

DIGITAL MAPPING TECHNIQUES 2015

The following was presented at DMT'15
(May 17-20, 2015 - Utah Geological Survey,
Salt Lake City, UT)

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2015)

<http://ngmdb.usgs.gov/info/dmt/>



UNIVERSITY
OF MINNESOTA



ACCESSING MINNESOTA'S GEOLOGICAL DATA USING ARCGIS ON-LINE

Jacqueline D. Hamilton

Minnesota Geological Survey – University of Minnesota

AGENDA

- ❑ Minnesota Geological Survey (MGS) – What do we really do.
- ❑ What is GIS and who is ESRI?
- ❑ How does the MGS use this technology?
- ❑ Story Map (Map Journal)- geological on-line data
- ❑ What GIS tools you can use to access MGS data.
 - ❑ Search or Browse – University Digital Conservancy
 - ❑ Find MGS On-line services with the Web App for ArcGIS
 - ❑ Find All MGS publications using the Find By Location Web App for ArcGIS
- ❑ What Can 4th Graders do?
- ❑ K12 GIS tools

MGS WEB PAGE HOSTS BOTH WEB APPS AND STORY MAPS

Minnesota Geological Survey

Home
About Us/Contact
Minnesota Geology
Classroom Materials
Data and Publications
Search or Browse
In-Print (Mapsales)
Online Services
Find By Location
County Well Index
County Geologic Atlas
MGS/USGS - State Map Program

umnm.maps.arcgis.com/apps/webappv

MGS - Find By Location

Mesabi Iron Range - Past vs. Present

Minnesota Mesabi Iron Range - Alterations to the physical and cultural geography of the Mesabi Iron Range, northern Minnesota

1 2

Minnesota's Mesabi Iron Range - 100 years of mining.

This story map demonstrates the aerial extent and amount of elevation change to the land surface as a result of mining activity on the Mesabi Iron Range between 1899 and 1999.

To find the publications and GIS data for this site click on the following links, [M-118](#) and [M-157](#)

These grids take some time to load so please be patient.

Legend

m118_m157_differe	Mesabi_Iron_Range
converted_graphics2	converted_graphics2
All lines	—
City street	1899 mines
Road	mineLocations_1899
Current NHDWaterbody	mines_from_1899maps
MineFeaturesCurrent	1899 mine dumps
Pit limit	minedumps_from_1899

Esri World Geocoding Region

Missouri

ONTANA

WYOMING

200mi

Original Line
Fusion Mine (1899-1999)
Duluth Mine (1899-1999)
Shovel Mine (1899-1999)
Cannon Mine (1899-1999)

Wadena Mine (1899-1999)

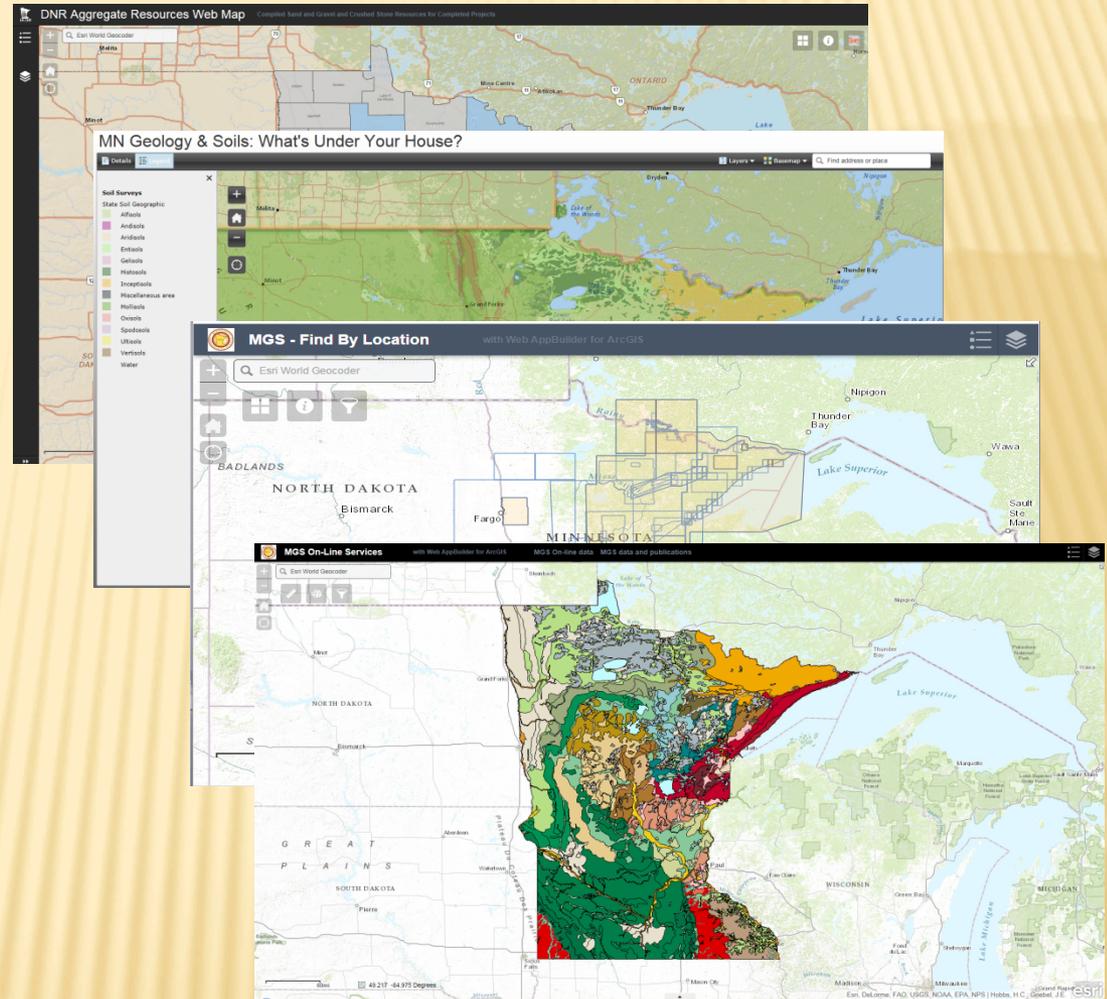
Witama Mine (1899-1999)

Ontario Base Map, Province of Ontario, Esri, HERE, DeLorme, Intermap, USGS, NGA, USDA, EPA, NPS

