

Year 2002 and 2003 Report on German IMAGES Activities

During 2002 and 2003 the following institutions hosted german activities within the IMAGES-PAGES program:

- the **GEOMAR** Research Center for Marine Geosciences in Kiel (D. Nuernberg, J. Reijmer, J. Schoenfeld, R. Thiedemann)
- the **Institute for Geosciences at the University of Kiel (IFG)** (V. Gebhardt, A. Holbourn, T. Kiefer, W. Kuhnt, M. Sarnthein)
- the **Institute for Baltic Sea Research at Rostock-Warnemuende (IOW)** (K.-C. Emeis, H. Schulz)
- the **Geosciences Institute at the University of Cologne** (W. Ricken and M. Weber)
- the **Alfred-Wegener-Institute for Polar and Marine Research in Bremerhaven (AWI)**, (A. Abelmann, R. Gersonde, A. Mackensen, G. Kuhn)
- **MARUM and the Geosciences Department at the University of Bremen (GeoB)** (U. Roehl, C. Ruehlemann, R. Schneider)

The german IMAGES research activities at the GEOMAR in 2002 concentrated on cores from the WEPAMA IMAGES VII, MD-122, in the Sea of Okhotsk. In combination with the KOMEX project studies were performed on MD01-2415 and MD01-2413 for the last 1,1 Mio years. Particular interest was given to variability in sedimentation of terrigenous detritus (IRD) and biogenic opal. Further studies are executed on IMAGES cores from PAGE, MD-127, 2002, Gulf of Mexico and Florida Strait (MD02-2576/75, DeSoto Canyon, and MD02-2581, Florida Strait). This work is in cooperation with the USGS (Gashydrates) and concentrates on the Caribbean throughflow of the Westatlantic warmwater route of the thermohaline conveyor and the terrigenous input by the Mississippi. The research is also part of the „Gateways“ Research Group at the IFG and the SONNE BMBF Project (RASTA, Kiel/Bremen). A third IMAGES activity at the GEOMAR in 2002 was the study of core MD99-2201, Bahama Bank, IMAGES V. Here the work is focused on the a 40 m long Holocene record from the Bimini shelf that provides evidence for decadal to centennial scale climate induced variability of aragonite production and water temperatures.

The IMAGES related objectives at Institute for Geosciences (IFG), University of Kiel addressed the reconstruction of the global thermohaline circulation (THC) at its onset (Denmark Strait Overflow) and terminus (northwestern Pacific) using various proxies for sea surface temperature, sea surface salinity, nutrient level, paleoproductivity, as well as density and the ventilation state of (upper) deep water. Scientists from the (IFG) participated at the WEPAMA VII Cruise in June 2001 (recovery of cores MD01-2416, MD01-2417, MD01-2418) and at the cross-Pacific transit leg VT56 from May to June 2002 (recovery of core MD02-2489). Co-operation was established with the University of Bremen (paleomagnetism, XRF-data; U. Röhl, F. Schmieder), Gif-sur-Yvette (paleomagnetic intensity, MD99-2268; C. Kissel), Cambridge University (data interpretation, T. Kiefer, H. Elderfield), and the Pacific Oceanographic Institute (S. Gorbarenko, ash layers, diatoms). Paleoceanographic records are already measured in cores MD99-2268, MD01-2416, and MD01-2417 (incomplete). This includes multiproxy records for sea surface temperature ($\delta^{18}\text{O}$, Mg/Ca-ratios, planktic foraminiferal assemblages), chronostratigraphy, and XRF-data. As first results the IFG team obtained high resolution proxy curves for paleotemperatures from core MD01-2416 that prove an antiphase correlation of

millennial-scale warmth peaks (3-5°C) in the NW-Pacific with Dansgaard-Oeschger stadials in the North Atlantic. This climate-“seesaw” is well confirmed for the NW-Pacific for the first time and suggests a global, millennial-scale transfer of climate signals dominantly by the oceanic THC during glacial periods (at sea level drop exceeding 45m), contrary to the atmospheric forcing of the monsoonal system in Asia. Two prominent warmth peaks mark the extreme stadial Heinrich I and provided a possibility for first human immigrations from NE-Asia to America. All glacial terminations during the last 800,000 years show extremely high, short-lived productivity spikes. For short periods, upwelling conditions were established similar to those prevailing prior to the closure of the Panama Strait and the full glaciation of Greenland.

A second IFG team at the University of Kiel also worked on the reconstruction of the ocean circulation and paleoproductivity in the Indonesian Seaway, Timor Strait for the last 460,000 years. Members of the team participated in the WEPAMA VII Cruise in June 2001 (recovery of cores MD01-2377, MD01-2378 in the Timor Strait). Multiproxy records of paleoproductivity (chlorins, TOC, dinoflagellates, benthic foraminifers) and water mass properties ($\delta^{18}\text{O}$, $\delta^{13}\text{C}$, XRF scans, planktonic transfer functions, Mg/Ca, clay minerals, pollen) are under completion in collaboration with the University of Bremen (Ursula Röhl), CNRS laboratory in Gif-sur-Yvette (C. Kissel), Tongji University (P. Wang, Z. Jian). Investigations of the spectral characteristics of the productivity records indicate a pronounced response to precessional forcing, which leads the benthic $\delta^{18}\text{O}$ change by 2-3 ky. Marked decreases in productivity are also evident at the onsets of Terminations 1, 2 and 5, which clearly precede the global sea level rise, and probably relate to changing climatic conditions within the IPWP and the Australasian continent prior to the global sea level rise.

The colleagues at the IOW in 2002 were engaged with studies on cores from IMAGES VI (2000) from Owen Ridge and the Oman Margin. The objective of their work is to extend the reconstructions for high-resolution climate variability in the paleoproductivity and the monsoonal signal in the Arabian Sea.

The research teams involved in IMAGES activities at the AWI in Bremerhaven as well as at the MARUM and GeoB at Bremen University finalized their work on cores from IMAGES II, MD105, NAUSICAA (1996). Their studies were dedicated on the reconstructions of the climate variability in the Agulhas and Benguela current systems. The major targets in this context were warm-water transport from the Indian Ocean to the South Atlantic, productivity changes in the Benguela coastal upwelling, dust transport to the South Atlantic, and changes in the deep-water circulation from the Antarctic ocean into the Cape Basin. All this work was performed in close cooperation with teams at the Universities of Amsterdam, Bordeaux, Cape Town, Oxford, and Utrecht. In cooperation with GEOMAR MARUM and GEOB participated on the studies of IMAGES cores from the Caribbean Sea and the Gulf of Cadiz. The researchers from the AWI were engaged with four IMAGES proposals submitted to the IODP evaluation panels for retrieval of Calypso cores in four different areas the Southern Ocean (for details see WG Southern Ocean, co-ordinated by R. Dunbar and A. Mackensen, on the IMAGES website).

In addition, in 2002 the first MARGO workshop (www.pangaea.de/projects/MARGO) was organised by R. Schneider (MARUM, Bremen) and M. Weinelt (IFG, Kiel) in cooperation with M. Kucera (Royal Holloway College, London) and C. Waelbroeck (GIF, Paris) which contributes to EPILOG working group.

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