

Ten Million Years of Dakota Sandstone

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Abstract

Marginal marine deposits commonly called Dakota Sandstone were deposited at the edge of the Cretaceous Western Interior Seaway from Late Albian (104 Ma) throughout the Cenomanian stage to the Cenomanian-Turonian boundary (94 Ma). These sedimentary rocks thus straddle the Albian- Cenomanian boundary (100-100.5 Ma), as ratified by the IUGS with a GSSP at Mount Risou, southern France, based on first occurrence of marine planktonic foraminifera *Thalmaninella globotruncanoides*. Obradovich and Matsumoto used radioisotopic Ar geochronology to date bentonites with planktonic foraminifera biostratigraphy in Hokkaido, Japan. Many Western Interior deposits that had been called Lower Cretaceous beneath the top Mowry Shale Clayspur bentonite or "Fish Scales" marker were shifted into the lower 2-3 Ma of the Cenomanian (Late or Upper Cretaceous). John Obradovich and Bob Weimer embarked on a campaign to determine the age of rocks broadly called Dakota Sandstone in the early 1990s; Obradovich subsequently dated over 50 samples of Dakota Sandstone and equivalents in the northern Rockies ranging over 6 My; by including units correlated with the Dakota Sandstone where Mowry Shale is absent (in UT, NM, CO, & KS), Dakota Sandstone ranges up in age to the Cenomanian- Turonian boundary (OAE2), dated by the $40\text{Ar}/39\text{Ar}$ age of *Neocardioceras juddi* ammonite bentonite "B" at 94.08 ± 0.06 Ma. Skull Creek Shale (104.69 ± 0.07 Ma) and Kassler Member (103.9-104.0 Ma) of the Dakota Sandstone ages at Dinosaur Ridge in the Denver Basin were established by U/Pb dating of zircon. Ages for the Taft Hill and Vaughn Members in Montana (103.1-102.7 Ma) overlap ages for Crownsnest Volcanics in Alberta. The Muddy Sandstone in the Bighorn and Wind River Basins is tightly constrained at 101.3 ± 0.1 Ma, distinctly older than the Newcastle Sandstone ages in the eastern Powder River Basin ranging from 99.8-99.5 Ma. The Albian/Cenomanian boundary in the Rockies probably occurs above the Muddy Sandstone in the Shell Creek Shale in the Bighorn (100.1 Ma) and Wind River Basins (99.7 Ma).

Younger Dakota Sandstone ages in Colorado (99.4 Ma), and from Detrital Zircon ages on the uppermost Dakota Sandstone at Horsetooth Reservoir (100 ± 2 Ma) and Dinosaur Ridge (99 ± 2 Ma), show a 4 Ma unconformity between the Kassler and upper Dakota trackways on the east side of the Dakota hogback. The top Mowry age of 97.5 Ma in the Powder River Basin is older than Dakota Sandstone ages that correlate with the WIK ammonite zonation in Kansas (95.5 Ma), New Mexico (96.2-95.5 Ma), and Utah (94.3-94.1 Ma). Marginal marine facies of the Dakota Sandstone were repeatedly deposited across the Western Interior Cretaceous region for over 10 My; sequence boundaries interpreted as representing less than a few 100 ky, turn out to be regional unconformities of several My; correlations of the Dakota across sequence boundaries and interbasinally within the Rockies are uncertain if unconstrained by independent isotopic geochronologic evidence.

Remembering Bob Weimer and his Contributions to Rockies Geology Monday, July 25, 11:25 AM