NEES, S. MARTINEZ, I., DE DECKKER, P. & AYRESS, M. 1994. A stable-isotope record for the Late Quaternary from the East Tasman Plateau. in *Evolution of the Tasman Sea Basin* (eds. van der Lingen, G., Swanson, K.M. & Muir, R.J.), pp. 197-202. Balkema, Rotterdam

A stable-isotope record for the Late Quaternary from the East Tasman Plateau

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ABSTRACT: The oxygen-isotope record of planktic foraminifers from a short core from the East Tasman Plateau is briefly presented. Results indicate a low sedimentation rate of the order of 1cm/year for the last 450,000 years. Brief mention is made to the correlation of this core with other standard isotopic curves for the Late Quaternary.

1 INTRODUCTION

In this brief note, the oxygen-isotope stratigraphy for the uppermost 5.5 metres of *Eltanin* core E36-23 is presented. Core E36-23 was drilled on the East Tasman Plateau (43°53.02'S, 150°03.02'E) at a water depth of 2,521 m. This core has been analyzed because of its unique location in the southwestern portion of the Tasman Sea for which no palaeoceanographic information was available so far. In addition, it was believed that its position on the East Tasman Plateau would provide a record free of carbonate dissolution effects due to the bathymetry of the Plateau. Additionally, this short note provides information of interest for two other papers published in this volume (Nees, this volume; Martínez, this volume).

Between 10 to 35 tests of the planktonic foraminifer *Globigerina bulloides* taken from the >125 µm size-fraction were picked from 61 samples taken approximately at 10 cm intervals through the 5.5 m of the core. Specimens were cleaned with methanol in an ultrasonic bath for approximately 10 seconds to remove possible contaminants, then rinsed several times with ultrapure distilled water. Isotopic compositions were measured using a Finnigan MAT 251 mass spectrometer at the ^{14}C-Laboratory, Institute of Pure and Applied Nuclear Physics, Kiel (Germany). Oxygen- and carbon-isotope data are reported in δ notation relative to the Peedee belemnite (PDB) standard. Precision for oxygen-isotope measurements is 0.07‰, and for carbon isotope measurements is 0.04‰ on the δ scale (PDB).

2 RESULTS

Comparison of data from core E36-23 with the internationally accepted stable-isotope chronology of deep-sea cores for the Late Quaternary (Imbrie et al., 1984; Prell et al., 1986; and Martinson et al., 1987) allows us to assign the $\delta^{18}O$ stratigraphy of core E36-23 down to stage 12 (Table 1 and Figure 1). The maximum peak observed corresponds to interglacial stage 11 (with a value equalled to ~1‰), whereas the minimum peak corresponds to glacial stage 2

