyr) episode of low oxygen conditions in the South Atlantic.

PP52B-09 1550h

Development of a Rare Earth Element Paleoproxy

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The rare earth elements (REEs) have demonstrated considerable potential as paleoproxies for changes in seawater chemistry. However, their utilization in paleoceanographic investigations has been mainly limited to neodymium isotopic analyses in metalliferous deposits and fossil apatite. The goal of being able to use the entire group of elements in foraminiferal shells has proven difficult. The problem with analysis of these elements in this matrix stems mainly from: (1) the ability to clean the shells of diagenetic aberrations and (2) the paucity of REE data in the environment where forams obtain their primary signature.

We recently measured pore water profiles of REEs using an interfaced Ion Chromatograph (IC) and Inductively Coupled Plasma Mass Spectrometer (ICP-MS) in a depth transect off the Coast of California, and a profile from off the Peru-Chile margin. The pore water results are surprising and will alter our view of REE marine geochemistry. For example, they call into question the traditional method of calculating a "Ce-anomaly." The profiles also show dramatic changes in REE concentrations and patterns with depth, and demonstrate that the REE signature preserved in epifaunal benthic versus infaunal foram species and diagenetically added phases should be easily identifiable. Preliminary REE results from forams cleaned via a recently developed flow-through technique will be shown and compared to matching pore water data. We will conclude by outlining the potential of foraminiferal REE content for paleoceanography that ranges from water mass tracer to proxies for organic carbon flux and oxygen concentration.

PP52B-10 1605h

A Proxy for Reconstructing Pore Water TCO2 Gradients and Carbon Oxidation Histories in the Northeast Pacific Using the Carbon Isotopic Composition of Benthic Foraminifera

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The tests of modern benthic foraminifera inhabiting the dysoxic, laminated sediments of the Northeastern Pacific margin record del13C values that reflect the isotopic composition of overlying (epifaunal species) and pore water TCO2 (infaunal species). Pore water TCO2 gradients indicate the rate of organic carbon oxidation occurring during early diagenesis, i.e. the fate of most Corg rain to the sea floor. Hence, reconstructing paleo-pore water TCO2 gradients can shed light on paleo-carbon rain rates as well as provide constraints on intermediate water ventilation histories in the North Pacific. In a previous study in Santa Monica Basin, CA, we showed that B. argentea secretes CaCO3 with a del13C value consistent with bottom water and the infaunal species (B. tenuata) had a del13C value equal to the del13C value of pore water TCO2 at 5 mm sediment depth. We used this relationship to reconstruct paleo-TCO2 gradients in Santa Monica Basin. We have now examined and will report upon the distribution of living infaunal forams, their isotopic values, pore water TCO2 gradients, pore water del13CO2 profiles and the amount of methane in pore waters at 2 additional Santa Monica Basin sites, one site in Santa Barbara Basin and 4 sites on the western continental margin of Mexico.

The foraminifera living within the upper 1 cm of dysoxic, laminated sediments show depth distributions that consistently have B. argentea living near the sediment water interface, B. tenuata living deepest and B.

subadvena living at intermediate depths. The stratification in species abundances is reflected their respective del13C values; B. argentea consistently reflects pore water del13C values near the sediment water interface, B. tenuata is the isotopically lightest, and B. subadvena del13C values fall between the other two species. Each species appears to secrete calcite at a preferred depth based upon the consistent isotopic value displayed by all Rose Bengal stained individuals. This observation is further verified by applying a diffusion/reaction model to the pore water TCO2 profiles. Using this model, we predict a del13CO2 pore water gradient for each site. From modeled del13CO2 distributions and measured foram del13C values, the depth at which a foram has precipitated its test is predicted. This predicted depth, in most instances, agrees with the depth of maximum abundance.

