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## Runningwater Formation, Middle Miocene of Nebraska

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In 1960 the name Runningwater Formation was introduced by the author (Cook, 1960) to designate certain deposits in western Nebraska temporally intermediate between the "Upper Harrison beds"<sup>2</sup> (= Marsland Formation as originally defined<sup>3</sup>) and the Sheep Creek Formation. For the most part, the Runningwater Formation consists of fluvialite sands and silts, in places deeply channeled into the underlying Marsland and at the type locality (fig. 1) channeled completely through the Marsland and Harrison Formations into the Monroe Creek Formation. The fossil vertebrate fauna of the Runningwater Formation indicates an age younger than the restricted Marsland and older than the Sheep Creek Formation. The author hopes to demonstrate here that this stratigraphic unit is separate from, and should not be included in, any of the formations the names of which are currently in use. In so doing he hopes to end the long-existing confusion in regard to some of the Miocene stratigraphy of western Nebraska.

It is unfortunate that Peterson (1906, p. 22) chose the name "Upper Harrison beds" for a set of beds that he found superimposed on the Harrison beds of Hatcher (1902, p. 117). These were not, as the name implies,

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<sup>1</sup> The late Dr. Cook had essentially completed the present paper at the time of his death. The manuscript has been edited by Malcolm C. McKenna, Associate Curator, Department of Vertebrate Paleontology, the American Museum of Natural History.

<sup>2</sup> Not to be confused with the upper part of the Harrison Formation as defined by Hatcher (1902).

<sup>3</sup> Schultz (1938) proposed the name Marsland to replace "Upper Harrison beds."

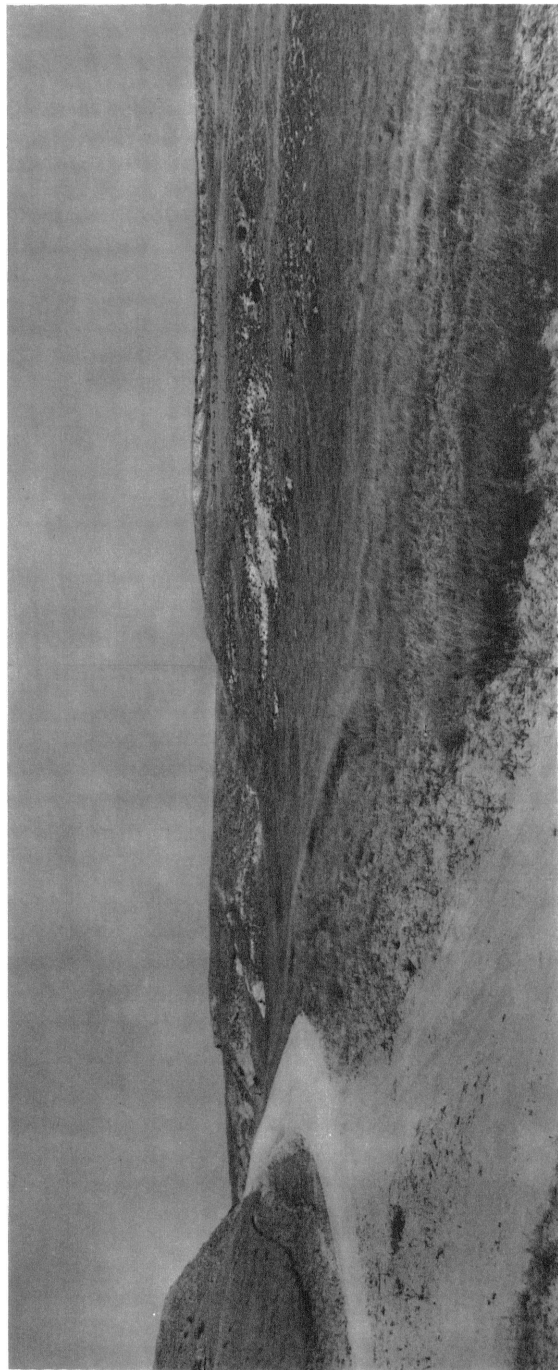


FIG. 1. Panoramic view (north to east) of the type locality of the Runningwater Formation. Location: W. 1/2, sect. 5, T. 28 N., R. 52 W., Box Butte County, Nebraska. See figure 2 for orientation.



