The nature and timing of fluvial response to changing base-level and climate over the last glacial-interglacial cycle in sub-tropical Australia.

Jacky Croke[1,2], Chris Thompson[1], Annegret Larsen[1,3], Ashneel Sharma[2]

[1] School of Geography, Planning and Environmental Management, University of Queensland, St Lucia, Brisbane Queensland, 4072, Australia.

[2] Department of Science, Information Technology, and Innovation, Dutton Park, Queensland, 4102 Australia.

[3] Institute of Earth Surface Dynamics, University of Lausanne, 1015 Lausanne, Switzerland

Jacky.croke@uq.edu.au

Submitted: *Quaternary Science Reviews.*

Abstract

Continental-margin fluvial systems are often found to be under the influence of both upstream (climate) and downstream (sea level) controls. In Australia, relatively little is known about fluvial adjustment in the upper reaches of large continental drainage systems. In the tectonically-stable setting of eastern Australia, climate is typically seen as the dominant factor governing fluvial response over the timescale of Quaternary glacial/interglacial cycles. This paper uses a 30m record of valley alluviation in the lower reaches of Lockyer Creek, a key tributary of the mid-Brisbane River in SEQ, to document (a) the timing of fluvial response to both sea level and climate change, and (b) the nature of the river's response to that change, over the past 230 ka. Chronostratigraphic units within the deep valley fill sequences reveal seven phases of channel incision and aggradation spanning the past 230 ka. The lateral and vertical extent of major valley fill units indicates a switch in depositional style from valley-wide coarse bedload deposition to narrower channel belt, fine-grained aggradation sometime after 120 ka. The preservation of multiple-age channel deposits across the wide valley floor indicates successive channel avulsion over this time-scale. Episodes of channel incision are reasonably aligned with sea level low stands during Marine Isotope Stage (MIS) 7, 6 and 3 where incision to bedrock over depths of 25 to 30 m occurred. However later episodes of channel incision dated to between 27-12 ka either pre-, or post-date the last glacial low stand.

The majority of the valley fill in the lower Lockyer consists of fine-grained alluvia which reflect restricted lateral channel mobility due to either, or both, bedrock or fine-grained alluvial confinement. When viewed within the context of past glacial/interglacial Quaternary oscillations, the record confirms a progressively drying continent based on the caliber of bedload material and lateral channel extent. Enhanced precipitation during MIS 5 is not readily apparent in the stratigraphy reported here and the data tentatively point to more reduced discharges relative to both earlier, and later, interglacial stages. The fluvial architecture post MIS 3 displays climate-related influences in terms of enhanced coarse bedload and fine-grained deposition. Rapid aggradation of coarse overbank sands due to crevasse splay and levee development indicate an increase in the nature and rate of episodic floodplain accretion which is attributed here to the increased frequency of more high magnitude flood events coincident with the timing of ENSO. A recent example of this type of flood occurred in January 2011 and forms a useful analogue for this style of floodplain deposition.

Key Words: avulsion, Lockyer Valley, south-east Queensland, sea level, climate change.