

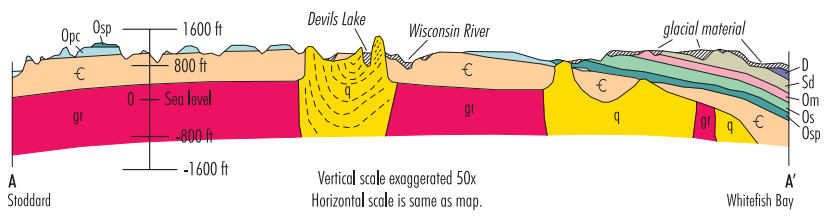
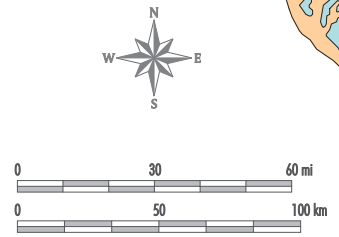
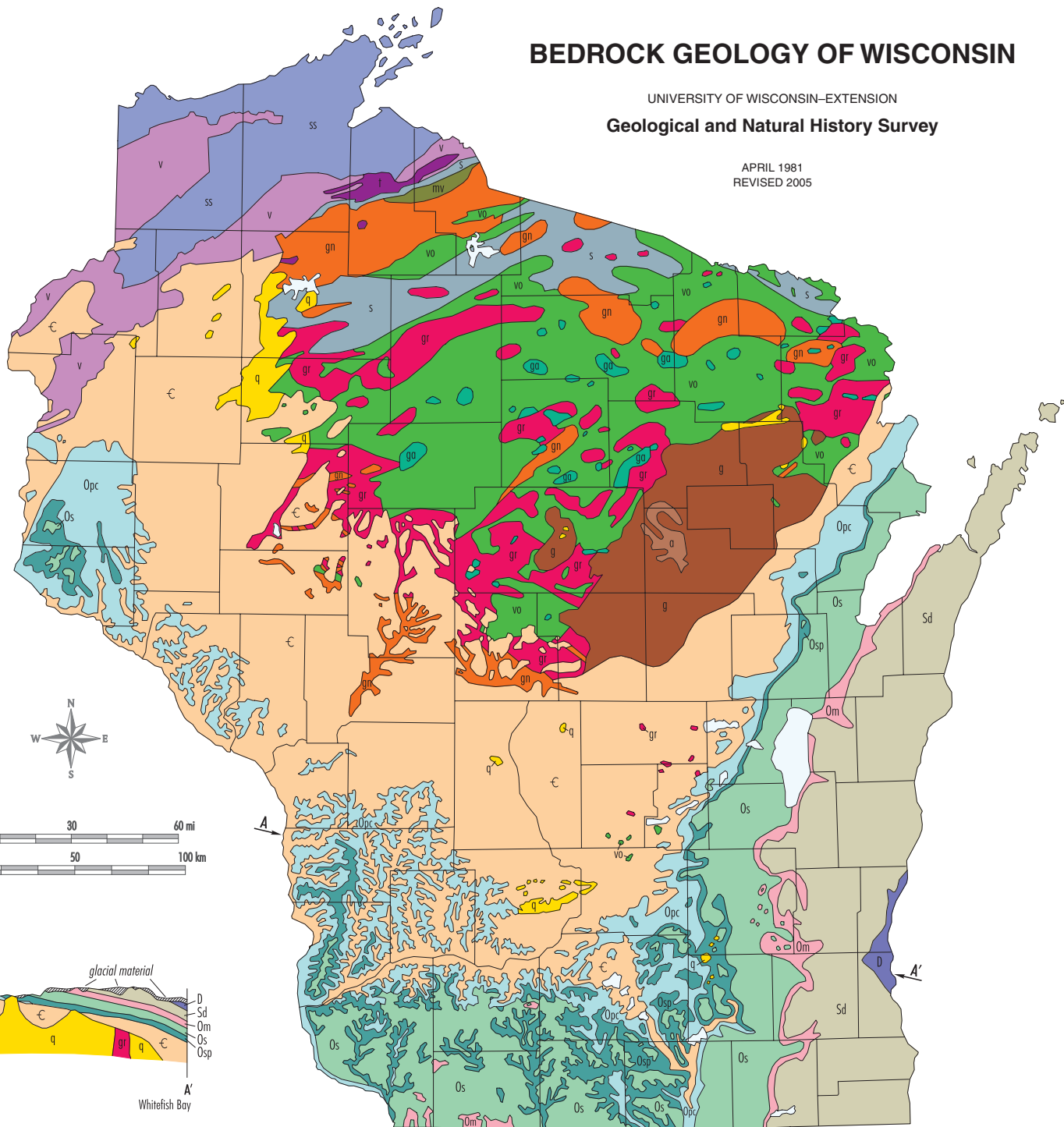
BEDROCK GEOLOGY OF WISCONSIN

