

**AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003**

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Avulsion of Valleys and the Continuity of Sequence Boundaries

Standard sequence stratigraphic models suggest a single deeply incised lowstand erosion surface (sequence boundary) forms during relative sea level fall associated with sediment bypass to more basin distal locations. This erosion surface is assumed to be continuous; extending laterally across adjacent interfluvies and seaward into a "correlative conformity". Where multiple high-relief erosion surfaces incise from the same horizon, it is generally assumed that they reflect downcutting of different rivers, each responding to the same episode of relative sea level fall.

Valley fills are common along some horizons within deposits of the Cretaceous Western Interior Seaway in North America. In many cases, deposits within these fills indicate large rivers, 5-10 meters deep. Locally abundant valleys seem to imply more large rivers than would be expected along a coastline: An alternative is that individual rivers have carved more than one valley during a single lowstand.

As accommodation falls, rivers incise where downstream slopes increase, but do not downcut where slopes decrease. Rivers need not incise along their entire course in response to falling accommodation. River gradients can vary downdip because of regional changes in subsidence and basin gradients, changes in depositional topography left by episodically regressing shorelines, and local tectonics within the basin. Where a river is not incised, it can continue to avulse. If downstream segments are incised, that valley will be abandoned and another may form in an adjacent location. The hypothesis that incised rivers can avulse where upstream areas are not incised significantly changes subsurface correlation strategies and valley fill character prediction.