PSProvenance and Sandstone Modal Compositional Trends from Upper Cretaceous Nonmarine Siliciclastic Strata of the Sevier Foreland Basin in Northern and Central New Mexico*

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Abstract

New provenance data are summarized from Upper Cretaceous nonmarine strata of the Sevier foreland basin throughout northern and central New Mexico. Here, strata outcrop directly east and along-strike of the San Juan Basin, along Laramide structures as well as the western margin of the Great Plains. Strata of interest include fluvial deposits of the Albian-Cenomanian Dakota Sandstone and Albian (?) Lytle Sandstone. In an effort to better understand both subcrop contributions to the Dakota and maximum depositional ages for the Lytle, we also report new provenance data from the Upper Jurassic Morrison Formation throughout northern New Mexico. Overall, sandstone modal composition trends from Upper Cretaceous strata are dominated by elevated occurrences of quartz, lesser lithics, and rare feldspar. Throughout central New Mexico, the Dakota contains lower amounts of quartz (Q=84%, F=1%, L=15%) compared to northern New Mexico (Q=98%, F=1%, L=1%). The Lytle in northeastern New Mexico directly underlies the Dakota and has comparable composition (Q=98%, F=0%, L=2%). The underlying Morrison contains a greater abundance of feldspar (K-feldspar) and lithic fragments (Q=87%, F=9%, L=4%).

Previous studies have assumed the Lytle is similar to the Dakota but there has been no age constraint to confirm this. As such, we also report compositional trends from the Morrison as a means to compare with the Lytle and Dakota. All Cretaceous and Jurassic units contain minor but regular occurrences of lithic sandstone, volcanic, and metamorphic fragments. Detrital zircon ages from the Dakota, Lytle, and Morrison share somewhat similar age peaks. The Dakota in central New Mexico exhibits peak ages at 103, 230, 412, 626, 1050, 1416, 1651 Ma with isolated occurrences of Archean grains from 2.5-3.2 Ga. Throughout northern New Mexico, the Dakota shows peak ages of 100, 177, 416, 588, 1021, 1418, 1664, 2728 Ma and rare 2.5-3.2 Ga grains. Underlying strata of the Lytle and Morrison contain peak ages of 183, 273, 572, 606, 810, 1038, 1164, 1448, 1731 Ma and rare occurrences of Archean grains from 2.5-3.2 Ga. Provenance trends from the Dakota support a model where detritus was being shed eastward from the Sevier fold/thrust belt as well as northward from the northern paleo-rift shoulder of the Bisbee rift in southern Arizona and southwestern New Mexico. There is also evidence that the Dakota in northern New Mexico contains recycled detrital contributions from the underlying Lytle and Morrison.

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Provenance and Sandstone Modal Compositional Trends from Upper Cretaceous Siliciclastic Strata of the Cordilleran Foreland Basin in Northern, Central, and Southern New Mexico

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(1) INTRODUCTION

Late Cretaceous (Albian–Cenomanian) strata of the Cordilleran foreland basin outcrop throughout parts of northern, central, and southern New Mexico and are thought to record the final phase of sedimentation associated with normal subduction of the Farallon plate beneath western North America, and resultant deformation and volcanism linked with the Sevier fold-thrust belt and Cordilleran arc, respectively. Presented here are U-Pb detrital zircon ages from N=7 samples (n=2046 total analyses) from fluvial deposits of the Albian–Cenomanian Dakota Sandstone and Dakota Group collected from across northern New Mexico (eastern margin of the San Juan basin in the San Ysidro region and western margin of the Great Plains near the western Dry Cimarron valley and Crestone anticline regions), central New Mexico (Carthage region), and southern New Mexico (Mescal Canyon near the Truth or Consequences region). Strata of interest also include fluvial deposits of the Albian (?) Lytle Sandstone and Upper Jurassic Morrison Formation in northern New Mexico (western Dry Cimarron valley and Crestone anticline region, respectively). Previous studies have assumed the Lytle is similar to the Dakota but there has been no age constraint to confirm this. We report new provenance data from the Morrison Formation in an effort to better understand both subcrop contributions to the Dakota and maximum depositional ages for the Lytle.

Overall, sandstone modal composition trends from Upper Cretaceous strata are dominated by elevated occurrences of quartz, lesser lithics, and rare feldspar. Throughout southern and central New Mexico, the Dakota contains lower amounts of quartz (Q=84%, F=1%, L=15%) compared to northern New Mexico (Q=98%, F=1%, L=1%). The Lytle in northeastern New Mexico directly underlies the Dakota and has comparable composition (Q=98%, F=0%, L=2%). The underlying Morrison contains a greater abundance of feldspar (K-feldspar) and lithic fragments (Q=87%, F=9%, L=4%). We report compositional trends from the Morrison as a means to compare with the Lytle and Dakota. All Cretaceous and Jurassic units contain minor but regular occurrences of lithic sandstone, volcanic, and metamorphic fragments.