esri

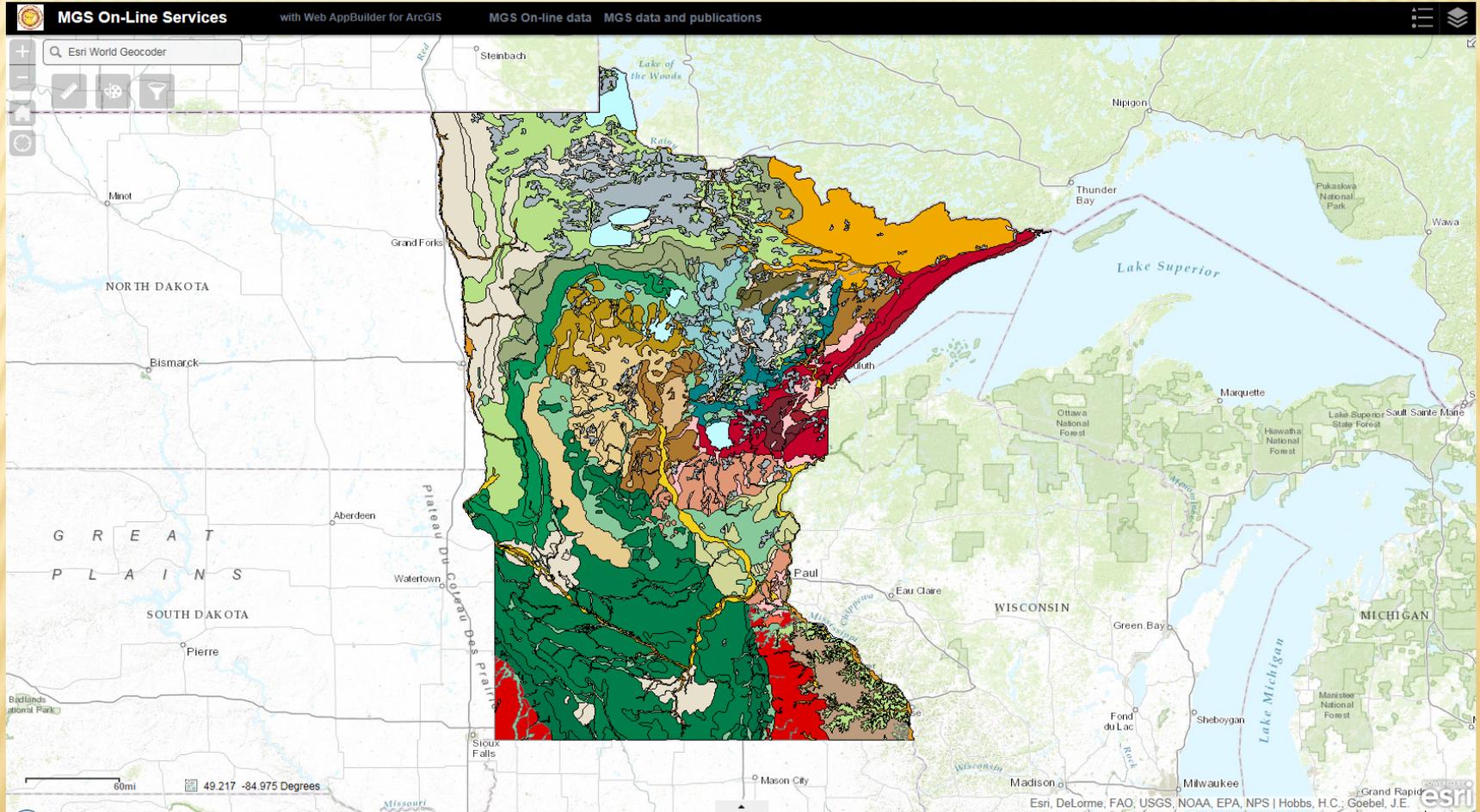
ESRI's Web AppBuilder for ArcGIS allows you to customize your web map.

- Easy configuration
- Import and export templates
- Build widgets & themes



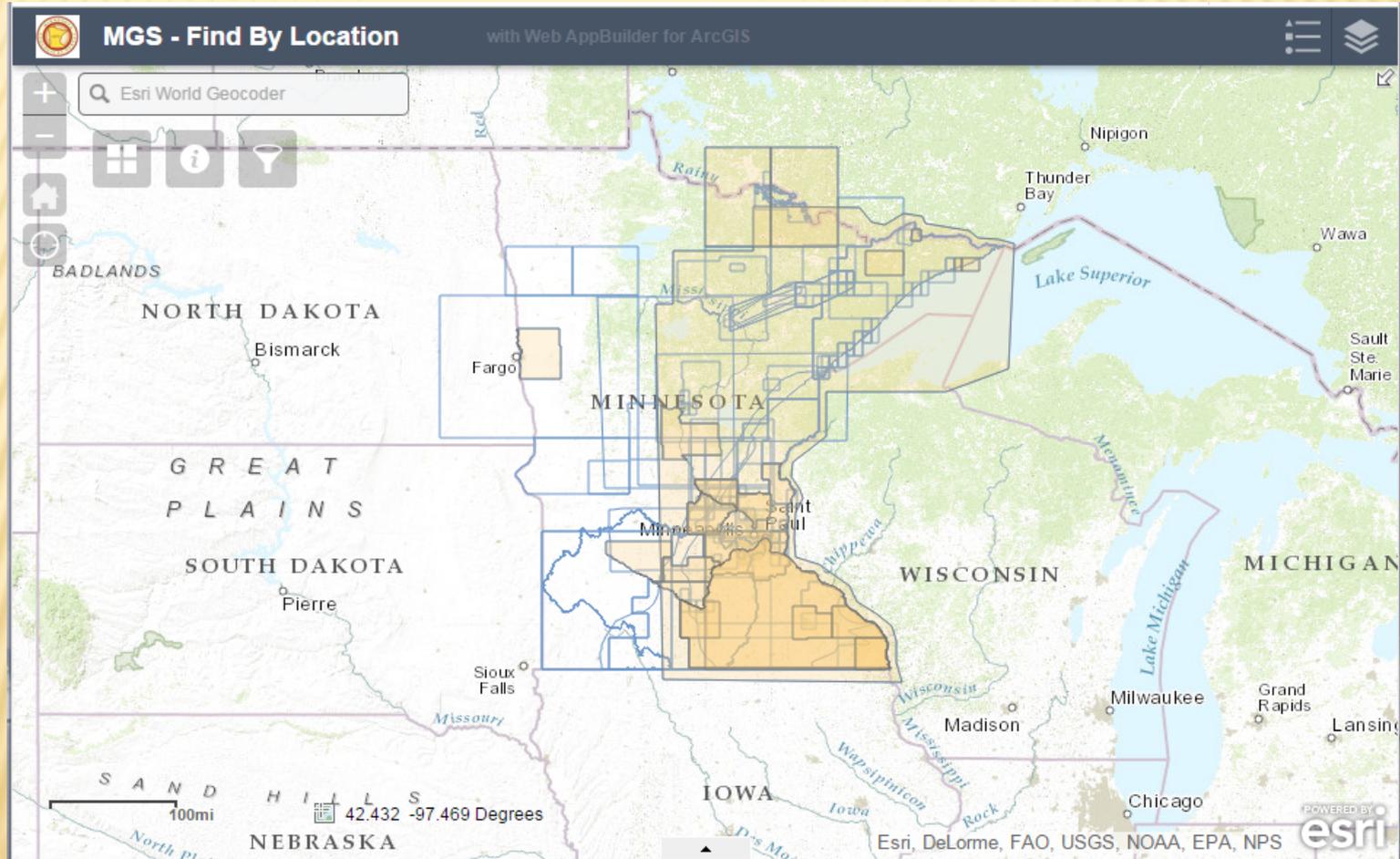
ARCGIS WEB APPBUILDER

MGS ON-LINE SERVICES



[MGS On-Line Services link](#)

FIND BY LOCATION



WEB APP BUILDER TOOLS

Legend

Regional 2011-2020



State 2001-2020



Layer List

- Regional 1941-1950
- Regional 1951-1960
- Regional 1961-1970
- Regional 1971-1980
- Regional 1981-1990
- Regional 1991-2000
- Regional 2001-2010
- Regional 2011-2020
- State 1861-1880
- State 1881-1900
- State 1901-1920
- State 1921-1940
- State 1941-1960
- State 1961-1980
- State 1981-2000
- State 2001-2020

Query

[← QUERIES](#) Options [APPLY](#)

Use spatial filter to limit features

- Only features touching the current map extent
- Only features touching the user-defined area













[Clear](#)

Add result as operational layer
With this option checked results will be kept on the map

[Clear Results](#)

Options Zoom to Clear Selection Refresh

Regional 2011-2020

State 2001-2020

descriptor	author(s)	document name	project name	publication date	scale if map	link to archive	document type
chandler, v, ofr11-3	Chandler, V.W. and Lively, R.S.	Enhanced Geophysical Model for Extent and Thickness of Deep Sedimentary Rocks	Open-File Report 11-3	2,011	0	http://purl.umn.edu	geophysics; bedrock geology
jirsa, m, m-191	Jirsa, M.A.	Bedrock Geology of the Western Gunflint Trail Area,	M-191	2,011	24,000	http://purl.umn.edu	bedrock geology

ESRI'S MAP JOURNAL TELLS A STORY

Map Journal Builder SETTINGS No pending change Application is shared publicly **SAVE**

A story map

Accessing Minnesota's Geological Data using ArcGIS On line

How do we start working with geologic data in the classroom? You can start by looking at some rocks and minerals and identifying their properties. You could then go on a field trip or two. This would be wonderful if you have a budget. However, there is a lot more to geology than just looking at rocks, (don't tell a geologist this). With today's technology you can bring more data into your classroom without setting a foot outside. Maps are a key to understanding the big picture. Using ArcGIS On-line makes learning geology easy and fun while staying warm and dry.

