OS32A HC: Hall III Wednesday 1330h

Biogeochemical Evolution of the Phanerozoic Ocean I

Presiding: **A PAytan,** Geological and Environmental Sciences

OS32A-118 1330h POSTER

Continental Drift and Basin Formation During the Phanerozoic: Geotectonics under 2-Body Mantle Convection

Robert Christian Bostrom (206/543-1087; rbostrom@washington.edu)

ESS Bx 351310,Un. of Washington, 15th Av. NE, Seattle, WA 98195

During the Phanerozoic the distribution of continents has varied from the singleton Pangea aggregation to the complicated distribution of post-Paleozoic times, providing biogenetically favorable marine basins and shorelines at all latitudes. Accounting for continental drift, thermal convection within the Earth's mantle is known to be inevitable, but fails to account for major features of plate motion.

The tectonic record is here examined in terms of 2-body convection. Of its essence convection is a gravity phenomenon, of necessity a function of total ambient gravity. The field within the Earth member of Kuiper's Earth/Moon double planet consists not only of the terrestrial field but that of its satellite, uniquely massive relative to that of its primary and in continuous close orbit [1]. The action of the mobile tidal bulges, some tens of cm in geocentric height at the Equator, is to induce vorticity dimensionally similar to that in convection of purely internal origin, but asymmetrical and peaked strongly in low latitudes. Convection under the joint field is of a two-body type, internally powered under Earth's highly supercritical Rayleigh number, but of form determined jointly by the internal plus external field. Heuristically it may be viewed as taking place under a minute permanent tilt, delimited by the departure from the geocentric vertical of phase-delayed water and solid-earth masses, averaged over one revolution. As measured by the tidal phase lag including that in the oceans, in low latitudes the asymmetric fraction of the convection may represent a large fraction of the whole [2].

Under this regime it is to be expected, for instance, that when a 'Pangea' aggregation breaks up the drift of its fragments resembles the development of an 'Atlantic Ocean', with absolute motion of the Americas towards the Pacific realm, encroaching on the Pacific realm [3]. Similarly asymmetric displacement is evident in the form of the western equatorial embayment of the Pacific towards Sundaland.

References: [1] RCB, 2000. Tectonic Consequences of Earth's Rotation (Oxford UP): 48-49. [2] Cartwright, D.E. and R.D. Ray, 1991. Energetics of global ocean tides from Geosat altimetry. JGR 96(C9); fig. 9. [3] Wilson, J.Tuzo, 1970. Some possible effects if N America has overridden part of the East Pacific Rise. Geol. Soc. Amer. Abstr. w. Programs 2; 7 pp. 722-723.

OS32A-119 1330h POSTER

Cenozoic Seawater Sr/Ca Ratio Curve from Marine Barite: A Preliminary Investigation

Kristen Averyt[1] (650 736 0655; kaveryt@pangea.stanford.ed)

Adina Paytan[1] (650 724 4073; apaytan@pangea.stanford.edu)

[1]Stanford University, GES Dept. 320 Braun Hall, Stanford, CA 94305, United States

On geologic timescales (1 million years), the relative weathering of carbonate versus silicate minerals, as well as metamorphic/hydrothermal processes, have the potential to influence the long-term carbon cycle. Consequently, perturbations affecting the rate or efficiency of these mechanisms may cause significant fluctuations in atmospheric CO2 concentrations. Since the relative intensity of these processes affect both the Sr isotope composition and Sr/Ca ratio of seawater, a combined, paleoceanographic record of fluctuations in seawater 87-Sr/86-Sr and Sr/Ca ratios may provide quantitative information about the roles of weathering and hydrothermal activity in long-term C cycling.

Several workers have attempted to develop a seawater Sr/Ca ratio paleocurve using biogenic calcite as a paleosource. However, variations in the resulting Sr/Ca ratio data can only be interpreted in terms of changes in the oceanic Sr concentration, since Ca is a primary component in both calcite and aragonite. Moreover, vital and diagenetic effects cannot be completely eliminated as a factor influencing the Sr/Ca ratio.

