THE DAKOTA CONTROVERSY

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ABSTRACT

The name Dakota was applied at the type locality near southeastern South Dakota to a sequence of sandy strata of Early and Late (?) Cretaceous age. However, in the Black Hills region the name "Dakota" has been applied to all or parts of an Early Cretaceous threefold sequence (Lakota sandstone-Fuson shale-Fall River sandstone) that is lithologically similar to the sequence at the type locality. The Fall River sandstone is overlain by the Skull Creek shale, above which a second sand-shale-sand sequence of Early Cretaceous age (Newcastle-Mowry-"Frontier") is present. In central South Dakota the name "Dakota" has been applied to at least two of the lower three sandstones.

INTRODUCTION

The Lower Cretaceous rocks in South Dakota rest disconformably on non-marine Jurassic and older rocks. During the deposition of the Early Cretaceous sequence, the environment changed from non-marine to marine as shown by marine fossils in the upper part of the Fall River sandstone.

The name Dakota was first applied to a sequence of sandy strata of Cretaceous age at Dakota City in northeastern Nebraska (Fig. 1) by Meek and Hayden in 1862. These men stated that the Dakota sandstone was a "yellowish, reddish and occasionally white sandstone with, at places, alternations of variously-colored clays and beds and seams of impure lignite," as reported by Meek in his paper of 1876, (2:25). It was also stated that the overlying beds belonged to the Fort Benton Group (Graneros, Greenhorn and Carlile formations). Meek and Hayden realized that the Dakota sandstone was not a distinct division and stated: "Although we still retain this as a distinct rock, our present impression is that it is probably only a subdivision or member of the Fort Benton Group," (1:420).

The Dakota sandstone in the Black Hills region was described by Newton and Jenney in 1880. These men correlated the basal Cretaceous sand with the type Dakota in northeastern Nebraska, which was thought to be Late Cretaceous.

In 1896, Darton stated "the geologic features of North and South Dakota are relatively simple, and they are mainly uniform over very

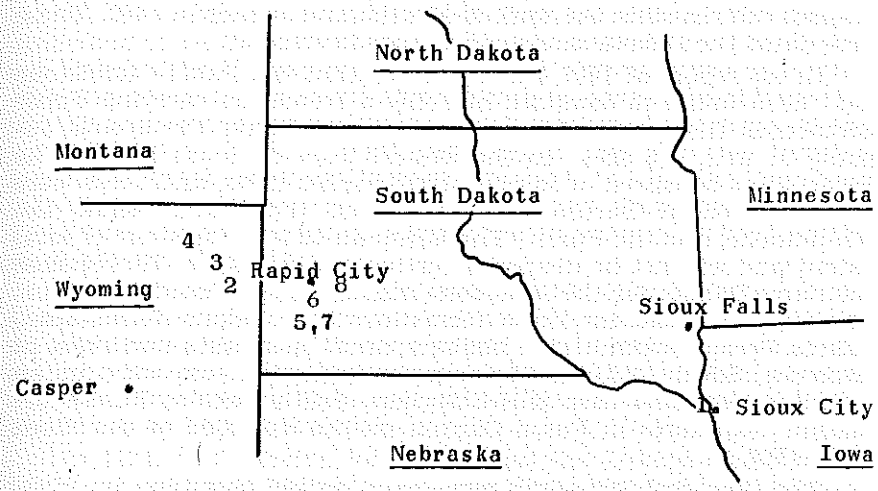

Figure 1. Type Localities of the Dakota Group

1. Dakota formation, Dakota City, Nebr.
2. Newcastle formation, Newcastle, Wyo.
3. Skull Creek formation, Skull Creek, southeast of Osage, Wyo.
4. Inyan Kara group, Moorcroft quadrangle, Wyo.
5. Fall River formation, Evans Quarry, Hot Springs, S. Dak.
6. Fuson formation, Fuson Canyon, S. Dak.
7. Minnewaste formation, two miles east of Hot Springs, S. Dak.
8. Lakota formation, four miles northwest of Hermosa, S. Dak.

wide areas," (4:610). At that time Darton believed that the Dakota sandstone formed a relatively flat, elongate basin which cropped out on the hogbacks around the periphery of the Black Hills and in eastern Nebraska at the type locality. This example of the ideal "Dakota Artesian Basin" has been cited in literature since about the turn of the century and as late as 1956 Bateman used this as a typical example of an artesian system, (11:859).

The drilling of large numbers of oil test wells, in the last few years, in North and South Dakota, has supplied a large amount of subsurface information unavailable to Darton. This information shows the Dakota sandstone contains a number of facies changes between the eastern and western parts of South Dakota.

WESTERN SOUTH DAKOTA

The Dakota problem has become more complex because the division between the Upper and Lower Cretaceous rocks in the Black Hills region has been placed progressively higher in the strati-

graphic column since the work of Newton and Jenney in 1880. These men dated the Dakota sandstone as Late Cretaceous.