M-119 Geologic map of the Duluth Complex and related rocks, northeastern Minnesota

LEGEND

Quaternary Geology
Quaternary Geology S1
1982

- co, Colluvium
- dag, Ground Moraine
- das, Stagnation Moraine
- dbe, End Moraine
- dbg, Ground Moraine
- dbt, Shale-Bearing Loess
- dcg, Ground Moraine
- ddl, Lake-Modified Till
- dce, End Moraine
- deg, Ground

OVERVIEW MAP

UNITED STATES

ADD SECTION ORGANIZE

Esri, DeLorme, FAO, USGS, NOAA, EPA, NPS | Hobbs, H.C.; Goebel, J.E.

[MGS Map Journal link](#)

MINNESOTA'S ON-LINE GEOLOGIC DATA SERVICES

A story map



Accessing Minnesota's Geological Data using ArcGIS On line

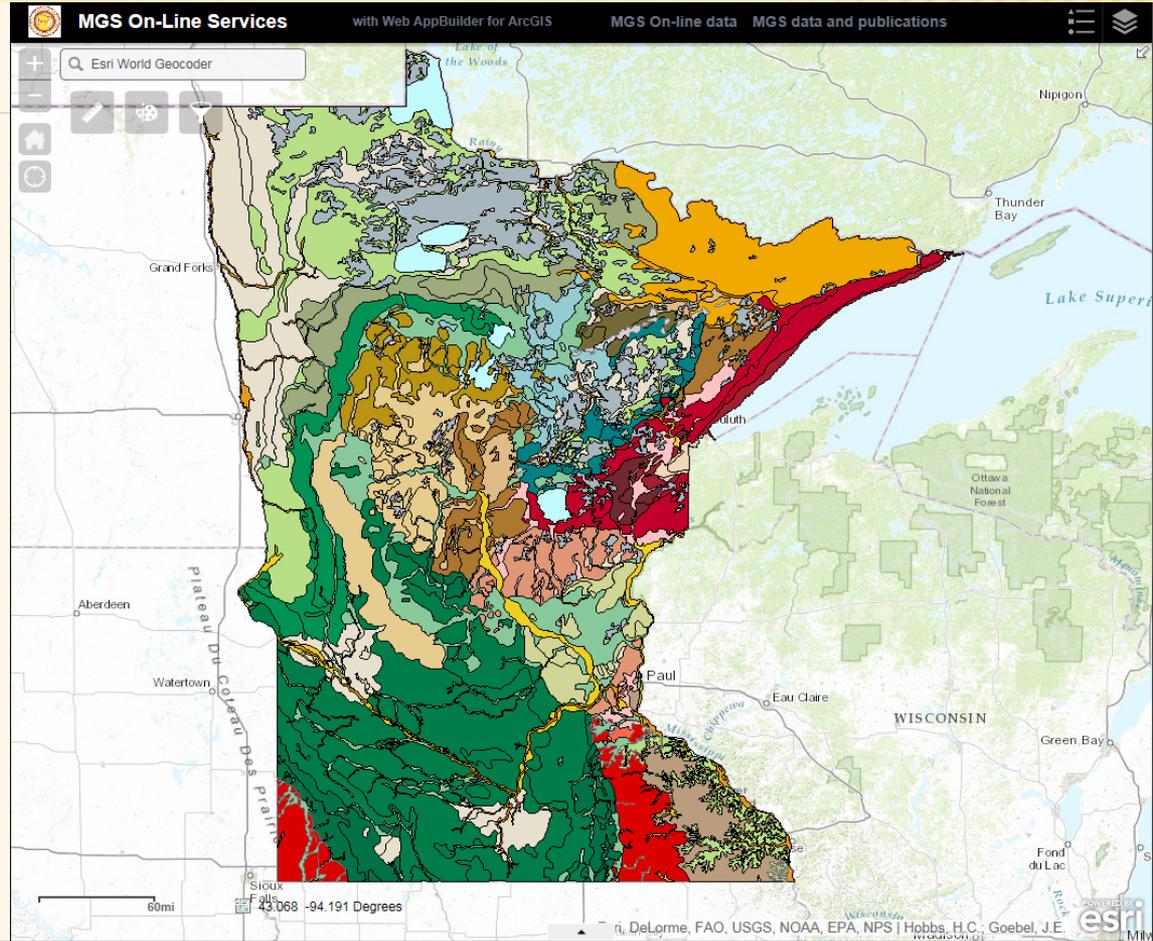
Minnesota's On-Line Geologic Data Service

The MGS host's a few on-line services that anyone can view. The data layers can be accessed by clicking the layer icon in the upper right corner of the map. There is also a legend icon in the upper right corner. The layers that can be found are:

- Quaternary Geology (shown)
- County Atlas Service
- Surficial Geology Mosaic
- Bedrock Geology Mosaic
- Rock Properties
- Bedrock Topography and Glacial Drift Thickness
- Gravity Data
- Extent of Paleozoic and Mesozoic Rocks
- Bedrock Geology

All of this data is free and available for download from our MGS On-Line data link at the top of the page.

