

Explore Minnesota: DIAMONDS

Minnesota has:

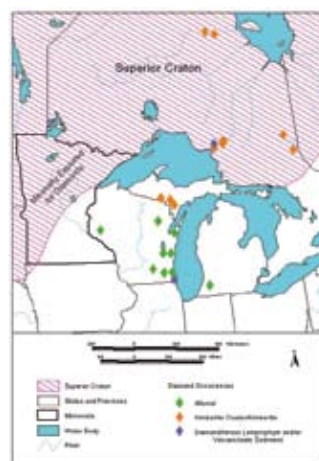
- an Archean-aged Superior Craton root that underlies two thirds of Minnesota, and diamondiferous kimberlites that have been found elsewhere within the Superior Craton in Ontario and Michigan.
- major crustal structures that cross-cut Minnesota's cratonic root, e.g., Vermilion Fault Zone, Great Lakes Tectonic Zone, Quetico Fault, etc., which are excellent kimberlite exploration areas.
- Kenora-Kabetogama and Keweenaw dike swarms that intersect these and other structures and could have provided pathways for kimberlite emplacement, e.g., similar to the kimberlites found in the Kyle Lake and Attawapiskat kimberlite clusters in northern Ontario.
- an Archean terrain with calc-alkaline lamprophyres that is time-equivalent with the Michipicoten greenstone belt in Ontario that has diamondiferous calc-alkaline lamprophyres associated with diamondiferous heterolithic breccias.

Minnesota also has:

- been a mining state for more than 110 years.
- reasonable mining taxation and economic incentives, as well as an established permitting process.
- excellent regional and local bedrock and glacial mapping.
- an excellent aeromagnetic and gravity database covering the entire state.
- drill core and associated records for more than 5,100 drill holes.
- an online database of mineral exploration records.
- regional and statewide glaciofluvial soil and stream sediment surveys.



Archean cratons in North America.



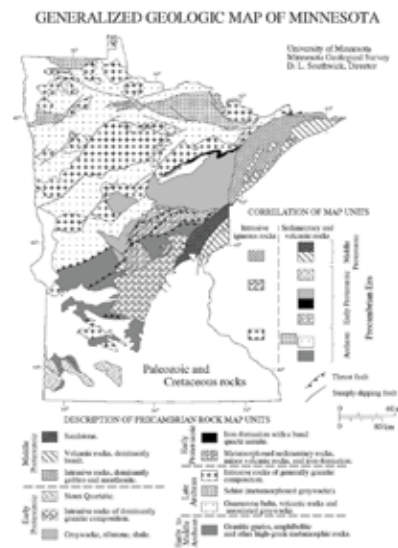
Location map of diamond occurrences in relation to the Superior Craton.

Minnesota is *underexplored* for diamonds. There has been limited exploration for diamonds by Exmin, a subsidiary of Sibeka (Belgium), that identified garnets, ilmenite, chrome spinel, and chrome diopside. Yet, Minnesota is underlain by the Archean-aged Superior Craton (after Kirkley et al., 1991, *Gems and Gemology*, with permission) that contains diamondiferous kimberlites and diamondiferous



Bedrock geological map of Minnesota.

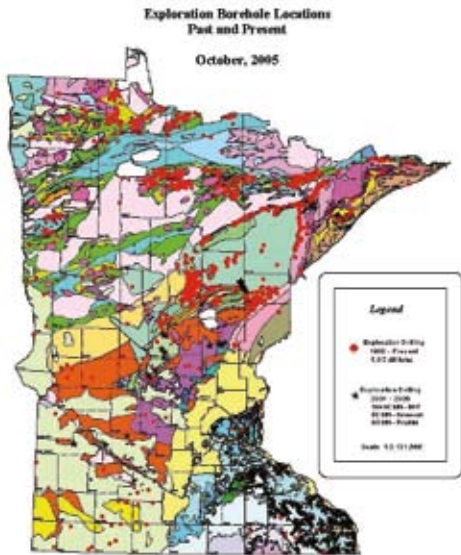
Quaternary geologic map of Minnesota.



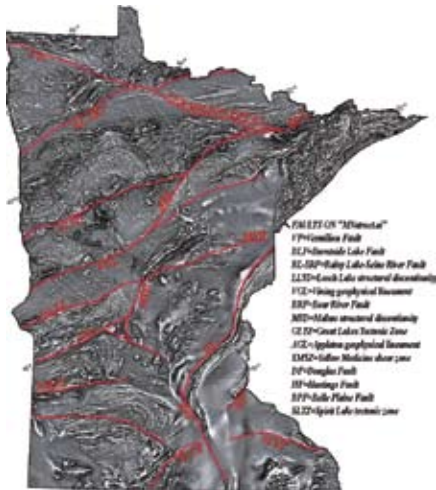
Generalized geologic map of Minnesota.

lamprophyres and related heterolithic breccias/volcaniclastic sediments. While Minnesota has variable thicknesses of glacial overburden, it has an excellent gravity and aeromagnetic survey of the entire state. The aeromagnetic survey also defines several continental-scale, e.g., Vermilion Fault System, Quetico Fault, Great Lakes Tectonic Zone, Rainy Lake-Seine River