UNIVERSITY OF WISCONSIN—EXTENSION
 Geological and Natural History Survey

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EXPLANATION

- DEVONIAN**
 D dolomite and shale
- SILURIAN**
 Sd dolomite
- ORDOVICIAN**
 Om Maquoketa Formation—shale and dolomite
 Os Sinnipee Group—dolomite with some limestone and shale
 Osp St. Peter Formation—sandstone with some limestone shale and conglomerate
 Opc Prairie du Chien Group—dolomite with some sandstone and shale
- CAMBRIAN**
 ε sandstone with some dolomite and shale
- MIDDLE PROTEROZOIC**
 ss Keweenaw rock—
 ss, sandstone
 v, basaltic to rhyolitic lava flows
 t, gabbroic, anorthositic and granitic rock
 Wolf River rock—
 g, rapakivi granite, granite, and syenite
 a, anorthosite and gabbro
- LOWER PROTEROZOIC**
 q quartzite
 gr granite, diorite, and gneiss
 s, metasedimentary rock, argillite, siltstone, quartzite, greywacke, and iron formation
 vo, basaltic to rhyolitic metavolcanic rock with some metasedimentary rock
 ga, meta-gabbro and hornblende diorite
- LOWER PROTEROZOIC OR UPPER ARCHEAN**
 mv, metavolcanic rock
 gn, granite, gneiss, and amphibolite



GEOLOGIC HISTORY OF WISCONSIN'S BEDROCK

INTRODUCTION

The bedrock geologic record in Wisconsin is divided into two major divisions of time: the Precambrian, older than 600 million years, and the Paleozoic, younger than 600 million years. The Precambrian rocks are at the bottom and consist predominantly of crystalline rocks. They are overlain by Paleozoic rocks which consist of relatively flat-lying, in some cases fossil-bearing, sedimentary rocks.

Precambrian rocks form the bedrock beneath the glacial deposits in northern Wisconsin and occur beneath the Paleozoic rocks in the south (see the cross section on the reverse side). Paleozoic rocks may once have covered northern Wisconsin, but if they did, they have been removed by erosion. Glacial deposits, including clay and sand and gravel, cover bedrock in the northern and eastern three-fifths of the state.

In areas covered by glacial deposits, surface outcrops are so sparse that details of the bedrock geology are obscured. In such areas the only clues to the underlying rocks are obtained from rock cuttings and cores obtained from drill holes and from geophysical surveys which disclose magnetic and gravity variations.

Precambrian Eon

The Precambrian is divided into two eras, the older Archean and the younger Proterozoic. Each is subdivided into three periods—Early, Middle, and Late.

Archean

Rocks older than 2,500 million years are termed Archean. The oldest Archean rocks are gneisses (gn), or banded rocks. These are more than 2,800 million years old and are in Wood County. Similar old ages have been determined for rocks south of Hurley, where recognizable volcanic rocks (mv) have been intruded by 2,700 million year old granite (gn). All of these rocks have been extensively deformed, and in many areas they are so highly altered that their original nature and origin are extremely difficult to interpret. Because of this difficulty, the older gneisses and some younger (Proterozoic) gneissic and crystalline rocks are combined on this geologic map.

Proterozoic

There are four principal groups of rocks in the Proterozoic. The oldest are around 1,800 to 1,900 million years old. These Early Proterozoic rocks consist of sedimentary (s) rocks including slates, greywacke and iron formation, and volcanic (vo) rocks. The sedimentary rocks dominate in the north, with volcanic rocks becoming more abundant in central Wisconsin. These layered rocks were intruded by gabbros (ga), diorities, and granites (gr) about the same time that they were being folded and deformed.

Quartz-rich Early Proterozoic sedimentary rocks (q) occur as erosional remnants, or outliers, on the older Proterozoic rocks; they were deformed about 1,700 million years ago. The Barron Quartzite in the Blue Hills of Rusk and Barron Counties, the Baraboo Quartzite in Sauk and Columbia Counties, and Rib Mountain Quartzite in Marathon County are some of the major remaining areas of once widespread blankets of sandstone.