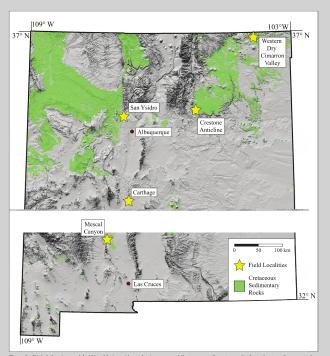
province), 625–595 and 430–415 (recycled Mesozoic colianites of the Colorado plateau), as well as 190–92 Ma (Cordilleran arc). The youngest group of zircon grains from nonmaine members of the Dakota Group in northern New Mexico range from ~104–93 Ma suggesting a youngest age of early Late Cretaceous (late Albian-Cenomanian). We note that there are several samples collected from established Dakota stratigraphy where occurrences of young Cretaceous-age zircons are sparse to entirely absent. Underlying strata of the Lytle contain peak ages of 152, 368, 418, 447, 604, 1043, 1474, 1802 Ma and rare occurrences of Archean grains from 2.5-3.2 Ga. Strata of the Morrison contain peak ages of 151, 189, 248, 427, 595, 1019, 1410, 1653 Ma and rare occurrences of Archean grains from 2.5-3.2 Ga.

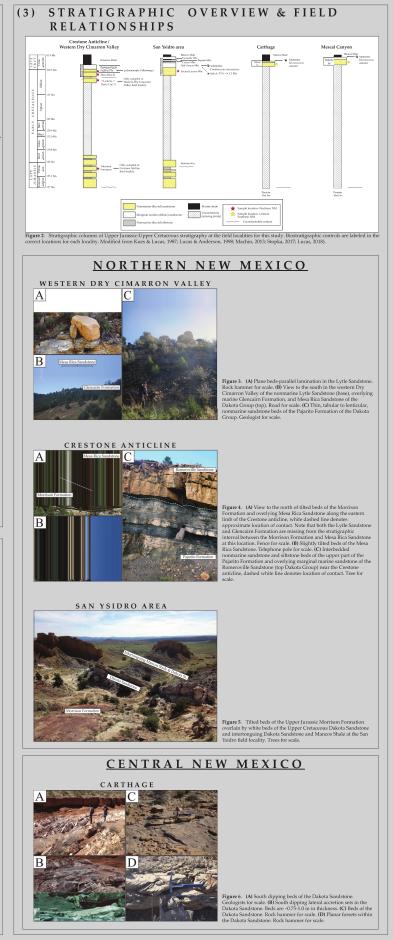
CENTRAL NEW MEXICO - Primary and secondary peak ages from the Dakota Sandstone

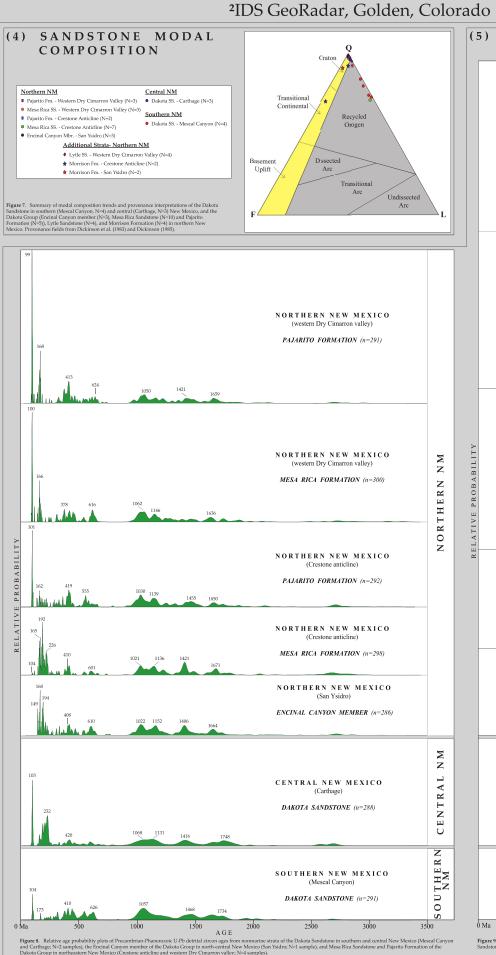
SOUTHERN NEW MEXICO - The Dakota Sandstone in southern New Mexico exhibits primary and secondary peak ages similar to the Dakota Group in northern New Mexico that occur primarily between 1800–1600, 1450–1350, 1300–1000, 625–595, 430–415, and 190–92 Ma. The youngest group of zircon grains from nonmarine portions of the Dakota in southern New Mexico range from ~107–99 Ma with a calculated Early Cretaceous (late Albian) MDA of 103.5+1.7 Ma. Although the sample locality in southern New Mexico is more proximal to our central New Mexico locality, there is no evidence of elevated Triassic-age zircon in this region.

