



SMR/1884-10

Conference on Milankovitch cycles over the past 5 million years

22 - 24 March 2007

Southern Africa

Dave ROBERTS

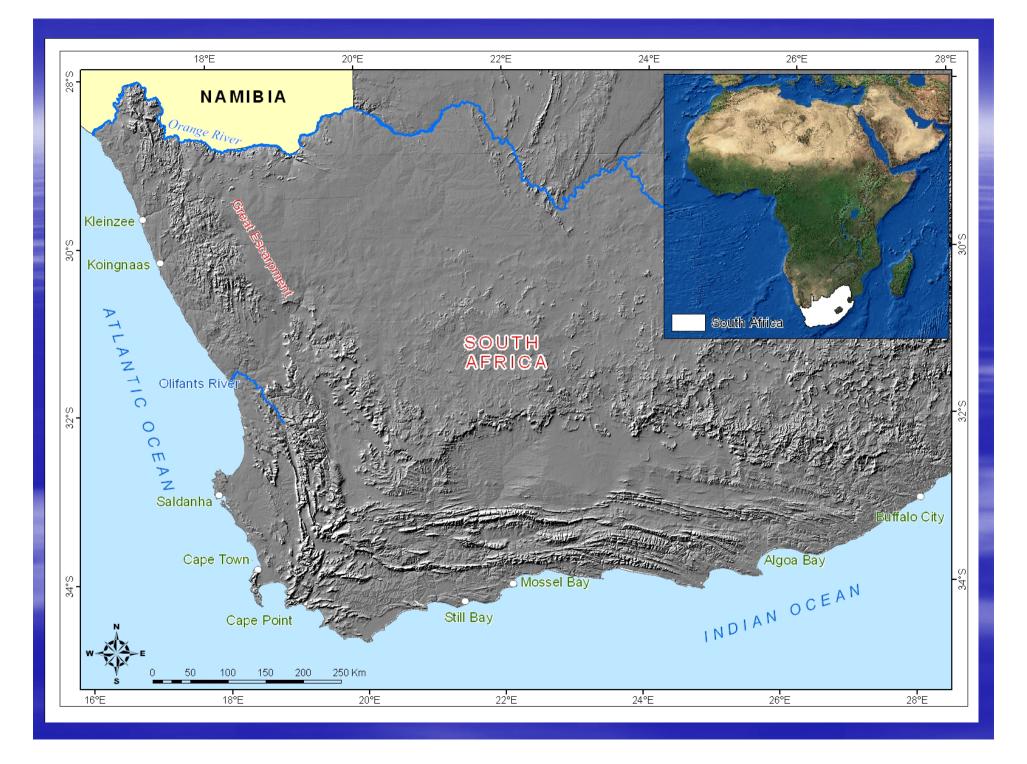
Council of Geoscience
P.O. Box 572
Bellville 7535



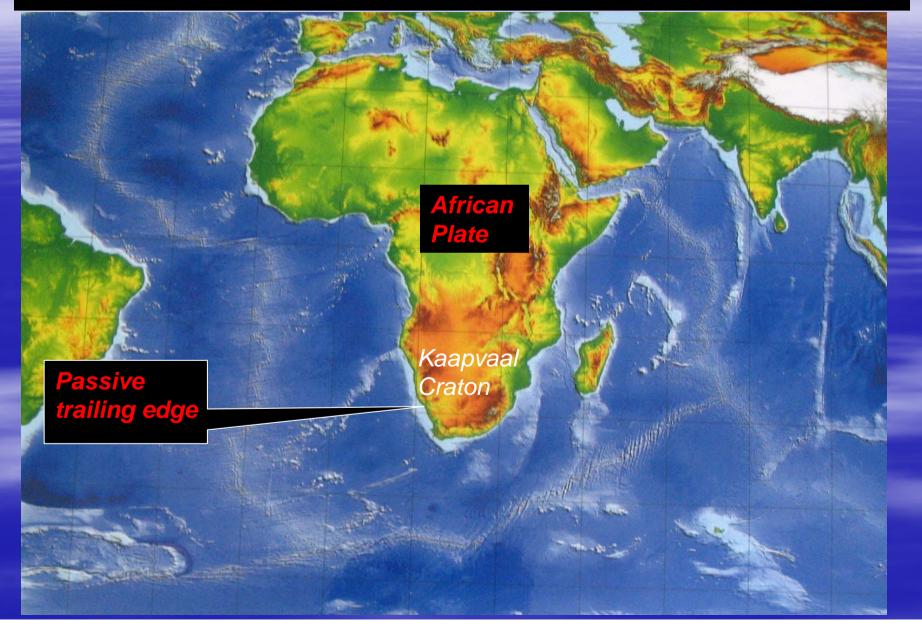
Archive of Palaeoclimate and Palaeo-oceanography



