

The timing of the penultimate interglacial and the stage 5a interstadial overlap peaks in 65°N insolation, and the 228 ka SL low and the 117 ka SL drop coincide with minima in 65°N insolation, suggesting Milankovitch forcing for periods of major climatic change. It appears that lags between insolation and SL rise are small, whereas lags between insolation and SL fall are significant for the last three interglacials.

## REWORKED NANNOFOSSILS IN QUATERNARY SEDIMENTS FROM THE CENTRAL ARCTIC: IMPLICATIONS FOR PALEOBIOGEOGRAPHY AND PALEOCLIMATES

G. Gard (Dept. of Geology and Geochemistry, Univ. of Stockholm, Sweden) and A. Crux

Two Jurassic, 77 Cretaceous and 40 Paleogene nannofossil species have been recorded in numerous short sediment cores from the central Arctic Ocean. They provide insights into nannofossil paleobiogeography, paleoclimates, sediment distribution on the shelf areas surrounding the Arctic Ocean and Quaternary sediment deposition patterns.

The reworked nannofossils are concentrated at levels where *in situ* assemblages are most common. Specimens with mutually exclusive stratigraphic ranges occur together. This suggests that the reworked specimens do not primarily reflect the local bedrock, but are transported to the central Arctic Ocean from the surrounding shelves. This mechanism of transportation and deposition is most active during warmer time periods. Sea ice provides a possible means.

The oldest nannofossils recorded are *Crucirhabdus primulus* Prins in Rood, Hay & Barnard and *Parhabdolithus liasicus* Deflandre from the Lower Jurassic. This is the furthest north that these species have ever been recorded.

The Lower Cretaceous is represented by eight species restricted to that interval, together with other longer-ranging taxa. The presence of *Micrantholithus speetonensis* Perch-Nielsen is the first record of this species outside NW Europe, and indicates the occurrence of Valanginian strata. The Lower Cretaceous species observed are all typical of temperate to high latitude assemblages of both the southern and northern hemispheres.

The nannofossils reworked from the Upper Cretaceous strata are the dominant component of the assemblages. *Nephrolithus corystus* Wind is recorded in the northern hemisphere for the first time. However, some of the distinctive high latitude species present in the southern hemisphere have not been observed in the Arctic sediments.

Paleocene, Eocene and Oligocene nannofossils are also recorded in the cores. The presence of discoasters and sphenoliths in such high latitudes suggests warmer conditions than at similar latitudes in the southern hemisphere.

## REGIONAL AND TEMPORAL CHANGES IN HYDROTHERMAL SEDIMENTATION IN THE LAU BACK-ARC BASIN, SW PACIFIC

B. Gehrke (GEOMAR, Kiel, Germany)

Sedimentological and geochemical investigations of surface samples and piston cores were undertaken in order to study regional and temporal variability of hydrothermal metalliferous sediment. The chemical composition of the bulk

sediment was determined by XRF-analysis. Additional surface samples were subjected to selective leaching for Fe, Mn, Cu, Zn, and Ni. To quantify the variability of sediment components downcore, mass accumulation rates (= flux) of components were estimated.

Results from reductive leaching show that only a small proportion of the total Fe (XRF-data) was dissolved (28%). Large amounts of undissolved Fe indicate large amounts of silicate debris. On the contrary most of the total Mn and Ni of the sediment was leachable (71%/79%). Leachable Fe and Mn occur as colloidal amorphous oxyhydroxides, formed by precipitation from hydrothermal solutions.

Spatial variability of Fe-Mn-oxyhydroxides indicate fractionation of Fe and Mn during transport. Decreasing Fe/Mn-ratios from the spreading centers to the basins implies settling of Fe near the vents, whereas dissolved Mn may be transported over long distances and accumulate in basinal sediments.

Sediments in the southern Lau Basin were enriched in leachable Mn-oxyhydroxides by a factor of 2, and may be caused by the chemical composition of the lava types and by high water-rock ratios due to the rugged andesitic basement in the southern Lau Basin, favoring the leaching of metal ions.

Temporal variations of the flux of Mn were indicated: for the last 400 ka, flux rates of Mn range between 5-40 mg/cm<sup>2</sup>ka in the northern and 5-90 mg/cm<sup>2</sup>ka in the southern Lau Basin (carbonate-free). Slightly higher amounts of 10-110 mg/cm<sup>2</sup>ka (NLB) and 10-130 mg/cm<sup>2</sup>ka (SLB) were reported for the time span 400-800 ka B.P. An elevated flux of Mn was observed during the interglacial periods, reflecting short-scale Milankovitch cyclicity (100 ka). Also large-scale cyclicity of MAR was indicated: the accumulation fluctuates on a high level during isotope stages 5-11 and 17-21, while it was lower during stages 12-16.

The observations suggest that the accumulation of hydrothermal derived Mn is partly controlled by Quaternary climatic cycles.

## EARLY GLACIAL DEPOSITS IN ICELAND: IMPLICATION FOR CLIMATIC CHANGES IN THE NORTH ATLANTIC

Á. Geirsdóttir (Dept. of Geosciences, Univ. of Iceland, Reykjavík, Iceland) and J. Eiríksson

The location of Iceland on the Atlantic Ridge system, directly below the Arctic Circle, provides a unique terrestrial setting to study and understand the climatic changes during the Quaternary. Preservation of glacial deposits is common in Iceland due to high frequency of effusive eruptions forming widespread lava flows which effectively shield underlying strata from subsequent erosion. The characteristic stratigraphy in Iceland shows numerous basaltic lava flows interbedded with sediments representing diverse depositional environments. Paleomagnetism and K-Ar dating provide absolute ages for most of the formations.

Deep sea paleoclimatic records show that the Quaternary climate around Iceland was sensitive to the shifting positions of the Polar Front. Studies on several key sections in Iceland indicate that similar oscillations are reflected in the late Pliocene and early Pleistocene stratigraphy. They provide important information about local and regional patterns of glaciation which are key factors in understanding the linkage between orbital forces and climatic responses. Detailed documentation of vertical and lateral facies associations at various sites in Iceland enabled delineation of the onset of glaciation. A fairly distinct trend is identified during the Pliocene-Pleistocene transition showing a progressive growth of an ice sheet from southeast to north and west. A total of