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# Patterns and processes of fluvial discontinuity and sediment residence times on the lower Macquarie River, Murray-Darling Basin, Australia

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The supply, transport and deposition of fine-grained sediment are important factors determining the morphology of lowland rivers that experience channel breakdown and have wetlands on their lower reaches. Sediment supply and residence time determine whether reaches accumulate sediment (wetland areas) or erode sediment (channelised areas). This research investigated how processes of sedimentation and erosion drive channel breakdown and reformation in the Macquarie Marshes, a large anastomosing wetland system in the Murray-Darling Basin, Australia. Channel breakdown is attributed to a dominance of in-stream sedimentation that leads to a point where single-thread river channels cannot be maintained and so avulsion and floodout processes create smaller distributary channels and wetlands. Avulsions may reconnect channels, changing the sediment supply regime in those particular channels. Channel reformation occurs on the trunk stream where the floodplain gradient steepens enough to allow convergence of small tributaries, locally increasing stream power (and erosive energy in channels). As each river reach reforms following channel breakdown, the channel is smaller, shallower and straighter than the previous reach. One reach in this system recently (in the 1970s) became connected with a parallel channel through avulsion and has morphological characteristics that indicate a significant change in flow and sediment supply. In a pilot study using uranium-series disequilibrium methods and OSL dating, a sediment residence time of 58 +/- 2 ka was determined for sediment in the base of the active channel and a sediment residence time of 153 +/- 5 ka was determined for sediment buried in an adjacent meander that was cut off from the main channel 1,000 years ago. The apparent dramatic decrease in sediment residence time to this active channel poses an interesting question about the role of relatively new channels in transporting and depositing sediment more rapidly than the discontinuous trunk stream reaches. Longitudinal disconnection caused by repeated trunk stream breakdown and reformation may lead to higher sediment residence time in the late Holocene system, whereas new distributary channels increase connectivity within the system. Sediment residence times may also be affected by complex catchment-scale changes in sediment dynamics related to human disturbance. These findings may be applicable to other fluvial systems in lowland settings that have experienced changes in hydrology and sediment supply.