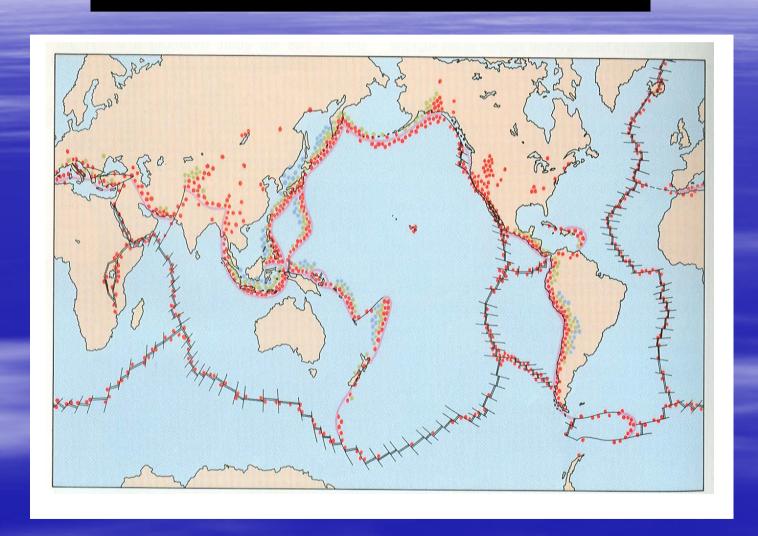
MTRODUCTION



STABLE PLATE TECTONIC SETTING OF SOUTHWESTERN AFRICA



GLOBAL SEISMICITY



Marine Terraces: Palaeoclimatic and Palaeo-oceanographic Archive

Marine deposits

Sea level history

Sea temperature

Wave regime

Ocean currents

Fauna

Aeolianites

Wind velocity

Wind direction

Precipitation

Fauna

LATE TERTIARY TERRACES AND DEPOSITS

Miocene aeolianites at Saldanha (12-10Ma)



Miocene aeolianites at Saldanha (12-10Ma)