In previous work, it has been demonstrated that marine barite is a potential alternative to biogenic calcite for some geochemical paleoproxy work (e.g. 87-Sr/86-Sr, Paytan et al., 1993). Both Sr and Ca substitute for Ba in the barite crystal structure, thus, it is possible that marine barite may record ambient (i.e. seawater) Sr and Ca concentrations. Here, we present results from a preliminary investigation to determine whether marine barite records paleoseawater Sr/Ca ratios, by analyzing the Sr/Ca ratio of barite from several Cenozoic age, ODP cores.

OS32A-120 1330h POSTER

Geochemical Evidence for Variations of Northwest Pacific Subarctic Front during the Last 400-KY

Naokazu Ahagon[1] (ahagon@jamstec.go.jp)

Katsunori Kimoto[1] (kimopy@jamstec.go.jp)

Naomi Harada[2] (haradan@jamstec.go.jp)

Masao Uchida[2] (uchidama@jamstec.go.jp)

[1]Mutsu Inst. Oceanography, Japan Marine Science and Technology Center, 690 Kitasekine, Sekine, Mutsu 035-0022, Japan

[2]Ocean Research Dept., Japan Marine Science and Technology Center, 2-15 Natsushima, Yokosuka 237-0061, Japan

We investigate the late Quaternary hydrography of NW Pacific to clarify how it was sensitive to the past climate changes. The sediment core taken from Suiko Seamount (44° 47.2'N, 170° 09.6'E, Water Depth: 1784m), located at midpoint of Emperor Seamount chain, was used for reconstructing sea surface temperature (SST) change and consequent variations of Northwest Pacific Subarctic Front.

Foraminiferal δ^{18}O, Mg/Ca ratio and alkenone SST indicate that this site was situated under influence of subtropical water at Marine Isotope Stage 9-11. Average SST difference between the last glacial cycle and MIS 9-11 was as much as 5°C, indicating poleward shifting of NPSF at MIS 9-11. Slightly heavier values of planktonic δ^{13}C (*G. bulloides*) at MIS 9-11 also imply the presence of warm subtropical water in this region. This warming at MIS 9-11 coincides with previously reported the period of high carbonate accumulation in NW Pacific. After MIS 8, subpolar water was gradually advanced into equatorward, and supply of ice-rafted materials was accelerated in this region.

OS32A-121 1330h POSTER

Deepwater circulation changes in the North western Pacific during the last 300 kyrs: Results from the metal/Ca ratio in benthic foraminifera

Katsunori Kimoto[1] (175-45-1387; kimopy@jamstec.go.jp)

Naokazu Ahagon[1] (175-45-1387; ahagon@jamstec.go.jp)

Naomi Harada[2] (468-67-9504; haradan@jamstec.go.jp)

Masao Uchida[2] (468-67-9504; uchidama@jamstec.go.jp)

Masayuki Yamane[3] (3-5351-6434; yamane@ori.u-tokyo.ac.jp)

[1]Mutsu Instutute for Oceanography, JAMSTEC, 690, Kitaseine, Sekine, Mutsu 035-0022, Japan

[2]Ocean Research Dept., JAMSTEC, 2-15, Natsushimacho, Yokosuka 237-0061, Japan

[3]Ocean Research Institute, University of Tokyo, 1-15-1, Minamidai, Nakano-ku 164-8639, Japan

Trace elements incorporated in foraminiferal shells in marine sediments provide us the essential information to clarify the paleo-oceanograpic condition. We investigated the thermohaline circulation changes in the north Pacific during the last 300 kyrs using metal/Ca ratio of benthic foraminifera in sediment core samples recovered from the Emperor Seamounts (44°47.2' N, 170°9.6' E, water depth: 1,784 m). Trace metals (Cd, Sr, Mg, Ca) were analyzed by the magnetic sector field inductively coupled plasma mass spectrometry (HR-ICP-MS). Cd/Ca ratio showed the glacial-interglacial variations: higher values in interglacial periods and lower values in glacials. Glacial Cd/Ca values are approximately 10 - 20 % lower than interglacial ones. It suggests that the glacial Pacific deepwater (PDW) was fresher than today. The difference between the carbon isotope records in planktic and benthic foraminifera was large in interglacial and small in glacial periods. These results suggest that the ventilation between surface and deeper water was relatively activated during the glacial periods.