FIG. 2. Geologic relations of a part of the Runningwater Formation in sect. 5 and 6, T. 28 N., R. 52 W., Box Butte County, and part of sect. 1, T. 28 N., R. 53 W., Sioux County, Nebraska. The route of the type section (fig. 3) is shown in sect. 5. Topographic base is enlarged from the Marsland Quadrangle, Nebraska, 15-minute series, edition of 1951, reproduced here at a scale of 2 inches = 1 mile. Geology by M. C. McKenna.

Abbreviations: Th, Harrison Formation; Tm, "Upper Harrison beds" = Marsland Formation as here restricted; Tmc, Monroe Creek Formation; Trw, Runningwater Formation.

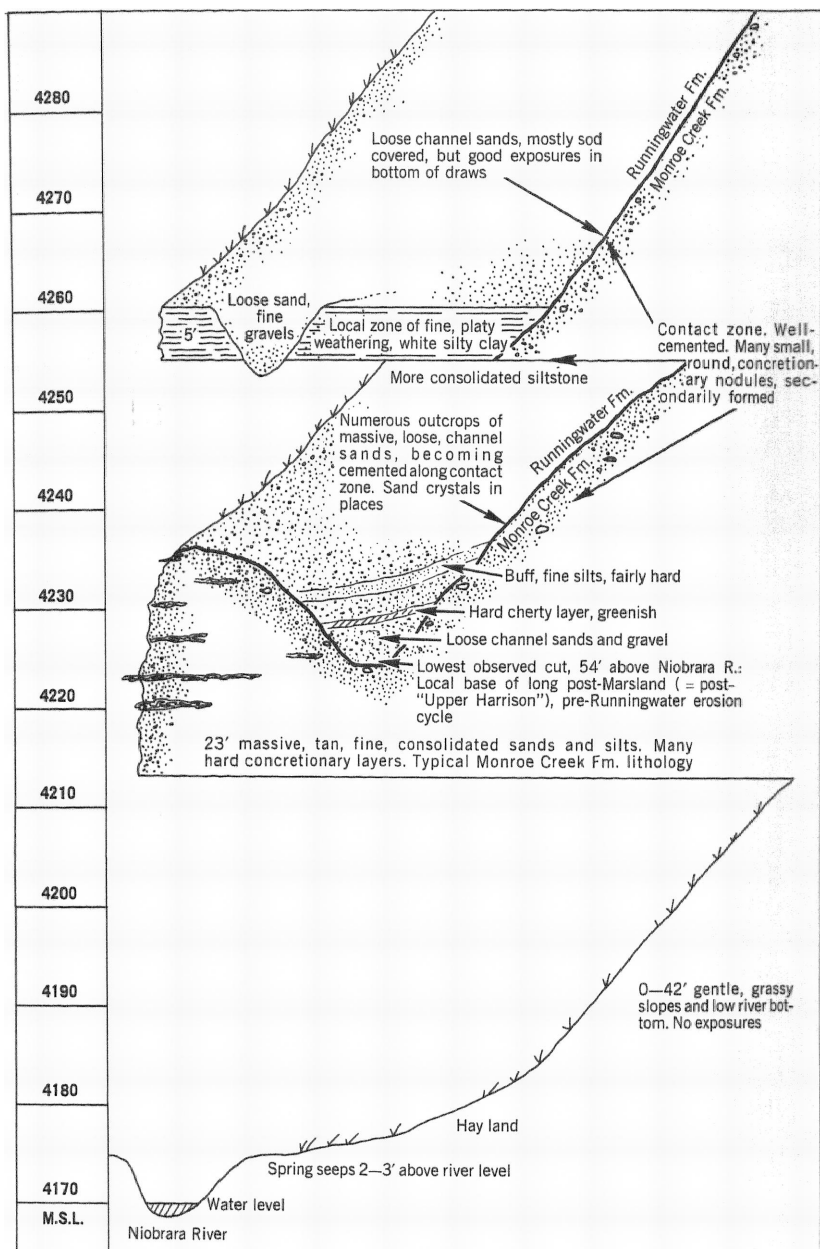
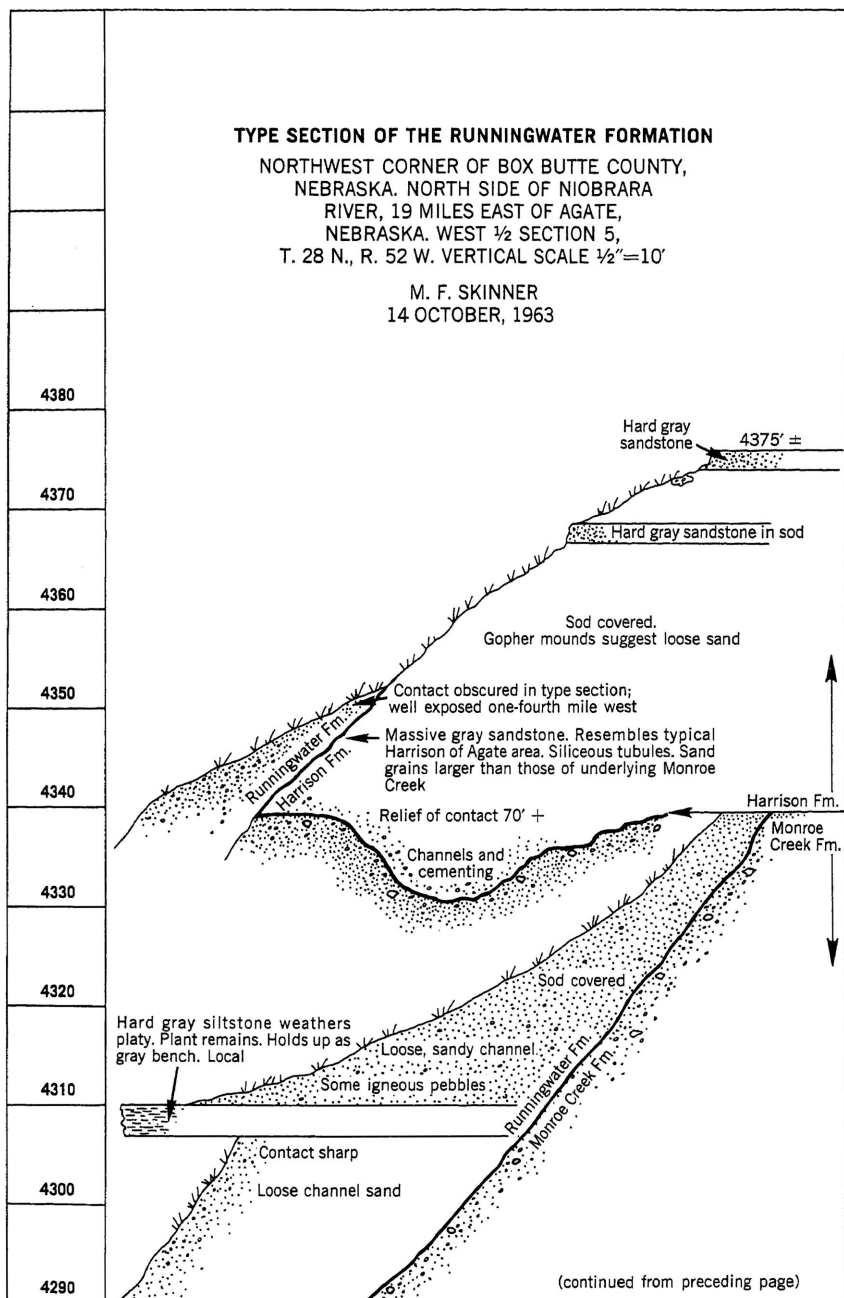


FIG. 3. (This page and the succeeding page). Type section of the Runningwater Formation. Geology by M. F. Skinner.

