The locations identified to date and the strategy for moving forward to install and maintain these moored observatories will be presented. Feasibility and availability of national support and shiptime as well as scientific priority have been weighed. Some high priority sites are in severe environments, such as the Southern Ocean, so the plan includes in its initial phase mooring design and engineering studies needed to build the moorings to be used in those sites. With a number of sites already occuppied and plans for the extension and implementation of other sites, the prospect for a global array is promising.

OS11K-08 1110h INVITED

Monitoring the Ocean Acoustically: A Review and Strategy for the Future

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Since ideas for monitoring the oceans acoustically were first voiced in the mid-1970's, ocean acoustic tomography has evolved into an effective tool for remote sensing of the ocean interior on a wide variety of time and space scales. Regional tomographic arrays have been employed at scales of up to about 1000 km for measuring changes in integrated heat content, for observing regions of active convection, for measuring transports through the Strait of Gibraltar, for observing the evolving ocean mesoscale, for measuring barotropic currents, for directly observing oceanic relative vorticity, and for measuring barotropic and baroclinic tidal signals. Basin-scale tomographic arrays have been employed out to ranges of 5000 km for measuring large-scale changes in temperature and heat content in the North Pacific, Mediterranean, and Arctic oceans. At these ranges acoustic methods give integral measurements of large-scale ocean temperature that provide the spatial low-pass filtering needed to observe small, gyre-scale signals in the presence of much larger, mesoscale noise, offering a signal-to-noise capability for observing ocean variability with climate relevance that is not readily attainable by an ensemble of point measurements. In addition, tomographic methods rely on the measurement of acoustic travel times, which can be made without risk of calibration drift. The remote sensing capability has proven particularly suitable for measurements such as those in the Arctic and in the Strait of Gibraltar, where the application of conventional in situ methods is difficult.

The appropriate roles for acoustic tomography in an ocean observing system appear to be (1) to exploit the unique remote sensing capabilities for regional programs otherwise difficult to carry out, (2) to be a component of process-oriented programs in regions where integral or large-scale heat content or transport data are desired, and (3) to move toward deployment on basin to global scales as the acoustic technology becomes more robust and simplified. Tomography is naturally complementary to other ocean measurement techniques. Altimetry senses the ocean surface, while tomography senses the ocean interior. Profiling floats provide high vertical resolution of the upper ocean, while tomography suppresses internal wave and mesoscale noise and reaches the deep ocean. The operational costs of a tomographic network are low, making the amortized cost of the technique attractive. Permanent open-ocean stations (e.g., planned as part of the Integrated Ocean Observing System (IOOS) and the NSF Ocean Observatories Initiative) will provide supporting infrastructure for the application of acoustical techniques on basin to global scales.

OS11K-09 1130h

The Ocean Observatories Initiative: Providing a New Mode of Access to the Oceans for Research

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Recent workshop and commissioned reports have underscored a perceived trend in the types of proposals being submitted to the Ocean Science Division (OCE) of the National Science Foundation (NSF). There is increasing emphasis on research involving long-term experiments and sustained time-series observations. This trend requires substantially different infrastructure to continue into the new millennium the rapid rate of scientific progress that began in the early 1960's.

Just as the diversely capable academic research vessel fleet provides access to the world's oceans to support a wide spectrum of traditional research requirements, a diversely capable network of ocean observatories is required to address new and evolving sustained time-series requirements. Several pilot projects have successfully installed seafloor observatories using newly developed junction boxes and fiber-optic cable protocols. Technology development efforts have also advanced moored and relocatable buoys, instrumentation, sensors, and communication capabilities. In response to increasing demands by researchers for sustained observations, and capitalizing on recent advances in technology, an initiative has been developed by OCE for providing the basic infrastructure necessary for implementing an integrated system of ocean observatories.

