DISTRIBUTION OF THE HOSKINNINI TONGUE OF THE CUTLER FORMATION IN SOUTHEASTERN UTAH AND ADJOINING PARTS OF ARIZONA AND COLORADO

By J. H. Stewart, T. E. Mullens, and G. A. Williams

Trace Elements Memorandum Report 803

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

AEC - 416/5

January 10, 1955

Mr. Robert D. Nininger
Acting Assistant Director
Division of Raw Materials
U. S. Atomic Energy Commission
16th and Constitution Avenue, N. W.
Washington 25, D. C.

Dear Bob:

Transmitted herewith are three copies of TEM-803, "Distribution of the Hoskinnini tongue of the Cutler formation in southeastern Utah and adjoining parts of Arizona and Colorado," by J. H. Stewart, T. E. Mullens; and G. A. Williams, October 1954.

We are asking Mr. Hosted to approve our plan to submit this report for publication in the Bulletin of the American Association of Petroleum Geologists.

Sincerely yours,

John H. Eric

for W. H. Bradley
Chief Geologist

Geology and Mineralogy

This document consists of 10 pages.
Series A

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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J. H. Stewart, T. E. Mullens,
and G. A. Williams

October 1954

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This preliminary report is distributed without editorial and technical review for conformity with official standards and nomenclature. It is not for public inspection or quotation.

*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

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	61

CONTENTS

ILLUSTRATION

DISTRIBUTION OF THE HOSKINNINI TONGUE OF THE CUTLER FORMATION IN SOUTHEASTERN UTAH AND ADJOINING PARTS OF ARIZONA AND COLORADO

By J. H. Stewart, T. E. Mullens, and G. A. Williams

ABSTRACT

Recent field work indicates the Hoskinnini tongue of the Cutler formation is present in much of southeastern Utah and adjoining parts of Colorado. Previously the Hoskinnini had been recognized only in the Monument Valley region of southeastern Utah and northeastern Arizona.

The Hoskinnini tongue is pale reddish brown and is composed mainly of silt and very fine-grained sand and minor quantities of fine, medium, and coarse sand grains. The Hoskinnini is indistinctly bedded in horizontal beds generally ranging from 1 to 2 feet thick, and individual beds are composed of indistinct discontinuous wavy laminae bounded by grayish-red clay or silt films.

The Hoskinnini is generally 50 to 120 feet thick but ranges up to 126 feet thick. Pinchouts of the Hoskinnini on the west are abrupt, and the Hoskinnini near some of these pinchouts contains unusual features such as intraformational and chert pebble conglomerates, contorted stratification, and petroliferous material.

The combination of coarse grains in the finer-grained matrix and discontinuous wavy laminae serve to differentiate the Hoskinnini tongue from the underlying and overlying formations. The distinctive combination of grain size and wavy laminae also assures correlation of the Hoskinnini with rocks not previously correlated with the Hoskinnini in southeastern Utah and adjoining parts of Colorado.

Although the Hoskinnini tongue is currently classified as a part of the Permian Cutler formation, stratigraphic relations show the Hoskinnini to be contrasted with typical Cutler rocks and to be closely related to the Lower and Middle (?) Triassic Moenkopi formation.

DISTRIBUTION OF THE HOSKINNINI TONGUE

Recent field work indicates that the Hoskinnini tongue which is assigned to the Permian Cutler formation extends into part of southeastern Utah and the adjoining part of Colorado where it has not been previously reported. The known and inferred limits of the Hoskinnini tongue are shown in figure 1. The western limit of the Hoskinnini can be located exactly in many places. The northern, eastern, and southern limits of the Hoskinnini are inferred to lie in covered areas between places where the Hoskinnini is present and where it is known to be or reported to be absent. The correlation of the Hoskinnini tongue was done by U. S. Geological Survey in connection with work on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

The Hoskinnini tongue was named and defined by Baker and Reeside (1929, p. 1422) in the Monument Valley region (fig. 1) of northeastern Arizona and southeastern Utah. In most of this region the Hoskinnini overlies the DeChelly sandstone member of the Cutler, which in turn overlies the Organ Rock tongue of the Cutler. The DeChelly pinches out to the north in the Monument Valley region and Baker (1936, pl. 1), for mapping purposes, did not differentiate the Hoskinnini from the underlying Organ Rock north of the pinchout.

