


Irwin-Williams, C. Uranium-series dates on vertebrate fossils from Valsequillo, Mexico. I. Planetary Science Let-

Comments on: "Surface Circulation of the Indian Ocean during the Last Glacial Maximum Approximately 18,000 yr B.P." by Warren L. Prell et al.

In the cited paper the authors utilize the CLIMAP planktonic foraminiferal biogeography of the Indian Ocean to estimate the sea surface temperature (SST) and the ocean circulation patterns during the last glacial maximum (LGM). Their reconstructions, based on present day foraminifera concentrations and transfer function techniques, yielded differences between the present distribution and the LGM as about -1.5° to -2.0°C averaged over the Indian Ocean and about -5°C along the tropical and sub-tropical West Australian coast.

The data base used in the study contained 42 Indian Ocean core samples which according to the authors is a significant improvement on the CLIMAP (1976) set. It is important to note at this stage that the study was based only upon one form of data, viz. the distribution of planktonic foraminifera. It did not incorporate land-based proxy data. Furthermore, the enhanced core network described in Figure 2 and Table 1 does not contain any core samples north of 19°S and east of 90°E. In other words, the entire northeastern equatorial Indian Ocean in the vicinity of Indonesia and northwest Australia is void of data. However it is the form of the data rather than its distribution that we will emphasize later.

The authors make specific reference to the work of Webster and Streaton (1978) by stating "... We conclude that the δSSTs of 7° to 11°C as suggested by Webster and Streaton (1978) (... in Table 2...) are highly unlikely in the equatorial Indian Ocean and western Pacific...". This statement appears to be based on an unfortunate misinterpretation of our Table 2 possibly reached by considering the table in isolation of a considerable discussion.

Our primary aim was to produce a picture of the climate of the LGM which was consistent with as many forms of proxy data (marine and continental) as were available. The basic philosophy, to which we still hold, was that a meaningful climate can be achieved only by a synthesis of widespread and diverse data. The task became quite difficult when the data from CLIMAP (1976), subsequently substantiated by Prell et al. (1980), appeared to be inconsistent with estimates of the LGM climate in the tropical north of Australasia based on palaeobotanical data summarized (for example) by Bowler et al. (1976).

The apparent differences were associated more with the magnitude of the SST than its distribution. Indeed, subsequent reference to Prell et al. indicates a substantial correspondence between our proposed climate structure and their ocean temperature distribution. Their evidence of an enhanced Western Australian current during the LGM and the indication of a much cooler SST distribution in the southern central Indian Ocean in summer is completely consistent with our proposed anomalous atmospheric long wave pattern, which seemed to envelope most of the proxy data sets over...
much of Australasia. Thus if the CLIMAP data were in error, it is an error in magnitude only and that probably only in the tropical regions.

A major thrust of our paper was an attempt to resolve the apparent paradox presented by the two data sets. Our Table 2 represented estimates of the surface temperature (not sea surface temperature) which would be consistent with the only evidence we have of the ancient structure of the low latitude atmospheric column above the ground, viz. the Mts. Jaya, Sirunke, Inim, and Wilhelm freezing levels which are substantiated by lower elevation proxy climatological data in the same region. Table 1 showed results of the opposite approach: the calculation of the LGM tropical freezing levels inferred from the CLIMAP SST estimates. Via either technique large disparities existed. Unfortunately these cores were characterized by extremely low sedimentation rates (Shackleton and Opydke, 1976) which render more difficult the usually confident inferences which may be made with the higher accumulation rate cores (Shackleton and Opydke, 1976). A number of cores lie east beyond 170°W from which surface temperature drops of 4–6°C have been inferred (CLIMAP, 1976). Indeed the enhancement of the surface temperature gradient presents other problems for the provision of a consistent regional climate in the Western Pacific Ocean. A larger longitudinal temperature gradient does not appear to be consistent with the general aridity of Australia as described by Bowler et al. (1976) during the LGM.

We may speculate further on the reconstructions in the Eastern Indian Ocean. We remarked in our paper that the influence of the western Pacific Ocean on the eastern Indian Ocean was probably reduced significantly during the LGM by the closing of Torres Strait. However, the reconstructions of Prell et al. (see their Fig. 7) still show the isotherms being almost parallel with lines of latitude to the northwest of Australia even though the only data point lies at 19°S which suggests a temperature drop of greater than 4°C! Possibly the orientation of the isotherms comes from an interpolation scheme from the patterns of the LGM temperature. Unfortunately isotherm distribution is considerably on an open question.

Despite these remarks, we hold the opinion that it is difficult to rule out one of the three candidate processes responsible for the LGM climate change, but that factors may be important to lesser degree.

There are two main reasons for this opinion. First it is to correct the interpretation of our results presented. Second is to reiterate that multiple data sets are needed in the process. The CLIMAP proxy data set with its high sedimentation rates and consequently it is clear that any inferences which it has been possible to make appear to be inconsistent. This paper sets the importance of these factors and insists that these aspects need to be addressed.

It may be of interest to note that this paper was held at Howman's Bay, near State, New Zealand in February 1981 (the entire conference) which was attended by Quaternary researchers from New Zealand. At the conference there was a proposal for a core data for selected regions of the world compared with a wide range of proxy data for the Atlantic region. proceedings of this conference will be published.

About Pigmies

In an extensive series of papers, T. A. Johnson (1983) studied the pigmy mammoths of the Aleutian Islands, Johnson (1983) found that elephants reached the Aleutians in the 15,000 years B.P. On the basis of subfossil floral structure Johnson suggested that the periods of lower
orientation of the isotherms in the reconstructions comes from the influence in the interpolation schemes of the V28 cores or from the patterns of the present sea surface temperature. Unfortunately, the present isotherm distribution probably relies considerably on an open Torres Strait.

Despite these remarks, it is still our opinion that it is difficult to discern which of the three candidates described above are responsible for the disparity; perhaps all factors may be important to a greater or lesser degree.

There are two main purposes for this letter. First it is to correct the misconceptions of our results presented by Prell et al. The second is to reiterate our belief in the use of multiple data sets in any reconstruction process. The CLIMAP data is the only proxy data set with global distribution and consequently it is clearly the most important as evidenced by the diverse uses to which it has been put. However, as there appear to be inconsistencies with other data sets the importance of the CLIMAP data insists that these apparent paradoxes be addressed.

It may be of interest that a conference was held at Howman’s Gap in Victoria in February 1981 (the so-called “CLIMANZ” conference) which was attended by many Quaternary workers from Australia and New Zealand. At this meeting the deep sea core data for selected time periods were compared with a wide range of land based proxy data for the Australasian region. The proceedings of this conference will be published later this year and will provide a first step in drawing attention to inconsistencies existing among different data sets at least in this region.

REFERENCES


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About Pigmy Mammoths of the Northern Channel Islands and Other Island Faunas

In an extensive article on the endemic pigmy mammoths of the Northern Channel Islands, Johnson (1978) concluded that elephants reached the islands by swimming. On the basis of submarine morphology and structure Johnson argued that even during the periods of lowermost sea level no continuous land bridge could have formed between the islands and the California coast. This assumption was shared by Madden (1981) in the ensuing discussion; the same idea is held by other scientists in California.

On geological grounds, however, Johnson’s argument to rule out the possibility of a