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MONTANA BUREAU OF MINES AND GEOLOGY

BUTTE, MONTANA 59701

General
Chouteau Co.

January 7, 1970

C Mr. Gerald S. ^{my}Snyder
Special Publications Division
National Geographic Magazine
Washington, D. C. 20036

Dear Mr. Snyder:

O I have your letter of December 17, 1969, pertaining to the
'White Cliffs' of the Missouri. Although I covered Montana pretty well
in the last 40 years, I have as yet to take the boat trip you mention. As
a result, I did not know exactly the area of your interest; hence the delay
in answering your letter. I have since found that the white cliffs you
mention occur along the Missouri River from a point immediately down-
stream from the village of Virgelle, downstream to about the mouth of
Judith River. This section of the Missouri River is shown on U. S. Geological
Survey topographic sheets shaded in red on the attached index maps. These
P maps can be obtained from the U. S. Geological Survey, Washington, D. C.,
for 50 cents each.

Y The only recent publications on the geology of this area is in two
maps indicated by the blue lines on the index map. These maps are:

- (1) U.S. Geol. Survey Map I-130, Geology of the Big Sandy
quadrangle, Montana, by R. M. Lindvall, 1956 (75¢).
- (2) U.S. Geol. Survey Map I-349, Geology of the Eagles Buttes
quadrangle, Chouteau County, Montana, by R. M. Lindvall, 1962
(50¢).

The White Cliffs are formed of sandstones of the Eagle Formation
of Cretaceous age, which extended from about 135 million to 70 million
years ago. The Eagle Formation was laid down about 80 million years ago.

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Mr. Gerald S. Synder

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The Eagle Formation in this area consists of three separate members. The oldest and lowest is the Virgelle Sandstone Member, consisting of white to buff sandstone, locally cross bedded (indicating dune conditions) and containing iron concretions. The member is 80 to 100 feet thick, but may form cliffs as much as 200 feet high due to dip of strata. This is the member responsible for the white cliffs.

The upper and middle members, 125 to 150 feet thick, consist of alternating beds of gray to buff soft sandstone and shale. There are two coal beds near the bottom of the middle. Some coal has been mined from these seams. The upper and middle members erode more easily than the Virgelle Member and form a more subdued topography.

C Suspecting that you would be interested in Lindvall's version of the geologic history of the area, I am enclosing a copy of his map no. I-349.

O The glacial history of the area is described in U. S. Geological Survey Professional Paper 174, "Physiography and Glacial Geology of Eastern Montana," by W. C. Alden. This report is out of print but can be consulted in many libraries in Washington, D. C. Pages 89-90 on changes in the course of the Missouri River should be of interest to you. According to Plate 29, facing page 88 in Prof. Paper 174, this white cliff area was one covered by the Iowan or Illinoisan stage of Keewatin glaciation, so the present topographic features are of more recent age than that.

P I am also enclosing a copy of Dr. Perry's "Montana in the Geologic Past."

Y I trust that this will give you the information you want, but if it does not, feel free to call on me again.

Sincerely,

Uuno M. Sahinen
Director and State Geologist

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Enclosures