

Revision of the Lower Part  
of the Tertiary System in the  
Central and Western Uinta Basin,  
Utah

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# Revision of the Lower Part of the Tertiary System in the Central and Western Uinta Basin, Utah

By THOMAS D. FOUCH

CONTRIBUTIONS TO STRATIGRAPHY

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*Correlation of lower Tertiary  
stratigraphic units recently penetrated  
in northeastern Utah*



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## CONTRIBUTIONS TO STRATIGRAPHY

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# REVISION OF THE LOWER PART OF THE TERTIARY SYSTEM IN THE CENTRAL AND WESTERN UINTA BASIN, UTAH

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By THOMAS D. FOUCH

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### ABSTRACT

Much of the lower part of the Tertiary System in the central and western Uinta Basin of northeastern Utah has been shown by recent drilling to consist of a thick section of lacustrine rocks. This lacustrine sequence is continuous with the overlying Eocene Green River Formation and is equivalent to surface exposures of the Flagstaff Limestone and the Colton Formations. In the central and western Uinta Basin, the lower boundary of the Green River Formation is moved downward to the base of the sequence of carbonate, mudstone, and sandstone beds, which is the base of the Flagstaff. Thus, the Green River is partly Paleocene in age. The Flagstaff is reduced in stratigraphic rank to a member of the Green River Formation. The Flagstaff consists of gray and brown carbonate and sandstone and gray to green mudstone units. The Flagstaff in much of the basin separates variegated red, gray, and green mudstone and sandstone units of the Paleocene and Eocene Colton Formation from the Paleocene and Upper Cretaceous North Horn Formation. The section of predominantly red beds on the north side of the basin, beneath the main body and above the Flagstaff Member of the Green River Formation, is assigned to the Colton Formation. The Wasatch Formation includes a sequence of red, gray, and green variegated sandstone, mudstone, and minor carbonate units which extends continuously downward from the base of the Eocene Uinta Formation to the top of the Upper Cretaceous Price River Formation, equivalent, or older units.

### INTRODUCTION

Recent regional and detailed examinations of the stratigraphy of the lower part of the Tertiary System in northeastern Utah have demonstrated the need for several changes in nomenclature and extension of existing terminology to new areas to accommodate the results of both surface and subsurface studies and to clarify the stratigraphic meaning of terms used. Several changes in stratigraphic terminology are set forth in this paper which are to be applied in the central and western Uinta Basin only, an area bounded on the east by the general position of the Green River (fig. 1).

Some of the Upper Cretaceous and lower Tertiary rocks of the Wasatch Plateau were subdivided by Spieker and Reeside (1925) into the Price River Formation and the lower member, Flagstaff Limestone Member

