

NATIONAL ACTIVITIES

WADI HOWAR - SETTLEMENT AREA AND THOROUGHFARE AT THE SOUTHERN MARGINS OF THE LIBYAN DESERT

Located on the southern fringes of the Libyan Desert, the Wadi Howar is the largest dry river system in the Eastern Sahara - stretching over 800 km from eastern Chad to the Nile. Geomorphological and palaeontological investigations have confirmed that this wadi was still an important tributary of the Nile during the early Holocene; later it was transformed into a chain of freshwater lakes fed by local rainfall. Since the Wadi Howar was both a settlement area with ecologically favourable conditions and a route connecting the inner regions of Africa and the Nile valley, the several prehistoric sites which have been discovered confirm that it was an important site of population activity and interregional cultural contacts.

The rich archaeological and archaeozoological potential and the geomorphological and topographical variety of these sites provide detailed insight into the structures of the settlements and their strategies for survival. They also supply the necessary data for a reliable chronological and clima-

tological sequence. The processes of climatic and economic change - due to desert encroachment - and their cultural implications will be examined with regards to the development and function of regional adaptation strategies as well as the large-scale role of the Wadi Howar as a connection between the Sahara and regions further south.

PALAEOECOLOGY AND THE LATE HOLOCENE SETTLEMENT OF NORTHERN NAMIBIA

Although the state of archaeological research in northernmost Namibia is not as advanced as in other parts of the country, the area has played an important role in many discussions regarding later prehistoric settlement of the whole of southern Africa. This particularly applies to the routes of the so-called "Bantu migrations" and the spread of food production and iron technology. This region, that extends from the Atlantic to the Zambesi, also provides various ecological settings for study: from desert to savannah and woodland conditions. Thus a primary aim of the project is to establish several relatively smaller study sites along a west-east transect, in order to

determine how adaptation strategies and innovations varied when subject to different and changing environmental conditions.

In the first phase of the project, long-term survey activities (including test excavations) will be carried out in close cooperation with botanists and geographers. Only then - and after the archaeological potential and the state of preservation of organic matter (especially botanical remains) has been examined - can more detailed archaeological studies be designed. Although the focus of the project is environmental and economical aspects and the different modes of human adaptation, it also aims at contributing to a more reliable chronological framework for the last 3,000 years of human and environmental history in this region.

Based on a text submitted by:

STEFAN KROEPFELIN

Coordinator, INQUA-PAGES Paleomonsoons Project
Paleomonsoon Project Office
Free University of Berlin
Podbielskiallee 62
D-14195 Berlin - Germany
Phone: +49(0)30 838-6368
Fax (ISDN): +49(0)30 841-00363
e-mail: skroe@zedat.fu-berlin.de

PEP II

PAGES Program in Taiwan (1992-1996)

The Past Global Changes (PAGES) program in Taiwan was initiated in March 1992 soon after the conclusion of the Asian IGBP workshop held in New Delhi, India. Since June 1992 various PAGES research projects have been funded by the National Science Council, Taipei (China). In addition, quite a few projects which are related to the PAGES have been also funded by other programs, such as LOICZ, KEEP (a JGOFS project) and the South China Sea Project. A new integrated program named Taiwan International Marine Past Global Change Study (IMAGES) has been formed and funded.

The first four years (1992-1996) were considered a promotion period for the PAGES Program, aiming to establishing research facility, expertise and protocols. A competent research team of more than 20 principal investigators has been established. Research has been conducted on a wide array of materials, ranging from historical documents, corals, tree rings, paleosols to lake and deep-sea sediments. To ensure proper analyses and further exploration of paleodata, collaboration among professional statisticians and geoscientists, in particular, has been greatly encouraged. Funding for PAGES Program has been in the range of USD \$500,000 per year, occupying 10-15%

of the budget of the NSC's Geology Program. Part of the funds has also come from the NSC's Marine Science Program. While stepping into the fifth year, requests for continuing support are under a more critical peer review based upon previous accomplishments in the past four years.

The program has had a significant impact on Taiwan soft-rock geosciences. For the first time, more than a dozen geoscientists were teamed up in an integrated effort to gain a better understanding of the past environmental changes in Taiwan and its adjacent areas. A team leader was elected every two years to coordinate the interdisciplinary effort and to promote dialog and integration among the various lines of research. Forums covering various progress reports have been held seasonally by the Global Change Center, National Taiwan University. PAGES sessions have been scheduled in almost every annual Geological Society Conference and annual Ocean Science Meeting. Formal presentations of PAGES results in these and other international meetings have been an obligatory task for all the principal investigators.

