



Pinewood Community School ROCKS!



<p>Gneiss <i>Metamorphic</i> 3.6 billion years ago This is a metamorphic rock characterized by bands of light and dark minerals. Formed deep within the Earth's crust, gneiss from the Minnesota River Valley is the oldest known rock in North America.</p>	<p>Granite & Granodiorite <i>Igneous</i> 2.6 billion Granite is molten rock with large quantities of silica that cools underground. Granodiorite may have foliation (lines) from the way magma cooled from slight metamorphism.</p>	<p>Biwabik Iron Formation <i>Sedimentary</i> 1.9 billion years old- Iron-bearing sedimentary rock formed when iron-rich sediments were deposited on the sea floor. Minnesota has multiple iron formations, the Biwabik is found on the Mesabi Iron Range.</p>	<p>Quartzite <i>Metamorphic</i> 1.7 billion years old - Formed by the metamorphism of sandstone, recrystallizing grains of quartz sand into interlocking crystals. Found in Southwest and Northeast Minnesota.</p>	<p>Gabbro <i>Igneous</i> Intrusive (coarse-grained) igneous rock formed from the slow cooling of magma rich in iron and magnesium below ground. The Duluth Complex formed during 1.1-billion-year-old rifting of North America and contains copper and nickel in Minnesota.</p>
<p>Basalt <i>Igneous</i> Extrusive (fine-grained) igneous rock formed from the rapid cooling of lava rich in iron and magnesium (mafic). Erupted 1.1 billion years ago during rifting of North America. It can be found along the North Shore near Duluth and in Taylors Falls Minnesota.</p>	<p>Granite <i>Igneous</i> Intrusive (coarse-grained) igneous rock formed from the slow cooling of magma rich in silica (felsic) below ground. Primary minerals are quartz, alkali feldspar, and plagioclase.</p>	<p>Limestone <i>Sedimentary</i> 500 million years old - Some sedimentary rocks in Minnesota are cut into special sizes and used for building stone and decorative uses, called dimension stone. Some people call this <i>Kasota Stone</i> referring to the location it comes from.</p>	<p>Dolostone <i>Sedimentary</i> 500 million years old - Extending into southeastern Minnesota, fossils in this limestone indicate the biological and physical environment of a part of the Ordovician time period in Minnesota.</p>	<p>Sand and Gravel <i>Glacial Sediment</i> Sand & Gravel is deposited by moving water in streams or by currents in large lakes. Most of the sand and gravel found in Minnesota was deposited by the meltwater of large continental glaciers. Sand and gravel overlies bedrock in most areas throughout Minnesota.</p>
<p>Quartz <i>Mineral</i> Quartz is the most abundant mineral on earth, resistant to physical and chemical weathering. It occurs in a wide variety of igneous, metamorphic, and sedimentary rocks in Minnesota, including many found here.</p>	<p>Magnetite & Hematite <i>Mineral</i> Magnetic, iron bearing, and found on Minnesota's iron ranges, where it formed within marine sedimentary deposits. It formed the great concentrations of "natural ore" mined on the iron range from the turn of the century until the 1960s. It is part of the "iron formations" which were formed along the shores of an ancient sea.</p>	<p>Mica <i>Mineral</i> A general term to a group of minerals such as dark biotite and light muscovite. Micas form in distinct layers that are soft and flexible. Mica can be found in all rock types, including schist, a metamorphic rock.</p>	<p>Pyrite <i>Mineral</i> Iron and sulfur-rich mineral with a distinctive cubic shape. It is a minor but common rock-forming mineral. Pyrite can be found in all rock types, including limestone. It is sometimes called <i>fools gold</i>.</p>	<p>Stromatolite <i>Fossil</i> Fossils from blue-green algae are among the oldest fossils on earth. Stromatolites form mound-like structures by growing through sediment. They are found in the Biwabik Iron Formation (1.9 billion years old) and limestone of SE Minnesota (500 million years old), including the dolostone here of the Prairie du Chien Formation.</p>