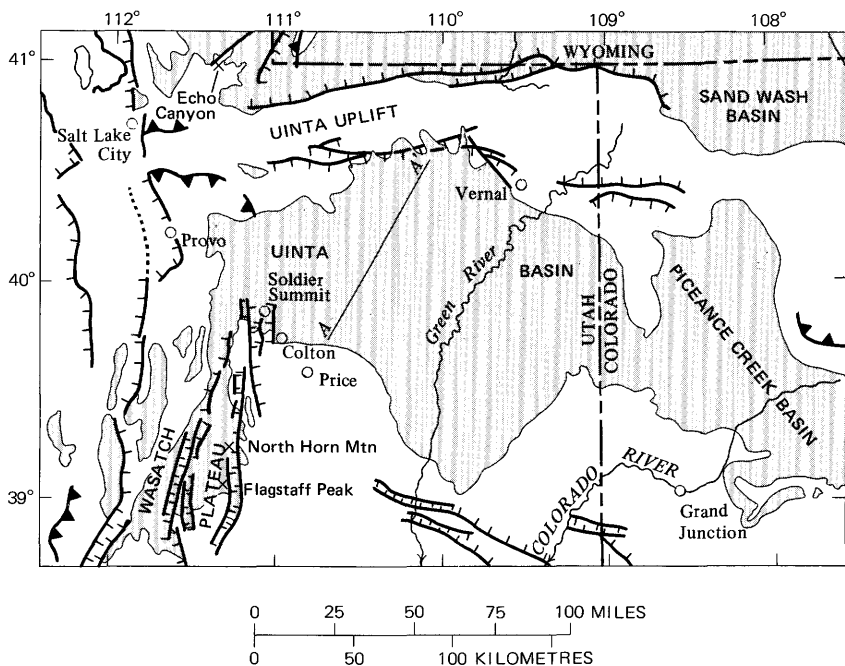


FIGURE 1.—Index map of northeastern Utah showing area of the report, Tertiary sedimentary rocks (patterned), and line of section *A-A'* (fig. 2).

(named for exposures on Flagstaff Peak, T. 20 S., R. 5 E., Salt Lake meridian), and the upper member of the Wasatch Formation. At that time, the Wasatch was considered to be early Eocene in age. Spieker recognized the problem of assigning the name Wasatch Formation to a rock sequence that contained units representing a longer time period than believed to be present at the type locality of the Wasatch Formation, and later he (Spieker, 1946) designated formational status to former members of the Wasatch Formation in central Utah. In doing so, he restricted the use of the term Wasatch Formation from central Utah. Though he did not resolve the uncertainty associated with the term Wasatch, Spieker felt that in view of the widespread usage of the name Wasatch by geologists, it might still serve to designate variegated sediments of the age indicated by the vertebrate fossils of the type locality. As described by Hayden (1869) the Wasatch includes strata exposed along the Union Pacific Railroad between Echo Canyon, Utah, and Carter Station, Wyo. (T. 17 N., R. 115 W., north of the map boundary).

### NORTH HORN FORMATION

Spieker (1946) renamed the lower member of the Wasatch Formation as the North Horn Formation and designated the exposures at North Horn



Mountain in Tps. 18 and 19 S., R. 6 E., Salt Lake meridian, as its type locality. He characterized the variegated shale, sandstone, conglomerate, limestone, and other beds as representing typical flood-plain, channel, and scattered lacustrine deposits.

The North Horn Formation is considered to be of latest Cretaceous and Paleocene age on the basis of vertebrate remains (Gilmore, 1946; Gazin, 1938, 1939, 1941) and palynomorph, ostracode, and charophyte assemblages (Griesbach and MacAlpine, 1973; Newman, 1974).

Uppermost Cretaceous and Paleocene deposits have been identified (Ryder and others, 1976) on outcrop exposures on the southwest flank of the basin and in drill holes in the central and western Uinta Basin (Fouch, 1975). The term North Horn Formation is here extended from the southwest flank of the basin to the northern, central, and western Uinta Basin to include the variegated mudstone, sandstone, conglomerate, and local deposits of carbonate which underlie the Flagstaff Member of the Green River Formation (as reassigned in this paper; fig. 2). The North Horn Formation is interpreted to contain rocks of alluvial, paludal, and local lacustrine origin.