In his report of 1901, Darton stated that the Dakota sandstone has "been found to comprise not only a formation carrying Upper Cretaceous flora, but an extensive series of Lower Cretaceous deposits as well," (5:526). In the western part of South Dakota the lower series consisted of several stratigraphic units, and these were differentiated by Darton into formations, the Lakota below, the Minnewaste, and the Fuson. The Minnewaste is a limestone of local extent and will not be discussed further in this paper. He retained the name Dakota for the sandstone resting on the Fuson formation. The type localities for these formations are: Lakota formation—Lakota Peak, a summit on a hogback range four miles northwest of Hermosa, South Dakota; Minnewaste formation—exposure in an anticline two miles east of Hot Springs, South Dakota; Fuson formation—exposures in Fuson Canyon on the east side of the Black Hills, (Fig. 1).

The time-rock boundary was again revised this time by W. L. Russell in 1927 on the basis of fossil plants. He stated that the supposed Upper Cretaceous Dakota sandstone in the Black Hills is actually Lower Cretaceous and substituted the term "Fall River" for the original name Dakota in the Black Hills region. The type section for the Fall River formation is Evans Quarry on Fall River, east of Hot Springs, South Dakota.

W. W. Rubey in 1930 suggested using the term "Inyan Kara" as a group name for the Lakota, Fuson, and Fall River in the western part of South Dakota, because at numerous places it is difficult to pick the boundaries of these formations. This group was named for exposures along Inyan Kara Creek in the northeastern part of the Moorcroft quadrangle in Wyoming.

Another fact which adds complexity to the Dakota sandstone controversy is the presence of a second sand-shale-sand sequence (Newcastle-Mowry-"Frontier") that is separated from the lower sequence by the Skull Creek shale. The "Frontier" sand is rather local and can be recognized in very few electric logs. In central South Dakota, however, the name Dakota has been applied to at least two of the other three sandstones.

EASTERN SOUTH DAKOTA

The time-rock boundary of the Dakota sandstone at the type locality has been placed progressively lower in the stratigraphic column since the original work of Meek and Hayden in 1862. The Dakota sandstone was originally dated as Late Cretaceous, mainly on the basis of paleobotanical evidence.
MacLaughlin is considered to be part of this stratigraphic unit.

W. H. Twenhofel in 1924 stated that he believed the Dakota sandstone to be Upper Cretaceous. He also believed that a shallow sea invaded the Kansas region. "This sea was narrowly connected with the ocean to the south and appears to have been dotted with islands and parted by peninsulas which weakened the force of the waves," (6:41). Streams built their deltas into the bay, forming lagoons in which black shales were deposited. "Ultimately the rivers extended their deposits over the marine and drove back the sea. For a time the sea retreated, but depression again permitted northward progress," (6:41).

W. L. Russell stated in his work of 1927 that he believed the Dakota at the type locality to be near-shore deposits resulting from an eastward-advancing Cretaceous sea. This was a means of explaining the progressively younger sandstone lenses which pinched out westward into the Graneros shale. He still considered the type locality to be Late Cretaceous.

In 1931, A. C. Tester concluded that the Dakota sandstone in Iowa and adjacent states was Lower Cretaceous on the basis of microfauna. In 1952, he added more conclusive evidence as to the early age of this strata, again based on microfauna.

CONCLUSIONS

A number of stratigraphers agree with Tester and believe that the abrupt variation in thickness and lithologic character of the Dakota sandstone in eastern South Dakota is the result of distributary sedimentation on and in front of a large delta. It is the opinion of the writer that the Fall River formation and the Newcastle sandstone, which are both Early Cretaceous, correlate with the lower and upper parts respectively of the Dakota formation at the type locality. Electric logs are the basis for this statement. Such wells as the Phillips No. 1-Dunn in Pennington county, Pohle No. 1-May and Carter No. 1-Danielson in Haakon county, Shell No. 1-McCrone in Stanley county, Shell No. 1-Olsen and Shell No. 1 and No. 2-Herman in Jones county show the "first sand" or Newcastle to be thickening toward eastern South Dakota. It is impossible for the writer to pick the electric log boundaries of the Newcastle sand in the General Crude No. 1-Straka well in southeastern Lyman county. However, it must be realized that there is almost a sixty mile gap between this well and the Shell No. 1-Herman, and since the Newcastle is very erractic in thickness, it would be difficult to make any reliable assumptions as to thickness or extent of the Newcastle sand between these two wells.

I believe that it is practically impossible to pick the boundaries of the Lakota, Fuson, and Fall River formations by use of electric logs and/or sample studies in the subsurface and even in a large

number of outcrops. For this reason I would suggest using the term Dakota Group for the Lakota, Fuson, Fall River, Skull Creek and Newcastle Formations. This term is picked since it has chronological precedence over Inyan Kara.

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