The proposed Ocean Observatories Initiative (OOI) has three elements: 1) a lithospheric plate-scale observatory consisting of interconnected sites on the seafloor that span several geological and oceanographic features and processes, 2) several relocatable deep-sea observatories based around a system of buoys, and 3) an expanded network of coastal observatories. It is envisioned that this new system of research capabilities will be a substantial component of the U.S. Integrated Ocean Observing System. Funding for the OOI has been requested through NSF's Major Research Equipment (MRE) account, and it is approved for consideration in some future NSF budget request.

OS11L HC: 319 A Monday 0830h

The Cycle of Carbon in the Southern Ocean (S.O.) I

Presiding: **P Trguer,** Institut Universitaire Europeen de la Mer**; T Trull,** Antarctic CRC**; P Sedwick,** Bermuda Biological Station for Research**; A J Watson,** School of Environmental Sciences, University of East Anglia**; K R Arrigo,** Stanford University

OS11L-01 0830h INVITED

Bottom-up Control of Primary Production in the Southern Ocean: the Co-limitation Question With Regard to the Availability of Fe, Si, and Light

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Southern Ocean waters have long been considered paradoxical in terms of their biogeochemical properties, e.g. low primary production rates in a high nutrient environment, apparent high sedimentary opal burial efficiencies, and atypical phytoplankton ecophysiological characteristics. The functioning of the Southern Ocean ecosystems, which together represent the largest HNLC area of the World Ocean, has been studied in detail since the 1970's and most intensively during the S.O. JGOFS program between 1990 and 2000. The Antarctic opal paradox has largely been resolved, by establishing coherent budgets of biogenic silica production rates, opal rain rates in the water column and opal sediment burial rates; opal preservation efficiencies have now been revised downward and now appear to be no different than elsewhere in the sea. The new data on phytoplankton limitation indicate a significant influence of several potentially limiting factors. The first evidence of the control of primary production by iron was obtained in 1988/1989, and the importance of vertical mixing in controlling the underwater light climate was reinforced in 1991. These limiting factors are not independent. Iron availability has been recognized as a major factor slowing down or even preventing the photoadaptation of Southern Ocean phytoplankton via pigment synthesis control. The question of the nutritional requirements of diatoms with regard to silicon is still a matter of debate. Silicic acid limitation of silica production has been detected at what would otherwise be considered non-limiting silicic acid concentrations. The first estimates of very high K_S were obtained well before the development of isotopic tracer studies using stable (^{30}Si) and later on radioactive (^{32}Si) isotopes. More recent studies using these modern techniques have also indicated surprisingly high K_S values, at least in areas remote from coastal/shelf influence. Some shipboard studies have suggested a link between in situ low iron concentrations and high K_S values and it is thus tempting to hypothesize an iron-related control of the silicic acid uptake mechanism similar to that for nitrate utilization or nitrogen fixation. Only a few enrichment studies have hitherto been conducted, but some of them indicate a relationship between iron availability and the K_S values of natural assemblages. However there does not appear to be a single general mechanism relating Fe requirement and silicic acid utilization and other trace-elements could also be involved; specific experimental process studies on natural diatom communities are needed to investigate this problem. However it is now clear that the question of the "limiting factor" in the Southern Ocean and elsewhere cannot be considered simply in terms of von Liebig's law, but rather that the factors which control primary production are multiple and interrelated, which leads us to the present concept of co-limitation of phytoplankton growth by trace-elements, nutrients, and light.