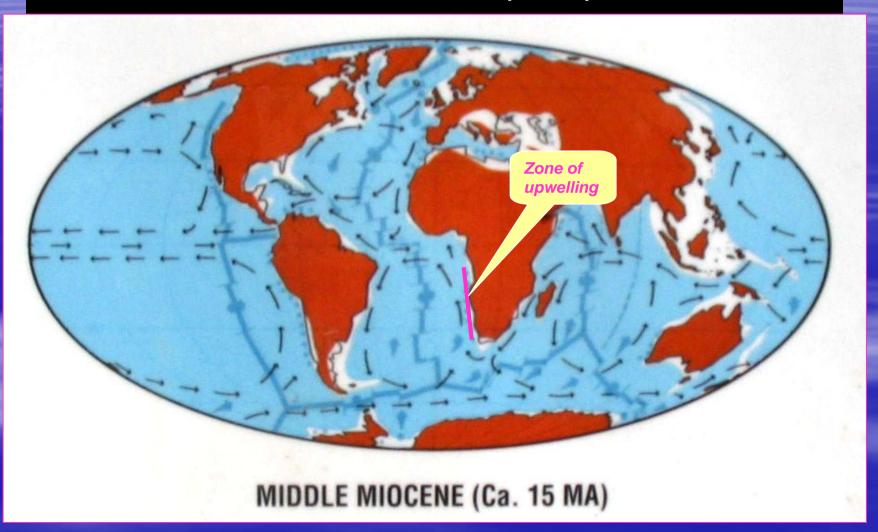




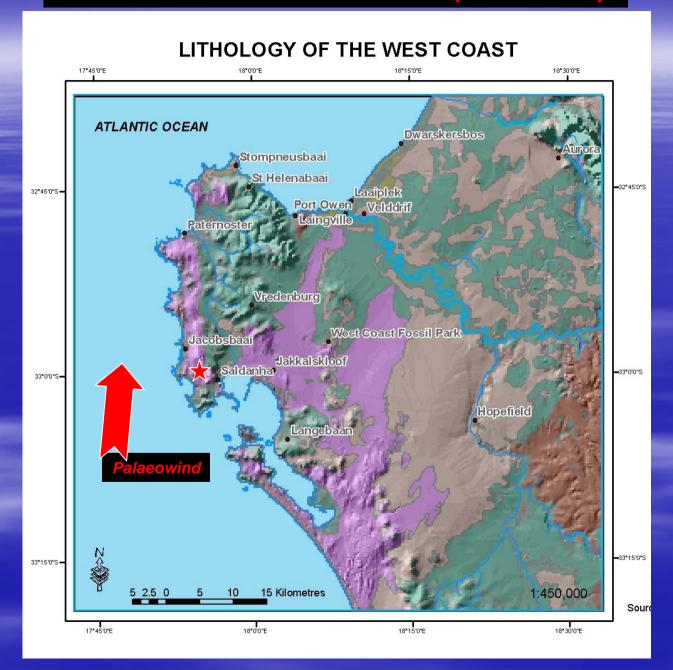
Diamantornis wardi (~12-10 Ma)

Aeolian cross-bedding

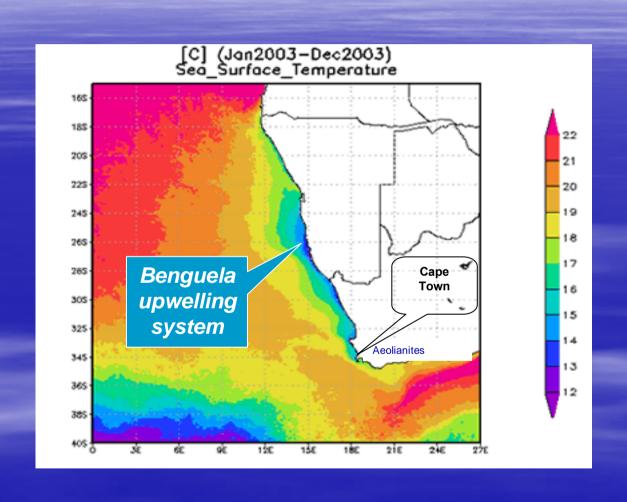
Miocene upwelling along the West African coast – Elsevier Chart (2004)



MIOCENE PALAEOWIND (12-10 Ma)



MIOCENE PALAEOWIND (12-10 Ma)



A girl's best friend or ecological disaster??



90 m Terrace with cliff Koingnaas, Namaqualand



50 M SHORELINE CLIFF AND WAVE-GULLIED TERRACE



30 m Terrace cut into steeply-dipping Palaeozoic quartzites-Olifants River Mouth



Older terrace truncated by a younger highstand at +30 m



Marine and aeolian deposits mantling the 30 m Terrace, Kleinzee



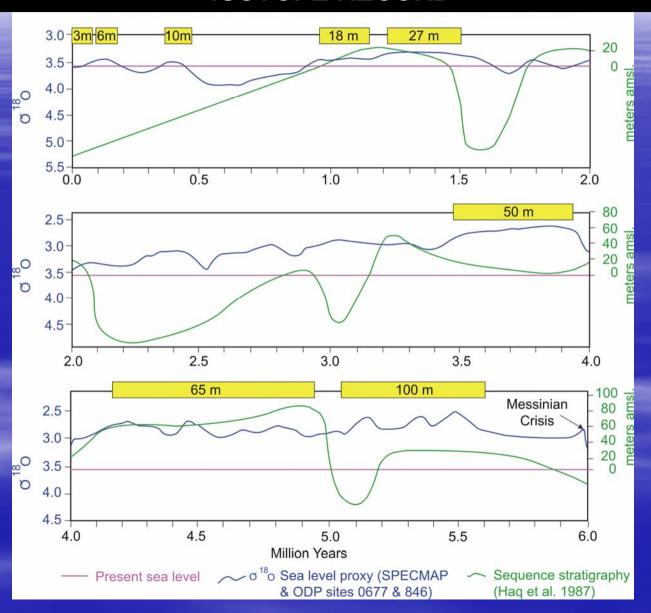
20 m marine bevel incised by + 5 m Late Pleistocene highstand