# TYPE SECTION OF THE RUNNINGWATER FORMATION

NORTHWEST CORNER OF BOX BUTTE COUNTY,  
NEBRASKA. NORTH SIDE OF NIOBRARA  
RIVER, 19 MILES EAST OF AGATE,  
NEBRASKA. WEST ½ SECTION 5,  
T. 28 N., R. 52 W. VERTICAL SCALE ½"=10'

M. F. SKINNER  
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the upper part of the Harrison Formation, but a totally new set of beds, recognizable on geologic criteria alone and with a different and distinctive fauna. Various authors followed Peterson's terminology for many years. In 1933, Cook and Cook (p. 28) pointed out that the Upper Harrison "... must be held a distinct formation." In the same paper (p. 31) the following statements were made: "The greatest gap in the faunal record of Nebraska, from the early Oligocene to the end of the Tertiary, occurs between the lower Miocene-Upper Harrison beds and the middle Miocene-Lower Sheep Creek beds. This gap will undoubtedly be filled in as later discoveries are accurately recognized and reported. The writer has examined one recently discovered horizon, and some of its fauna, which appears partially to fill in this gap. It occurs in the region where for years we have predicted that such a stage should be found." In the columnar section in the same publication (p. 44), the term "unnamed beds" was placed in a position between the Upper Harrison and the Sheep Creek, but the newly discovered sediments were not named until more data could be obtained.

### RUNNINGWATER FORMATION

The writer proposed<sup>1</sup> the name Runningwater Formation (Cook, 1960, p. 205) for certain beds which were deposited after deposition of the typical "Upper Harrison beds" of Peterson (1906) to which Schultz (1938) applied the replacement name Marsland Formation, and before the deposition of the Sheep Creek beds of Matthew and Cook (1909). The name Marsland is here regarded as restricted to those beds which Peterson called "Upper Harrison beds," though Schultz (1938), Lugin (1939), and others have also included in the Marsland various additional sediments later than the Harrison and older than the Sheep Creek. Certain Runningwater deposits have been referred to as "Upper Marsland" by Schultz and Falkenbach (1947) and others.

The principal exposures of the Runningwater Formation occur in the drainage breaks of the Niobrara River (locally known as the Runningwater), in eastern Sioux, northern Box Butte, and southern Dawes counties, Nebraska, where it locally underlies sediments correlated with the Box Butte Member of the (?) Sheep Creek Formation and overlies the

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<sup>1</sup> Dr. Cook's proposal in 1960 unfortunately did not meet the requirements of either the then-existing or the subsequent Code of Geologic Nomenclature for the establishment of valid geologic names. The Geologic Names Committee of the United States Geological Survey (letter to Mrs. H. J. Cook, December 7, 1962) has regarded the name Runningwater Formation as permanently reserved for these deposits, when properly validated.—M. C. McKenna.

(restricted) Marsland and older formations. The Runningwater Formation is deeply channeled into several older formations and in places even rests upon the Monroe Creek Formation. The type locality (fig. 1) of the Runningwater Formation is in the northwest corner of Box Butte County in the west half of sect. 5, T. 28 N., R. 52 W., just east of where the present road from Agate to Marsland turns north to ascend the hills in the northwest part of Section 5 [see United States Geological Survey, Marsland Quadrangle, Nebraska, 15 minute series (topographic), scale 1:62,500, edition of 1951; see also United States Department of Agriculture Commodity Stabilization Service, photograph 6-18-61, 1:20,000, CBE-2BB-170].

As the accompanying map<sup>1</sup> and section<sup>2</sup> (figs. 2, 3) show for the type area, the Runningwater Formation was deposited after a long interval of erosion, during which irregular relief was cut deeply into older sediments. In the vicinity of the type locality the Runningwater rests upon the Monroe Creek Formation at the base of the exposures and also upon the Harrison Formation. The closest observed approach of the Runningwater to an "Upper Harrison" (= restricted Marsland) exposure in the type area is in sect. 1, T. 28 N., R. 53 W., where flat-lying (restricted) Marsland (= Upper Harrison beds) caps a hill (fig. 2).

Cementation of the Runningwater-Monroe Creek contact in the type area is locally pronounced. "Sand crystals" are locally abundant just above the base of the Runningwater and pebbles up to ½ inch in diameter of various granitic rocks were noted in the conglomeratic phases of the Runningwater. These coarse granitic pebbles are the first such known by the author to occur in several hundred feet of antecedent Miocene sediments in this part of Nebraska and indicate increased stream competence, probably resulting from renewed uplift to the west, as discussed by the author in 1951 and 1960.

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<sup>1</sup>Geologic map by M. C. McKenna.

<sup>2</sup>Geologic section by M. F. Skinner; courtesy of H. E. Anthony.

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