Montana Ground-Water Assessment Atlas No. 1, Part B, Map 2
October 1998
Revision 1 - Dec. 17, 1998

Montana Bureau of Mines and Geology
A Department of Montana Tech of The University of Montana

Thickness of Unconsolidated Deposits, Lower Yellowstone River Area: Dawson, Fallon, Prairie, Richland, and Wibaux Counties, Montana

by

Larry N. Smith

Note - this map was originally published at a scale of 1:250,000 but the page sizes have been modified to fit the size of the paper in your printer. A full sized 36” X 45” colored print of this map can be ordered from the Office of Publications and Sales of the Montana Bureau of Mines and Geology, 1300 West Park Street, Butte, MT 59701.
Phone: 406-496-4167 E-mail: http://mbmgsun.mtech.edu
Thicknness of Unconsolidated Deposits, Lower Yellowstone River Area: Dawson, Fallon, Prairie, Richland, and Wibaux Counties, Montana

by

Larry N. Smith

Introduction

This map depicts thicknesses of unconsolidated deposits of sediment near land surface in the Lower Yellowstone River Area. The deposits consist of sand, silt, gravel, and minor clay within the Yellowstone and Missouri River valleys and in upland areas. Unconsolidated sands and gravels in the river valleys are important aquifers. The unconsolidated deposits described by this map are those beneath the land surface.

The thickness of unconsolidated deposits can sometimes be interpreted by comparing nearby wells. Because of inherent problems in the well logs from inaccurate locations and descriptions, data points were contoured only where at least two nearby well logs showed similar thicknesses. Therefore, contours were fitted through most data points. The hand-drawn contours were digitized and plotted.

The contours of zero thicknesses, shown as the outer boundary of the yellow shading, are taken from map contacts of the unconsolidated deposits. Areas where no surficial sediment is mapped are generally bedrock outcrops of the Pierre, Fox Hills, Hell Creek, and Fort Union formations. Locations where well logs report zero thicknesses of unconsolidated sediment are shown by red circles. Isolated red circles included within areas where unconsolidated deposits are shown may represent small areas where no surficial sediment exists, where there are poorly described deposits, or where the surficial deposits are 10-20 feet thick. Data points on the map that locally conflict with the thickness. These discrepancies are sufficiently large to severely limit the usefulness of the surficial deposits, and the thickness is estimated to be about one half of the interval between contours.
are generally unconsolidated mixtures of silt, clay, sand, and gravel but not glacial-till deposits where compacted clay may tightly bind clasts. Deposits in upland areas are mostly bench-like features (stream terraces) separated from similar deposits in river valleys by bedrock outcrops. The upland deposits range from 10s to 100s of feet in altitude above current drainages. Thickness differences are caused by irregularity in deposition thicknesses, the river’s natural state, and by post-depositional erosion, especially in the uplands. While the largest quantity of unconsolidated sediment is contained in river valleys, deposition in upland areas are of significant areal extent but are thin. Glacial deposits cover significant areas of Richland County, north of the line shown on the map but are generally thin compared with alluvial deposits in the Yellowstone and Missouri River valleys. Unconsolidated deposits accumulated in a few environments. Extensive description of the deposits are found in Vuk-Foster et al. (1986) and Colton et al. (1994) and are briefly summarized as follows:

- Fine- to coarse-grained sand and gravel deposited within modern river valleys and on ancient valley floors (now bench-like features) are thin to moderately thick. The thickness of about 150 feet in a buried channel of the Yellowstone River near Sidney, Montana (Reiten in preparation).
- Silt, clay, and minor sand deposited as overbank floodplain on flood plains, as sheetwash at the bases of hillslopes, and as alluvial fans. The deposits in lakes formed by glacial damming of the Yellowstone River.
- Heterogeneous mixtures of locally consolidated clay, silt, sand, and gravel deposited by glaciers north of the glacial boundary indicated on the map; older till units are increasingly consolidated. The unconsolidated sediment is part of the shallow hydrogeologic systems of the basin.

