U. S. GEOLOGICAL SURVEY. REPORTS - OPEN FILE, NO. 73.

PRELIMINARY REPORT ON THE GENERAL GEOLOGY AND ENGINEERING GEOLOGY OF NOONAN QUADRANGLE, NORTH DAKOTA _/

_/ Open-file release by permission of the Director, U. S. Geological Survey.

by

R. C. Townsend

U. S. Geological Survey,

Contents

PRELIMINARY REPORT ON THE GENERAL GEOLOGY AND ENGINEERING GEOLOGY OF NOONAN QUADRANGLE, NORTH DAKOTA

By
R. C. Townsend

Introduction

The Noonan quadrangle is in northwestern North Dakota adjacent to the Dominion of Canada and approximately 35 miles east of Montana. The small coal-mining, farm, and railroad town of Noonan is located near the eastern edge of this sparsely populated area. The east-west State Highway 5 bisects the quadrangle.

Cultural development in this area depends largely on agricultural exploitation of the glacial deposits that mantle the bedrock. For this reason, emphasis in this report is on the description, classification, and analysis of the surficial deposits.

The geologic map is the base of the report. The map explanation includes a description of the material found in the various deposits along with the distinctive topographic and lithologic characteristics. Most of the text and the analyses of samples are written in tabular form so that specific information may be easily found. Depth relations may be determined from the cross section attached and the data on the map page.

Most of the subsurface data in this report are inferred from drill-hole logs and water-well information provided by the North Dakota State Geological Survey, the U. S. Bureau of Reclamation, and the Ground Water Division of the U. S. Geological Survey.

Physiography

The Noonan quadrangle is in the glaciated Missouri Plateau section of the Great Plains physiographic province. The surface is generally flat or gently undulatory and slopes slightly to the northeast, except for the Max moraine, which is a jumble of irregular-shaped hills and enclosed depressions of all sizes. The Max moraine is part of the great Missouri Coteau, a southeast-trending belt of glacial debris 10 to 25 miles wide and several hundred miles long. Long Creek (intermittent) is the only drainage course developed enough to warrant a name.

The rigorous northern continental climate is characterized by a wide temperature range, scant precipitation, low humidity, and strong winds. Droughts are common, and dry winds from the northwest prevail. Blizzards and dust storms are characteristic. Average frost penetration is approximately 4 feet and reaches a maximum of $6\frac{1}{2}$ feet.

Geologic History

The oldest formation exposed in the Noonan quadrangle is the Fort Union formation, deposited in the Paleocene epoch in widespread swamps, lagoons, floodplains, and shallow lakes. Beds of marl, silt, and fine sand were intercalated with organic matter as swamps changed to lagoons and lakes and back again to swamps. Chemical action and the compaction of accumulated beds turned the organic matter to coal. Deposition stopped when the lakes and swamps disappeared, and valleys were eroded in the soft weak beds of the Fort Union formation, making an uneven terrain similar to the present badlands in North and South Dakota.

Stream erosion continued until glaciers moved southward over the area in the Pleistocene epoch. The mesa-and-butte or badlands type of topography of the Fort Union formation was blanketed with ice. As the ice flowed from areas in Canada, it picked up and transported rock material of all sizes from clay to boulders. This material was later deposited, some of it filling valleys that existed prior to glaciation and generally covering the area during advance of the ice; the remainder of it formed the present ground surface in late Wisconsin time. Probably more than one glacier flowed over the area, or a single ice sheet may have advanced, retreated and readvanced. In either case each advance of the ice brought and deposited additional rock debris and picked up and redeposited material left from previous advances.

Most of the material comprising the present ground surface was deposited during the melting and disappearance of the last of the ice sheets that covered the area. The bedrock surface under the Max moraine is higher in altitude and probably more dissected that the bedrock under the ground moraine. This high, irregular, bedrock surface caused an extremely uneven distribution of the rock load in the flowing ice. As the ice covering the area of high bedrock finally began to melt, the rock material settled out. Hills were created where the rock load in the ice had been heavy, and valleys left where the load was light. Thus, the topography in the Max moraine is more rugged than in the ground moraine.

The front of the glacier was not definite during deglaciation, but was, instead, a marginal zone of stagnation, crenulated and ever-changing in outline. Melting and evaporation were prevalent. The variety of deposits in the northern half of the quadrangle is characteristic of this marginal zone. Huge blocks of ice were stranded, leaving kettles when they finally melted. Kames and boulder kames were formed by material washed into holes and re-entrants in the ice and at the edge of the ice. Kame terraces were formed by material washed into the depressions between masses of ice and valley walls. Eskers were formed when the rock load of streams on and in the ice settled to the ground. As the glacier finally disappeared, the material that was not washed from the ice settled slowly to the ground and added to the accumulation of ground moraine.

Although the marginal zone was in the area of the Max moraine, no drainage was developed because of the rugged jumble of hills and valleys. Meltwater accumulated in undrained depressions where it evaporated or soaked into the ground. In contrast, as the ice melted on the great plain to the north of the Max moraine, water flowed in shallow valleys or drainage courses near the edges of masses of ice and accumulated from time to time in wide, shallow basins. Marl, clay, silt, sand, and gravel are deposited in various places in these drainage courses and basins; the sand bars alone have a topographic outline. As the ice marginal zone moved northward the source of meltwater disappeared in first one place and then another, and water abandoned one or another of its courses in favor of easier paths.

Today most of the Pleistocene drainage courses and shallow basins are dry, or contain only intermittent streams that flow slowly to undrained depressions. Minor amounts of slope wash and alluvium are present in the valley of Long Creek and in other drainage courses. Except for the development of sand dunes, the surface of glacial deposits remains essentially unmodified by recent erosion.

DEPARTMENT OF THE INTERIOR

INFORMATION SERVICE

EOLOGICAL SURVEY

or Release FEBRUARY 8, 1951

REPORT ON GEOLOGY OF NOONAN QUADRANGLE IN NORTH DAKOTA RELEASED

Completion of the geologic mapping on the Noonan quadrangle in northwestern orth Dakota was announced today by the United States Department of the Interior.

A preliminary report and map of the geology of the area have been placed in iles open to the public in Grand Forks, N. Dak.; Denver, Colo.; and Washington, D.C: e report and geologic map are the result of geologic investigations made in the mmer of 1947 by R. C. Townsend, field geologist of the Geological Survey, as part f the Interior Department's program for the development of the Missouri River Basin.

The glacial deposits of the area, which are of Pleistocene age, contain comercially valuable sand and gravel. Bedrock in the area is formed by the Fort Union rmation which contains lignitic coal. The map and report include data on the pth to bedrock, an engineering description of all the deposits, and a brief geogic history.

The preliminary geologic map and report may be examined at the Geological Survey fices, rooms 1033 (Library) and G-234, General Services Bldg., Washington, D. C., Bldg. 12-B, Denver Federal Center, Denver, Colo., and at the office of the State ologist, University of North Dakota, Grand Forks, N. Dak.

x x x

.N. 90007

pocket contains 5 pieces