



The ancient Murray River on the Lacepede Shelf, South Australia: Late Quaternary migrations of a major river outlet and strandline across a broad Miocene carbonate platform

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The Murray River drains Australia's most extensive river system, the 1.1 million km² Murray-Darling Basin, and discharges into the sea at the Murray Mouth in southeast South Australia. The outlet faces the 180-km wide Lacepede Shelf and forms part of a wave-dominated beach barrier/lagoon complex, the largest of its type on the Australian coast. Global glacial cycles during the Pleistocene produced lowered sea levels and exposure of much of the Lacepede Shelf, with the palaeoshoreline advancing out to the present edge of the continental shelf during glacial maxima, including the Last Glacial Maximum (LGM) *ca* 20 ka and the Penultimate Glacial Maxima *ca* 138 ka. Mapping and sediment sampling of the Lacepede Shelf in 2006 and 2007 during RV *Southern Surveyor* Voyages SS02/06 and SST02/07 allowed the ancient course of the Murray River on the shelf to be traced and studied for the first time. A 200 km-long system of ancient infilled channels and lagoons was revealed. The main system of anastomosing Pleistocene channels begins southeast of the present Murray mouth, off

Lakes Alexandrina and Albert, runs southward initially but then veers WSW across the central Lacepede Shelf before heading southwest directly south of central Kangaroo Island, and splaying into the head of Sprigg Canyon at the shelf edge. The LGM channel starts near the current Murray mouth and forms part of this channel system. A pre-LGM channel system ran a more direct, shorter 150-km SSW path from off Lakes Alexandrina/Albert to the shelf edge. Onset of uplift associated with doming centred near Mt Gambier or damming by barrier sands may have deflected the Murray River to the more westerly outlet.

The Lacepede Shelf is founded on a platform of gently folded shallow-marine carbonates equivalent to the Late Oligocene-Middle Miocene Gambier Limestone of the Otway Basin. The top of the carbonate platform is a prominent regional flat-lying erosional unconformity with local karstic relief in the order of 10 m. Unconsolidated sediment cover (?Pliocene-Quaternary) is mostly relatively thin or absent.. However, a depocentre, commonly 6-10 m thick and here named the Lacepede Basin, underlies the central Lacepede Shelf and that part of the shelf directly south of Lakes Alexandrina/Albert. This basin comprises estuarine, lagoonal/lacustrine and fluvial facies of the palaeo Murray River, including channel fill and point-bar deposits. Sediment drifts and residual palaeo dune fields are common components of the young sediments on the shelf. A Holocene yellow/red fine quartz sand less than a metre thick, formed from reworked LGM aeolian sheets/dunes, is the predominant sediment type at the surface of the central and northern Lacepede Basin. Palaeochannels or palaeovalleys of the Murray River incised into the Miocene carbonate platform are typically 10-20 m deep, are 450-1000 m wide and contain up to 25 m of sedimentary fill and cover.