Intergovernmental Oceanographic Commission
Workshop Report No. 106

IOC/WESTPAC Workshop on the Paleographic Map

Bali, Indonesia
20-21 November 1994

UNESCO

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SUMMARY REPORT

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1. INTRODUCTION

The IOC/WESTPAC Workshop on the Paleographic Map was held in Bali, Indonesia, from 20-21 November 1994, immediately prior to the Third IOC/WESTPAC Symposium (Bali, Indonesia, 22-26 November 1994).

The meeting was jointly chaired by Professor Wang Pinxian and Dr. Marita Bradshaw, the co-project leaders of WESTPAC Project on the Paleogeographic Map, and Dr. Bradshaw also served as Rapporteur. Representatives from Australia, Belgium, China, Indonesia, Japan, Malaysia, the Netherlands and Thailand participated in the Workshop. Dr. Sergei Ganzei, Pacific Institute of Geography, Vladivostok, Russia, was unable to attend. However, he travelled to Shanghai to meet Professor Wang the preceding week, and his maps were presented to the meeting by the latter. A list of participants is attached as Annex I.

2. BACKGROUND

After initial introductions, Prof. Wang and Prof. Kagami, the Programme Coordinator on WESTPAC Programme on Ocean Science in Relation to Non-living Resources (OSNLR), reviewed the history of the IOC/WESTPAC Paleogeographic Map Project. The regional WESTPAC group first met in Townsville, Australia in 1986. At the Fourth Session of the then IOC Regional Committee for the WESTPAC (now renamed the IOC Sub-Commission for the WESTPAC) (Bangkok 1987), Dr. Peter Cook (then with the Bureau of Mineral Resources, Australia, now Director of British Geological Survey, Britain) proposed the Paleogeographic Map Project. The Fourth Session of the IOC Regional Committee for WESTPAC adopted the proposal as one of two projects in WESTPAC Programme on OSNLR, the other one being Tectonics and its Impact on the Coastal Zone. The compilation of paleogeographic maps will be of use in climate change studies, mineral resources exploration and archaeology; The First Planning Meeting was held in Shanghai in 1988, and the Workshop on the Paleogeographic Map was formally proposed and adopted at the Second WESTPAC Symposium (Penang, Malaysia, November 1991), with a view to compiling data for the paleogeographic map of the Last Glacial Maximum (LGM, 20,000-15,000 years ago).

3. PRESENTATION OF COUNTRY REPORTS

Participants from the WESTPAC countries were invited to present their Country Reports and to provide their own paleogeographic map of the LGM, together with a data-base map, list of sites and list of references. These Country Reports are summarized in Annex II. Paleogeographic and data maps presented for LGM covered the period dating back some 20 to 15 thousand years, and their coverage extended from the Arctic to the Antarctic.

4. DISCUSSION

Discussion was held on how to compile data for the publication of the LGM maps. Questions were posed by Prof. Wang, with a view to guiding deliberations during the Workshop in terms of each different topic addressed.

How far did sea level fall in the Last Glacial Maximum (LGM) - 100 m, 130 m or 200 m? What have been the varying impacts of eustatic change and tectonics in the WESTPAC region ? China, Japan and Indonesia have been tectonically very active. In eastern Indonesia, 30,000-

year old coral reefs are uplifted 130 m. Present-day bathometry in these cases is not a good guide to the LGM shoreline. However, in tectonically active zones the continental shelf is usually narrow and at the 1:20 million scale these problems may not greatly affect the final map.

What was the distribution of coral reefs during LGM ? Was there the same amount of reef as today, only displaced seaward, or was there substantially less reef and a contraction towards the Equator ? Data on LGM reef is hard to come by, and most drilling is too shallow. The rapidly uplifting Houn Peninsula, Papua New Guinea (John Cappellís work) may provide information, and a recent publication (Zhu k others, 1993, Aust. J.Earth Sciences) lists a reef dated at 29 Ka.

There is little data to control the interpreted drainage patterns on the exposed shelves during the LGM. High resolution seismic may be useful in areas such as the Fly Delta in PNG. In China, dry conditions during the LGM may have precluded the Yellow River from reaching the sea.

More paleoclimatic data are required for the compilation, in particular pollen diagrams. Was Indonesia dry or humid in the LGM ? Colder sea surface temperatures in the sea around northwest Australia would result in less rain in Indonesia. Also, with lower sea level the ocean gateways between the Pacific and Indian oceans would have been more restricted. These changes have major implications for the global climate.