Aggregate Resource Mapping Web



MGS – FIND BY LOCATION

A story map  

Accessing Minnesota's Geological Data using ArcGIS On line

Minnesota Geological Data and Publications



Minnesota Geological Survey

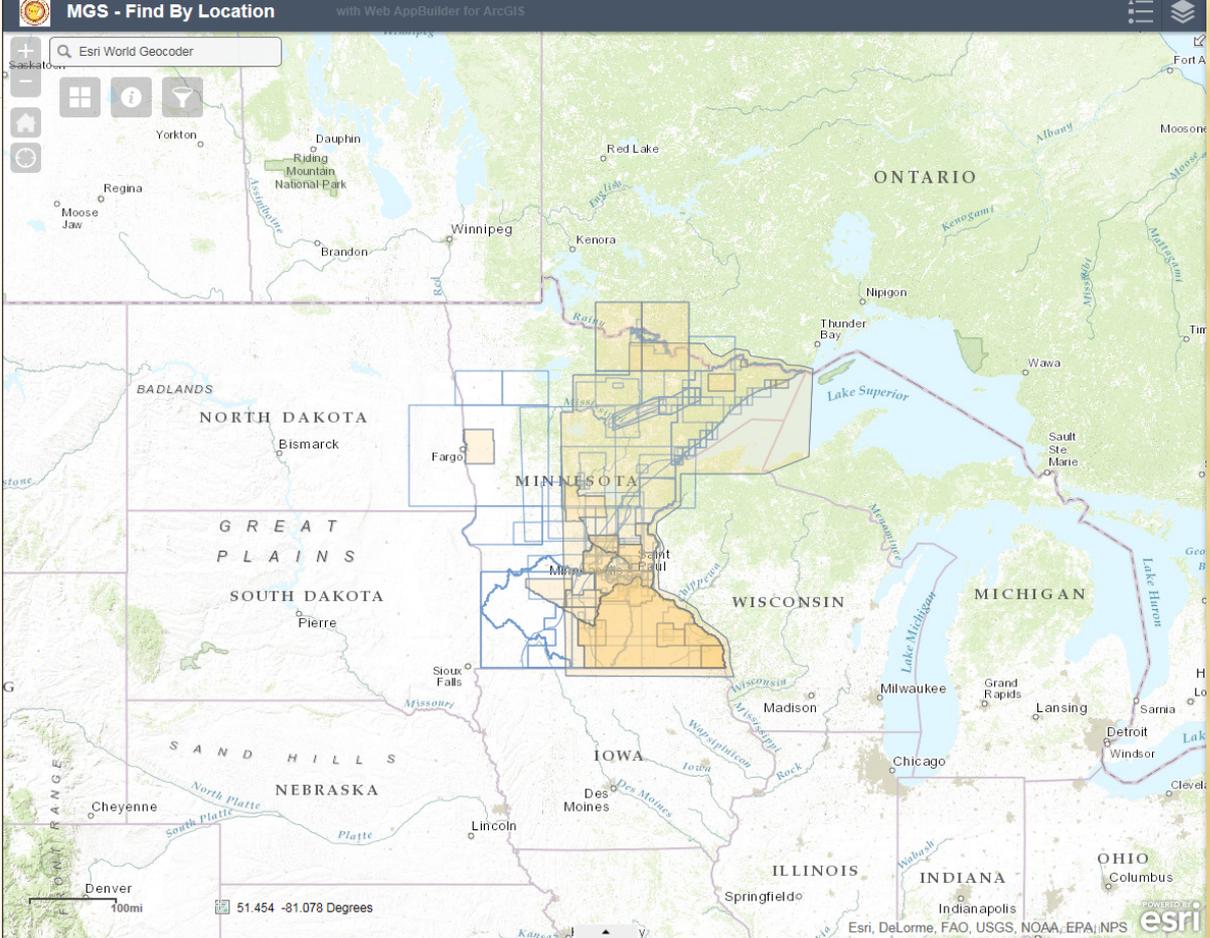
All of Minnesota's Geological Survey's Publications, as early as 1884, are accessible through this visual story map. Minnesota Geological Survey has a number of links that you can access. You may also visit our [web page](#) or [facebook page](#) and find links to the data as well.

Minnesota's On-Line Geologic Data Service

The MGS host's a few on-line services that

MGS - Find By Location

with Web AppBuilder for ArcGIS



Esri, DeLorme, FAO, USGS, NOAA, EPA, NPS

[Find By Location Link](#)

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

A story map



Accessing Minnesota's Geological Data using ArcGIS On Line

Aggregate Resource Mapping Web Map Services

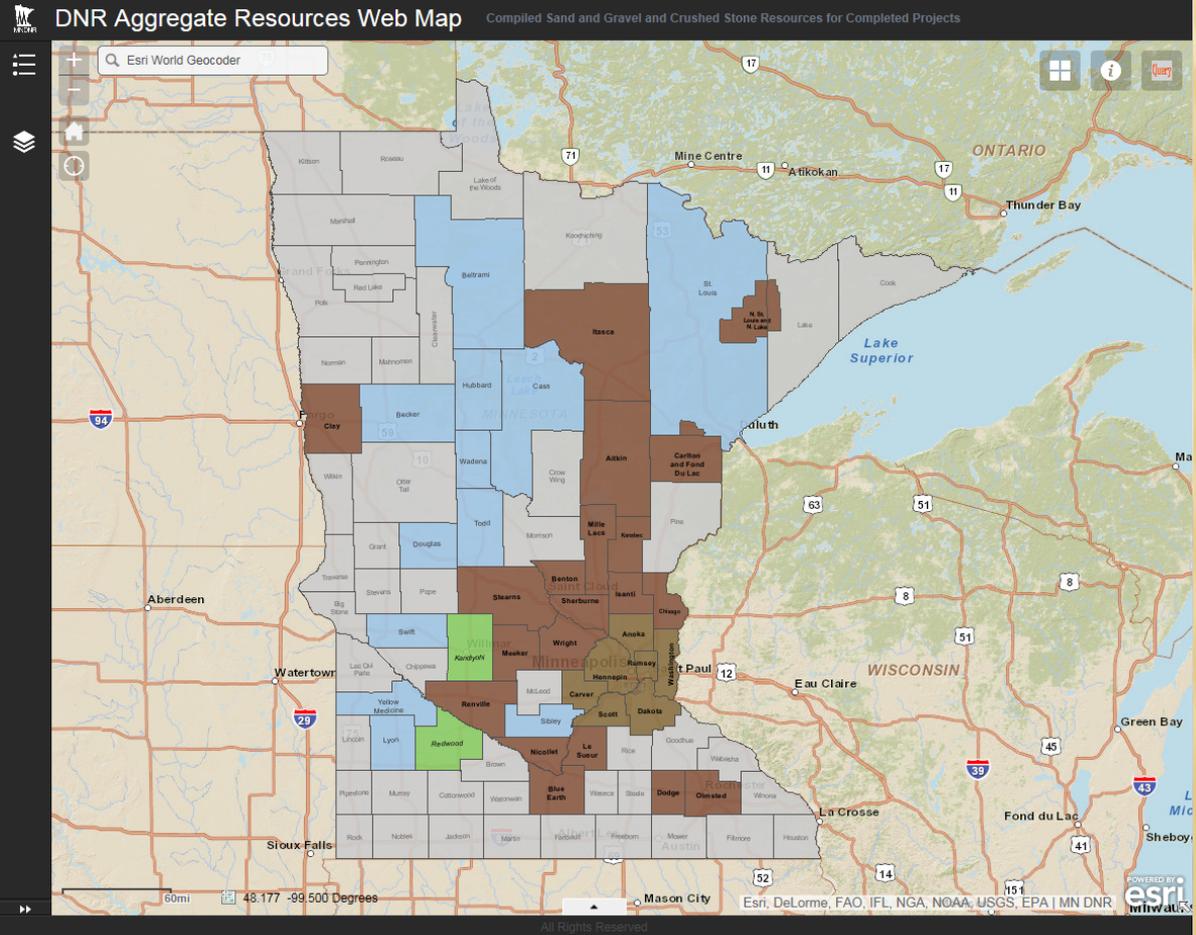
This [web map](#) application is based on a compilation of GIS aggregate resources (sand and gravel, crushed stone) data spanning **twenty-seven county projects** completed over a number of years (1987-present). Twenty of the projects have been completed by the DNR's Aggregate Resource Mapping Program (ARMP) and seven were completed by the Minnesota Geological Survey's (MGS) for the Aggregate Endowment of the 7-County Metropolitan Area (1999). The attribute data available varies as a result of the varied years of completion and changes in databases structure and verbiage over time. The past project GIS data has been loaded into the current file geodatabase used by the Aggregate Resource Mapping Program. Therefore the data from the most recent completed counties (Aitkin, Stearns, Kanabec, Olmsted) have the most complete attribute table, while the earlier mapped counties (Sherburne, Wright, Isanti) have limited attribute data. This web map application features 5 distinct GIS map services:

- Sand and Gravel Resource Potential
- Crushed Stone Resource Potential
- Identified Resources: Gravel Pits, Quarries, and Prospects
- Geologic Field Observations and Test Holes
- Status Map of Completed, In-Progress, and Requested Projects

What's under your house

[Minnesota geologic & soil maps](#)

Click on the drop down Layers tab to select the type of information you wish to view. You can also type in your address to see the geology near & below you.



DNR – MN GEOLOGY & SOILS

A story map



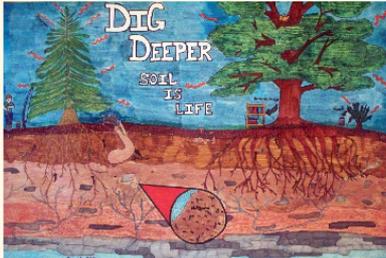
Accessing Minnesota's Geological Data using ArcGIS On line

What's under your house

Minnesota geologic & soil maps

Click on the drop down Layers tab to select the type of information you wish to view. You can also type in your address to see the geology near & below you.