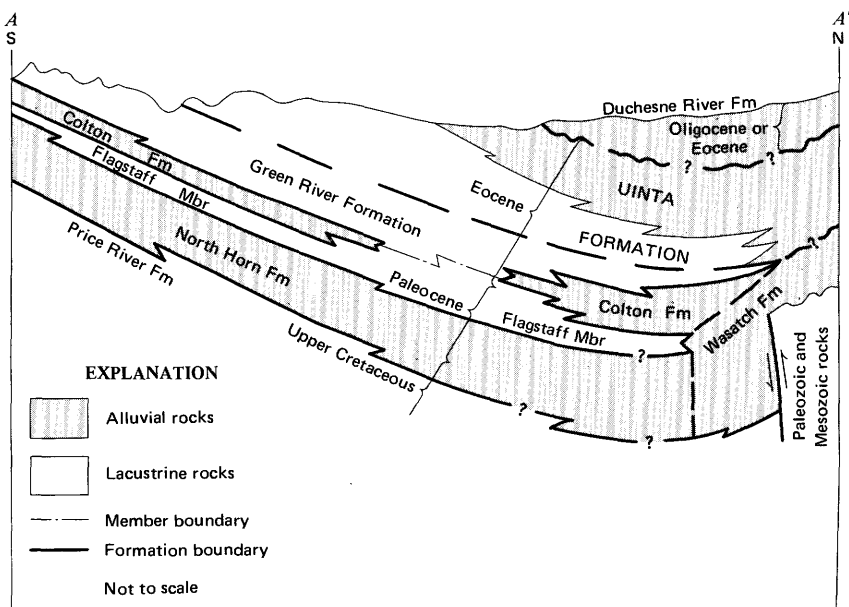


FIGURE 2.—Generalized section from outcrops near Willow Creek-Indian Canyon to the north-central Uinta Basin showing nomenclature of the lower part of the Tertiary System. Uinta Formation includes saline facies and equivalent lacustrine rocks assigned to the Uinta by Dane (1954). Line of section shown in figure 1.

## FLAGSTAFF MEMBER OF THE GREEN RIVER FORMATION

The Flagstaff Limestone Member of the Wasatch Formation (Spieker and Reeside, 1925) was elevated to formational status and termed the Flagstaff Limestone (Spieker, 1946). The Flagstaff was described as consisting of freshwater limestone interbedded with gray shale, sandstone, gypsum, oil shale, and volcanic ash with local accumulations of coal. Spieker considered the Flagstaff to have the form of a tongue of the Green River strata between flood-plain deposits, and he believed the Flagstaff to represent the beginning of widespread lacustrine conditions which continued uninterrupted through the deposition of the Green River Formation (1946, p. 136). However, Spieker chose not to designate the Flagstaff Limestone a tongue of the Green River Formation because of its extent and possible Paleocene age, though he considered the unit to represent an extension in area as well as in time of the Eocene Uinta Lake of Bradley (1930).

The Flagstaff Limestone was considered by Spieker to be of uncertain age, but on the basis of the presence of freshwater mollusk species he believed it to be more likely of late Paleocene than of Eocene age. La Rocque (1951, 1960) described the molluscan fauna of the Flagstaff in detail and subdivided the formation into three gross units (1960, p. 73-75). He considered the lowest unit to be of Paleocene age, the middle unit to be of Paleocene or Eocene age, and the upper unit to be of Eocene age. La Rocque attributed the termination of the Flagstaff Lake to encroachment of alluvial sediments (upper member of the Wasatch Formation, Spieker and Reeside, 1925; Colton Formation of Spieker, 1946) and to merger with Lake Uinta which spread into its area from the north.

Newman (1974), on the basis of palyomorph assemblage, assigns the main body of the Flagstaff Limestone at Soldier Summit in the southwestern part of the Uinta Basin to the Paleocene but considers the uppermost part of the unit to be of Eocene age. S. R. MacAlpine and F. R. Griesbach (oral commun., 1970-74) believe the main body of the Flagstaff on the south-central flank of the Uinta Basin to be of Paleocene age on the basis of ostracode, charaphyte, and palynomorph assemblages; however, they recognize that some rocks assigned to the Flagstaff along the Wasatch Plateau are of Eocene age.

A continuous section of organic-rich rocks of lacustrine origin in the center of the Uinta Basin has been penetrated by oil and gas tests drilled since 1969 (fig. 2). The section is in part equivalent to the Colton Formation and the Flagstaff Limestone. The lower part of this sequence of carbonate, mudstone, and sandstone beds can be traced from outcrop exposures of the Flagstaff on the south flank of the basin to the subsurface of the central and western Uinta Basin where it is continuous with carbonate, mudstone, and sandstone beds of the Green River Formation (Ryder and others, 1976; Fouch, 1975). The Flagstaff exposed along the