PP52B-11 1620h INVITED

A 23 kyr Record of Surface Water pH and pCO2 in the Western Equatorial Pacific

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We have measured the boron isotope composition and Mg/Ca ratios of 20 samples of Globigerinoides sacculifer taken from core ERDC-92 collected from 2S 160E (1598 m) in the western equatorial Pacific. The samples range in age from 0.4-23 ka and the data have been used to reconstruct the pH and pCO2 values of surface water during this period. These calculations show that surface water pCO2 waters were in equilibrium with the atmosphere over most of this time, but that they were significantly higher in the interval 13.5-17.5 ka. The greatest deviation occurred during 13.8-15.7 ka, when surface water pCO2 values reached 90+/-35 ppmv above those of the contemporaneous atmosphere. Deviations in surface water pCO2 values of this magnitude only occur in this area of the modern ocean during La Nina events. Hence, the boron isotope data suggest that this interval (which also coincides with the Bolling warm interval within the precision of the 14-C dating of this core) was characterised by an increased frequency of such events. Support for this hypothesis is provided by climatic records from additional areas (Arabian Sea and Carioco Basin) that are also sensitive to La Nina-type conditions. This study demonstrates that boron isotope studies of the type discussed here have the potential to provide us with CLIMAP style maps of the history of pCO2 deviations between the ocean and atmosphere, and thus provide important information concerning the mechanism by which ocean-atmosphere CO2 exchange changed during glacial-interglacial intervals.

PP52B-12 1635h

Examining the Evidence for the Influence of Carbonate Saturation State on Benthic Foraminiferal Mg/Ca

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Benthic foraminiferal Mg/Ca paleothermometry is based on an empirical relationship between the Mg/Ca of benthic foraminifera recovered from core tops and in situ bottom water temperatures (Rosenthal, 1997; Martin et al, in press; Lear et al, in review). While there is a tight correlation between shell Mg/Ca and temperature over a broad range of temperatures (-1 to 20 degrees C), Mg/Ca variation over the small range of deep water temperatures reveals departures from the calibration curve at low temperatures. Lower Mg/Ca values are generally associated with the deepest sites from the Atlantic and Pacific, contributing to an apparently steeper Mg/Ca-T response for abyssal benthics.

The steeper response of abyssal benthics may reflect an influence of decreasing carbonate saturation with depth. Saturation related effects have already been documented for Mg in planktonic foraminifera and for other metals (Cd, Ba, and Zn) in benthic foraminifera shells (see Marchitto and ref. therein). Although it is difficult to definitively separate the effects of various environmental parameters (including temperature, depth, and relative saturation states), which often change in unison, we can use the core top Mg/Ca data to estimate the potential influence of saturation state.

An alternative calibration of the benthic Mg/Ca T relationship can be derived from core top benthic foraminifera based only on sites bathed in waters above carbonate saturation that yields a slightly smaller change in Mg/Ca per degree C (9.5% vs. 11%) but better explains benthic Mg/Ca from the coldest sites (-1degrees C). Using this alternative Mg/Ca T relation and a subset of data from the Ceara Rise and Ontong Java Plateau, we can estimate a maximum Mg/Ca offset attributable to saturation state. By comparing core top and downcore data, we can also address possible differences in the primary Mg-T response and carbonate saturation related effects between different genera (Cibicidoides and Uvigerina).

PP52B-13 1650h

Sulfur in Foraminifera Shells, a New Paleoceanographic Proxy for Carbonate Ion in Seawater

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Paleo-carbonate ion chemistry of the oceans is essential for understanding past changes in the global carbon cycle, particularly CaCO3 dissolution cycles in the deep ocean and related variability in atmospheric CO2. Laboratory cultures of planktonic and benthic foraminifera showed the existence of a distribution coefficient for SO42- in their CaCO3 shells with respect to the SO42-/CO32- ratio in seawater. Hence SO42- concentration in foraminifera shells may have as a novel proxy for paleo-CO32- concentrations in the oceans. In-situ calibrations of this proxy were tested in the Little Bahama Bank (LBB) and the Gulf of Eilat. These studies showed significant variability in SO42- within and between species that was correlated with Mg content. Because Mg in foraminifera varies with temperature, we have normalized the SO42- concentration of the LBB depth gradient to a constant temperature (and constant Mg). This procedure yielded the expected negative relations between SO42- in the foraminifera and CO32- in the water column. Preliminary comparisons of the SO42- in benthic foraminifera from the present and last Glacial showed variability in pH similar (but not identical) to that estimated independently from 11/10B.