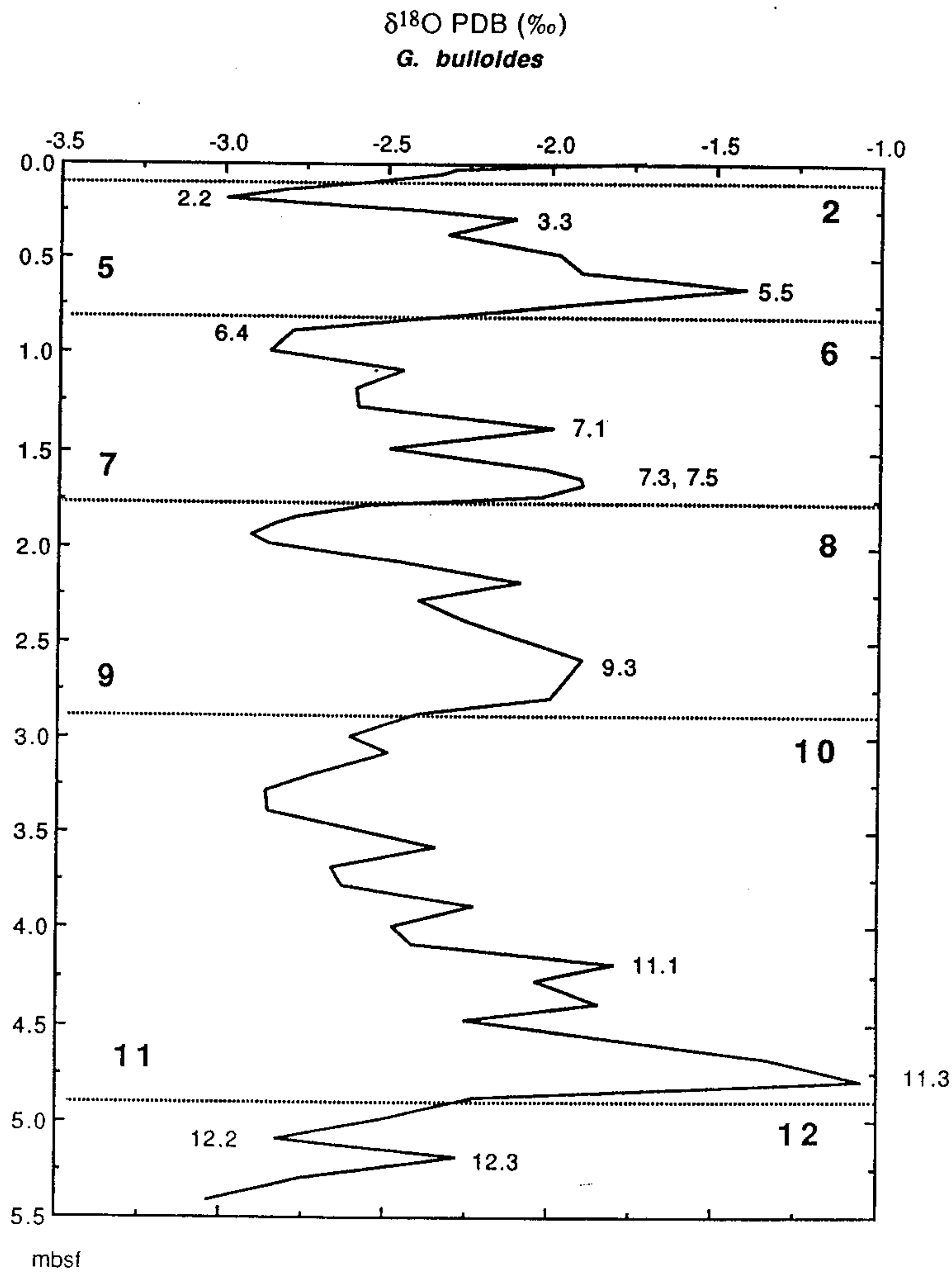

Figure 1. Oxygen-isotope stratigraphy of core E36-23. Bold numbers denote isotopic stages; whereas small numbers denote the conventional isotopic 'events' (from Imbrie et al., 1984; Prell et al., 1986; Martinson et al., 1987). Dashed lines indicate stage boundaries. Note the more negative values for interglacial stage 11 as compared to other interglacial stages.

Table 1. Core E36-23. Oxygen and carbon isotope data (per mil deviations from the PDB standard) for *Globigerina bulloides*.

Depth (cm)	$\delta^{18}O$ (PDB)	$\delta^{13}C$ (PDB)	Depth (cm)	$\delta^{18}O$ (PDB)	$\delta^{13}C$ (PDB)
0.5	1.72	-1.03	239.5	2.26	0.01
3.5	2.30	0.03	249.5		
6.5	2.34	-0.36	259.5	1.90	-0.27
10.5	2.58	-0.38	269.5	1.04	
14.5	2.81	-0.43	279.5	2.00	-0.14
19.5	3.00	0.31	288.5	2.40	-0.32
24.5	2.42	-0.09	299.5	2.61	-0.42
29.5	2.11	-0.44	308.5	2.49	-0.29
38.5	2.32	0.19	319.5	2.73	-0.46
48.5	1.98	0.05	328.5	2.87	-0.04
58.5	1.91	-0.10	339.5	2.86	0.11
66.5	1.41	-0.67	347.5	2.63	-0.18
78.5	2.13	-0.71	358.5	2.35	0.00
88.5	2.79	-0.55	368.5	2.67	0.31
99.5	2.86	-0.61	378.5	2.63	0.28
108.5	2.45	-1.07	388.5	2.23	-0.01
118.5	2.60	-0.35	399.5	2.48	0.25
128.5	2.59	-0.26	408.5	2.42	0.30
138.5	1.99	-0.48	419.5	1.80	-0.13
149.5	2.49	0.04	428.5	2.04	0.09
159.5	2.02	-0.31	439.5	1.85	0.12
164.5	1.91	-0.21	447.5	2.26	0.39
168.5	1.90	-0.33	459.5	1.71	0.31
174.5	2.03	-0.48	468.5	1.33	0.28
178.5	2.56	-0.45	479.5	1.05	0.15
184.5	2.78	-0.26	488.5	2.23	-0.29
188.5	2.84	-0.16	499.5	2.50	-0.08
194.5	2.92	0.21	509.5	2.83	-0.21
199.5	2.86	0.32	519.5	2.28	-0.30
208.5	2.45	0.24	529.5	2.76	-0.09
219.5	2.09	0.14	541.5	3.04	0.18
228.5	2.40	-0.02			

(~3‰). Stratigraphic resolution is rather poor particularly for the last 125 ky (stage 5 to 1; Figure 2). Isotopic stage 4 and details of stage 5 (substages) are unresolved due to the coarse sampling interval and the now-recognized low sedimentation rate in the core. The interval with maximum sedimentation rate corresponds to the period covering isotopic stages 9 to 11 (Figure 2). Sedimentation rates for stages 5 to 1 (the last 125 ky) are less than 1 cm/ky, whereas for the interval between stages 9 and 11 an average of ~6 cm/ky is estimated. The glacial/interglacial amplitude in $\delta^{18}O$ between stages 2-1 is ~1.5‰; this value is comparable to the interval covering the transition between isotopic stages 6 and 5.