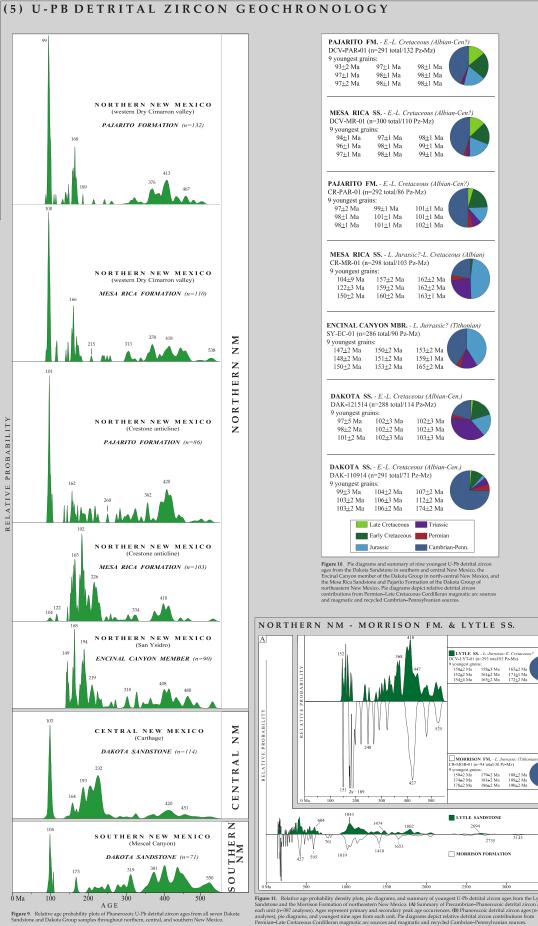
Provenance trends from the Dakota support a model where detritus was being shed eastward from the Sevier fold/thrust belt as well as northward from the northern paleo-rift shoulder of the Bisbee rift in southern Arizona and southwestern New Mexico. There is also evidence that the Dakota in northern New Mexico contains recycled detrital contributions from the

(2) FIELD AREAS



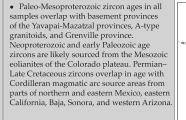






(6) PROVENANCE SUMMARY

• The Dakota Sandstone and Dakota Group across New Mexico are quartz-rich with minor but regular occurrences of lithics and rare feldspar. Southern and central New Mexico contain lesser quartz compared to northern New Mexico. The Lytle Sandstone in northern New Mexico has similar composition with high occurrences of quartz, whereas the Morrison Formation contains higher amounts of feldspar and lithics and lesser quartz. The Morrison Formation is soured from transitional continental/craton and the Lytle Sandstone and Dakota



 Triassic age zircons are elevated in central New Mexico and may have been sourced from both the underlying Triassic Chinle Formation and Triassic parts of the Cordilleran arc. The Dakota in southern New Mexico does not contain an elevated occurrence of Triassic-age zircons. The Dakota in northern New Mexico also contains relatively low occurrences of

Sandstone of the Dakota Group at the Crestone anticline field locality, which contains slightly elevated occurrences of Tria

. The elevated occurrence of Jurassic-age zircons in the Dakota Group in northern New Mexico likely reflect

• The Dakota Group in northernmost New Mexico (western Dry Cimarron valley) contain the highest occurrer of early Late Cretaceous-age zircons (Cenomanian) compared to all other field localities.

 While the Dakota Sandstone and Dakota Group contain Cretaceous-age zircons, both the Lytle Sandstone and Morrison Formation: however, do not contain any occurrence of Cretaceous zircons,

• In the case of the Lytle, it is possible that the youngest zircons in this unit (as well as the overlying Dakota Group) represent reworked, air-fall tuffs (rather than fluvial, water-laid deposits). In this scenario, the absences of Cretaceous grains in the Lytle could be interpreted as a temporary hiatus in air-fall material to the Lytle during the Early Cretaceous. If this were the case, the similarity in zircon ages and provenance between the Morrison and Lytle could be explained by later reworking and recycling of Morrison detritus into the Lytle.

(7) ACKNOWLEDGEMENTS

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