

OFR-17-01, Minnesota Geological Survey 1:100,000 surficial geologic texture database

To support regional and statewide applications, Minnesota Geological Survey (MGS) has initiated a geological mapping database to compile county and quadrangle-resolution mapping – nominally 1:100,000 – beginning with surficial geology maps. These maps may be regarded as soil parent material maps, and are appropriate for applications that call for inference of near-surface materials such as sediment in the second and third meter, having obtained information on the uppermost meter from soil mapping. Reconciliation of adjacent maps to produce a seamless mapping database has also been initiated, and is expected to be a multi-year process. Current focus is on parsing of legends, to facilitate queries using broadly accepted, well-defined terminology, and thus to facilitate inference of properties – beginning with sediment texture. For the longer term, it is anticipated that thickness will progressively be more indicated, while increasing specification of properties will gradually be accompanied by indications of heterogeneity and uncertainty.

The data for this Open File is contained in an ArcMap document that has been compressed into an ArcGis Map Package (mpk). Opening the mpk will create an ArcMap project mxd on the local drive that is compatible with several recent versions 10 of ArcMap. The data coordinate system is UTM, NAD83, Zone 15 extended.

Features in the mxd are stored in a local geodatabase and include:

County boundaries;

Quaternary surficial lithostratigraphic units from Figure 5, QLUM volume, MGS Report of Investigations, RI-68;

Map footprints that can be used with the Identify tool in ArcMap and provide a link to the original map stored at the University of Minnesota Archive site, (UDC);

Surficial geology map containing polygons of existing surficial map data and colored by USDA texture as described below.

In addition to this readme file the Open File contains a PDF copy of an Excel file showing a summary list of the possible entries that could be made for each unit in the GIS attribute table.

Information in the map attribute table currently is derived from 38 previously published maps, including county geologic atlas and regional hydrogeologic assessment surficial geology plates, as well as maps published by MGS as miscellaneous maps and open file maps. Where county or quadrangle-scale mapping is unavailable, the database is based on 1:500,000 mapping (Hobbs and Goebel, 1982).

Predicted texture of sediments underlying areas mapped as surficial geology polygons in the Minnesota Geological Survey 1:100,000 geological mapping database has been updated relative

to information on the original published maps using information needed to support the best readily achievable inference of texture as categorized by US Department of Agriculture terminology.

Note that map labels are not unique and may represent disparate materials. In general, units described as “thin over” something else have been classified according to the lowermost unit (reflecting materials in the second and third meter). In some cases, where indicated thickness of the uppermost material is greater than 2-3 m, the overlying material is characterized. Where possible, the lithostratigraphic formation and member names are indicated (Johnson and others, 2016), even if that information was not present on the original map. Glacial lobe and provenance have also been added, although this information may not be complete.

The following procedure was used to infer a categorization of sediment texture more specific than was provided by the original map authors. The MGS sediment sample and analysis database – part of the MGS Quaternary Data Index (QDI) – was queried for analyses within 3 m depth for each unit of each map. To exclude outliers, values of <10% or >90% sand were excluded in areas mapped as till, and remaining data were inspected so outliers could be excluded on the basis of available information and judgment.

Resulting data for each map unit on each map were plotted on a ternary plot of percent sand, silt, and clay. If the plot showed a clear data cluster not straddling categories, a single texture classification was assigned based on USDA terminology. For cases of a cluster straddling categories, the accompanying table of average texture was used to make a class assignment. For data that was not well-clustered, a texture classification was assigned based on other factors, such as author notes, other mapping sources, or published map-unit description.

The sediment texture categorizations of the maps were then merged into a state-wide map coverage so that discrepancies between adjacent maps could be evaluated and addressed. In some cases, textural classifications were revised after adjacent maps were further considered.

A code was assigned to indicate the method used to assign the texture classification: Method 1 was based on robust textural data, author notes, interpretation, map legend; Method 2 was based on more limited textural data or range, NRCS histosols layer, interpretation, and map legend; and Method 3 was based on little to no textural data, and interpretation based on regional geology and map legend.

It is noted that sediments across Minnesota were in most cases deposited by glacial processes, resulting in considerable heterogeneity. Assignment of a single textural classification to any map unit thus is a generalized regional approximation. Furthermore, availability of data is sparse over broad areas.

The intention is to regularly augment the database as new mapping is completed, as additional data are compiled, and as methods are refined. In its current format, this database has undergone minimal editing and may contain inconsistent or inaccurate information. Ultimately, this open-file version will be replaced by the digital seamless compilation that is currently underway.