The map to be produced by the Paleogeographic Map group is a test of the CLIMAP model. Do we find evidence of the predicted climatic regime in the actual sediments? The model could benefit from more data from marginal seas and ocean gateways. The map highlights data gaps and is an aid to planning further field work and data collection in the region. Current gaps in the project coverage include Korea, Vietnam and the Philippines. The USGS could be approached to provide coverage in the Bering Sea and Alaska.

5. CONTENT OF THE MAPS

The Workshop agreed upon the key information to be compiled on the LGM maps as presented in Annex III.

6. TIMETABLE FOR PUBLICATION

The Workshop decided on a timetable for the publication of the LGM (20 to 15 thousand years ago) maps for the entire WESTPAC region in 1995-1996 (Annex IV). It is planned to publish the map initially as a UNESCO/IOC monograph and then to publish in a special issue of a journal, such as "Paleo 3" or Marine Geology, a general paper on the results of the IOC/WESTPAC Paleogeographic Map Project with papers on detailed aspects of the LGM from the Member States.

The Workshop also decided that the next maps to be compiled by the group will be Holocene Optimum Map (some 6,500-5,000 years ago), the badly-needed map for the prediction of the consequences of the future sea-level rise.

ANNEX I

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ANNEX II

A SUMMARY OF COUNTRY REPORTS

AUSTRALIA (by Dr. Bradshaw)

The maps were developed by Anne Walley from originals produced by the AGSO-APIRA projects. Paleogeographic maps at 1:10 and 1:20 million scale and a data map at 1:10 million scale were shown. A list of references and a table of data points were also provided. The area mapped included the Australian plate - eastern Indonesia, PNG, the south-west Pacific, Australia, New Zealand and Antarctica. The -100 m contour was used as a rough guide to the LGM shoreline. Major features on the map included an expended area of permanent sea-ice around Antarctic, larger glacial areas in the Soup Island of New Zealand, Tasmania, south-east Highlands of Australia and along the central mountain chain of New Guinea. Large areas of exposed shelf surrounded Australia linking it to New Guinea and Tasmania. The pattern of wind directions during the LGM are preserved by the whorl of desert dunes in central Australia.

JAPAN (by Dr. Shinji Tsukawaki)

The Japanese Association for Quaternary Research published a series of Quaternary maps in 1987 from the work of over 150 scientists. The maps are at 1:4 million scale and are for the last interglacial, the last glacial and the mid-Holocene. Archaeological sites as well as paleogeographic features are shown on the maps. A published Quaternary geological map of Japan at 1:1 million scale in three sheets was also displayed. Numerous tephra layers provide good correlation control.

During the LMG, seaways existed between Honshu and Hokkaido, and between Japan and Korea, so that circulation could flow in and out of the Sea of Japan. Glaciers existed in Hokkaido with valley glaciers in central Honshu.

The last glacial map covers the period 60 to 10 thousand years ago - a compilation of data covering a broad time-slice rather than a "snap shot" of the LGM (20 - 15 Ka). However, this map is a reasonable representation of the narrower time interval as the actual shoreline mapped is that of the LGM taken at -100 m; A data map of the LGM could also be compiled from the existing information, augmented by more offshore data. It was decided that the giant volcanic eruption some 22 Ka should be included because of its magnitude and possible impact on global climate, as a trigger to the LGM ?

The question was raised as to whether there was any record from offshore Japanese sites of the eolian deposits transported from the Asian mainland during LGM.

INDONESIA (by Dr. Wahyoe)

A digitized map of the LGM shoreline, taken at -150 m was presented. Data are also available for the last interglacial and mid-Holocene. During the LGM the Indonesian Archipelago was the Indonesian maritime continent, with the Sunda Shelf exposed and rivers probably flowing both north and south around Borneo. The loss of the pool of warm water on the Sunda Shelf would have had a major impact on global climate in the LGM. However, the deep ocean gateway between the emergent Sunda and Sahul shelves would have remained open. Palynological studies for eastern Indonesia during the LGM are available and extension of this coverage further westward would help test the climatic models. A drier climate is expected with exposed shelf, and colder waters in the Indian Ocean rainforest may have been replaced by other vegetation types. There was mention of data from Sumartra that suggested that Pinus extended down to 300 m during the LGM.

Isotopic studies are underway on handed porites corals to understand recent climatic change. A well-controlled Holocene sea level curve is available for Indonesia with information from around 70 dated sites.

