

Invited: Fluvial Stratigraphy Across the Permian-Triassic Boundary in the Beardmore Glacier Region, Antarctica: Was Plant Extinction or Tectonics the Driving Mechanism for Producing Changes in Fluvial Style?

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Changes in sedimentation patterns across the Permian-Triassic boundary in South Africa, Spain, Australia, and in Antarctica have been attributed to an increase in sediment yield following mass-extinction of land plants. For these areas, extinction is invoked as the driving mechanism that induced a change from Upper Permian flood-plain dominated successions to coarse-grained channel-dominated succession in the Lower Triassic. Although much attention has been given to the boundary in Antarctica, the fluvial sedimentology and stratigraphy of these strata remain an enigma. In 2003-04, we conducted a regional survey across the P-T boundary in the Beardmore Glacier region and found that (1) an unconformity separates strata of the Permian Buckley Formation from strata of the Triassic Fremouw Formation, (2) an abrupt change in composition from volcanoclastic to quartzo-feldspathic sandstones occurs at the boundary, and (3) channel stacking patterns and fluvial styles vary across the basin and are different from the patterns predicted by the extinction hypothesis.

Within strata of the Buckley and Fremouw formations, regional changes in fluvial stratigraphy indicate that sedimentation occurred within at least three different large-scale depositional sequences in an under-filled foreland basin. Upward within each sequence, a clastic wedge (high density stacking pattern) expands transversely into the basin. Expansion of the wedge is accompanied by a cratonward displacement of the deposits of a longitudinal basin axis (low density stacking pattern) and a transverse cratonic-margin (high density stacking pattern) drainage systems. Sequence boundaries are marked by unconformities, abrupt shifts in the deposits of the various drainage systems back toward the orogenic belt, abrupt changes in fluvial style and channel stacking patterns, and by abrupt changes in sandstone composition. Because the contact between the Buckley and Fremouw formations marks one of these boundaries, abrupt changes in fluvial style and sandstone stacking patterns occur within vertical successions. However, various combinations of channel densities are juxtaposed at different localities within the basin. The occurrence of sequences in the Beardmore Glacier region suggests that tectonism was a major control on the development of fluvial stratigraphy within these strata.