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Is it possible to disentangle natural and anthropogenic forms of channel adjustment in dynamic floodplain wetlands?

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Anthropogenic impacts on hydrology and sediment supply are recognized as leading factors contributing to change in many rivers and wetlands. However it is difficult to distinguish between key causes and forms of channel adjustment in fluvial systems where intrinsic geomorphic processes lead to change on a timeframe similar to that of human disturbance. In the Macquarie Marshes, a large (circa 2,500 square kilometres) floodplain wetland in south-eastern Australia, intermittent flooding drives sedimentation and erosion leading to levee development, avulsion and floodout. Some contemporary channel change is attributed to human disturbance in the system (e.g. channel incision), which, together with river regulation and recent droughts, have left much of the floodplain high and dry. Distributary channels formed since European settlement in the early 19th century have low sinuosity (1.1 to 1.2), show little evidence of lateral migration, accumulate fine sediment rapidly (0.5 to 10 mm/yr) in levees and floodouts, and avulse or terminate in wetlands. Avulsion appears to occur rapidly; within 100 years. In contrast, the older, discontinuous trunk stream of the lower Macquarie River is more sinuous (1.3 to 1.5) and there is abundant evidence of lateral migration over time followed by levee development on top of ridges and swales. ITRAX core scanning and XRF from sediment profiles in a Macquarie River meander abandoned around 1 ka and subsequently filled with overbank fines revealed no laminations and no evidence of significant geochemical enrichment near the surface that is usually associated with anthropogenic sources (e.g. Pb and Cu). These results indicate a transition in depositional regime and channel adjustment processes from lateral migration to vertical accretion with greater levee development and avulsion in the late Holocene. A clear anthropogenic signal was not found in the sediment record, despite earthworks and other activities contributing to channel change. We conclude that levee formation and avulsion are not uniquely anthropogenic forms of channel adjustment in this system, but that sedimentation and erosion leading to avulsion seem to occur more rapidly now than prior to major disturbance in the catchment. Higher resolution geochronology and geochemistry will be required to isolate the signature of anthropogenic impacts in these dynamic floodplain wetlands.