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Jurassic stratigraphy of Utah and Colorado

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This is one of many related papers that were included in the 1951 NMGS Fall Field Conference Guidebook.

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JURASSIC FORMATIONS OF THE SOUTH AND WEST SIDES OF THE SAN JUAN BASIN, NEW MEXICO AND ARIZONA

The Jurassic formations of the south and west sides of the San Juan Basin form an extremely complex system of sediments. They are nearly all non-marine and were deposited in similar environments giving rise to nearly identical lithologies and sedimentary structures. Any discussion of these formations cannot avoid going far afield from the confines of the San Juan Basin proper because nearly all of the formational names used have their type localities beyond the margins of the Basin. Generalized descriptions of the formations are divided geographically, partly because of the areas used as type localities and partly because of the familiarity of the authors with more localized occurrences.

The three papers which comprise this discussion were first presented at the conference on Jurassic stratigraphy at the annual meeting of the New Mexico Geological Society on April 6, 1951. Some conclusions in these articles may already be outdated because of current field work by various branches of the U. S. Geological Survey on mineral resources and ground water, continued field work by the geological staff of the A. E. C. in the region and the activities of private companies and individuals. The first paper describes the formations as they appear in Colorado and Utah and serves to introduce much of the nomenclature. The second paper describes the units as they occur in the Navajo Reservation and applies most directly to the west side of the San Juan Basin. The third paper attempts to summarize the problems presented by the first two papers and to suggest regional distribution patterns and their controls.

JURASSIC STRATIGRAPHY OF UTAH AND COLORADO*

Lawrence C. Craig and Clifford N. Holmes**

(Abstract of a paper presented before the New Mexico Geological Society, April 6, 1951)

Jurassic rocks of the Colorado Plateau are divided into three major units -- the Glen Canyon group, San Rafael group and Morrison formation in ascending order. This classification can be extended to most of the Jurassic rocks of Utah and Colorado.

This paper deals with the classification of Jurassic strata in Colorado and Utah except north-central Utah.

The Glen Canyon group consists of the Wingate sandstone, Kayenta formation, and Navajo sandstone in ascending order. The age assignment of the Glen Canyon is in question because of the lack of diagnostic fossils. This group is tentatively assigned to the Jurassic. A recognizable hiatus is lacking at the base of the Glen Canyon; the component formations are separated in most places only by gradational and arbitrary contacts.

The Wingate sandstone and Kayenta formation form two broad lens-shaped deposits extending through all of southeastern Utah and into southwestern Colorado. The Wingate is mostly eolian in character in the center of this area but shows increasing effects of subaqueous deposition to the north and east. The Kayenta is fluvial in origin. The western limit of the Wingate and Kayenta is between the Circle Cliffs and Zion Canyon areas of southwestern Utah. The character of this limit is not clearly described in the literature and considerable difference of opinion prevails concerning its position. The northwestern and northern limit lies beneath the Wasatch Plateau and the Uinta Basin. To the east the Wingate and Kayenta lose their identity along a north-south line in southwestern Colorado, as a result of various combinations of facies change, convergence, and erosion. The name Dolores formation has been applied in southwestern Colorado to the interval thought to contain inseparable equivalents of formations of the Glen Canyon group and the Upper Triassic series.

The Navajo sandstone forms an irregular wedge of predominantly eolian sandstone extending through all southern and eastern Utah into southwestern Colorado. The Navajo is thickest in southwestern Utah and corresponds to the even thicker Aztec sandstone of southern Nevada. The Navajo thins to the north and east and is correlated with the Nugget sandstone of central Utah and southwestern Wyoming. This unit extends southeastward into the central Colorado basin as far as Rifle. In southwestern Colorado the Navajo reaches a featheredge, probably as a result of both depositional convergence and pre-San Rafael erosion.

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The San Rafael group is divided into four formations -- the Carmel formation, Entrada sandstone, Curtis formation and Summerville formation, in ascending order. The Carmel has been dated as early Upper Jurassic and the Curtis as middle Upper Jurassic from marine invertebrate fossils. The Entrada and Summerville lack diagnostic fossil remains.

The Carmel formation was deposited throughout southern Utah. It is not preserved west of southwestern Utah. It thins to the northeast and reaches a featheredge in southwestern Colorado. A limestone- and gypsum- bearing sandstone and shale facies in central and southwestern Utah has been distinguished from a red silty sandstone facies in southeastern Utah. A critical study of facies relations in southeastern Utah is necessary to determine the extent of the red silty sandstone facies of the Carmel into New Mexico and Arizona.

The Entrada sandstone was deposited throughout southern and eastern Utah and most of Colorado. It correlates locally with the Garo sandstone (Stark et al., 1949) Exeter sandstone (Lee, W. T. 1902) and the lower part of the Sundance formation in central and eastern Colorado. A red earthy sandstone facies in central and southwestern Utah has been distinguished from a clean sandstone facies in Colorado and eastern Utah. The earthy sandstone facies is largely of subaqueous origin, and the clean sandstone facies was deposited in an alternating subaqueous and subaerial environment. The Entrada pinches out against the Ancestral Rockies in southwestern and central Colorado, and locally contains basal conglomerates of igneous and metamorphic rocks where it rests on the pre-Cambrian of the positive elements.

Where the Entrada sandstone overlies the Carmel formation the basal contact is an arbitrary lithologic boundary, but in most of Colorado the Carmel, as well as underlying units of the Glen Canyon group, are absent and the base of the Entrada is a sharp erosional break, with the Entrada resting on Triassic or upper Paleozoic sedimentary rocks.