The distribution and thickness of unconsolidated deposits represent the erosional and depositional record of the recent part of the area’s geologic history, which was dominated by erosion of and deposition along the Yellowstone and Missouri rivers and their tributaries. Alluvial fill within the Yellowstone River is mostly fine to coarse sand and gravel. For example, the thickness of many areas that have less than 20 feet of fill. Northwest of Glendive and west of Terry, the valley contains bedrock outcrops such as the upper 200 feet of Tertiary, such as near Terry, Tertiary, and Glendive, the thickest accumulations of unconsolidated materials in the Yellowstone River valley. Unconsolidated deposits appear to reach maximum thicknesses near the valley margins which erode and subsequently refill of the bedrock valley by the ancestral Yellowstone River (Reiten in preparation) or due to local aggregation on top of the valley floor by unconsolidated materials deposited from side slopes and tributaries. The unconsolidated deposits on dissected upland areas, such as the mountains of the Missouri River, are under terraces about 300 feet above the Yellowstone River. Unconsolidated deposits forming the terraces are thickest along the north and south sides of the valley in Richland County, on both sides of the valley in Dawson County, and along the southeastern side of the valley in Prairie County. The location of thick deposits represent ancestral positions of the Yellowstone River valley more recently dissected by erosion. Northwest of the Yellowstone River, generally less than 20 feet of unconsolidated deposits occur on dissected surfaces at the 100s of feet high terraces through tributary drainages. Unconsolidated deposits along most tributaries to the Yellowstone River and Missouri rivers are generally less than 20 feet in thickness but are thickest along the Powder River, O’Fallon Creek, and Beaver Creek. Some low-lying flood plains of the Missouri River in Richland County have up to 200 feet of fill along their lower reaches.

The till that has been mapped on most of the upland surfaces north of the line depicting the limit of glaciation (Prichard and Landis 1975; Colton et al. 1994; Bergantino and Wilde 1990a, b). The till is generally less than 15 feet thick, but may be described lithologic logs, or where there are inaccurate well locations. Black circles distributed where no surficial sediment is mapped indicates areas where thin (less than 1 feet thick) and thick (greater than 10 feet) accumulations of surficial sediment are too small to map.

**Map Use**

The distribution and thicknesses of surficial sediment can be useful for delineating aggregate resources. Areas known to have unconsolidated deposits greater than 20 feet thick offer potential sources of aggregate for road building or other construction. Individuals looking for aggregate resources can use this map to target areas for further testing.

The unconsolidated deposits, except the glacial till deposits, have greater permeability and porosity than the underlying sandstones and mudstones of the Fort Union, Hell Creek, Fox Hills, and Pierre Formations and therefore may be either important aquifers, or areas of ground-water recharge. Low-permeability till apparently slows water movement, in comparison to other unconsolidated sediments, much like bedrock lithologies in the area. Permeable, unconsolidated deposits within river valleys or in areas of unconsolidated deposits, particularly areas near important aquifers, or areas of ground-water recharge. Water is quickly infiltrated into the deposits and either percolates downward into underlying bedrock aquifers or travels laterally to springs along the edges of the deposits. Water quality for wells completed in the Fort Union Formation directly under unconsolidated sand and gravel deposits are similar to 100s of feet. In places where completed within the overlying unconsolidated deposits. This similarity in water chemistry allows water movement downward. Therefore, knowing the location of mappable unconsolidated deposits also help to protect aquifers within or below the deposits.

**Map Accuracy**

Map accuracy is affected by data availability, accuracy of descriptive logs and well locations, errors in interpretation of log data, and smoothing during contouring. Wells are not delineated on the map; accuracy is greater near data points. Water-well locations are typically accurate within 200 feet of the well. Field checks by MBMG personnel are accurate to within a 2.5-acre area. The locations of the wells are as reported on the well logs and have not been checked in the field; 24% were visited by MBMG or other agencies. Water quality was recorded by the Montana Department of Natural Resources and Environment, the Montana Department of Fish, Wildlife and Parks, the United States Geological Survey, the Montana Well Drilling Association, and private companies.

**References**


roads are

Digital

Library, from
e available

data used

Water

of Mines

Montana,

necessary
are all

by Dick

and Wayne

geologic map

Montana
dec 98

geologic map

Montana

geologic map

Montana

unit Lower

and Geology

of 1:250,000.

Cenozoic

U.S.
map of the

Robocker,

and Wibaux

North

gic Map No.
gic map

of Mines

Printed by the U.S. Government Printing Office

Transverse Mercator Projection
Central Meridian +180 Degrees
1927 Horizontal Datum

Scale 1:250,000

0 5 10 15 miles

Author’s Note: This map is part of the Montana Bureau of Mines and Geology (MBMG) Ground-Water Assessment Atlas for the Lower Yellowstone River Area ground-water characterization. It is intended to stand alone and describe a single hydrogeologic aspect of the study area, although many of the area’s hydrogeologic features are interrelated. For an integrated view of the hydrogeology of the Lower Yellowstone River Area the reader is referred to Part A (descriptive overview) and Part B (maps) of the Montana Ground-Water Assessment Atlas No. 1.

Geographic information system production by Joel Hall and Larry Smith. Digital cartography by Don Mason.