MALAYSIA (by Mr. Kamaludin bin Hassan)

The Malaysian contribution included a digitized map of the LGM shoreline taken at -200 m. The inland limit of the Holocene transgression has also been mapped for peninsular Malaysia. A map of the drowned drainage systems on the Sunda Shelf is also available for transfer to the LGM map. A data map is to be compiled. Shallow seismic surveys undertaken for tin exploration may he a source of additional information from the offshore. A key question is the size of the deltas built by the Sunda rivers during the LGM, with the proposed drier climate where river flow is less. The results of recent studies from well-dated profiles through the late Quaternary from Pantai Mine, a coastal site in Perak, were presented.

THAILAND (by Ass. Prof. Suparb Poobrasert)

During the LGM Thailand and much of the Gulf of Thailand was a land area. Publications are available that show the interpreted pattern of drainage across the exposed shelf and offshore data exist on the Gulf of Thailand. Most data onshore are for sites younger than 15 Ka. A map of the shoreline for the Holocene Optimum was shown and the history of transgression commencing at 18 Ka was outlined, the present shoreline reached at 13 Ka, maximum inundation reaching to Argthong at 5.5 Ka and then the coastline prograding to its present position today, south of Bangkok.

Dr. Saskia Jelgersma noted that eolian sand deposits, possibly related to the LGM or earlier glacial intervals, have been reported from the Khorat Plateau, indicating a previous much drier climate.

RUSSIA (by Prof. Wang Pinxian on behalf of Dr. Sergei Ganzei)

The LGM maps displayed included two paleogeographic maps - one showing interpreted lithologies, the other oceanography - and accompanying data maps. Maps of paleo-vegetation based on palynology were also available and notes and a list of references were provided. Dating control was provided by micropaleontology, lithology and geomorphology. The maps gave a lot of detail on land including areas of ice cap, eolian deposits and periglacial features such as patterned ground and permafrost. There were large areas of exposed shelf during the LGM interpreted to be mantled with eolian deposits. Ice shelf extended into the Sea of Okhostsk, and isotherm and salinity data derived from micropaleontology were displayed. The sea is interpreted as being 6-8 ppm less salty during the LGM.

CHINA (by Prof. Wang Pinxian)

Data maps and two paleogeographic maps - one for lithology, the other of oceanography - were shown. A list of references and a table of dated sites were also provided. A key question for reconstruction of the LGM is whether the Yangtze and Yellow rivers reached the sea during this time of aridity. Their lowstand deltas have not yet been identified on the shelf. The results of a recent cruise to the South China Sea were reported. High sedimentation rates of 1 cm/17 yrs were found, as the Pearl, Red, Mekong and Paleo-Sunda rivers all fed directly into the deep water of the South China Sea in LGM. The South China Sea was still open to the Pacific in the LGM as the sill depth is 2600 m, but closed to the south across the Sunda Shelf where the sill depth is only 35 m. Many sites with paleo-temperature data suggest a 6 to 9 degree drop in winter compared to today, with winter temperatures being about 18 degrees C as compared to 26 degrees C in the Pacific. Cores from the modern coral reefs show a break during the LGM. Temperatures may have remained warm enough in the southern South China Sea for coral growth but information from deeper sites is required to find any LGM coral reef. No obvious salinity change was observed or expected in comparison to today, as there was no direct input of glacial meltwater.

ANNEX III

CONTENT OF THE MAPS

(Map scale 1:10,000,000 for compilation
1:20,000,000 for publication)

(i) Coastline:

- use all sites with dated coastline markers
- use -100 bathometric line for areas without dated markers

(ii) Onshore:

- hills and mountains (> 300 m, now >200 m - lakes and rivers
- sand dune area, eolian deposits

- permafrost
- active volcanoes -
swamps and marsh

(iii) Offshore:

- sediment types
- growing coral reefs
- sea surface temperatures
- current directions
- sea ice limits

ANNEX IV

TIMETABLE FOR PUBLICATION

MAPS

1994 - 26 Nov.	Existing maps and data submitted to Prof. Wang
- 31 Dec.	Supplementary data (and maps if any) sent to Prof. Wang, In meantime looking for unified base map to be distributed to all members (Dr.Bradshaw)
1995 - 31 Mar.	First version of compiled maps completed & distributed to all members for correction & supplements
	Short papers (explanatory text for maps) from each member country submitted to Prof. Wang
- 30 Jun.	Final version of compiled maps completed
1996 - 31 Jan.	Publication of IOC/WESTPAC Monograph

PAPERS

1995 - 30 Jun.	Manuscripts from individual countries submitted to guest editors for review
1996 - 31 Mar.	All papers for the special issue submitted to the editors of the u journal

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