The interval between the top of the Entrada sandstone and the base of the Morrison formation is complicated by numerous facies changes and several formation and member names. The Curtis and Summerville formations are the main units occupying this interval. The Curtis is predominantly grayish to

greenish sandstone and minor greenish shale; the Summerville is predominantly red silty shale and sandstone. Both overlie the Entrada conformably except in central Utah, where an angular unconformity locally marks the base of the Curtis. The Curtis formation has been recognized in southwestern, central and northeastern Utah and in northwestern Colorado. Unfossiliferous thin-bedded sandstones and shales along the northern part of the Front Range in Colorado may be equivalent to the Curtis. Thick gypsum deposits southwest of the Ancestral Uncompahgre Uplift and southeast of the Ancestral Front Range Uplift probably formed in restricted parts of the Curtis Sea. The Summerville formation has been recognized throughout south-central and southeastern Utah and part of southwestern Colorado. Where both formations are present the Summerville overlies the Curtis. In northeastern Utah and northwestern Colorado the Curtis occupies the entire interval between the Entrada sandstone and the Morrison formation. Southward from central and south-central Utah the Curtis grades into the Summerville and the Summerville occupies the entire interval between the Entrada and the Morrison. In a north-south belt through Moab, Utah, the Moab tongue of the Entrada sandstone occupies most of the interval between the Entrada and the Morrison. To the east and west of Moab, and to the south on the west flank of the Abajo Mountains, it tongues and grades out into the red shales of the Summerville. The Bluff sandstone of southeasternmost Utah was defined as a basal member of the Morrison formation; but its depositional characteristics relate it to the San Rafael group and it tongues and grades northward into red shales of the Summerville. In part of southwestern Colorado the interval between the Entrada and the Morrison is occupied by the Wanakah formation, formerly considered a member of the Morrison. The Wanakah formation is subdivided into three members of varying geographic extent -- the Pony Express limestone member, the Bilk Creek sandstone member, and a marl member. A fourth unit-- the Junction Creek sandstone, here considered a member of the Wanakah -- is present at the top of the Wanakah in the Durango, Piedra River, and Dolores areas. The Junction Creek has also been treated as a member of the Morrison formation and as a separate formation. The Junction Creek is similar to and appears to occupy the same stratigraphic position as the Bluff sandstone. The relation of the Junction Creek to the Morrison formation has not been definitely established and an upper part may have been deposited

synchronously with lower beds of the Morrison in southwestern Colorado.

The Morrison formation was deposited throughout Colorado and eastern Utah. It reaches a featheredge in the Kaiparowits Plateau of south-central Utah, probably as a result of increasing erosion toward the southwest prior to deposition of the Dakota sandstone of Upper Cretaceous age. The northwesterly extent of the Morrison in Utah is not known, but the formation has been reported in the vicinity of Salt Lake City and Salina in central Utah. In eastern Utah and western Colorado, the Morrison may be divided into an upper part and a lower part, but in central Colorado these units cannot be separated. The Salt Wash sandstone member occupies the lower part of the Morrison in eastern Utah and western Colorado. It consists of interstratified fluvial sandstones and claystones. The orientation of cross-laminae and increase in thickness and coarseness indicate that the source of the Salt Wash lay southwest of south-central Utah, probably in west-central Arizona. Beds equivalent to the Salt Wash were probably deposited in central Colorado, but because of the absence of scour-fill sandstones they cannot be differentiated from the upper part of the Morrison. The upper part of the Salt Wash intertongues and grades into the Recapture shale member of the Morrison formation in south-eastern Utah, south of Blanding. The Recapture is extensive in northeastern Arizona and northwestern New Mexico. The Brushy Basin shale member occupies the upper part of the Morrison formation in eastern Utah and western Colorado and consists of the variegated claystones with minor lenticular sandstones, conglomerates and limestones. It is thought to represent combinations of fluvial and playa deposits and it probably contains large contributions of volcanic ash. These deposits cannot be differentiated from the lower part of the Morrison in central Colorado. The Brushy Basin is similar to the typical Morrison of most of the western interior of the United States. In the Blanding area of southeastern Utah the Westwater Canyon sandstone member of the Morrison intertongues and grades into the lower part of the Brushy Basin member. The Westwater Canyon member is extensive in northeastern Arizona and northwestern New Mexico.

The Winsor formation of central Kane County, southwestern Utah, may occupy the stratigraphic

position of part of the San Rafael group and the Morrison formation, or the Morrison formation may have been removed by pre-Dakota erosion in this area.

Lower Cretaceous formations overlie the Morrison in Colorado and most of eastern Utah. In places the Lower Cretaceous beds are difficult to separate from the upper part of the Morrison because of similar lithologic characteristics.

JURASSIC STRATIGRAPHY OF THE NAVAJO COUNTRY*

J. W. Harshbarger, C. A. Repenning, R. L. Jackson **

Introduction

At the request of the office of Indian Affairs, the Ground Water Branch of the United States Geological Survey is making an investigation of the ground-water resources of the Navajo country. It became apparent, early in this investigation, that a study of regional stratigraphic relationships was essential. Certain phases of such a study are now being carried on. This paper is a preliminary report on the Jurassic stratigraphy of the Navajo country.

The Navajo country comprises parts of northeastern Arizona, southeastern Utah and northwestern New Mexico (pl. I). The Jurassic rocks of the Black Mesa basin and the southwestern part of the San Juan Basin are discussed in this paper.

Intertonguing, lateral gradation and facies changes in the formations considered to be Jurassic and Jurassic (?) obscure the regional correlations. This paper presents only preliminary conclusions as to correlations among the strata.

The nomenclature used in this paper follows closely that recommended by Baker, Dane and Reeside (1936, p. 37; 1947) and Gregory's subdivision (1938, p. 58) of

* Publication authorized by the Director, U.S. Geological Survey.

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