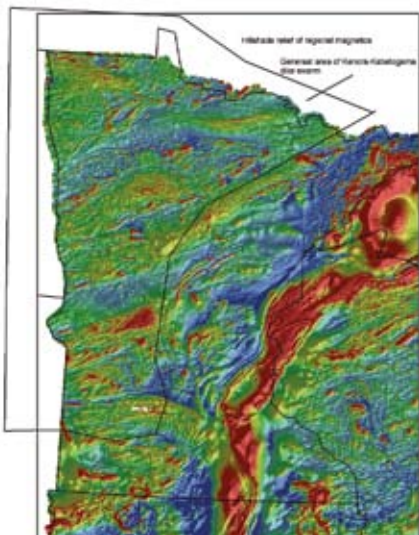
Fault. The Paleoproterozoic Kenora-Kabetogama (2.1 Ga) and Mesoproterozoic Keweenaw dike swarms and their intersections with the continental scale fault/shear zones offer possible structural sites for emplacement of kimberlites. With the formation of the Mesoproterozoic (1.1 Ga) Mid-



Exploration borehole locations in Minnesota.



Major structural zones in Minnesota superimposed on the aeromagnetic map of Minnesota.

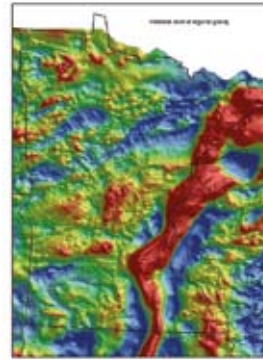


Aeromagnetic colored shaded relief map of Minnesota.

Continent Rift System, several 1.1 Ga kimberlites have been identified in the Kyle Lake and Wawa areas in Ontario on the flanks of the rift.

Minnesota has a drill core depository of more than 5,100 drill holes from across the state along with related drill hole and other data. Most of the drilling records and related data can be found online (see next page for contact information). Along with other historical data, hardcopies of maps/reports are also available.

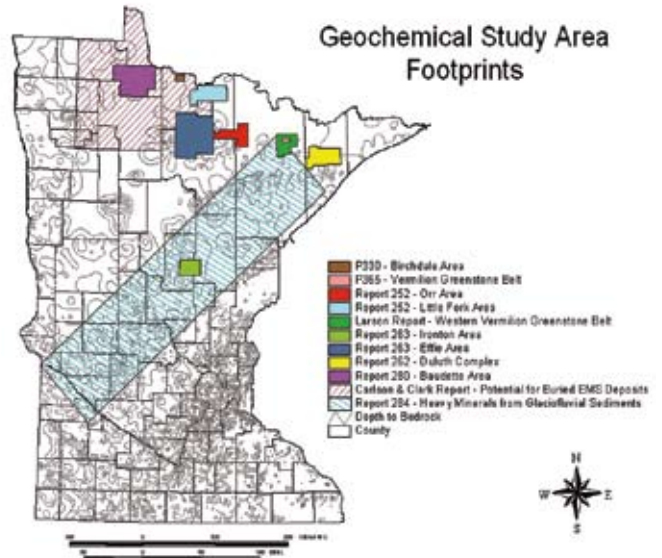
Excellent statewide and regional geophysical data exists for gravity (>57,000 stations) and aeromagnetics. Aeromagnetic data were collected at 300 ft. (~100m) and flown at quarter-mile spacings (~400m). All data are digital, and the aeromagnetic data are currently being reprocessed



Color shaded relief gravity map showing the Mid-Continent Rift System gravity high in Minnesota.



Distribution of 57,905 gravity stations in Minnesota.



Location of various geochemical soil/till sampling campaigns in Minnesota.

using the latest technology. Both the gravity and aeromagnetic data well illustrate the Mesoproterozoic Mid-Continent Rift System (red N-S linear feature left). The aeromagnetic data clearly illustrate the regional structures and the Kenora-Kabetogama dike swarm, which intersect or are cut by the major structural zones, setting up possible structural sites for kimberlite emplacement similar to kimberlites emplaced in the Attawapiskat Region.

Statewide and regional geochemical surveys have been conducted for a variety of purposes, and most of these surveys were analyzed for a host of different elements. In some cases, samples still exist for resampling.

Minnesota is *underexplored* for kimberlites. Minnesota offers a wide variety of exploration targets in an area underlain by an Archean-aged, deep continental root that is cross-cut

by crustal-scale structural zones that make excellent sites for kimberlite emplacement. Finally, Minnesota has a long mining history.

For more information, contact:

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dan.jordan@state.mn.us

The "Dig" Program provides up to 20 percent of the cost of an exploration drill hole. For more information, visit:
<http://ironrangeresources.org/natural?page=123>

Minnesota Drill Core Library/Online Minerals Database

Minnesota Department of Natural Resources
Division of Lands and Minerals
1525 Third Avenue East
Hibbing, MN 55746
http://www.dnr.state.mn.us/lands_minerals/index.htm
<http://minarchive.dnr.state.mn.us/>
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St. Paul, MN 55155-4045
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