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Gneiss

Metamorphic



Granite & Granodiorite

Igneous



Biwabik Iron Formation

Sedimentary



Quartzite

Metamorphic



Gabbro

Igneous



Basalt

Igneous



Granite

Igneous



Limestone

Sedimentary



Dolostone

Sedimentary



Sand and Gravel

Glacial Sediment



Quartz

White Mineral



Magnetite & Hematite

Black Magnetic Mineral



Mica

Flaky-Shiny Mineral



Pyrite

"Fools Gold" Metallic Mineral



Stromatolite

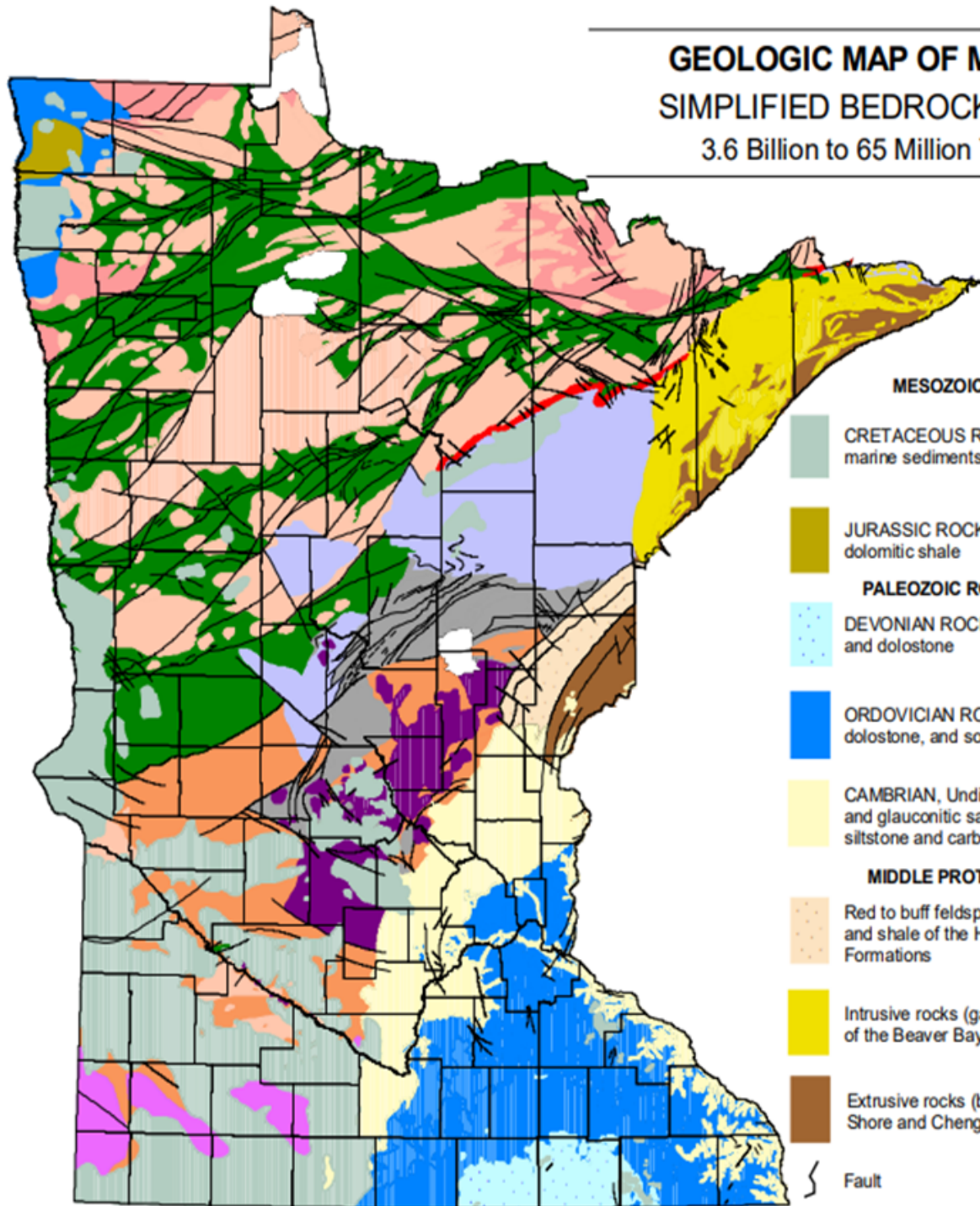
Bubble-like Layered Fossil



GEOLOGIC MAP OF MINNESOTA

SIMPLIFIED BEDROCK GEOLOGY

3.6 Billion to 65 Million Years Ago



DESCRIPTION OF MAP UNITS

(mya = million years ago, bya = billion years ago)