Fossil hippopothamus jaw from a marine terrace

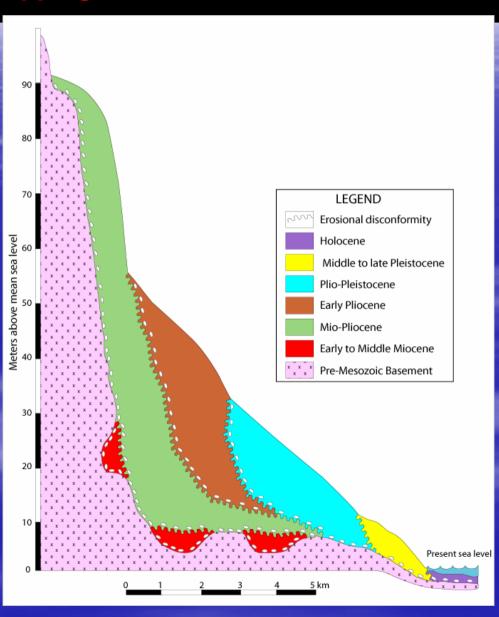


CORRELATION OF MARINE TERRACES WITH THE MARINE ISOTOPE RECORD

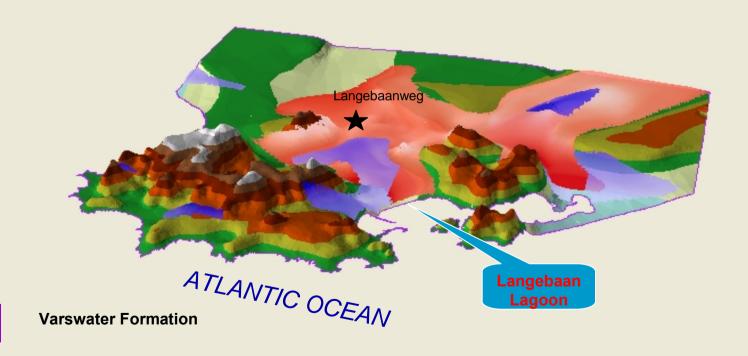


Marine Terraces of the West Coast 5.6 - 5 Ma 4.9 - 3.5 Ma 100 m 1.5 - 1.3 Ma 1.2 - 0.9 Ma 65 - 50 m High cliff inhibits 27 m 400 ka terrace 18 m development 10 m Sea cave 6 m 120 ka 3m 6-3 ka 0 m Erosion of 50 and 100 m terraces

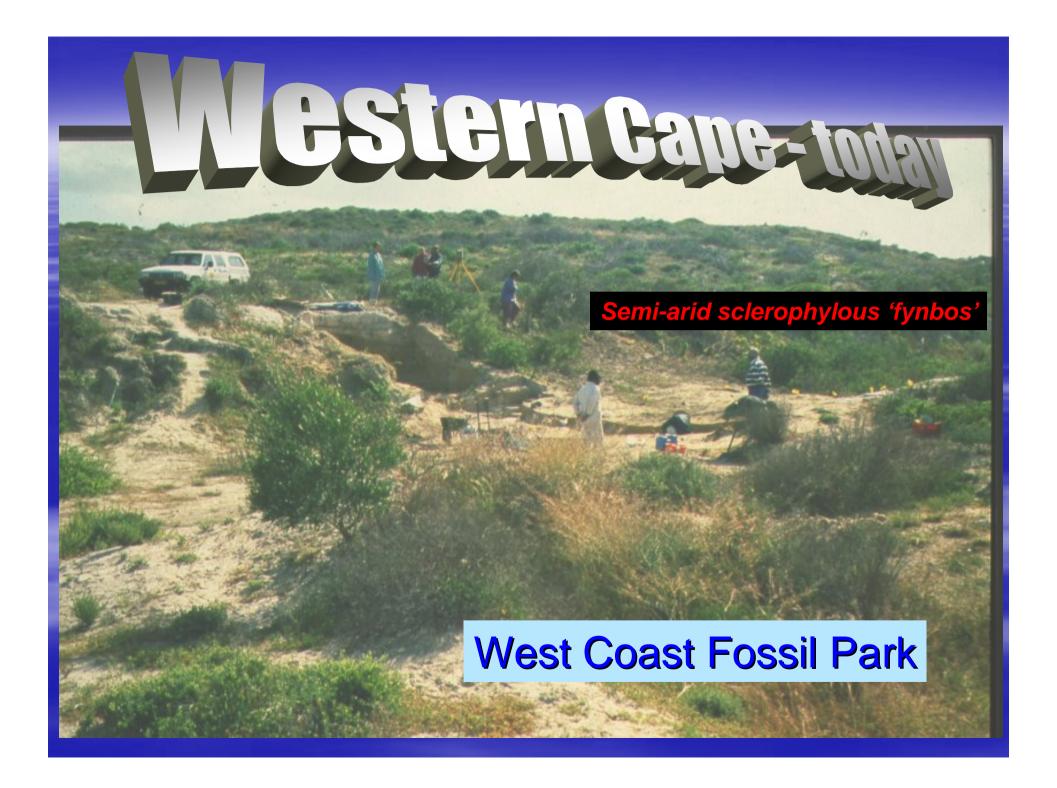
Offlapping marine terraces of the West Coast