southwest side of the Uinta Basin is underlain by the North Horn Formation and is overlain by the Colton Formation; however, in the central part of the basin, the variegated rocks of the Colton have graded laterally into lacustrine rocks of the Green River Formation. This central core of carbonate, sandstone, and mudstone of interpreted lacustrine origin is not entirely accommodated by the existing outcrop-derived nomenclature, and it is reasonable to view the lacustrine sequence and associated tongues as part of the Green River Formation. S. R. MacAlpine (oral commun., 1974) recognizes no microfossil evidence from the subsurface to indicate unconformities within this Paleocene and lower Eocene sequence. Ryder, Fouch, and Elison (1976) cite microfossil information which places the Paleocene-Eocene boundary near the top of the Flagstaff on the north-central flank of the basin.

The term Flagstaff Member of the Green River Formation is applied here to dominantly medium- to dark-gray carbonate, light-gray sandstone, and light-gray to gray-green claystone beds, which are between the variegated mudstone and sandstone beds of the Colton and North Horn Formations or underlie the predominantly gray-brown carbonate and claystone of the main body of the Green River. Though the Flagstaff contains much limestone, many other rock types are present in abundance and so the word "limestone" is not included in the name of the member.

The inclusion of the Flagstaff with the Green River Formation is consistent with Spieker's observation that the Flagstaff on the Wasatch Plateau had the form of a tongue of the Green River Formation. Within the subsurface of the western and central Uinta Basin, the unit is demonstrated to be a part of the Green River Formation. This usage of the Green River Formation extends its age in northeastern Utah into the Paleocene.

### COLTON FORMATION

Strata formerly designated the upper member of the Wasatch Formation were named the Colton Formation by Spieker (1946, p. 139) for exposures near Colton, Utah, T. 11 S., Rs. 8 and 9 E., Salt Lake meridian, the type locality. He interpreted the irregular and discontinuous red beds of the Colton to be of flood-plain and channel origin and enclosed in and gradational with lacustrine rocks of the underlying Flagstaff Limestone and the overlying Green River Formation.

The section of red beds on the north side of the basin beneath the main body of the Green River Formation and overlying the Flagstaff Member of the Green River Formation is here assigned to the Colton Formation because of its continuity in the subsurface of the east-central part of the basin with the Colton Formation of the southwest flank of the basin (Ryder and others, 1976; Fouch, 1975, fig. 5).

Although Spieker found no definitive paleontologic evidence in the Colton Formation, he considered the unit to be of early Eocene age.

Newman (1974) assigned an early Eocene age to the Colton Formation in the southwest part of the basin, but Eocene palynomorphs were recovered from only the upper half of the unit. S. R. MacAlpine and F. R. Griesbach (oral commun., 1972-74), on the basis of palynomorph, ostracode, and charophyte assemblages, placed the Paleocene-Eocene boundary on the south-central flank of the basin within the upper third of the formation and on the north flank of the basin near the top of the underlying Flagstaff Member of the Green River Formation. This evidence, then, indicates a late Paleocene and early Eocene age for the Colton Formation in the western and central Uinta Basin.

### WASATCH FORMATION

In 1946 Spieker elevated the members (lower, Flagstaff Limestone, upper) of the Wasatch to formation status and abandoned the term Wasatch Formation for strata contained in the former members. However, in view of the widespread usage of Wasatch to designate a variety of rocks of differing physical description, age, and origin (Fisher and others, 1960; Abbott, 1957), it is recommended that the name Wasatch Formation be retained in the central and western Uinta Basin. Where the Flagstaff Member of the Green River Formation is not present to separate the variegated sandstone, mudstone, and minor carbonate units of the Colton and North Horn Formations (as used in this paper) and to verify stratigraphic position, the designation as Wasatch Formation is preferable to assignment of undifferentiated variegated rocks to the Colton or North Horn Formation. The Wasatch Formation in the area of this report includes the predominantly red, gray, and green variegated sequence of sandstone, conglomerate, mudstone, and minor and discontinuous carbonate beds which, in the subsurface of the northern Uinta Basin, extend continuously from the base of the Eocene Uinta Formation to the Upper Cretaceous Price River Formation.

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