On the other hand, Mg/Ca and Sr/Ca ratio shows different result between each other. Mg/Ca shows similar image with the oxygen isotope record of foraminiferal shells, however, Sr/Ca record shows inconsistent pattern with oxygen isotope record. Moreover Sr/Ca values decreased gradually at the middle to lower part of the core, and this pattern is similar with CaCO3 contents of the core. It might suggest that Sr/Ca record represented the carbonate dissolution history rather than the temperature of seawater.

OS32B HC: Hall III Wednesday 1330h

Biogeochemical Processes in Anoxic and Suboxic Environments I

Presiding: **M Scranton,** State University of New York**; J Murray,** University of Washington

OS32B-122 1330h POSTER

Does Sulphurization Create an Early Diagenetic Link Between Trace Elements and Organic Matter? - Evidence From the Southeast Atlantic

Verena Heuer[1] (+49-421-218-3929; vheuer@uni-bremen.de)

Sabine Kasten[1]

Matthias Zabel[1]

Horst D. Schulz[1]

[1]Fachbereich Geowissenschaften, Universitt Bremen , Postfach 330 440, D-28334 Bremen, Germany

The remineralization of organic matter is one of the most important biogeochemical processes and its impact on the distribution of trace elements has been shown in many studies. However, it is not the only possible reaction in the sedimentary organic carbon cycle. In anoxic marine sediments sulphurization, i.e. the reaction of organic matter with reduced inorganic sulphur species, is another important mechanism during the early stages of diagenesis. It works as an antagonist to remineralization since the intra- and intermolecular incorporation of sulphur supports the preservation of organic compounds. While in the last two decades numerous studies have investigated possible mechanisms for sulphurization and provided hypotheses for various reduced sulphur species and classes of organic compounds (e.g., Sinninghe Damsté and de Leeuw, 1990) little attention has been paid to its consequences for the fate of trace elements.

In this contribution we present data from the Southeast Atlantic that indicate a close relation between the sulphurization of organic matter and the distribution of trace elements in the upper tens of meters of diagenetically active sediments (Heuer et al., submitted). Our observations are based on a high resolution (5 cm steps) survey of 16 trace elements in the solid phase of two gravity cores that were taken from the highly productive upwelling region off Namibia and from the Niger deep sea fan. The gravity cores are 10.7 m and 20.2 m long and record the last 135 and 245 ka. The influence of productivity related primary input and the potential effects of early diagenesis are checked with Ba as a proxy for paleoproductivity and porewater analysis, respectively.

References:

Heuer V., Kasten S., and Schulz H. D. (submitted) Does sulphurization create an early diagenetic link between trace elements and organic matter? - Evidence from the upwelling region off Namibia, Southeast Atlantic. Geochimica et Cosmochimica Acta.

Sinninghe Damst J. S. and de Leeuw J. W. (1990) Analysis, structure and geochemical significance of organically-bound sulphur in the geosphere: State of the art and future research. Advances in Organic Geochemistry 1989 (eds. B. Durand, F. Behar) Organic Geochemistry 16, 1077 - 1101.

URL: http://www.geochemie.uni-bremen.de

OS32B-123 1330h POSTER

Preservation of Terrestrial and Marine Organic Matter in an Intermittently Anoxic Coastal Fjord; Effingham Inlet, BC.

Jaime L. Grocock[1] (206-675-0218; jgrocock@u.washington.edu)

Richard G. Keil[1] (206-616-1947; rickkeil@u.washington.edu)

[1]University of Washington, School of Oceanography Box 355351, Seattle, WA 98195-5351, United States