+ 90 M PHOSPHATIC VARSWATER FORMATION DISTRIBUTION



Elandsfontyn Formation







5 MILLION YEARS
AGO

WEST COAST FOSSIL PARK



MIO-PLIOCENE WEST COAST FOSSILS



Agrotherium sp. skull, next to the skull of an adult male lion





Langebaanweg Phosphatic Marine/Estuarine Deposits (Varswater Formation)



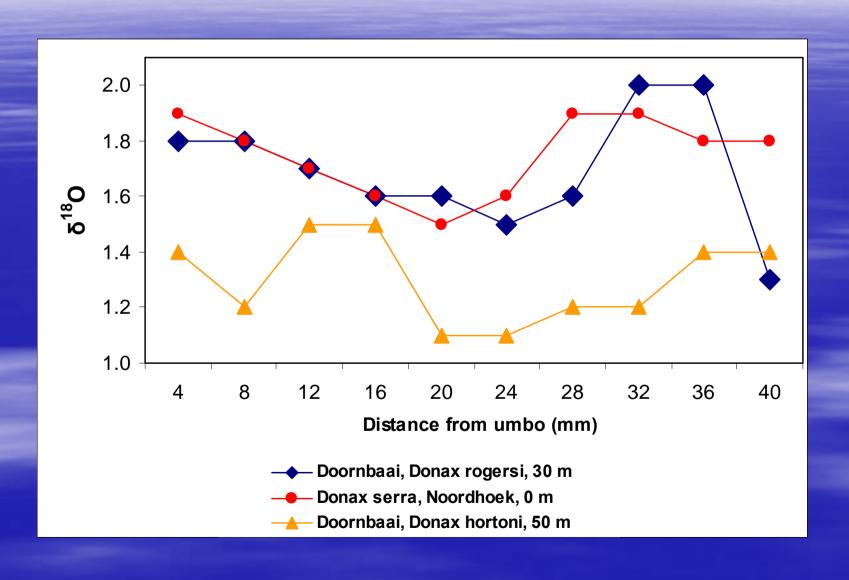
Miocene (~10Ma) phosphatic gravel (+20 m)



50 m Terrace with the index mollusc Donax haughtoni



Oxygen isotopes of fossil and modern Donax sp.

