

Intra-Channel Detrital Zircon Provenance Variability: Implications for Paleogeographic Reconstructions and Sedimentary Provenance Sampling Strategies.

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Summary

Distinct changes in sediment provenance have been discovered within a 20m thick channel complex of the Late Cretaceous Gallup Sandstone Formation in northwestern New Mexico. Using a combination of detrital zircon U-Pb data (n=504) supplemented with modal sandstone compositions (n=3768 point counted grains), changes in regional paleogeography attributed to tectonic forcing in the Sevier foreland were documented. At the base of the channel, detrital zircon ages are mixed with no major peaks in any age, this is indicative of recycled Sevier fold-and-thrust belt sediments. The upper channel fill, however, has an overwhelming source of 1.6-1.8 Ga zircons which is the source signal for the nearby Mogollon Highlands to the south.

The petrographic data further establishes this change in source due to the high amount of lithic fragments found in the lower channel, specifically volcanics from the Cordilleran Magmatic Arc to the southwest and sedimentary lithic fragments recycled from the Sevier Orogeny to the west. The upper channel however, contains recognizably less lithics, an increase in feldspathic minerals and is texturally more immature.

This blockage in sediment derived from the west/southwest through time is attributed to forebulge migration from west to east through this retroarc foreland basin. This tectonic forcing likely caused a minor drainage divide between the Gallup Delta to the east and the other western siliciclastic systems along the Western Interior Seaway during the late Turonian-Coniacian period. This paleodrainage reorganization caused the source area of this fluvio-deltaic system to decrease by approximately half (~220,000 – ~110,000km²) based on prior paleogeographic reconstructions.

Tectonic forcing and subsequent increases in sediment supply are likely more dominant allogenic influences on regional-scale stratal architectures than eustatic processes during the Cretaceous greenhouse period which is dominated by low amplitude, frequent changes in sea level; compared to modern icehouse periods, which are dominated by high amplitude, frequent eustatic variations. This study also proves the importance of collecting multiple (N= >1) samples in provenance studies as provenance can change drastically within a single sedimentary Formation.