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Rapid fill of the Dirranbandi incised valley system, Queensland, Australia

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The Lower Balonne River of southern Queensland is part of the greater Darling River drainage system. The region is extensively irrigated for cotton production, and understanding of the area's geomorphology and subsurface regolith architecture is critical to keeping groundwater and salinity levels within acceptable limits. Recent research into the regolith and hydrogeology of the area has revealed new insights into the history of fluvial processes in the system.

The current landscape consists of a mosaic of active and inactive low relief alluvial fans with anastomosing distributaries, including that of the modern Balonne River. Beneath the flood plain is a large, bedrock-incised palaeovalley system, eroded into weathered Cretaceous marine sediments. The trunk valley has been buried to depths of up to 200 m and tributaries contain approximately 100 m of sediment. Infill has occurred in two stages; an early phase in which deposition was confined by the sides of the palaeovalleys, and a later phase when sedimentation spilled across and buried the landscape. Sedimentation appears to have been essentially continuous during infill, however the change in depositional environment from confined to unconfined flood plains triggered a change from anastomosing or braided channels to extensive braid plains when the valley sides were first over topped. These braided systems later reformed as the present day set of anastomosing distributaries of the Balonne, Moonie, and Maranoa rivers.

The date of incision is unknown. It must postdate erosion and weathering of the Early Cretaceous marine sediments and the deposition of quartzose conglomerates on the weathered surface, now preserved as silcreted remnants of inverted relief. This suggests is no older than Early Tertiary. Incision must also predate deposition of the in-

filling sediments. At present, the only age controls are provided by palynology, which suggests that the infill is no older than Pliocene. The trigger for incision is unknown, but is likely to be related to the Neogene uplift of the Eastern Highlands of Australia.

The Dirranbandi palaeovalley and its fill represent what are, by Australian standards, an unusually rapid example of palaeovalley incision, infill, and eventual burial. This contrasts with other palaeovalley systems in Australia which are typically filled by Eocene, as in the case of those marginal to the Eucla Basin, or Oligocene sediments, as with those peripheral to the Murray Basin.

The predominantly anastomosing nature of the channel sands within the sedimentary sequences imposes a high degree of anisotropy on groundwater flow. This in turn implies that hydrological responses to anthropogenic changes are also likely to be anisotropic. The “steers head” geometry of the sedimentary fill implies that changes in groundwater level from increased recharge or extraction will be non-linear due to the near-asymptotic increase in storage volume at shallower depths. Both these features have important implications for environmental management.