



**HOLOCENE and LATE PLEISTOCENE
BENTHIC FORAMINIFERA
and
INFERRED PALAEO SEA LEVELS,
SPENCER AND ST VINCENT GULFS
and
SOUTHEASTERN SOUTH AUSTRALIA**

by

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SUMMARY

This study records assemblages of species of Late Quaternary benthic foraminifera recovered from vibrocored and surficial sediments of Spencer and St Vincent Gulfs, southern South Australia. The distributions of species within Late Pleistocene and Holocene sequences have been interpreted to infer southern Australian palaeo sea levels for these time intervals.

In modern gulf waters, bioclastic components predominate in a regime of cool-temperate carbonate sedimentation. Benthic foraminifera are abundant in all surficial sediments and the numerical distribution of many species is closely related to water depth. For example, *Massilina milletti* is most common in mid-gulf waters at depths of about 40 metres. In contrast, species such as *Nubecularia lucifuga* and *Discorbis dimidiatus* are characteristic of shallow subtidal seagrass environments. Two species of *Elphidium*, *E. crispum*, favouring shallow water, and *E. macelliforme*, more common in deeper water, provide a particularly useful numerical ratio. For the sediment size fraction 0.50 - 0.25mm, the logarithmic relative abundance of these two species strongly correlates with water depth. This was found to be particularly so for the cooler, deeper waters of Gulf St Vincent where a correlation factor of 0.89 was determined. These observations have been applied, in a uniformitarian sense, to interpret the significance of distributions of species of benthic foraminifera within vibrocored sediments taken from both gulfs.

An extensive suite of vibrocores were taken from northern Spencer Gulf by other workers, who determined a stratigraphic framework and palaeo sea level history for the sediments so obtained. Foraminiferal analysis of eight cores, identified by the original researchers to be particularly significant, generally supported the framework of sedimentation during oxygen isotope sub-stages 5e, 5c and 5a, with intervening regressions during the 5b and 5d sub-stages. However, on micropalaeontological evidence, there is a need for some revision of the original findings.

For example, vibrocore #SG179 contains neither fossils of foraminifera nor other evidence of marine sedimentation within the interval 200 to 80cm. The assignment of these sediments to the Lowly Point Formation, corresponding to the marine transgression of oxygen isotope sub-stage 5a, is therefore unlikely to have been correct.

Marginopora vertebralis was previously known as an indicator species of foraminifera for the 5e transgression sediments, locally known as the Glanville Formation. The present study shows that *Pseudomassilina australis* and *Quinqueloculina polygona* also appear to be confined to this unit. On the evidence of the combined presence of these three species, an interval within vibrocore #SG245, originally identified as Lowly Point Formation, should be reassigned to the older Glanville Formation.

Northern Spencer Gulf has a maximum depth of about 20 metres so was not inundated by the somewhat lower oxygen isotope stage 3 transgression. Vibrocored sediments of this age were, however, recovered from deeper waters of adjacent Gulf St Vincent. Radiocarbon and amino acid racemisation dates confirm that they were deposited during the interval 45 000 to 30 000yr B.P..

Using both the general assemblage of foraminiferal species, and the relative abundances of the two species of *Elphidium*, relative palaeo water depth curves were established for the Late Pleistocene and Holocene sediments and it was possible to recognise a pattern of sea level changes that could be reconciled with that determined for the uplifted coral reef terraces of the Huon Peninsula and elsewhere. Local palaeo sea level corresponding to Huon Peninsula transgression stage IIIb has been calculated to be -27 to -24 metres.

For Pleistocene intervals, where the euryhaline species *Elphidium articulatum* and *Ammonia beccarii* were present, the *E. crispum*/*E. macelliforme* failed to yield meaningful palaeo water depth signals. However, when numbers of *E. crispum* and *E. articulatum* were combined in the numerator, plausible inferences were derived from the data.

For Holocene intervals, palaeo water depths implied from both the general assemblage and the *Elphidium* ratio were consistently detailed and could be correlated between cores. In northern Spencer Gulf they are sufficiently detailed to have recorded isostatic events attributable to the Holocene transgression.

In southeastern South Australia, Late Pleistocene and Holocene sea levels are recorded in a sequence of coastal beach-dune-barrier complexes and interbarrier deposits of marine lagoonal shelly sediments. Molluscan faunas which inhabited Holocene lagoon and coastal marine environments were gathered as a food source by Aboriginal populations and are preserved as sequentially stratified midden deposits which have contributed useful data for palaeoenvironmental analysis.