OS11L-02 0850h

Effects of Iron Limitation on Southern Ocean Biogeochemistry and Phytoplankton Community Structure Assessed With a Natural Community Continuous Culture Incubation System

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Shipboard growout and open ocean addition experiments have been used to demonstrate that iron availability controls phytoplankton growth and carbon fixation in large areas of the Southern Ocean. These methods have provided strong evidence for iron control of primary productivity, but their application to understanding in situ processes is uncertain. Both growouts and open ocean fertilizations use unrealistically high single applications or multiple pulses of iron and are highly perturbed, non-steady state experiments. In contrast, natural communities usually receive their iron supplies from low-level, relatively continuous inputs from upwelling, mixing, or ice melting, and biomass removal processes are often in approximate balance with production. In order to understand the effects of iron at realistic supply rates and concentrations in a steady state system, we have adopted laboratory chemostat methods to shipboard use. Iron was supplied to phytoplankton communities from the Australian sector of the Southern Ocean continuously at low concentrations. Natural removal processes were simulated by losses through the chemostat outflows, resulting in a steady state experiment that closely reproduces the actual range of variability in iron inputs and biomass levels. Changes in phytoplankton community structure were monitored using microscopy, pigments analyses, and flow cytometry, and nutrient and carbon biogeochemistry were also followed. Shipboard chemostats are

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a unique new tool to examine the biogeochemical and biological effects of iron much more realistically than has been possible in the past, giving insights into how subtle changes in natural iron fluxes may affect carbon biogeochemistry in the past and present day Southern Ocean.

OS11L-03 0905h

The Effect of Iron on the C/N/P/Si Composition of Phytoplankton: Does Fe-deficiency Affect Structural or Labile, Soluble Pools?

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Recent laboratory and field experiments show that the N/P, N/Si and C/P ratios of phytoplankton can be much lower than the classical Redfield values under Fe-limited growth. These results are potentially significant because they suggest that (1) marine ecosystems in Fe-poor regions of the contemporary ocean operate under non-Redfield stoichiometry, and (2) the elemental stoichiometry of biogenic export to the deep ocean may have shifted with glacial-interglacial changes in Fe availability. The biogeochemical significance of the observed departures from classical Redfield values, however, is intimately linked to the biochemical response at the cellular level. Phytoplankton under nutrient limitation generally accumulate reserves of non-limiting nutrients in soluble form. Such reserves are readily released during decomposition, grazing and death and are thus unlikely to accumulate in sediments. Our results indicate that the changes in the elemental ratios of Fe-limited phytoplankton are primarily driven by increases in cellular P and Si, and that C and N remain relatively constant. We hypothesize that phytoplankton accumulate soluble reserves of P and Si under Fe-limited growth because their assimilation into structural pools is limited by the availability of C skeletons and energy. A preliminary test of this hypothesis was performed by growing phytoplankton under conditions of Fe-sufficiency and deficiency and quantifying the allocation of N, P and Si to structural and labile, soluble pools.

OS11L-04 0920h

Iron Distribution and Phytoplankton Growth in Subantarctic Waters: A Synthesis of Results from the Australian and Indian Sectors of the Southern Ocean