The oldest Middle Proterozoic rocks include the granites, syenites, and anorthosites (g, a) of the Wolf River complex. This extensive body of related granitic rocks was intruded into Lower Proterozoic volcanic and sedimentary rocks around 1,500 million years ago.

The youngest Proterozoic rocks in Wisconsin are about 1,100 million years old and are called Keweenaw rocks. At the time of their formation a major rift or fracture zone split the continent from Lake Superior south through Minnesota and into southern Kansas. Keweenaw rocks can be divided into two groups: an older sequence of igneous rocks including lavas (v) and gabbros (t); and a younger sequence of sandstone (ss). These rocks occur in northwestern Wisconsin. In central Wisconsin diabase dikes were also emplaced at this time.

At the close of the Precambrian, most of Wisconsin had been eroded to a rather flat plain upon which stood hills of more resistant rocks such as the quartzites in the Baraboo bluffs.

Phanerozoic Eon

The Phanerozoic is divided into three eras. They are from the oldest to the youngest: the Paleozoic (old life), Mesozoic (middle life), and Cenozoic (most recent life). The Paleozoic is repre-

sented by a thick sequence of sandstones, shales, and dolomites (dolomite is similar to limestone); the Mesozoic, possibly by gravels; and the Cenozoic, only by glacier-related deposits.

In the Paleozoic Era the sea advanced over and retreated from the land several times. The Paleozoic Era began with the Cambrian Period (€) during which Wisconsin was submerged at least twice beneath the sea. Sediments eroded by waves along the shoreline and by rivers draining the land were deposited in the sea to form sandstone and shale. These same processes continued into the Ordovician Period (Opc, Osp, Os, Om) during which Wisconsin was submerged at least three more times. Animals and plants living in the sea deposited layers and reefs of calcium carbonate which are now dolomite. Deposits that built up in the sea when the land was submerged were partially or completely eroded during the times when the land was elevated above sea level. At the close of the Ordovician Period, and in the succeeding Silurian (Sd) and Devonian (D), Wisconsin is believed to have remained submerged. There are no rocks of the Paleozoic Era younger than Devonian in Wisconsin. Whether material was deposited and subsequently removed by erosion, or was never deposited, is open to speculation.

Absence of younger Paleozoic rocks makes interpretation of post-Devonian history in Wisconsin a matter of conjecture. If dinosaurs roamed Wisconsin, as they might well have in the Mesozoic Era some 200 million years ago, no trace of their presence remains. Available evidence from neighboring areas indicates that toward the close of the Paleozoic Era the area was gently uplifted and it has remained so to the present. The uplifted land surface has been carved by millions of years of rain, wind, running water, and glacial action. With the possible exception of some pebbles about 100 million years old, no Mesozoic age bedrock has been identified in Wisconsin.

In the last million years during a time called the Pleistocene, glaciers invaded Wisconsin from the north and modified the land surface by carving and gouging out soft bedrock, and depositing hills and ridges of sand and gravel as well as flat lake beds of sand, silt, and clay. In this manner, the glaciers smoothed the hill tops, filled the valleys, and left a deposit of debris over all except the southwestern part of the state. The numerous lakes and wetlands which dot northern Wisconsin occupy low spots in this Pleistocene land surface. Glacial deposits are not shown on the map of bedrock geology. A separate glacial deposits map is available.

Cross Section

To assist in understanding the bedrock geology of Wisconsin, a cross section has been prepared (see reverse side). A cross section represents a vertical slice of the Earth's crust showing the subsurface rock layers in much the same way as a vertical slice of cake shows the layers of cake and frosting. The Wisconsin cross section shows the subsurface geology along a line from Stoddard in Vernon County, through Devils Lake near Baraboo in Sauk County, to Whitefish Bay in Milwaukee County. The horizontal scale is the same as that of the geologic map, but the vertical scale is exaggerated so that vertical thicknesses are expanded 50 times compared to horizontal distances. The Paleozoic rocks are shown as layers, the younger units lying above the older units. They are also shown dipping to the west in the western part of the state and dipping east in the eastern part of the state, thus forming an arch. The center and oldest parts of this arch are found in the Baraboo bluffs, where the Baraboo Quartzite is exposed at the surface. As shown in the cross section by fine lines in the quartzite, the Baraboo area was folded into a U-shaped structure, or syncline, before the Paleozoic rocks were deposited. Quartzite and granite underlie the Paleozoic rocks along this section.

The gray unit shown at the top of the rock sequence in the eastern part of the cross section represents glacial materials which do not occur to the west.



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