MESOZOIC ROCKS (225 to 65 mya)

CRETACEOUS ROCKS, Undivided - Dominantly marine sediments; shale and sandstone

JURASSIC ROCKS, Undivided - Reddish brown dolomitic shale

PALEOZOIC ROCKS (600 to 225 mya)

DEVONIAN ROCKS, Undivided - Limestone and dolostone

ORDOVICIAN ROCKS, Undivided - Limestone, dolostone, and some sandstone and shale

CAMBRIAN, Undivided - Quartzose and glauconitic sandstone; lesser amounts of siltstone and carbonate

MIDDLE PROTEROZOIC (1.6 to 0.9 bya)

Red to buff feldspathic to quartzose sandstone and shale of the Hinckley and Fond du Lac Formations

Intrusive rocks (gabbro, granite and anorthosite) of the Beaver Bay and Duluth Complexes

Extrusive rocks (basalt and rhyolite) of the North Shore and Chengwatana Volcanic Groups

Fault

EARLY PROTEROZOIC ROCKS (2.5 to 1.6 bya)

Sedimentary and Metamorphic rocks of the Sioux Quartzite formation

Intrusive rocks (granite and granodiorite) of the Penokean orogeny

Meta- and sedimentary rocks (argillite, slate, shale, graywacke) of the Virginia, Thomson and Rove Formations

Iron-Formation (hematite and taconite) of the Biwabik and Gunflint Iron Formations

Metasedimentary rocks (slate, quartzite and metagraywacke) intercalated with volcanic rocks and iron formations

LATE ARCHEAN ROCKS (3 to 2.5 bya)

Intrusive rocks (granite, granodiorite and tonalite) of the Algoman Orogeny

Meta-igneous rocks (granitic gneiss, schist and granite-rich migmatite) grading into granitic rock

Meta-igneous extrusive rocks of mafic to felsic composition (greenstones/amphibolites) and metasedimentary rocks

MIDDLE ARCHEAN ROCKS (3.6 to 3 bya)

Quartzofeldspathic gneiss, amphibolite, and other high-grade metamorphic rocks

Pinewood ROCKS!

Each rock tells a story

Use your senses to figure out the story of each rock: what colors or shapes do you **SEE**? How does the rock **FEEL** with your hands? Does the rock have a **SMELL**? Does the rock have a **SOUND** if you tap or knock on the rock? Can you **IMAGINE** if the rock is heavy or light?

Each of these clues help **GEOLOGISTS** figure out the story of a rock: how it formed, how it changed, and how it got to its current location. A **GEOLOGIST** is a person who studies the earth, also called an earth scientist. A geologist may study rocks and minerals, fossils, groundwater, oceans, or earth processes including earthquakes, volcanoes, and mountains.

How did these rocks get here?

These rocks originated from all over Minnesota. The large boulders with rounded edges, were smoothed and transported by glaciers from their original spot in the ground (bedrock.) The rocks with sharp edges were mined at quarry sites where the bedrock is an important source of crushed stone for roads, construction, landscaping; a source of dimension stone for decorative use in buildings; or a source of iron used to make steel and other key uses. Each rock was specially selected for Pinewood.

Painted Rocks

The painted rocks represent the connection to the Pinewood Community, each rock painted by a Pinewood student. The hand-sized rocks came from glaciers in this area over 10,000 years ago, and were generously donated by Martin Marietta-Apple Valley, a source of construction sand and gravel to the area.

Additional information and Resources:

Minnesota DNR: <https://www.dnr.state.mn.us/education/geology/index.html>

Minnesota Geological Survey: <https://cse.umn.edu/mgs/classroom-materials>

Minnesota Minerals Education Workshops: www.mcmre.org

Geologic information and resources compiled by Sara Welna, Pinewood family and MN Professional Geologist (Lic #48131.) Questions and further resources can be directed to Sara Welna at sarawelna@gmail.com.