Data sources from the Minnesota Geological Survey (MGS), Department of Natural Resources (DNR), and Natural Resources Conservation Service (NRCS). Hosted by the DNR.



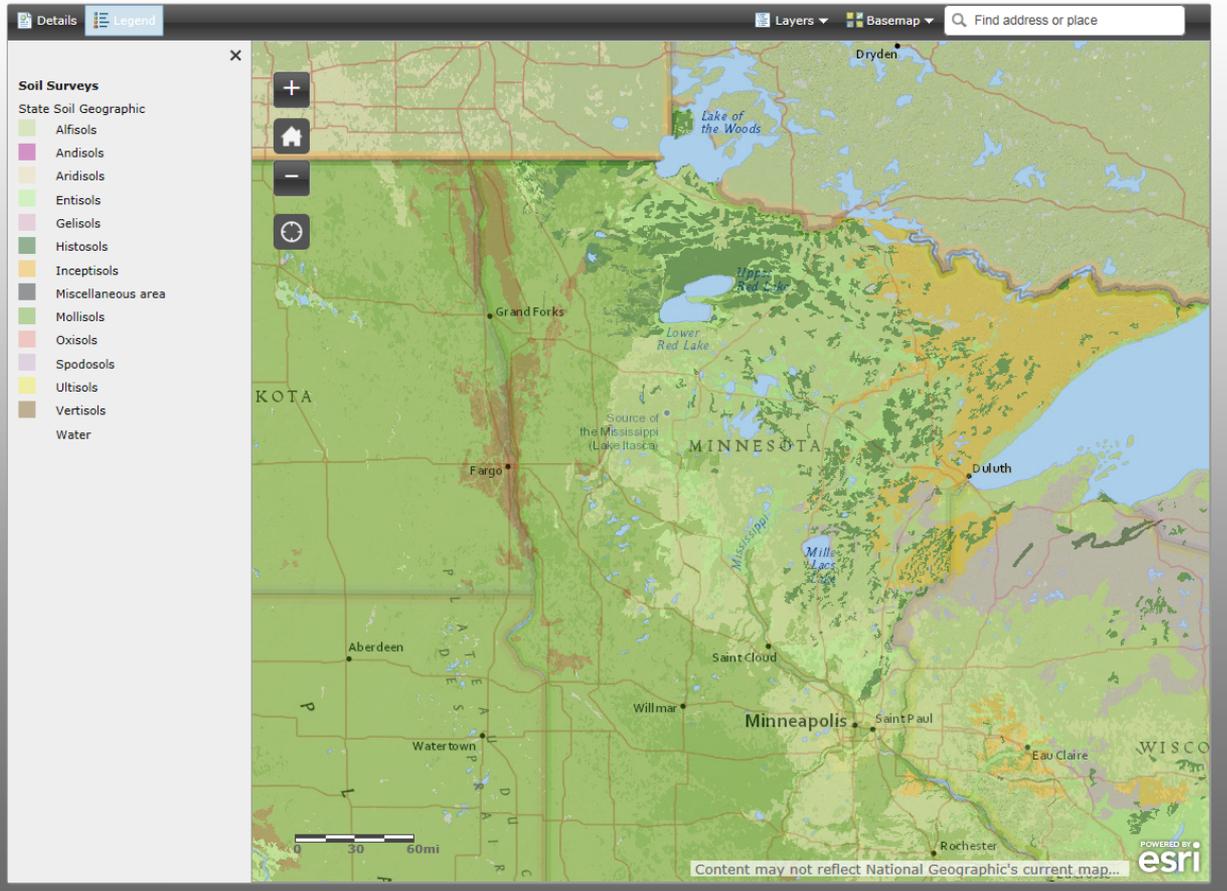
Kathryn Ricke, 6th Grade, John Boise Middle School, Benton County, Missouri.
Winner of the 2014 Soil & Water Conservation poster contest.

Minnesota's Drill Core Library

Minnesota's Drill Core Library

This web map application displays the geographic distribution of drill core

MN Geology & Soils: What's Under Your House?



DNR – MINNESOTA'S DRILL CORE LIBRARY

A story map    

Accessing Minnesota's Geological Data using ArcGIS On line

Minnesota's Drill Core Library

Minnesota's Drill Core Library.
This web map application displays the geographic distribution of drill core samples from DNR's Drill Core Library in Hibbing, Minnesota along with geologic maps and all state minerals leasing. This application is hosted by the MN Department of Natural Resources (DNR) with data sourced from the Minnesota Geological Survey (MGS), DNR, and the University of Minnesota-Duluth.

Elevation profiles

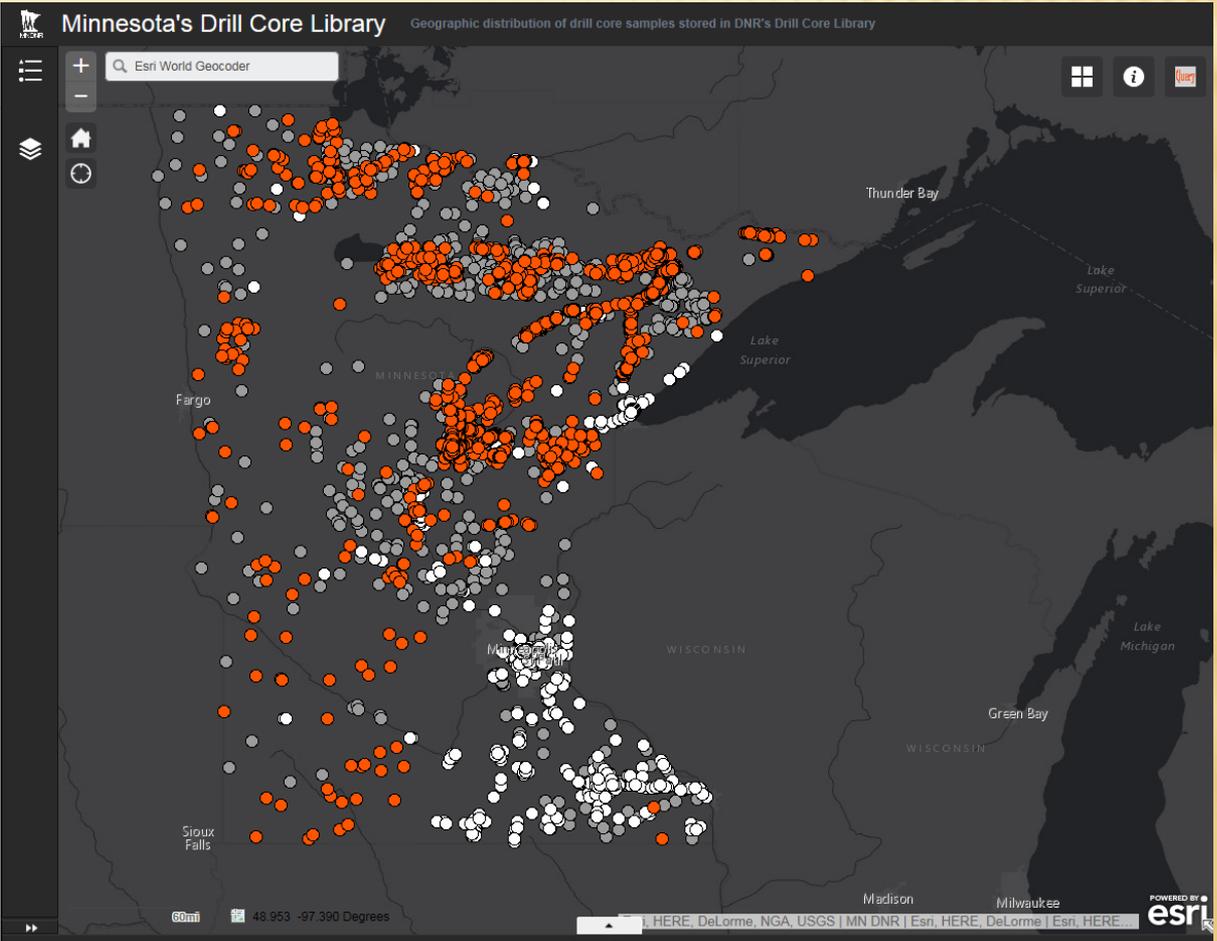
A web page map for creating elevation profiles.