T. E. Mullens, during field work immediately north of the Monument Valley region, found, after detailed study, that the Hoskinnini could be separated from the Organ Rock tongue on the basis of distinctive lithologic characteristics although the DeChelly sandstone is absent. Mullens traced the Hoskinnini north as far as White Canyon (fig. 1) in southeastern Utah. J. H. Stewart and other members of the Geological Survey then traced the Hoskinnini north of White Canyon into east-central Utah and west-central Colorado and located a western limit of the Hoskinnini.

The Hoskinnini tongue is a thin, but widely distributed stratigraphic unit that can be used as a "marker bed" in the highly variable Permian and Triassic rocks in southeastern Utah. It is pale reddish brown and composed mainly of poorly sorted silt and very fine-grained sand and minor quantities of fine,

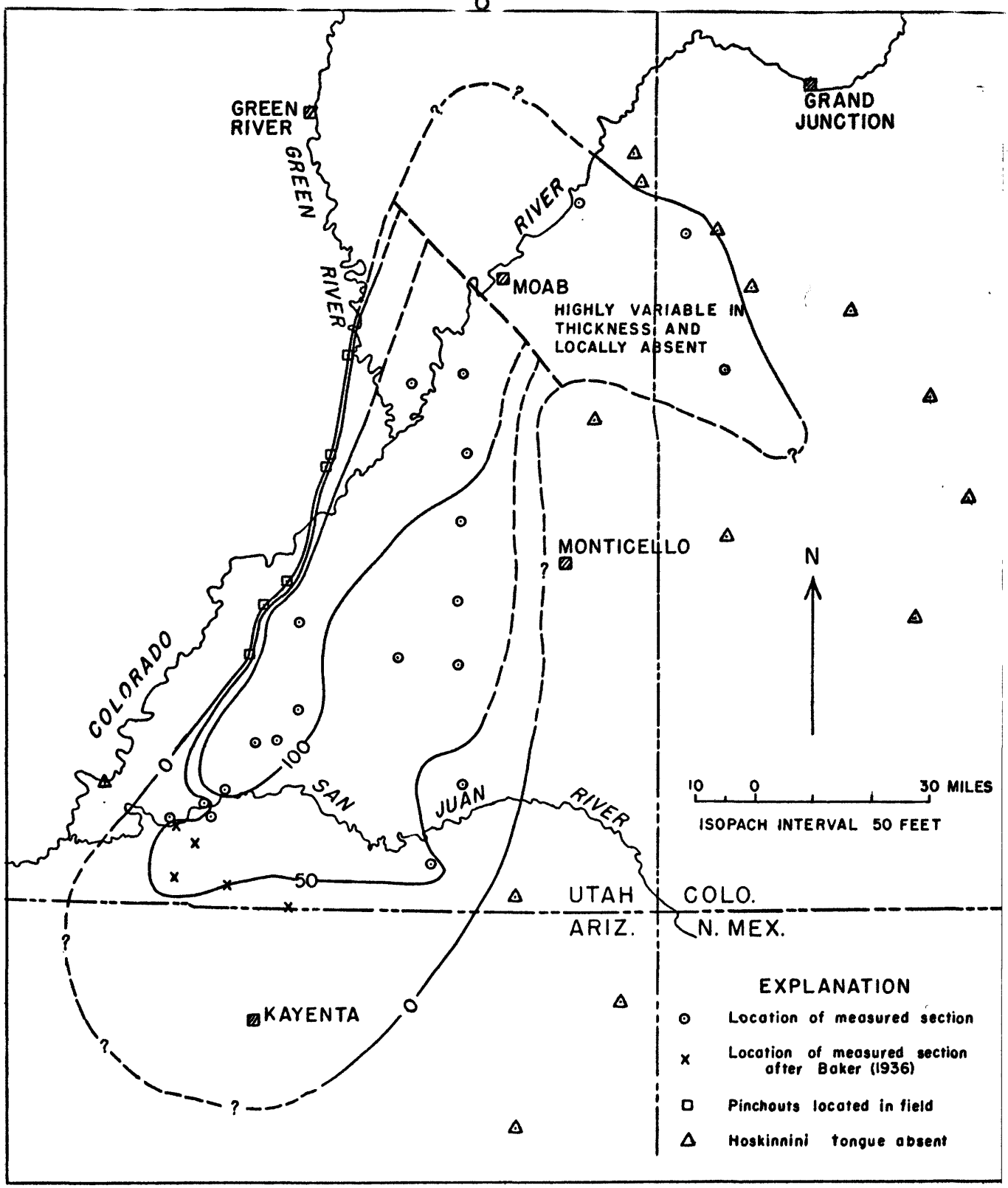

Figure 1. ISOPACH MAP OF THE HOSKINNINI TONGUE OF THE CUTLER FORMATION IN SOUTHEASTERN UTAH AND ADJOINING PARTS OF ARIZONA AND COLORADO

medium, and coarse grains. The coarser grains generally are well-rounded and are mostly disseminated but locally they are congregated into lenticular or irregular masses generally from one-fourth to 1 inch in thickness and one-half to 2 inches in length. The Hoskinnini is indistinctly bedded in horizontal beds generally ranging from 1 to 2 feet thick. These beds in most places are composed of indistinct, although characteristic discontinuous wavy laminae generally bounded by grayish-red clay or silt films. The Hoskinnini is well-indurated and weathers to form a nearly vertical cliff that contains many smooth and rounded surfaces. Commonly the rock chips off as thin rounded spalls.

The Hoskinnini tongue, in most of southeastern Utah and adjoining parts of Arizona and Colorado, ranges in thickness from 50 to 120 feet (fig. 1). The maximum measured thickness is 126 feet. Near and east of Moab, the Hoskinnini is highly variable in thickness and is locally absent.