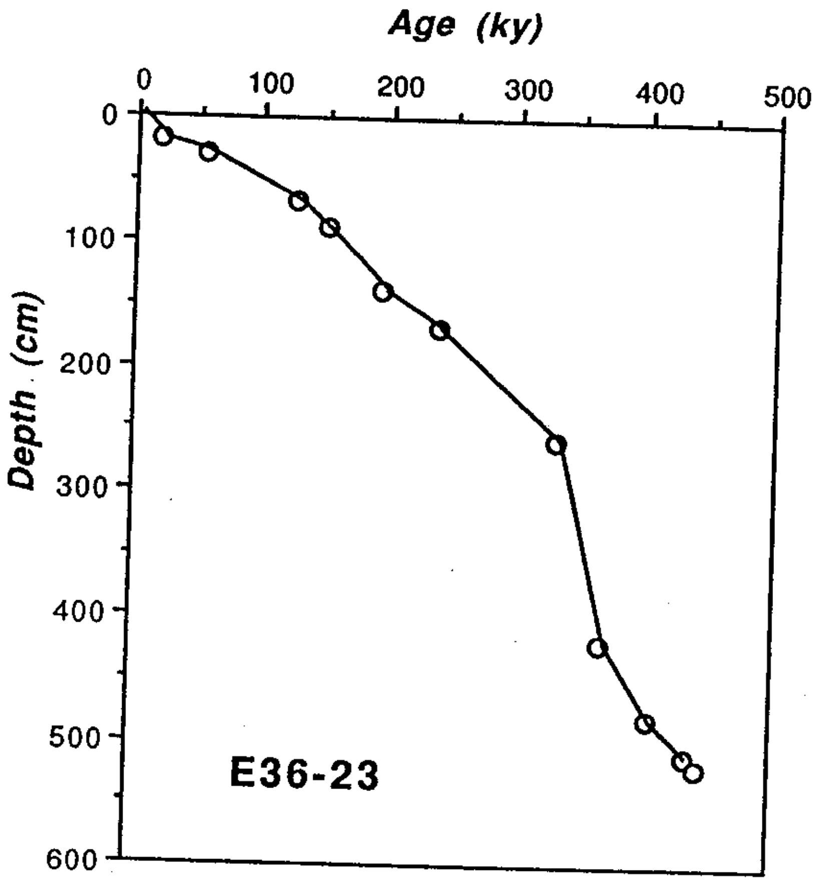

Figure 2. Age-depth model for core E36-23. Control points refer to isotopic 'events' as in Figure 1, calibrated against the astronomically-tuned chronology (Imbrie et al., 1984; Prell et al., 1986; Martinson et al., 1987). Note that sedimentation rates for most of the core are < cm/ky, except for the interval between ~300 and ~500 cm (stages 9 to 11).

3 COMPARISON WITH OTHER RECORDS

The very low sedimentation rates of core E36-23 make this record unsuitable for detailed palaeoceanographic studies; bioturbation is expected to 'blur' the $\delta^{18}O$ signal where sedimentation rates are less than 2 cm/ky (Peng et al., 1977). Nevertheless, the general pattern of E36-23 $\delta^{18}O$ record is comparable to other Tasman Sea records such as core DSDP 593 (Nelson et al., 1993) which shows similarities in the relative magnitude of interglacial stages. Stage 11 shows more negative values than stage 5 in both records (E36-23 and DSDP 593). A similar relationship is observed in core DSDP 594 collected southeast of New Zealand (Nelson et al., 1985). This pattern is not observed in other Southern Ocean cores (see Howard & Prell (1992) for further details on these cores).

Howard & Prell (1992), on the other hand, documented the latitudinal migration of the Subtropical Convergence and estimated sea-surface temperature variations based on faunal analysis for the Late Quaternary of the southern Indian Ocean. At stage 11, sea-surface temperature estimates were found to exceed those of the Recent, and in most cores, for stage 5 values as well. This factor must indicate the poleward migration of the Subtropical Convergence in the Southern Ocean (in the Indian Ocean sector). The phenomena discussed above have yet to be recognized for the Tasman Sea and Southwest Pacific since we possess so few cores that are located on either sides of the present-day position of the Subtropical Convergence.

It is our intention to publish elsewhere our results and interpretation of the faunal record of core E36-23 for both planktic and benthic foraminifers, together with that of ostracods. Preliminary results of benthic foraminifers from this core are already presented elsewhere in this volume (Nees, this volume).

ACKNOWLEDGEMENTS

We are grateful to Dr. H. Erlenkeuser who performed the stable-isotope analyses at the ^{14}C-Laboratory of the Institute of Pure and Applied Nuclear Physics in Kiel (Germany).

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