Topographic profiles, or elevation profiles, is a cross-section view along a line that is drawn on a topographic map. ESRI, USGS, National Geographic and many others pulled together this terrain profiler tool to aid students, researchers and anyone who is interested in understanding topographic maps. Geologists use terrain analysis to analyze numerous geologic problems.

Minnesota's Drill Core Library

Geographic distribution of drill core samples stored in DNR's Drill Core Library



The screenshot shows a web map application titled "Minnesota's Drill Core Library" with the subtitle "Geographic distribution of drill core samples stored in DNR's Drill Core Library". The map displays a dark background with numerous orange and grey circular markers representing drill core samples across the state of Minnesota. Key geographical features are labeled, including "Thunder Bay", "Lake Superior", "Fargo", "Sioux Falls", "Madison", "Milwaukee", "Green Bay", and "Lake Michigan". The map interface includes a search bar with "Esri World Geocoder", navigation controls (zoom in/out, home, layers), and a legend. The bottom of the map shows a scale bar (0 to 60 miles) and coordinates (48.953 -97.390 Degrees). The map is powered by Esri, with logos for HERE, DeLorme, NGA, USGS, and MN DNR.

TERRAIN PROFILE TOOL

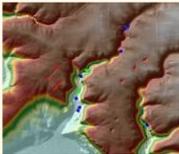
A story map



Accessing Minnesota's Geological Data using ArcGIS On line

Elevation profiles

A web page map for creating elevation profiles.



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Lake Superior - Born of Fire and Ice

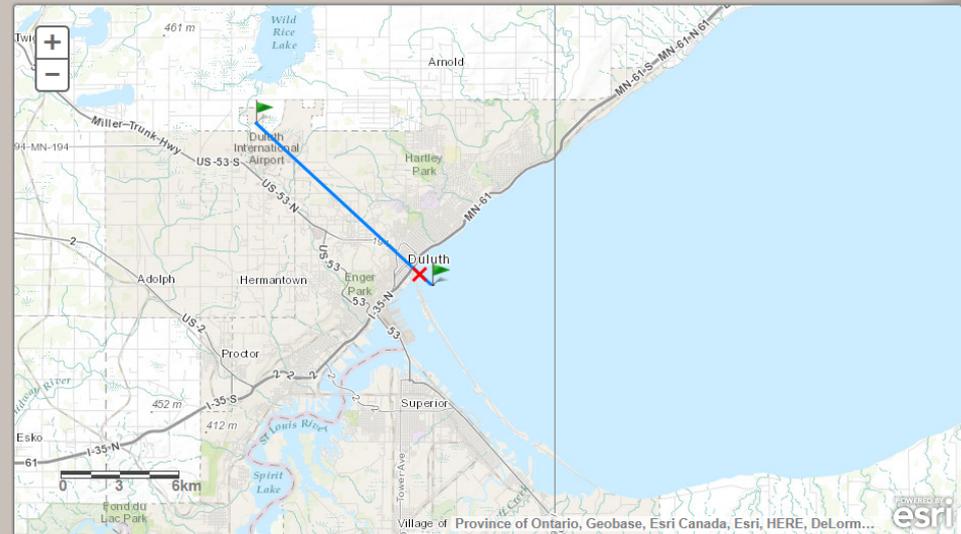


Terrain Profile - <http://esriurl.com/elevation>

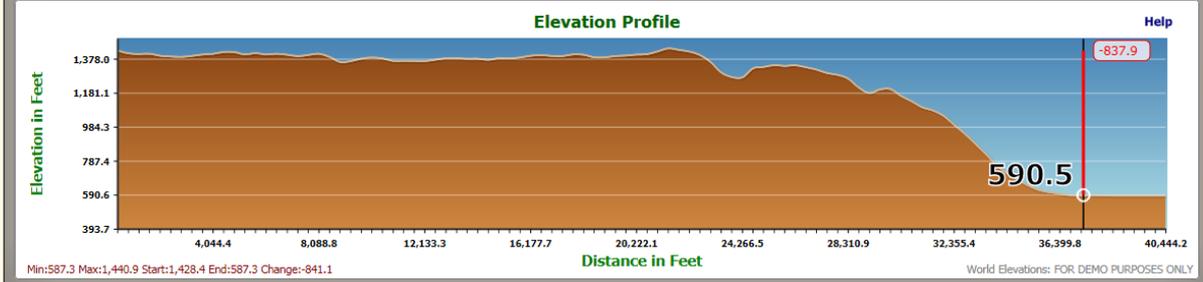
A map for creating elevation profiles at scales from global to local. Use Measure/ruler tool to plot a path.

Measure ▾

This map lets you create an elevation or terrain profile, from global to neighborhood scale. Use the **Measure (ruler)** tool to plot a path (click-click-click; clickclick to end) and see it in the profile window. Hover the mouse along the profile to see corresponding locations in the map.



graticule



TETTEGOUCHE STATE PARK GEOLOGY

A story map    

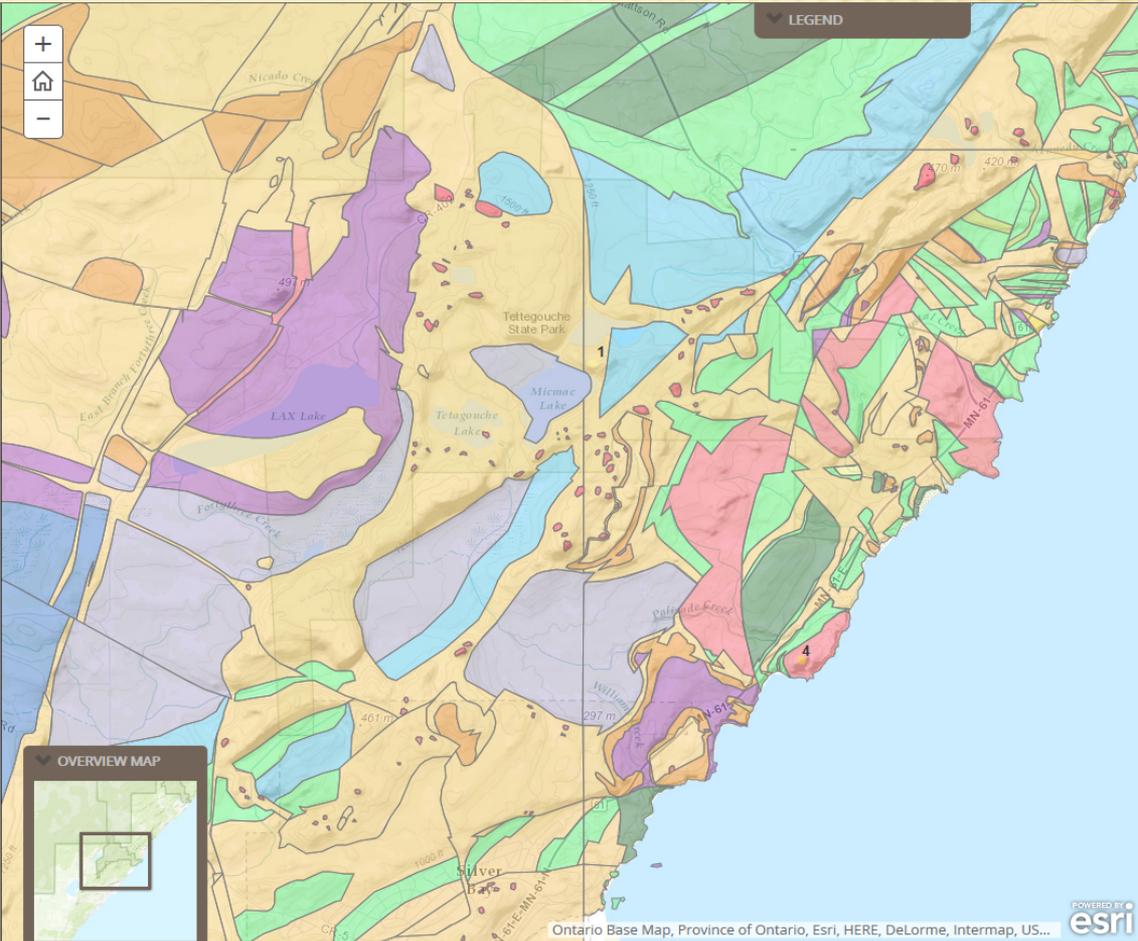
Accessing Minnesota's Geological Data using ArcGIS On line