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Research during the past decade has firmly established the role of iron deficiency in regulating phytoplankton growth and species composition in high-nitrate low-chlorophyll (HNLC) areas of the open ocean. The Subantarctic region of the Southern Ocean, located between the Polar and Subtropical water masses, is among the largest of the HNLC areas, and it is also one of the largest oceanic sinks for atmospheric carbon dioxide, due in part to biological uptake by phytoplankton. However, the majority of Southern Ocean iron studies have been conducted south of the Polar Front, and the distribution and nutritional sufficiency of iron in the Subantarctic region remain poorly known. We have used flow-injection analysis to measure dissolved iron (dFe; 0.4 μm filtered) and total-dissolvable iron (TDFe; unfiltered, acidified) in water-column samples collected during two cruises in the Subantarctic Southern Ocean: the SAZ Project (Australian Subantarctic region, 142-143°E, March 1998) and the ANTARES-4 Project (Indian Subantarctic region, 62.5-65°E, January-February 1999). In quasi-latitudinal sections of the upper water column (< 300 m depth), our data reveal significant north-south gradients in dFe and TDFe concentrations, which appear to reflect inputs of iron from the Australian continental shelf (SAZ study region), the Crozet Islands platform (ANTARES-4 study region), and possibly aeolian deposition in the north of both study regions. There is no evidence of significant upwelling of dissolved iron. In the SAZ study region there is a north-to-south decrease in dFe and TDFe concentrations in the upper mixed layer, from ~0.6-0.8 nM near the Subtropical Front, to ~0.05-0.1 nM within the Subantarctic Zone and Polar Frontal Zone, with slightly higher values (up to ~0.2 nM dFe and 0.4 nM TDFe) within and just north of the Subantarctic Front. Comparison with data for samples collected from this same region in January 1995 suggests a seasonal drawdown of ~0.1-0.2 nM iron in the Subantarctic Zone and Polar Frontal Zone, as well as a seasonal accumulation of particulate iron on the northern edge of the Subantarctic Front. In contrast, samples from the ANTARES-4 study region show a north-to-south increase in dFe, from ~0.1-0.2 nM in the southern Subtropical Zone and confluence of the Subtropical and Subantarctic Fronts, to ~0.2-0.4 nM in the Polar Frontal Zone east of the Crozet Islands. The ANTARES-4 TDFe concentrations follow a similar distribution, except for an elevated concentration in Subtropical surface waters, which may reflect aeolian dust input. Results of shipboard iron-addition experiments conducted during both the SAZ and ANTARES-4 cruises suggest that phytoplankton community growth is limited by dFe concentrations below about 0.4 nM, although this 'limiting' dFe concentration is likely to vary with spatial and temporal changes in algal community composition and mixed-layer depth. Our observed iron distributions, and the inferred limitation of algal growth by iron deficiency, are generally consistent with the distribution of algal biomass in surface waters of the Subantarctic region as estimated from SeaWiFS data.

OS11L-05 0935h

The Iron Content of Seasonal Sea-ice: a Biologically Significant Source of Iron to the Southern Ocean?

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The Southern Ocean sea-ice pack seasonally expands and contracts over approximately 15 x 10^6 km^2 profoundly affecting the oceans physical, chemical and biological characteristics. Generally surface water iron (Fe) concentrations in the Antarctic seasonal sea-ice zone (SIZ) are extremely low and are thought to be a dominant factor controlling phytoplankton growth in light and macro-nutrient replete conditions. Incidences of increased surface water Fe concentrations coinciding with melting sea-ice suggest that biologically significant quantities of Fe may be released from melting sea-ice in the SIZ. Here we present total Fe data from ultratrace-metal clean sea-ice cores drilled from seasonal sea-ice in the Western Pacific sector of the Southern Ocean and estimate potential new production that may result from this iron source.

OS11L-06 1010h INVITED

EisenEx-1: Test of the Iron Hypothesis in a Southern Ocean Eddy

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The iron hypothesis has been raised to provide a possible explanation for glacial-interglacial variations of atmospheric CO2 concentrations. According to this hypothesis, phytoplankton primary production in the sunlit upper ocean, which fuels the biological carbon pump to the deep ocean and sediment, is currently limited by lack of iron in vast areas of the remote open ocean, but was enhanced by increased iron input through wind-blown dust in the drier glacial periods. A significant effect of iron supply is expected in those ocean regions where inorganic macro-nutrients like nitrate are abundant. Among these HNLC regions the Southern Ocean is considered to be of highest potential influence on global biogeochemical cycles. The results of EisenEx-1 add to the overall evidence obtained from the three preceding in situ fertilization experiments carried out in HNLC waters, IronEx 1 and 2 and SOIREE, demonstrating that the iron hypothesis cannot be rejected.

