

Maps of Gridded Bedrock Elevation and Depth to Bedrock in Minnesota

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This open-file of bedrock elevation (be) and depth to bedrock (dt) grids and data points for Minnesota represents the first phase of an ongoing process to create new statewide maps from these data. The grids and data can be viewed using either ArcView 3.x with Spatial Analyst or ArcMap 8, 9.x. The grids and point data use the UTM, NAD 83, Zone 15 projection and datum. ArcMap .lyr files are provided to color each map in ArcMap at a preset interval. No legend files are provided if using ArcView to view the grids. The Mn state outline and County outlines are also provided.

As a first step we created two grids, "be_loc" and "dt_loc," from the most accurate primary data available—wells in the County Well Index (CWI) database with verified locations that intersect the bedrock surface. These grids are the best algorithm-based representations of bedrock topography and bedrock depth available at the present time. The CWIpt_loc data set should be reviewed so that the user can see where accurately located data are plentiful and where they are sparse or absent. The likelihood that the grids accurately represent real conditions is less in areas of sparse data. As a second step we created two additional gridded surfaces, "be_loc_unloc" and "dt_loc_unloc" that added data from wells without verified locations from the CWI data set. The positions of wells in the unlocated set were derived from township, range, and section data that appeared on the original records. Additional uncertainty is attached to elevations that were extracted from a 30 meter DEM grid, and interpretations of what constitutes the bedrock surface may be in error through lack of interpretation. Nevertheless, the increase in detail gained by using the unlocated wells may be significant, so the maps are provided with the caveat that errors may be found and changes will occur. Both sets of maps represent point-in-time data models that can be verified or altered with acquisition of additional data.

The utility of these maps varies with the density of data in any given area—some areas might appropriately be used for some purposes at scales as large as 1:24,000, but in other areas, where data are widely distributed or nonexistent, usage may not be appropriate at any scale. The greatest value of the current grids is in the statewide perspective they provide. Locally, state bedrock elevation and depth to bedrock maps have been created by more reliable and comprehensive methods.

The grids that are part of this report were created by algorithm-based calculations from CWI water well data and represent the initial statewide compilation of depth to bedrock data in digital form. The Minnesota Geological Survey intends to update the maps of bedrock topography and depth to bedrock as additional data becomes available and most importantly, the interpretation of the data by geologists. That interpretation is essential

because it incorporates knowledge of geologic processes and history to create the map. For example, many of the drill holes in northern and western Minnesota encounter thick zones of weathered bedrock known as saprolite. This can be difficult to discern from dense and clayey glacial sediments based upon drill records alone, but a geological interpretation can make that distinction and thus provide additional points to the depth to bedrock data set.

Future iterations of these maps will include some or all of the following in the process:

- 1) new records from the continually updated CWI files of located and geologically interpreted wells;
- 2) Removal of data found to contain an erroneous location, elevation, or interpretation of material type;
- 3) Incorporation of bedrock topographic mapping from within and adjacent to Minnesota from various studies conducted at quadrangle, county, and regional scales;
- 4) The inclusion of bedrock elevations from a bedrock outcrop database; and
- 5) Interpretation of all data using geologic considerations, such as differences of the various bedrock types, bedrock structure, natural drainage patterns, and geologic history.

This index lists the files developed and used for the preparation of the grid maps:

The projection used is UTM, zone 15. The datum is NAD83.

All shapefiles and grids are compressed into the zip file ofr06_02.zip for distribution.

Questions concerning the digital products should be directed to Rich Lively (lively@umn.edu or 612-627-4780). Questions concerning CWI data should be directed to Emily Bauer (bauer010@umn.edu or 612-627-4780).

PDFS:-----PDF (page size) versions of the maps constructed from the grids and point data are provided in the folder PDFs.

shapefiles -----

line----- Mncomdt.shp: Polygon file of Minnesota county outlines

line----- Mnoutln.shp: Polygon file of the outline of Minnesota

point ----- CWIpt_unloc.shp: Point data from the County Well Index (CWI). Point data in this file are unlocated, meaning the locations and data in the file have not been independently verified, so bedrock elevations and depth to bedrock values may be in

error and stratigraphic records have not been interpreted by a Minnesota Geological Survey geologist. Data may be from water wells or exploration borings.

point----- CWIpt_loc.shp: Point data from the County Well Index (CWI). Point data in this file are located, meaning the locations and data in the file have been verified through field checks and stratigraphic records have been interpreted by Minnesota Geological Survey geologists. Data may be from water wells or exploration borings.

Both of the above point files may contain some holes drilled at an angle. That deviation and the apparent well depth for those was not corrected for in this iteration.

grids-----

be_loc----- Raster (ArcInfo grid) showing the bedrock elevation calculated from located CWI points only. Bedrock elevation was calculated by subtracting depth-to-bedrock values from surface elevation. Grid cell size is 250 meters. Minimum interval class should not be less than 50 feet.

be_loc_unloc----- Raster (ArcInfo grid) showing the bedrock elevation calculated from located CWI points and the unlocated CWI point file. Grid cell size is 250 meters. Minimum interval class should not be less than 50 feet. Bedrock elevation was calculated by subtracting depth-to-bedrock values from elevation. Elevation of unlocated points was obtained by extracting elevations of point location from TRS values where they intersected a 30 meter DEM grid for Minnesota. These elevations are not as reliable as those from the located CWI points.

dt_loc----- Raster (ArcInfo grid) showing the depth to bedrock calculated from located CWI points only. Grid cell size is 250 meters. Minimum interval class should not be less than 50 feet.

dt_loc_unloc----- Raster (ArcInfo grid) showing the depth to bedrock calculated from located CWI points and the unlocated point file. Grid cell size is 250 meters. Minimum interval class should not be less than 50 feet.

Layerfiles: folder containing ArcMap lyr files to color the grids at fixed intervals to match the PDFs.

bdrkelevation_all.lyr-----to use with the bedrock elevation grid created from the located and unlocated CWI data.

bdrkelrvation_located.lyr-----to use with the bedrock elevation grid created from only the located CWI data.

depthtobdrk_all.lyr----- to use with the depth to bedrock grid created from the located and unlocated CWI data.

depthobdrk_located.lyr----- to use with the depth to bedrock grid created from only the located CWI data.