In order to test this new proxy more thoroughly, we have developed a rapid method for the isotope dilution analysis of sulfur in foraminifera using hexapole collision cell ICPMS technology (Micromass IsoProbe). Collisions of O2+ ion (the principle interference in ICPMS 32S+ analysis) with xenon added to the collision cell destroys most of the O2+ ion and leaves only a small residual interference on 32S+/34S+ isotope ratio analysis. Additionally, magnet scans to masses 24 and 46 allow for the simultaneous determination of Ca (nonlinear standard curve) and S/Ca and Mg/Ca; we found good agreement between the ID S determinations (with Ca measurements by ICPMS and FAAS) and direct ICPMS determinations of S/Ca. The relation was so good that isotope dilution may not even be necessary, although it is always comforting as it is completely unaffected by matrix effects.

PP61A MCC: Hall D Saturday 0830h

Paleoclimate, Global Change, and the Future I Posters *(joint with C, A, OS, GC)*

Presiding: **K Alverson,** PAGES International Project Office**; R Bradley,** University of Massachusetts**; T Pedersen,** University of British Columbia

PP61A-0281 0830h POSTER

A 290-year Record of Atmospheric Circulation over the North Pacific from A Mt. Logan Ice Core, Yukon Territory

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Calibrations between sodium (Na) concentrations from a Mt. Logan ice core and sea level pressure (SLP) series show that Na concentrations are closely correlated with the autumn-time (September-October-November) Aleutian Low (AleuLow) and the summertime (June-July-August) North Pacific High (NPaciHi). Both the deepening of the AleuLow and intensification of the NPaciHi strengthen the transport of sea-salt aerosols from the North Pacific to the Mt. Logan region. Mt. Logan Na records are used to develop a 292-year (1688-1979) reconstruction of the AleuLow and NPaciHi. Examination of the proxy records reveals a dramatic intensification of atmospheric circulation over the North Pacific region since the 20th century. Mean SLP of the AleuLow is about 1 mb lower, and 0.6 mb higher for the NPaciHi during the 20th century. The strongest deepening of the AleuLow was accompanied by a strengthening of the NPaciHi in the 1950s. Evolutionary spectral analysis of the proxy records shows significant periodicity consistent with a bidecadal oscillation (20-30 years) of North Pacific atmosphere-ocean circulation as well as the solar Gleissberg cycle (80-90 years).

PP61A-0282 0830h POSTER

Radiocarbon Dating of Holocene Moraines in Lapland, Northern Sweden

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Two palaeosols were investigated within glacial moraines in front of Nipals glacier, Lapland, Sweden. Some decades ago Wibjörn Karlén dated these soils already by conventional radiocarbon dating techniques. We present new results from AMS-dating of promising different components from these soils, such as *Coleoptera* (beetle) fragments, *Cenococcum geophilum*-spores and a sieved fraction <0,09 mm of woody plant tissues. The ages of four dated parts of one soil show two age clusters at 740-1170 and 1630-2340 cal yr BP. The first cluster is composed by spores and beetles and the second cluster by woody plant tissues and the soluble organic fraction. The cluster around 1000 cal yr BP is well known from former studies in Swedish Lapland, whereas the second cluster represents a soil development event in the Holocene that is not yet known in Swedish Lapland. Our preferred hypothesis to explain two clusters represented in one soil is that two different aged soils have been smeared into each other by a later advance of Nipals glacier. A second dated soil shows an age of 4300-6300 cal yr BP based on spores,