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U-series evidence for widespread reef development in Shark Bay during the last interglacial

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Abstract

Field observations and U-series ages reveal that Shark Bay, Western Australia (WA) has been inundated by the sea on at least three occasions during the Late Pleistocene/Holocene, resulting in a succession of marine deposits around the Bay. The exact age of these deposits has until now been problematic due to a lack of reliable and accurate age data. This study reports 16 new U-series coral dates from emergent reef deposits around Shark Bay, and point to an extended period of coral reef development during the peak of the last interglacial, marine isotope stage (MIS) 5e. This is attributed to enhancement of marine circulation within the reaches and basins, a result of higher sea levels and an absence of major sill and bank structures. Stromatolites are absent from the geological record within Shark Bay until the late Holocene, suggesting that sea levels and marine sedimentary processes that have operated during the present sea-level highstand are unique to this period. There is little direct evidence of fossil reef development occurring during interglacials of the middle/late Pleistocene (MIS 9/11).

Keywords: Shark Bay; Stromatolite; Reef; U-series; MIS 5e; Hypersaline

1. Introduction and environments

Present-day Shark Bay on the central west coast of Australia (24.5° to 26.5° South latitude) has a depauperate (to non-existent in inner bay waters) coral fauna when compared to Ningaloo reef in the north and the Houtman–Abrolhos in the south (Fig. 1A). The presence of large barrier islands to the east and north, as well as the length and shallowness of the embayments, restricts oceanic circulation within Shark Bay (Logan and Cebulski, 1970). As a result, permanent high salinities and steep temperature gradients limit the occurrence of modern coral growth to the seaward margins of the embayments (Marsh, 1990). There is however evidence of reef development, having occurred, well within the present metahaline and hypersaline embayments during previous interglacials (Logan et al., 1974).

Although limiting present-day coral growth, the hypersaline environments such as those present today in Hamelin Pool and L'Haridon Bight, Shark Bay, are ideal for the development of microbial communities

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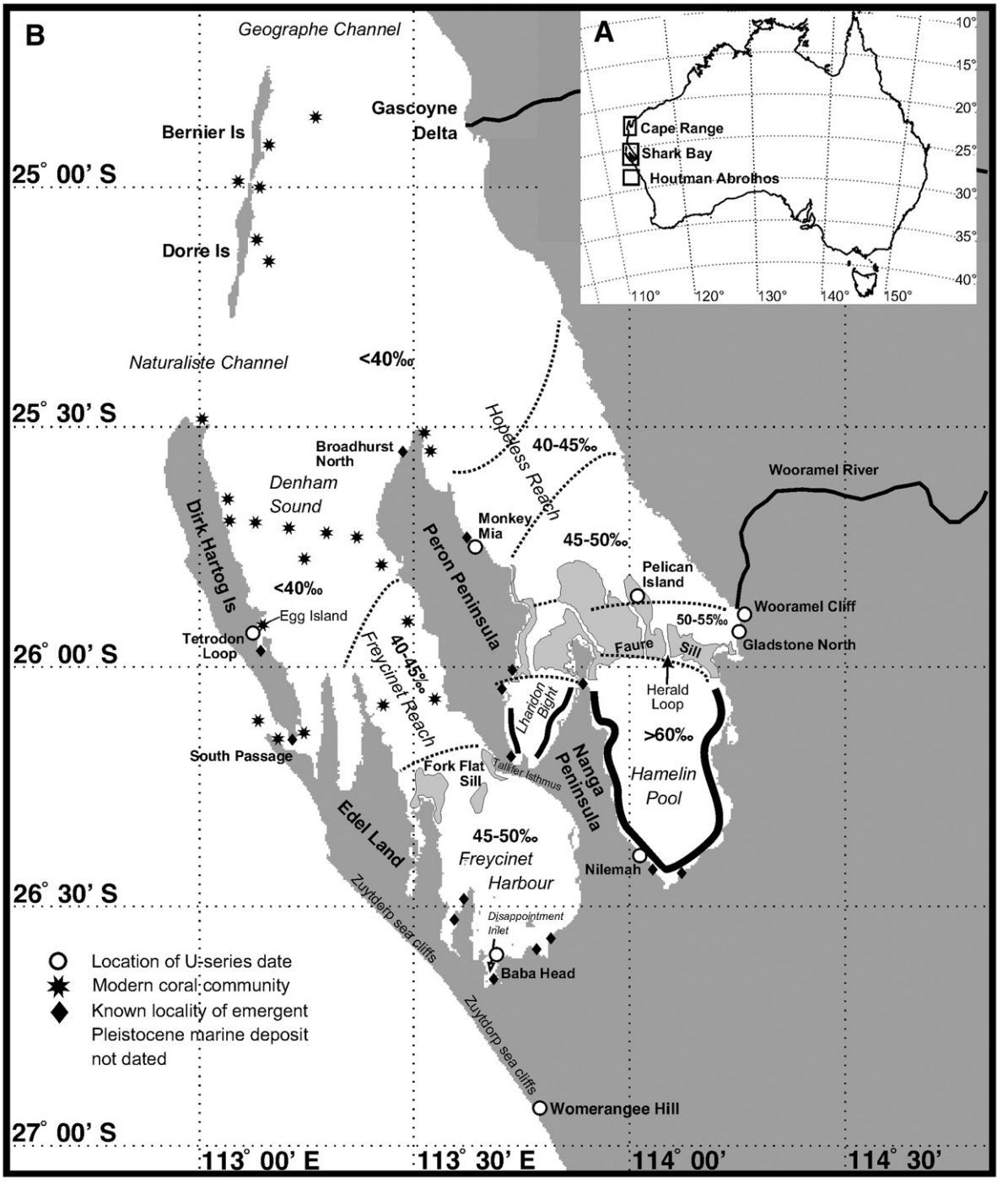

Fig. 1. A) Map of Australia showing location of three principal reef growing regions along the West Australian coast including; Ningaloo Reef (Cape Range) 21°–23° S, Shark Bay (study location), 24.5–26.5° S and the Houtman Abrolhos (island group) 28° S. B) Location Map of Shark Bay. Salinity contours for in parts per thousand (ppt). Thick black lines represent areas of extensive stromatolite growth. Open circles show location of Pleistocene reef outcrop with U-series date. Black stars indicate presence of living corals (modified from Marsh, 1990). Black diamonds represent other known exposures of emergent Pleistocene marine deposits. Note the proximity of emergent Pleistocene marine outcrops with present Holocene shoreline.