CRETACEOUS ROCKS OF THE ALBUQUERQUE COUNTRY

Attempts were made by the Field Conference Committee to obtain for this Guidebook at least two papers dealing with the Cretaceous stratigraphy of the Albuquerque country and a third dealing with the igneous geo-

logy of the Mount Taylor volcanic field and particularly its volcanic necks. Because of previous commitments, those approached were unable to prepare the solicited papers. In view of the economic significance of the Cretaceous stratigraphy, authors' abstracts of several published papers are reprinted here.

CHARLES B. HUNT, 1936, GEOLOGY AND FUEL RESOURCES OF THE SOUTHERN PART OF THE SAN JUAN BASIN, NEW MEXICO; PART 2, THE MOUNT TAYLOR COAL FIELD; U. S. GEO. SURVEY BULL. 860-B, P. 31-80, ILLUSS.

"The Mount Taylor coal field was studied primarily to determine its coal and other fuel resources. The exposed rocks range in age from Jurassic to Recent. The Jurassic, cropping out only locally, is represented by the Morrison formation, of variegated shale and some sandstone. Its top is marked by an erosional unconformity. The overlying Upper Cretaceous covers most of the area and is represented by three formations—in ascending order the Dakota (?) sandstone, the Mancos shale, and the Mesaverde formation. The Dakota (?) sandstone is a lenticular clastic deposit and is locally absent. The Mancos consists mostly of marine shale; three sandstones found in the lower 330 feet in the area east of Mount Taylor thin out to the northeast. The relations between the Mancos and the next younger formation, the Mesaverde, are complex. In the southern part of the field the Mancos is only 1,000 feet thick and represents only the earlier part of Colorado time (Benton and earliest Niobrara). It is overlain by the predominantly continental, coal-bearing Mesaverde formation, which, however, includes in its lower part two thick zones of marine shale. In passing northward there is a marked and rapid change in the lower part of the Mesaverde; the continental beds and the nearshore sandstones become thinner and less conspicuous, and the two marine shale zones become correspondingly thicker. This transition continues until, at the north edge of the field, the sandstones and continental beds practically disappear and the two shale units merge with the older shale to form an expanded Mancos about 2,000 feet thick. The shale units within the Mesaverde at the south are thus seen to be tongues of the Mancos. In the northern part of the area the Mancos represents all of Colorado time and perhaps earliest Montana time as well. The main body of the Mesaverde continues northeastward as a coal-bearing formation. Late Tertiary clastic deposits are present in the eastern part of the area, and there are recent deposits of alluvium and gravel throughout the area.

"Intense volcanic activity occurred in this area in middle and late Tertiary time, beginning with the eruptions on Mount Taylor. The huge depression covering nearly 4 square miles at the head of Water Canyon and just east of Mount Taylor Peak marks the old crater, now enlarged by erosion. The eruptions began with rhyolitic tuff, followed by a series of porphyritic latite and trachyte, and ended with porphyritic andesite. The eruptions continued until a cone at least 2,000 feet high had been built. However, with the gradual lessening of the activity of Mount Taylor lava was erupted from vents that broke out on the periphery of the old crater. These vents are marked by lava cones and volcanic necks. They surround Mount Taylor but are most numerous northeast of the mountain. None of these later vents seem to have been very long-lived, each supplying one or at most very few sheets of a relatively nonporphyritic andesite or basalt. This later activity was extended far to the north and northeast. The basaltic lava flows in the San Jose Valley, along the south border of this area, and the Albuquerque volcanoes, 10 miles east of this area, are very recent and not directly related to the volcanism on and around Mount Taylor.

"Most of the field lies in the southeastern part of the San Juan Basin where a gentle northward dip generally prevails. However, there are several domes which locally have steep dips and numerous faults. The shallower zones have been tested for petroleum in most of the domes, but no production has yet been obtained. The eastern part of the field lies in the Basin and Range province and has been severely faulted. All the faults, so far as known, are normal and have nearly parallel trends at the surface. The displacements reach a maximum of about 2,500 feet. In general the major faults within this part of the field produce a stepdown to the west. The faulted blocks generally dip east, although the amount of dip has considerable range. The deformation probably began in middle Tertiary time and continued until after the basal beds of the Santa Fe formation had been deposited in the eastern part of the field.

"There is generally a sharp boundary separating the severely faulted eastward-tilted beds in the Basin and Range province and the slightly faulted northward-tilted beds of the San Juan Basin. The boundary lies chiefly along faults that have dropped the areas in the Basin and Range province with respect to those in the San Juan Basin. The coal beds of the Mount Taylor field are confined to the Mesaverde formation. The coal is of subbituminous rank, and many beds are present. The usual thickness of the coal beds is about 15 inches, but there are numerous exceptions, and some are as much as 6 feet thick. The lack of good roads over most of the field precludes commercial mining on a large scale at this time. However, the south side of Mount Taylor is near the Atchison, Topeka & Santa Fe Railway and United States Highway 66, and the northeast corner of the field is near a State highway, and several small mines are active in these two localities."