Lake Superior - Born of Fire and Ice



From this vantage point, the exceptionally rugged land surface of this part of the North Shore is apparent. This high relief is due to the large concentration of intrusive igneous rock and the contrasting erodability of this rock and the two main types of volcanic rock - basalt and rhyolite. Although the igneous activity that produced the rocks occurred about 1,100 million years ago during the formation of the Midcontinent Rift, sculpting of the present-day landscape was largely accomplished over the past 2 million years by glacial erosion. In a glacial environment, erosion is largely accomplished by abrasive action of sediment-laden

ice and by the prying action of freezing and thawing of



Ontario Base Map, Province of Ontario, Esri, HERE, DeLorme, Intermap, US... 

[Born of Fire and Ice data link](#)

MINNESOTA'S BEDROCK GEOLOGY MAP

A story map    

Accessing Minnesota's Geological Data using ArcGIS On line

Bedrock Geology of Minnesota



This map is a new construct that incorporates existing geologic maps where prior mappers had adequate ground control, and new interpretations based on drill hole, geophysical, and unpublished data where they did not. The interpretation differs significantly from previous maps to reflect new data and accommodate scale. It portrays our current geologic understanding of the temporal and geographic distribution of units within major Precambrian terranes and of the Phanerozoic strata. The western part of the mapped Precambrian terrane is inferred largely from geophysical maps, anchored locally by drilling. In many places, contacts are drawn between units of the same or similar apparent rock type (and same unit label); these are recognized as geometrically distinct, though geophysically or lithologically similar. Digital files corresponding to this map allow removal of Cretaceous, Paleozoic, and some parts of Mesoproterozoic strata to reveal an interpretation of the underlying Precambrian bedrock.

 ADD SECTION  ORGANIZE

MGS Map S-21: Bedrock Geology of Minnesota

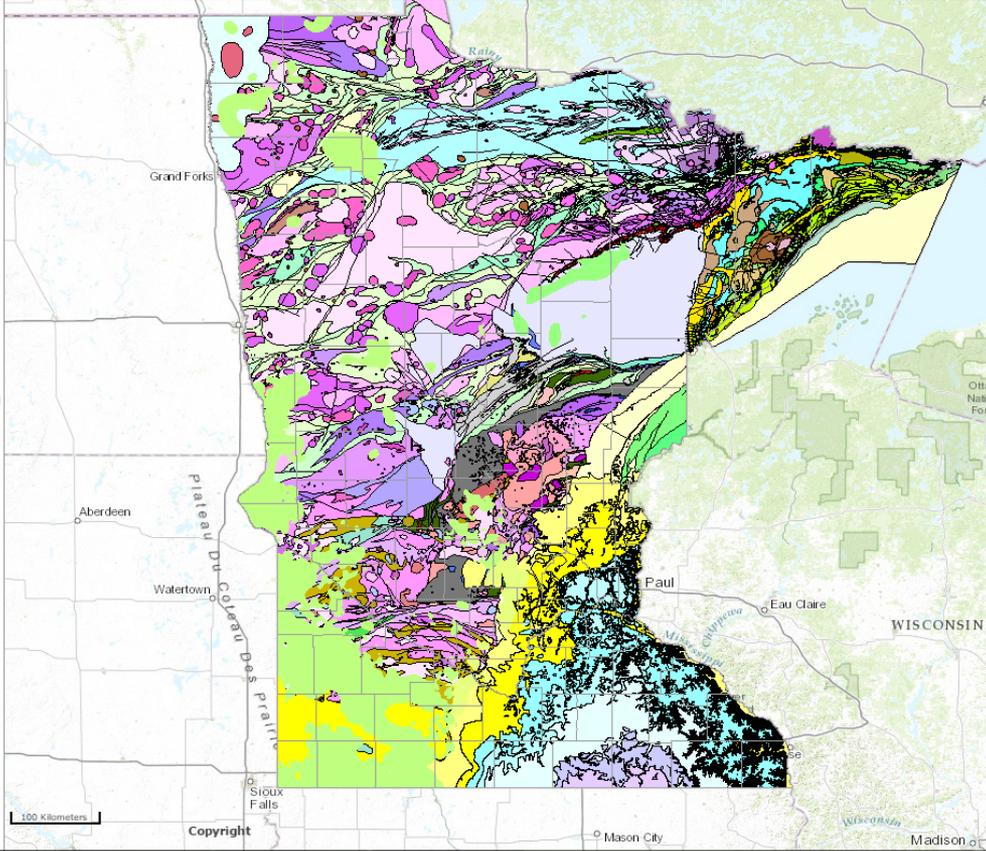
MGS | MGS Digital Publications | Help

1:4,622,324

Results

Map Contents

- S-21 Minnesota Bedrock Geology
 - County boundaries
 - Cretaceous bedrock
 - Jurassic bedrock
 - Paleozoic faults
 - Paleozoic bedrock
 - Kwnwn sed rocks under LkSup
 - Kwnwn vol rocks under LkSup
 - Precambrian dikes
 - Precambrian form lines
 - Precambrian contacts_faults
 - Precambrian bedrock
- World_Topo_Map
 - Citations



Copyright

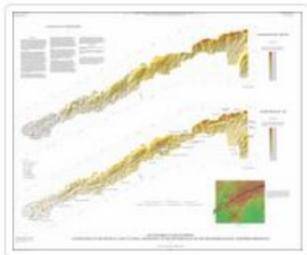
100 YEARS OF MINING

A story map



Accessing Minnesota's Geological Data using ArcGIS On line

One Hundred Years of Mining



Lively, R.S.; Morey, G.B.; Bauer, E.J. (Minnesota Geological Survey, 2002)

One Hundred Years of Mining

In time. Taking field survey data that was collected from the USGS back in the 1800's and converting the data into electronic form gave way to a glimpse of how the landscape has changed over time. This app takes time to load so please be patient.

The full publication and data for this project can be found in the University of Minnesota Digital Conservancy, [M-118](#) and [M-157](#).

Mesabi Iron Range - Past vs. Present

Mesabi Story Map



Minnesota Mesabi Iron Range - Alterations to the physical and cultural geography of the Mesabi Iron Range, northern Minnesota

Minnesota's Mesabi Iron Range - 100 years of mining.