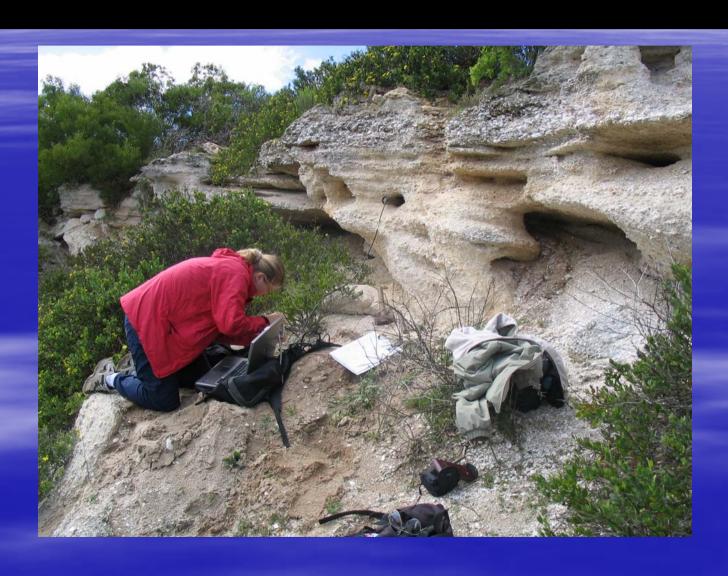


LATER PLEISTOCENE TERRACES AND DEPOSITS

Late Quaternary Marine Terraces Cape Point, Cape Town



SAMPLING PALAEO-BEACH DEPOSITS (+7 M) FOR LUMINESCENCE DATING



EARLY STONE AGE ARTEFACTS



Oldest (MIS11?) Late Quaternary marine deposits, Mossel Bay, South Coast



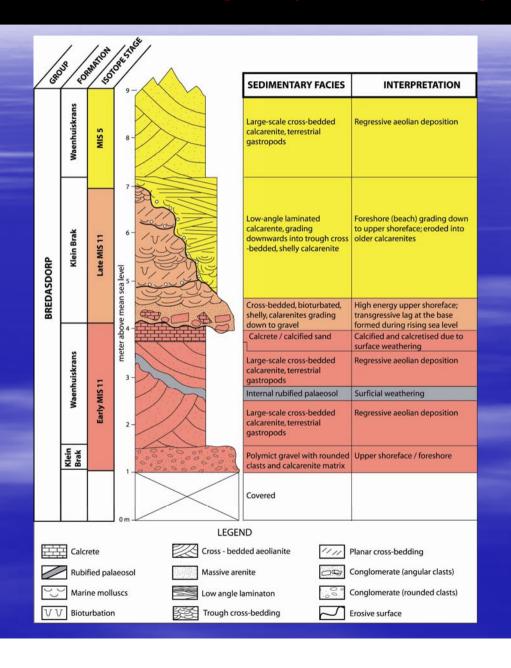
Juxtaposed MIS 11 and MIS 5e at Mossel Bay South Coast







Middle to late Pleistocene stratigraphy at Mossel Bay, South Coast



Multiple phases of deposition during MIS 5e, Buffalo City, east coast

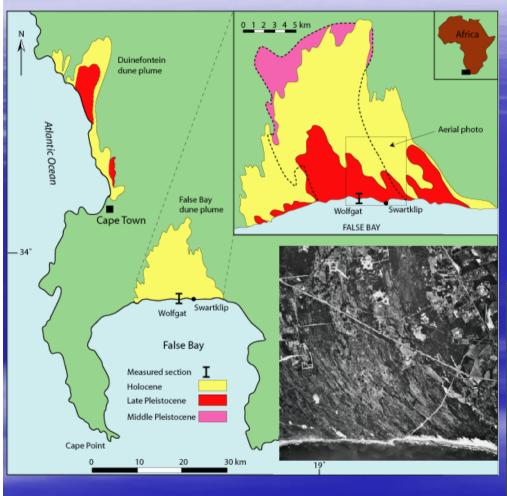


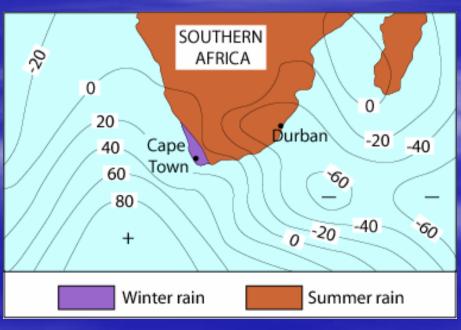
Multiple phases of deposition during MIS 5e, Buffalo City, east coast