The PAGES team followed the recommendations of the IGBP PAGES (IGBP Report No.6, 1988) in emphasizing two temporal

streams: 1) the past 2000 years, 2) the last 150,000 years. The main endeavor in the beginning phase was to focus on the multi-proxy reconstruction of past environmental changes and data integration. Taking advantages of the availability of multiple archives in Taiwan and the adjacent areas, scientists obtained season, decade, century and millennium paleorecords from coral, tree-ring, paleosol, lake and marine sediments. Further integration and exploration of these proxy data are being undertaken.

A readjustment of the original PAGES research strategy has been made in collaboration with the new research foci as specified by the PAGES new workplan (IGBP Report No. 28, 1994). The Taiwan area is situated in a key linking area bridging the northern and southern hemispheres in the PEP II transect. The changing conditions of the Asia monsoon, west Pacific warm pool, ENSO and marine circulation are sure to leave discernible reflections in the paleo-records of Taiwan. The PAGES team strives to reconstruct local records and to interpret the records regionally, if not globally.

To foster PAGES research in the monsoon Asia area, an international workshop was held in Taipei, Taiwan, April 21-23, 1993. The theme was: the "High Resolution Records of Past Cli-

mate from Monsoon Asia: the last 2000 Years and Beyond". The workshop was sponsored by the IGBP PAGES Program, and was financially co-sponsored by the National Science Council, Republic of China and the National Science Foundation, USA. More than 150 participants from eight countries attended the workshop. A full report of the workshop conclusions and recommendations was compiled by Raymond Bradley (USA) as a PAGES Workshop Report (Series 93-1), and a summary was published in the EOS (74:601-603). A selection of papers presented in the workshop was published in 1994 by the Terrestrial, Atmosphere and Oceanic Sciences in a special PAGES issue (TAO, vol. 5, No. 3, p.349-442).

While the team members rejoice over a number of significant accomplishments, they acknowledge that there will be a continuing

struggle to ensure that Taiwan geoscientists can make further significant contributions to this global project. The initial success is only seen as the beginning of yet more promising progress in PAGES research in the areas of East Asia monsoon as well as in the crucial linkage of the subtropical area in the PEP II transect.

KUO-YEN WEI AND PING-MEI LIEW

Department of Geology, National Taiwan University

DAVID DER-DUEN SHEU AND CHEN-TUNG ARTHUR CHEN

Institute of Marine Geology and Chemistry,
National Sun-Yat-Sen University

KUO-YEN WEI

Professor of Geology

Dept. of Geology, National Taiwan University 245

Choushan Road

Taipei, TAIWAN, ROC

Phone: 886-2-2691143

Fax: 886-2-3636095

e-mail: weiky@cc.ntu.edu.tw

record of paleoceanographic changes in the southern South China Sea was reported by Chen et al (submitted).

Century to Decade Records from Lake Sediments

The interlaminated dark and light-colored lake sediments obtained from several mountain lakes appear to reflect large-scale wet and dry cycles over the past 2,400 years (Chen et al., 1993; Lou et al, 1996). The detected 450-years periodicity is similar to that of the solar oscillation (Chen et al., 1993). The Medieval Warm Period (1000-1300 AD) and the Little Ice Age (1300-1850 AD) were recognized (Lou et al., 1996). These two epochs were also identified from palynological records of the Central Range (Liew et al., 1995). Pollen data in Taiwan imply the occurrence of a mid-Holocene climatic optimum during 7 - 3.7 ka and a cooling period during 3.7 - 2 ka (Liew et al., 1995). A drastic floral change took place at about 4.8 ka (Liew and Huang, 1994).

Palynological data indicated that the vegetation distribution displaced vertically by about 800 m between the last glacial and the Holocene, implying a 4.8°C change in temperature in the western foothill region of central Taiwan (Huang et al, in press a). It is inferred that in east Asia, during the LGM (21 - 15.8 ka), the forest in the uplands became half open, while most of the lowlands were occupied by grassland. Less humid conditions than today prevailed in Taiwan during the LGM (Liew et al., submitted).

