Distinguishing Climatic from Autogenic Signatures in Alluvial Systems: A Quaternary Perspective with Implications for the Rock Record

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To distinguish between the influence of climatic and autogenic controls on continental basin-fill successions, a high resolution chronostratigraphic scheme is required that can be applied to successions with a well known climate history, which largely limits examples to the Quaternary period. Alternatively, sedimentary deposits considered indicative of specific climatic conditions (e.g. evaporites, coals, lake deposits etc.) can be used to constrain climate in the basin, but do not contain information on the climate in the catchment. Climate in the catchment controls sediment supply to the basin and strongly influencing the development of fluvial successions in continental basins. The recognition of the distinction between the influence of climate in the catchment from climate in the basin is crucial to understanding alluvial architecture in continental basins.

Quaternary examples from the Basin and Range, Gulf of Mexico, Venice Basin and San Joaquin Basin are used to illustrate the importance of the climate regime in the catchment as a control on alluvial architecture. These examples show that: 1) sediment supply in the same basin can be at a maximum or minimum during either glacial or interglacial times, 2) adjacent alluvial systems can have a completely different stratigraphic architecture due to different catchment climate regimes and 3) marine connected incised valley-fill successions can be cut and filled during either the LGM or during post-LGM interglacial conditions.

These examples illustrate that one of the most important controls on alluvial architecture is the climate in the catchment and that predicting/invoking climate change as a control on alluvial architecture in the rock record will be extremely difficult to determine. Whilst it is recognised that the examples used to illustrate these points are developed during icehouse conditions, it is likely that climatic fluctuations during greenhouse conditions would be much more subtle and difficult to constrain, particularly as evidence for climate in the catchment is not preserved in the rock record.