While the preceding Southern Ocean experiment SOIREE was conducted in the Pacific Sector in late austral summer when the light climate is favourable due to water column stability, EisenEx-1 (Polarstern cruise ANT-XVIII/2, 24 Oct. - 3 Dec. 2000) was carried out in the Atlantic Sector in austral spring when frequent storms cause variable mixed layer depths. Besides SOIREE was conducted in a hydrographically quiescent region of the Antarctic Circumpolar Current (ACC) south of the Antarctic Polar Front (APF). The goal of EisenEx-1 was to monitor the biological and chemical responses to fertilization in a patch of water north of the APF in the Polar Frontal Zone (PFZ). The PFZ is where excess macro-nutrients are subducted along fronts and hence deserves attention because enhanced primary production would result in subduction of biologically fixed carbon instead of unutilized nutrients.

As the ACC is composed of swift and meandering frontal jets, tracking the fertilized patch poses a problem. This was overcome by selecting a mesoscale eddy as the experimental site. The cyclonic eddy, shed by the APF, was rich in nitrate and phosphate, moderately rich in silicate and low in iron concentrations; phytoplankton biomass was low but the species composition was very diverse and the mixed layer sufficiently shallow to provide a favorable light climate.

Iron sulphate solution was released into the ocean in three portions, on Nov. 7, 15 and 24; the first portion was marked with an inert tracer, SF6, and released along a spiralling track around a drifting buoy deployed close to the eddy center. During the experiment, the fertilized patch circled within the eddy while increasing in area from less than 50 km2 to roughly 500 km2. First signs of a response by the phytoplankton, an increase in photosynthetic efficiency, were found two days after initial fertilization. Over the duration of the experiment, the chlorophyll concentrations inside the patch increased roughly fourfold compared to the surrounding waters. Only a few phytoplankton species (large diatoms) from the diverse community were responsible for the increase in biomass. Bacterial production, microzooplankton biomass and microbial food web activity also increased on iron addition. The biomass increase was accompanied by a decrease in CO2 partial pressure, which was partly replenished with CO2 from the atmosphere during storm events. However, no increase in carbon export to the deep ocean inside the patch compared to outside was observed in the 3 weeks of observation. The bloom was in full swing at the time of departure.

OS11L-07 1030h

How Rapid Dilution Influences Southern Ocean Iron Fertilization Experiments: Comparison Between EISENEX and SOIREE

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EISENEX and SOIREE were two in-situ iron fertilization experiments carried out in contrasting conditions in the Southern Ocean. Plankton blooms in response to iron fertilization were observed in both experiments, but the EISENEX bloom developed more slowly, and to lower total biomass, than did the SOIREE bloom. During SOIREE, the mixed layer was relatively deep and winds were moderate through most of the experiment. Horizontal spreading of the patch was relatively slow, with the patch size doubling in the two weeks during which the ship was present, and satellite data indicating that it continued to grow at approximately this rate for a further four weeks. During EISENEX by contrast, repeated storms and a periodically stratified mixed layer caused more rapid dilution and spreading. The dilution was episodic, but averaged several times the dilution rate observed during SOIREE.

We expect these differences to have an important effect on the results of the experiments. The bloom biomass becomes substantially reduced if the loss term due to dilution is of the same order as the increased growth rate due to iron fertilization. It is not necessary to postulate any other difference between the two experiments to explain the generally lower rate of increase of chlorophyll during EISENEX compared to SOIREE. The relatively small nutrient depletions seen in both experiments are probably also due to the comparable sizes of the dilution and growth terms. This dilution effect is an artefact of small-scale patches: experiments at x 10 larger horizontal scales might be expected to be far less affected by dilution.

OS11L-08 1045h

Are Mesoscale Perturbation Experiments in Polar Waters Prone to Physical Artefacts? Evidence from Algal Aggregation Modelling Studies.