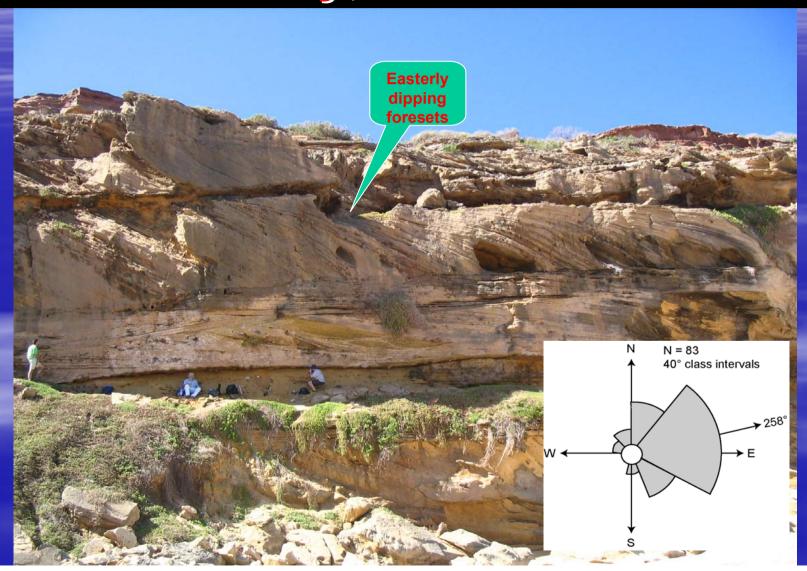


False Bay Dune Plume with attenuated Late Pleistocene component

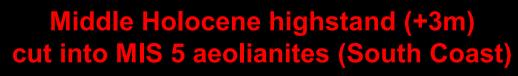




Cross-stratified MIS 5 aeolianites Still Bay, south coast

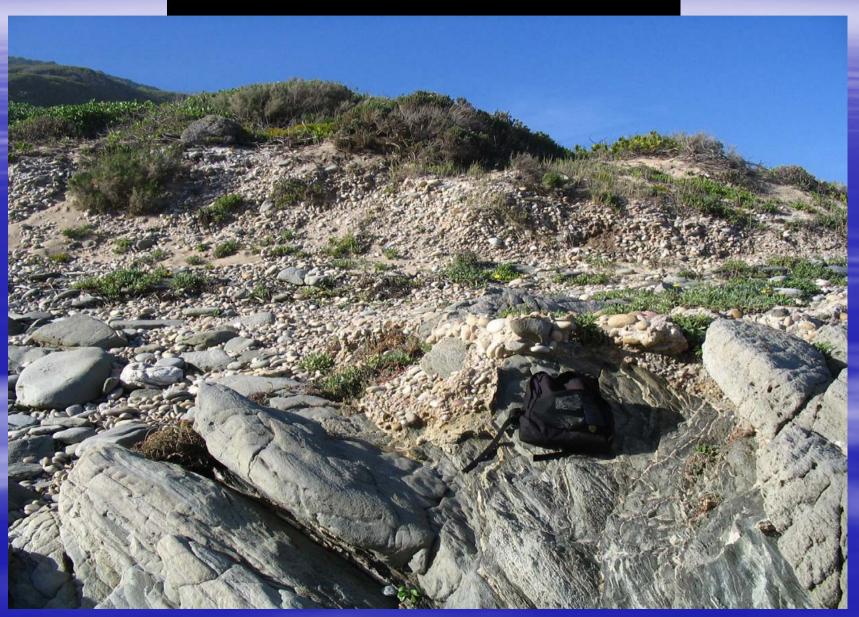


MIDDLE HOLOCENE TERRACES AND DEPOSITS





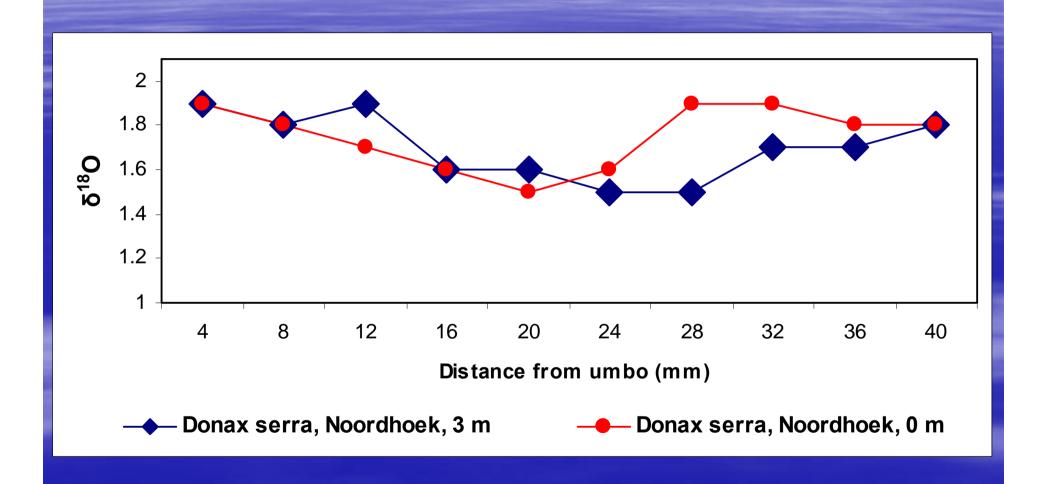
Middle Holocene Highstand (+3m) South Coast