Documenting Past: Environmental Changes in Taiwan and Adjacent Areas Results of PAGES Taiwan 1992-1996

Compiling and analyzing high-resolution records of past environmental changes from both historical and natural archives has been a major task of PAGES (Sheu et al., 1994). Although the Taiwan PAGES Program only started in 1992, significant results have already appeared in various international and local periodicals. Some such results are summarized in this document.

Millennium Records from Deep-sea Sediments

Paleoceanographic studies (Wei et al., 1996, Huang et al., in press b, Wei et al., in press) indicate that the last glacial maximum (LGM) in the marginal seas around Taiwan was at about 14 -15 thousand years ago (ka) (in carbon-14 age), corresponding to a calibrated calendar age of 17-18 ka. During the LGM, the axis of the Kuroshio shifted slightly to the east (Chen et al., 1992). The summer sea-surface temperatures (SSTs) off the east coast of Taiwan were similar to today's at about 29°C through the late Quaternary, whereas the winter SSTs (~22.5°C) were ~4°C lower than today during the last glacial period (Chen et al., 1992).

The South China Sea witnessed a colder winter during the LGM: the SSTs were about 18°C, which is ~6°C lower than today's winter SST (Wei et al., 1996). The winter monsoon was considered to have been stronger during the LGM than today (Fig. 1); consequently, ocean surface was better mixed and yielded higher biological productivity (Wei et al., 1996, Huang et al., in press b, Wei et al., in

press). A higher terrigenous flux during the LGM, together with higher sea-surface productivity, resulted in higher sedimentation rates and a larger accumulation of organic carbon and carbonates during the LGM. A carbonate preservation spike occurred at ~12 ka, synchronous with the global preservation event of the Termination I (Wei et al., 1996, Chen et al., in press). A 1.05 million-year

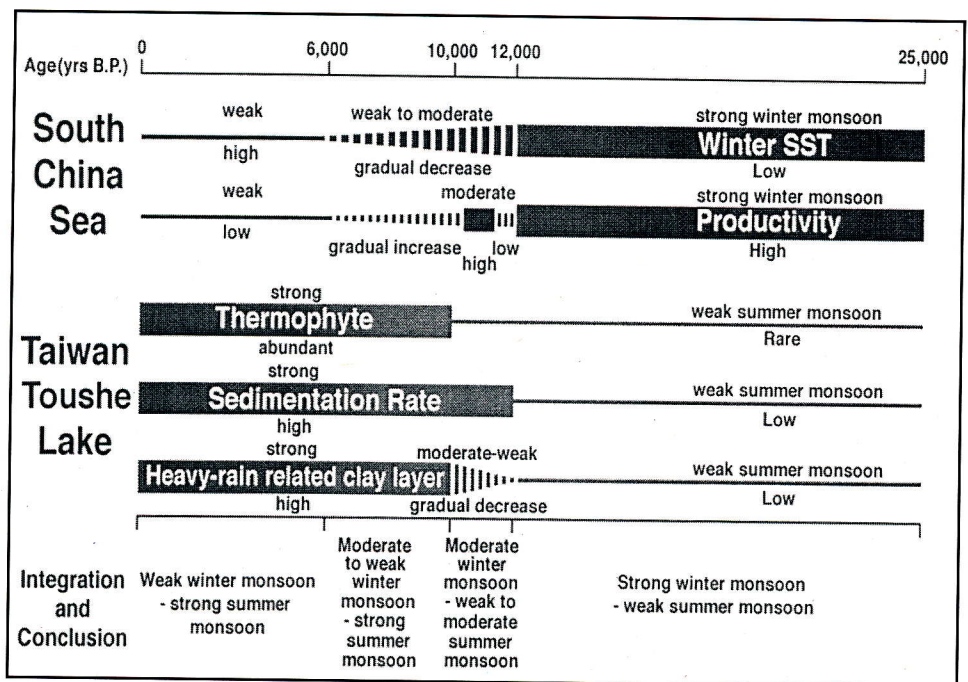


Fig. 1: An integrated monsoon history inferred from the proxy records in South China Sea and central Taiwan lake cores for the last 25,000 years. The marine and lake records are complementary and consistent, suggesting that the East Asian monsoon system has evolved from an strengthened winter monsoon during the last glaciation through a moderate to weak winter and summer monsoons during the deglaciation to an enhanced summer monsoon in the Holocene. (from Huang et al., in press a).