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The exceptional longevity (more than 50 d) of a phytoplankton bloom following the mesoscale iron-enrichment of Antarctic polar waters (SOIREE) considerably exceeded that reported for naturally-occurring blooms (15-20 d) in this region. During SOIREE, SF_6-labelled waters increased from 50 km^2 to 1100 km^2, and the greatest algal loss term was lateral advection (0.1 d^{-1}), akin to cell-washout required to maintain laboratory algal chemostats. To test whether such advective losses could delay the onset of mass sedimentation, a published algal aggregation model was employed. It successfully simulated temporal trends in the onset of mass sedimentation during the tropical IronEx II bloom, yet suggested no such event during SOIREE. However, when an iron-enrichment of 100 km length-scale (i.e. characterised by low lateral advection) was mimicked for SOIREE, a marked increase in algal aggregate size occurred after day 15, indicative of the onset of mass sedimentation. Thus, careful interpretation of results is essential especially for the fate of algal carbon from such experiments. In particular for polar waters where the ratio of net algal growth to advective losses is low (2, SOIREE), compared to tropical waters (10, IronEx II), suggesting that the understanding of polar experiments will require the proper compensation for artefacts.

OS11L-09 1100h

Seawater pH in the Southern Ocean: Interannual Variability and Response to an Iron Enrichment Experiment

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A consequence of changes in carbon dioxide uptake by the oceans is a modification of the pH of seawater which has geochemical and biological implications. For example, an increase in the seawater pH at constant alkalinity enhances the oceans capability to absorb carbon dioxide from the atmosphere, and changes in pH have been suggested to alter the physiology of marine plankton. We present spectrophotometric pH data using a new underway method (Bellerby, Olsen, Johannessen and Croot. Talanta, in press) from the CARUSO and EISENEX studies in the Southern Ocean. We document surface pH, with a precision of better than 0.001 pH units, from the region between the prime meridian and 20E which provide a benchmark from which future pH changes due to the uptake of anthropogenic carbon may be measured. Importantly, the study of an iron enriched patch of seawater illustrates the pH response, within the context of the complete carbon dioxide system, to artificial ocean fertilization. It was seen that during the whole EISENEX experiment seawater pH increased (using in-patch out-patch differences) by over 0.02 pH with high frequency measurements detailing structure in the carbon dioxide field not possible through conventional inorganic carbon system techniques.

OS11L-10 1115h

Accumulation of Biogenic and Lithogenic Material in the Pacific Sector of the Southern Ocean During the Past 30,000 Years.

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The ^{230}Th-normalization technique was applied to surface sediments and down-core records from the Pacific sector of the Southern Ocean between 120°W and 170°W in order to reconstruct vertical rain rates, corrected for lateral redistribution of sediment. Preserved rain rates of opal, organic carbon and biogenic Ba all indicate that biological productivity south of the Antarctic Polar Front (APF) was much lower than today during the Last glacial Maximum (LGM), possibly in response to increased ice cover. By analogy with modern opal fluxes south of the ACC, we show that year-round ice cover is not a prerequisite for very low rates of opal accumulation. Available records from north of the APF indicate little to no change in opal export, in contrast to records from the Indian and Atlantic sectors, which show enhanced opal export north of the APF during the LGM. Glacial records from north of 66°S in the Pacific all show lithogenic fluxes were greater than today, but significantly lower than lithogenic fluxes in the glacial Atlantic and Indian sectors. The observed inter-basin distribution of lithogenic fluxes and opal burial, and the presumed geographical distribution of increased dust input to the Southern Ocean during the LGM, are consistent with an Atlantic-Indian-Pacific gradient in the degree of iron-stimulated diatom productivity. Carbonate burial rates south of 64°S in the Pacific were slightly greater during the LGM than the Holocene, but north of 64°S carbonate burial rates were lower during the LGM relative to today. Down-core changes in Pa/Th and Be/Th seem to reflect primarily changes in particle composition, but some uncertainties remain, particularly for Be/Th records. Together, these new records from the Pacific sector show that during the LGM the three basins of the Southern Ocean were significantly more differentiated than today, in terms of the magnitude and composition of particle flux.