The pinchouts of the Hoskinnini on the west are abrupt, and near the pinchouts the Hoskinnini has many unusual features. In White Canyon the Hoskinnini thickens from its pinchout to 60 feet in 1, 500 feet along the outcrop and to 110 feet by scouring into the underlying units in 2 miles further along the outcrop. The other pinchouts are similarly abrupt. Generally, intraformational conglomerates and contorted stratification are found near these western pinchouts. Near the two southernmost pinchouts that can be located in the field, the Hoskinnini contains a few lenses of conglomeratic sandstone containing angular pebbles of chert. These chert pebbles are similar to pebbles in the basal part of the overlying Triassic Moenkopi formation, and the pebbles in both units were probably derived from the Permian Kaibab limestone that is found in central and south-central Utah. In addition to the presence of conglomerates, the Hoskinnini near its pinchout in White Canyon coarsens to dominantly a fine- to medium-grained sandstone. This sandstone contains some petroliferous material that appears to have been caught in a stratigraphic trap formed by the pinchout of the Hoskinnini between fine-grained rocks and by the lateral gradation in the Hoskinnini to a fine-grained rock away from the pinchout.

The combination of coarse grains in a fine-grained matrix and wavy laminae serves to differentiate the Hoskinnini tongue from the underlying and overlying formations. In some places, however, the top 10 to 30 feet of the Hoskinnini does not contain the characteristic rounded fine to coarse grains, and the distinctive stratification is not conspicuous. In these places the base of the lowest unit containing the characteristic ripple-laminated strata of the Moenkopi formation is chosen as the contact. One notable exception to the absence of rounded fine to coarse grains in a fine-grained matrix in the overlying rocks is in western Colorado and the adjoining parts of Utah where the strata that overlie the Hoskinnini also contain these fine to coarse grains. These strata, however, do not contain the characteristic stratification of the Hoskinnini but are composed of well-developed horizontal laminae, thin beds, and a few ripple-marked beds.