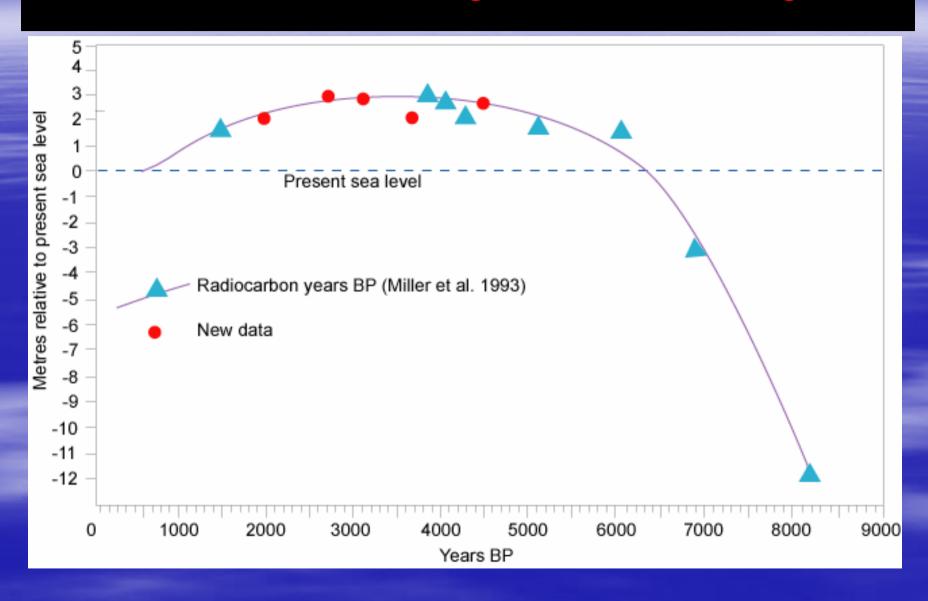
Middle Holocene highstand deposits (+3 m) with shells and volcanic pumice Noordhoek, Cape Town

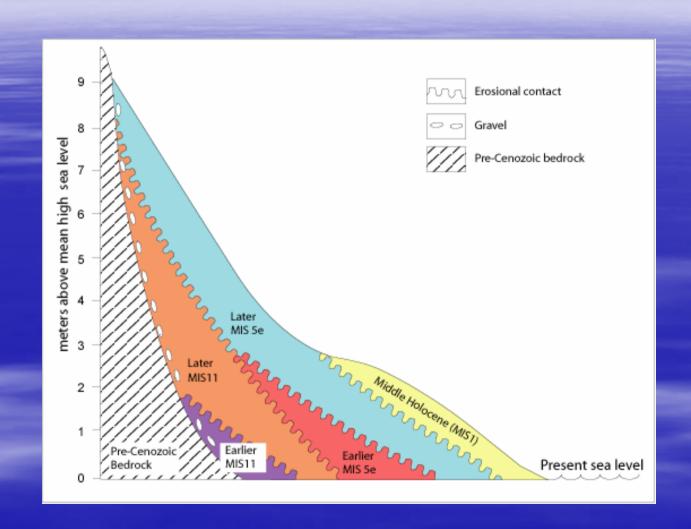


Oxygen isotopes of middle Holocene and modern *Donax serra* (bivalve)



Holocene sea level curve showing the Middle Holocene highstand





CONCLUSIONS

- Marine terrace deposits host detailed empirical palaeoclimatic and palaeooceanographic records dating from the Middle Miocene to the Holocene which.
- Late Tertiary terraces record longer term highstands apparently with large amplitudes.
- Palaeowind orientation and marine phosphorites indicate cold upwelling along the West Coast during the later Middle Miocene, extending well into the Pliocene.
- Late Quaternary Milankovitch cyclicity is well expressed onshore, showing sea level fluctuations within MIS 11 (+2m and +12 m) and MIS 5 (+1 m and +6 m).
- A Middle Holocene highstand attained a maximum of 2-3 m between 4.5- 2.5 ka.
 The forcing agency is not well understood.
- The dimensions of Pleistocene and Holocene dune plumes at False Bay suggest a weakening of the South Atlantic anticyclone during MIS 5.

Last Interglacial Fossil human footprints ('Eves' footprints)