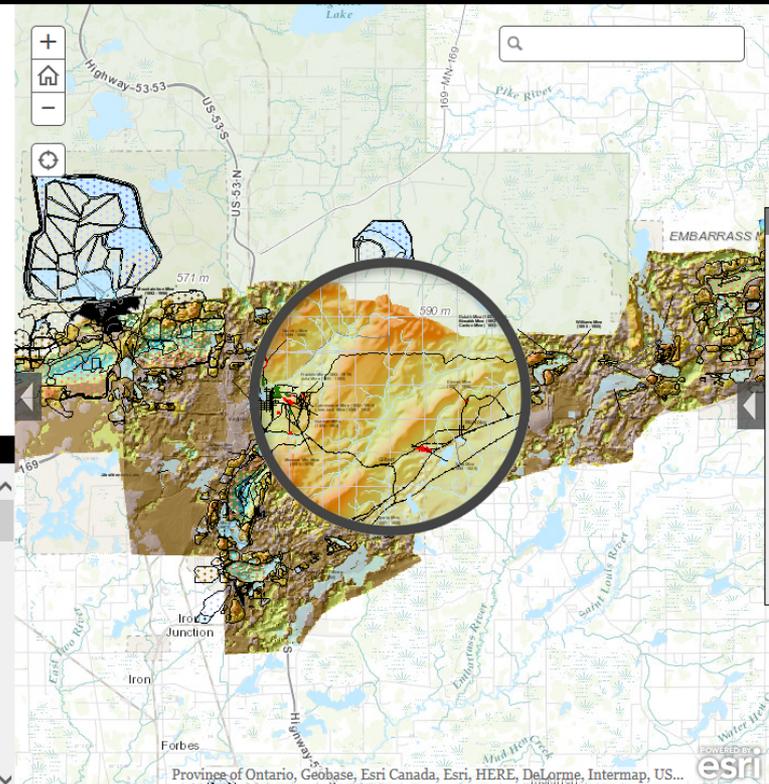
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m118_m157_differe	Mesabi_Iron_Range
converted_graphics2	converted_graphics2
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City street	1899 mines
Road	mineLocations_1899
Current NHDWaterbody	mines_from_1899maps
MineFeaturesCurrent	1899 mine dumps
Pit limit	minedumps_from_1899



SONORA ELEMENTARY SCHOOL – ESRI USER CONFERENCE – 2014

A story map    

Accessing Minnesota's Geological Data using ArcGIS On line

Sonora Elementary in Springdale, Arkansas

Charlie Fitzpatrick and Jack Dangermond introduce the amazing work by students as Sonora Elementary in Springdale, Arkansas. Here they introduce three projects that the elementary school worked on through out the year using ESRI products.



Teacher Josh Worthy and 4th grade students, Rikki Vaughan and Kylie Miller speak at the ESRI International User Conference

<http://video.esri.com/watch/3665/connecting-gis-with-education>

GIS is US K12 Education
In 2013, President Barack Obama

SonoraESRI User Conference (Sonora GIS Day Presentation) 



0:00 / 15:42  

US K12 GIS

A story map    

Accessing Minnesota's Geological Data using ArcGIS On line

Elementary school worked on throughout the year using ESRI products.



Teacher Josh Worthy and 4th grade students, Rikki Vaughan and Kylie Miller speak at the ESRI International User Conference

<http://video.esri.com/watch/3665/connecting-gis-with->

GIS is US K12 Education

GIS is US K12 Education

In 2013, President Barack Obama launched ConnectED, challenging businesses to help get all US schools into digital learning with more devices, more connectivity, more digital content, and more training for teachers.

US K12 GIS

GIS for K12 Education    

- 1
- 2
- 3
- 4
- 5
- 6
- 7

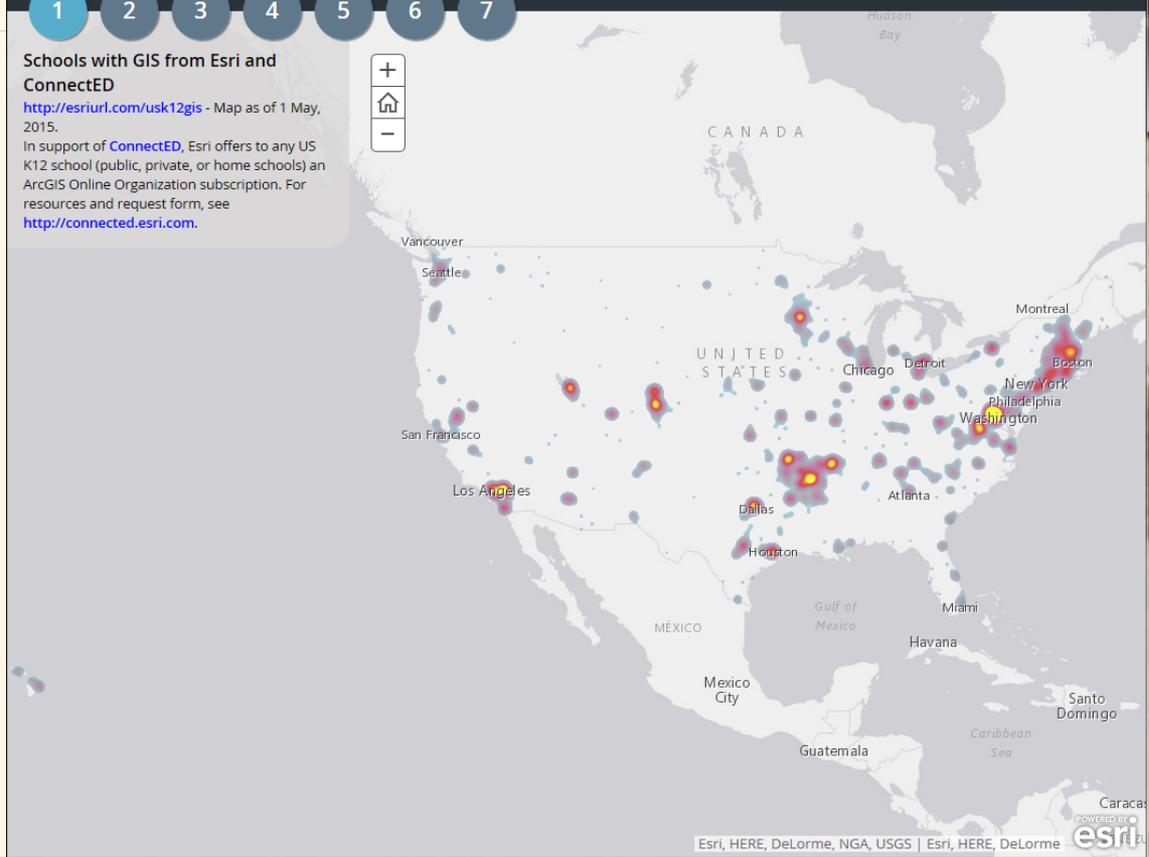
Schools with GIS from Esri and ConnectED

<http://esriurl.com/usk12gis> - Map as of 1 May, 2015.

In support of **ConnectED**, Esri offers to any US K12 school (public, private, or home schools) an ArcGIS Online Organization subscription. For resources and request form, see <http://connected.esri.com>.







The map displays the United States with various cities labeled, including Vancouver, Seattle, San Francisco, Los Angeles, Dallas, Houston, Chicago, Detroit, Atlanta, Miami, Havana, Mexico City, Guatemala, Santo Domingo, and Caraca. Red and yellow heatmaps indicate the density of schools with GIS from Esri and ConnectED. Major clusters are visible in the Northeast (Boston, New York, Philadelphia, Washington) and the Midwest (Chicago, Detroit). Smaller clusters are scattered across the West Coast and South.

Esri, HERE, DeLorme, NGA, USGS | Esri, HERE, DeLorme 

THANK YOU

✘ Questions?

- ✘ Jacqueline Hamilton
- ✘ Minnesota Geological Survey
- ✘ stub0035@umn.edu