The Hoskinnini contains a distinctive thin bed that may correlate over almost all southeastern Utah. This bed varies widely in composition, but it is distinctive because of color and bedding characteristics. It is composed of a few inches to 2 feet of dominantly light-colored rock with small scale wavy or "crinkly" stratification. The bed may be sandy siltstone, limy sandstone, or fine crystalline gypsum or limestone. The limestone or limy parts commonly contain very small lenses of orange chert. This bed has been described by Baker (1936, p. 39) in the Monument Valley area. This bed is tentatively correlated, on the basis of similar characteristics and stratigraphic position, from the Monument Valley area to the area near the junction of the Green and the Colorado Rivers. In general this bed lies near the base of the top third of the Hoskinnini, but in the area near the junction of the Green and Colorado Rivers it descends in the Hoskinnini so that it lies near the top of the bottom third of the unit.

The unit that is now known to be Hoskinnini has been recognized by previous workers in some areas as a separate unit but not as a correlative of the Hoskinnini, whereas, in other areas it has been included as a part of larger units. Gregory (1938, p. 46), in most places in an area north of the San Juan River and as far north as White Canyon, recognized what is now known to be the Hoskinnini as a separate unit and called it the "Division B" of the Organ Rock tongue of the Cutler formation. Baker (1933), in an area near and south of Moab included the Hoskinnini in the Moenkopi formation and did not separate it as a distinguishable unit. In an area immediately west of the junction of the Green and the Colorado Rivers,

Baker (1946, p. 37 and 46) recognized an "unnamed upper unit" of the Cutler formation which is the Hoskinnini. At the time of field mapping, McKnight (1940, p. 36) included what is now known to be the Hoskinnini as part of the Moenkopi formation in the area near the junction of the Green and Colorado Rivers. Following the later field work by Baker (1946) in the area immediately west of the junction of the Green and Colorado Rivers, McKnight called the unit that is now known to be Hoskinnini the "upper member" of the Cutler. In an area near and northeast of Moab, Utah, Dane (1935) did not separate the unit that is now known to be the Hoskinnini, and this unit was included in the Moenkopi.

In west-central Colorado and adjacent parts of Utah, Shoemaker (1952 and in preparation) and Cater (in preparation) included the Hoskinnini in a lower member of the Moenkopi formation. In places the Hoskinnini comprises all of this lower member of the Moenkopi, in other places it comprises only a small part of the member, and in still other places it may possibly be entirely absent from the member. Generally the Hoskinnini lies near the base of this lower member but locally as much as 23 feet of this member lies below the Hoskinnini. The exact relation, however, of the Hoskinnini to the rest of this member of the Moenkopi is not entirely understood, and further work might show that the entire lower member may correlate with the Hoskinnini in adjoining areas to the west.

Although the Hoskinnini tongue is classified as part of the Permain Cutler formation, stratigraphic relations show the Hoskinnini to be contrasted with typical Cutler rocks and to be closely related to the Lower and Middle (?) Triassic Moenkopi formation. These stratigraphic relations are best developed in western Colorado and adjoining parts of Utah where the lower member of the Moenkopi, which contains the Hoskinnini, is strongly contrasted lithologically with the underlying arkosic conglomerate typical of the Cutler formation. In addition, this lower member rests unconformably on the typical Cutler strata and in places this unconformity is strongly angular. Regionally the Hoskinnini appears to be closely related to the Moenkopi in that the Hoskinnini and a large part of the Moenkopi maintain a remarkably consistent lithology. The typical Cutler strata, on the other hand, undergo a pronounced facies change from siltstone and quartzose sandstone in central Utah to a conglomeratic arkose in western Colorado. Additional evidence of the relation of the Hoskinnini to the Moenkopi is found at the pinchout of the Hoskinnini directly west of the junction of the Green and Colorado Rivers where the Hoskinnini appears to intertongue with the Moenkopi strata and to pinch out about 65 feet above the base of the Moenkopi.

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