OS11L-11 1130h

Modeling Controls of Phytoplankton Production in the Southern Ocean–Modern and Glacial Scenarios

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To elucidate controls of primary and export production in the Southern Ocean we developed a one-dimensional physical/biological model. The model is applied to four stations in the southwest Pacific sector spanning the Subantarctic Zone, the Polar Front, and the seasonal Ice Zone. The biological model component tracks the elemental cycles of nitrogen and silica. Diatoms are represented as a separate functional group. Small phytoplankton and zooplankton are tightly coupled.

The one-dimensional model cannot explicitly represent horizontal fluxes of heat, freshwater and nutrients. Since these fluxes are important, we restore the temperature, salinity and nutrients in the model to available observations.

We use two different approaches to include the effect of low iron availability. In modern ocean simulations, iron availability is taken into account implicitly by typical phytoplankton growth rates and a typical Si:N cell quota of diatoms. In other modern and glacial simulations, iron is included semi-explicitly, that is, iron modulates the photosynthetic efficiency and is taken up during phytoplankton growth but not tracked in the pelagic system.

The model captures the essential features of the different zonal subsystems. "Top-down" control of small phytoplankton by intense grazing and "bottom-up" control of diatoms by light and silicic acid supply are the main factors for the simulated behavior. In simulations of glacial scenarios–assuming an increase in available iron–primary and export production increase, in particular if we assume an acclimation of the Si:N cell quota of diatoms in response to the higher iron levels.

OS11L-12 1145h

Phytoplankton Community Composition and Nitrogen and Carbon Uptake Rates off George V Coastland, Antarctica

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A floristic analysis of the phytoplankton in the Mertz polynya region was done based on sampling during December-January, 2000-2001. Samples were collected at the surface and in the fluorescence maximum over the continental slope, shelf, and in coastal regions dominated by both fast and pack ice. There was no significant difference in community composition at the two depth horizons. There was a distinct change from diatom to Phaeocystis dominated regions from northwest to southeast in the study area. Pennate diatoms, dominated by *Fragilariopsis spp.*, composed the majority of the diatom community in the northwest, while centric diatoms dominated in coastal regions. The region where *Phaeocystis* dominated was in lee of the Mertz glacier and in a region of grounded glaciers, where mixed layers were shallower. Although nowhere near as numerous, preliminary estimates show *Fragilariopsis spp.* making up about 1/5 of the community in the southeast. Uptake measurements for nitrate, ammonium and carbon were done at nine stations. Euphotic zone primary productivity ranged from 200-262 mgC m^{-2} d^{-1}, new (nitrate) production ranged from 0.6-5.9, mmoles m^{-2} d^{-1} and f-ratios varied between 0.12-0.77. The highest f-ratio was associated with a *Phaeocystis* dominated community in the southeast.

OS11L-13 1200h

Summer Plankton Production and Nutrient Consumption Patterns in the Mertz Glacier Region of East Antarctica

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Oceanographic samples were collected off the George V Coast of eastern Antarctica in late December, 2000 and January, 2001 that sampled regions near the fast ice in coastal regions as well as pack ice in more offshore regions. Maximum Chl *a* concentrations were found near the coastal fast ice, the edge of the Mertz glacier tongue, and at the edge of the dense pack ice near the Ninnis glacier in the eastern part of the region. Ship Chl *a* measurements were similar to SeaWiFS estimates. Estimates of nutrient consumption based on the concentration difference between surface water and sub-surface winter remnant water suggested that seasonal new (nitrate) production exceeded 500 mmoles m^{-2} in coastal regions in Commonwealth Bay and around the Mertz glacier. Phosphate utilization exhibited a similar pattern, but silicic acid uptake was markedly different and greater in the northwest than southeast. The ratio of Si/NO_3 utilization showed these differences clearly. The pattern in the Si/NO_3 utilization ratio may be partly due to the greater proportion of non-diatom species in the southeastern region, as well as the lower iron levels in the northeastern region. The later effect may have induced a higher Si to NO_3 uptake ratio in diatoms growing there.

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