"The exposed rocks are of Upper Cretaceous and Tertiary age. The Dakota (?) sandstone, at the base of the Upper Cretaceous series, and the overlying Mancos shale, of marine origin, crop out only in the eastern part of the area. Above the Mancos shale lies a varied assemblage of partly marine and partly continental beds, which are included in the Mesaverde formation but differentiated into five members — the marine Hosta sandstone at the base, the Gibson coal member above

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it, the Allison member still higher, the marine Chacrásandstone member at the top in the western part of the area, and the marine La Ventana sandstone at the top in the eastern part. The overlying formation, the Lewis shale, is thin where it lies above the Chacrásandstone but increases greatly in thickness eastward by the successive passing of all of the Chacrásandstone and the upper part of the La Ventana sandstone into gray marine shale. Above the Lewis lies the thick Pictured Cliffs sandstone, the highest marine formation of the Upper Cretaceous. The coal-bearing Fruitland formation, the Kirtland shale above it, and the conglomeratic Ojo Alamo sandstone are also included in the Upper Cretaceous series. Above the Ojo Alamo lie rocks of Eocene age—the banded drab clay and light-colored sandstone of the Puerco (?) and Torrejón formations, capped by the conglomeratic sandstone of the Wasatch formation.

"The area lies in the southeastern part of the San Juan Basin, in which the rocks are gently warped into the form of a great shallow bowl about 100 miles in diameter. The structure of the basin is mostly simple, showing low dips toward the center, with irregular low undulations but no pronounced folds. The rocks are broken by some normal faults of small throw. The western flank of the Nacimiento Mountain uplift forms the eastern margin of the basin along the eastern edge of this area, and here the rocks are steeply folded and even overturned toward the basin.

"The coal is of subbituminous rank and of fairly good grade, but the coal beds are very irregular and lenticular. Most of the coal beds are thin, but some beds are from 5 to 9 feet thick. Coal occurs in the Fruitland formation and in the Chacrás, Allison, and Gibson members of the Mesa-Verde formation. Considerable prospecting and some commercial mining has been done on Allison and Gibson coals along the Rio Puerco in the eastern part of the area, where railroad transportation is available."
Mancos shale. Farther east, a tongue of shale, the Mulatto, comes in between the Dilco and the Dalton, and a higher tongue of shale, the Satan, splits the Hosta sandstone member. These two shale tongues thicken steadily easterly. Concurrently, the intervening units of the Mesaverde grow thinner, and some die out; in the southeastern part of the basin even their most persistent layers, two thin sandstones that represent, respectively, the Gallup and a union of the Dalton and lower Hosta, become nothing more than sandy zones in the midst of a great body of shale about 2,000 feet thick. That shale body, a union of the thin Mancos farther west with the greatly expanded Mulatto and Satan tongues, forms the Mancos of the southeastern and eastern parts of the basin. It is directly overlain by the upper part of the Hosta sandstone, which in that part of the field marks the base of the restricted Mesaverde. Thus the Mancos-Mesaverde boundary rises stratigraphically about 1,200 feet in a distance of 100 miles from west to east—a direction that is basinward but oblique to the trends of the ancient shore lines.

"The depositional history of the three transgressive and three regressive stages that are recorded in the rocks of the Mancos and Mesaverde is outlined in the concluding section of the paper, in accordance with the general concept of depositional processes herein presented."

There have been a number of revisions in the nomenclature since the last paper was published. Field conferences held by the New Mexico Geological Society in 1950, 1951, 1953, and 1959 passed through parts of the Albuquerque country and the guidebooks prepared for these conferences contain papers dealing with Cretaceous stratigraphy. Most such papers include selected bibliographies, and thus are highly useful as a starting point for bibliographic research.

NOTE ON CRETACEOUS FOSSILS BY EDITOR

Cretaceous rocks are exposed over extensive areas in the northern half of the State. At first, continental sedimentation predominated; this was followed by marine sedimentation and then alternating marine and continental sedimentation; finally, the seas withdrew from New Mexico and continental sedimentation prevailed.

Fossils of Cretaceous (predominantly Upper Cretaceous) age may be collected at a number of localities in the Albuquerque country, notably (1) in the Rio Puerco valley west of Albuquerque—all the way from Cuba and La Ventana southward to Correo, Suwanee, and the vicinity of Mount Taylor—and (2) in smaller areas east of the Rio Grande—such as the Tijeras coal basin, the Hagan-Tonque basin, and in the vicinity of Madrid and Cerrillos.

Marine strata yield abundant fossils, including oysters such as *Ostrea soleniscus*, as much as 24 inches in length; clams such as *Inoceramus*, nearly as large; snails; coiled ammonites 15 to 20 inches in diameter; and shark teeth of both flesh-cutting and shell-crushing types. Other groups of organisms, such as corals, brachiopods, scaphopods, worms, echinoids, and asteroids, are rare. Foraminifers are common but because of their small size not conspicuous.

The continental deposits of rivers, deltas, lakes, and swamps yield abundant leaves and silicified wood; land animals such as dinosaurs; and fresh-water clams, snails, fishes, turtles, and crocodiles. (Large septarian concretions are often mistaken by the uninitiated for fossil turtles!) Interesting specimens have been found in the Rio Puerco valley of logs riddled by the burrows of *Teredo*, the boring pelecypod, whose living descendants are known as "shipworms."

Relatively few reports have been published describing and illustrating these Cretaceous fossils, and, what is still more unfortunate, the reports are mostly from earlier years and now out-of-print.