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Research paper

Sedimentology of the Bondi Main heavy mineral beach placer deposit, Murray Basin, southeastern Australia

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Abstract

Drilling and pit wall exposures at the southern end of the Bondi Main heavy mineral beach placer deposit provided access to the Loxton–Parilla sands, which are here divided into five lithofacies. The depositional environment of each lithofacies is interpreted as shoaling zone, breaker zone, surf zone, swash zone, and backshore dune. Other units encountered include the Duddo Limestone, Loddon River Group, Bookpurnong Formation, and Shepparton Formation. The interpreted depositional environments for these units are, respectively, shallow marine, fluvial, shallow marine/shelf, and fluvio-lacustrine. A palaeogeographical model is presented, which proposes that the Bondi Main deposit formed at the southern end of a north-trending shoreline. This shoreline was truncated to the south by the Dundas Tableland and is broadly analogous in its geomorphological setting to the modern Geographe Bay in Western Australia. The deposit therefore appears to have formed in association with a heavy mineral "trap" at its southern end. Postdepositional weathering overprints include ferruginous mottling, clay eluviation, and possibly quartz fracturing and disaggregation. The ferruginous mottles formed under spatially and temporally variable redoximorphic conditions, with Fe being derived from the weathering of Fe-bearing primary minerals, particularly ilmenite. Postdepositional clays in the Loxton–Parilla sands are interpreted as being derived from the overlying Shepparton Formation.

Keywords: Loxton–Parilla sands; Lithofacies analysis; Murray Basin; Placer deposits; Weathering

1. Introduction

The intracontinental Murray Basin occupies over 300,000 km^2 of inland southeastern Australia and contains an extensive preserved strandplain that provides a remarkable record of sea level change throughout the Late Miocene and Pliocene (Fig. 1). This variably buried strandplain is characterised by a series of dominantly northerly to northwesterly trending ridges and swales that extend over a strike length of some several hundreds of kilometers. Although previously noted by earlier workers (e.g., Hills, 1939),

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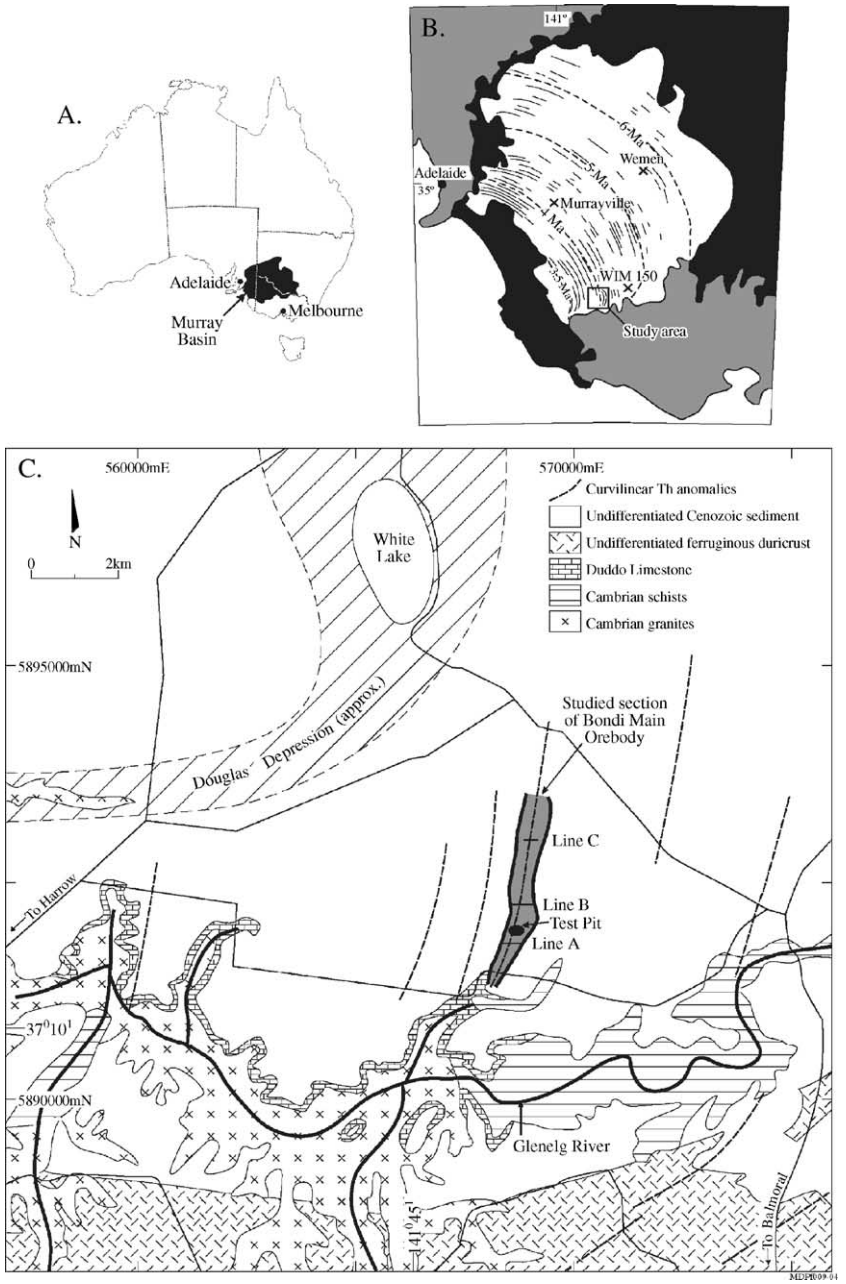

Fig. 1. (A) Location of the Murray Basin within southeastern Australia. (B) Distribution of the Loxton–Parilla sands within the Murray Basin (shaded black). Orientation of the strandlines and their assumed ages modified after Kotsonis (1995) and the location of some of the many heavy mineral placer deposits within the basin. (C) Location of the studied portion of the Bondi Main heavy mineral deposit, the three drill traverses used in this study (lines A, B, and C), and the location of the test pit. Geology is adapted from the first edition (1971) of the Hamilton 1:250 K Geological Map Sheet, Geological Survey of Victoria, Australia. Curvilinear Th/U anomalies traced from radiometric imagery for the area provided by the Department of Primary Industries, Geological Survey of Victoria.