Simplified Bedrock Geologic Map of Maine

DEPARTMENT OF CONSERVATION
Maine Geological Survey


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2002

Stratified Rocks
(Sedimentary, volcanic, and metamorphic rocks)

Ordovician - Volcanic and related sedimentary rocks in north and west. Gneiss, schist, and marble along central coast.

Silurian - Limy marine shale in north grading to lime-bearing gneiss and schist in southwest. Some volcanic rocks in central coast.

Cambrian - Volcanic and related rocks in northwest. Gabbro and related rocks in central coast.

Precambrian - Gneiss and marbles in northwest. Limestone, marble, sandstone, slate, and volcanic rocks in central coast.

Mesozoic - Small intrusions in southwest. Mostly syenite and related intrusive rocks with some associated volcanic rocks.

Carboniferous - Large granites and small gabbro intrusions in southeast.

Ordovician - Granite, gneiss, quartz, granite, and gabbro in north and west.

Cambrian - Gabbro and related rocks in northwest.

Cambrian - Gabbro and related rocks in northeast. Limestone, marl, sandstone, slate, and volcanic rocks in central coast.

Ordovician - Marine sandstone and slate in southeast grading to gneiss and schist in southwest.

Ordovician-Silurian - Marine sandstone and slate in east grading to gneiss and schist in southwest.

Cambrian-Ordovician - Mostly volcanic rocks and related sedimentary rocks in northwest. Schist, marble, and gneiss along central coast.

Precambrian(?)-Ordovician - Wide range of volcanic and associated rocks and sedimentary rocks that have been metamorphosed to gneiss and schist.

Cambrian-Ordovician - Mostly volcanic rocks and related sedimentary rocks in north and east. Schist, marble, and gneiss in central coast.

Ordovician-Silurian - Marine sandstone and slate in east grading to gneiss and schist in southwest.

Ordovician-Carboniferous - Unmetamorphosed terrigenous conglomerate and sandstone.

Ordovician-Carboniferous - Marine sandstone and slate in east grading to gneiss and schist in southwest.

Devonian - Granite, granodiorite, and gabbro throughout state.

Ordovician - Granite, quartz syenite, diorite, and gabbro in north and west.

Devonian - Granite, granodiorite, and gabbro in north and west.

Ordovician - Granite and related rocks in northwest.

Cambrian - Gabbro and related rocks in northwest.

Precambrian - Gneiss and marbles in northwest. Limestone, marble, sandstone, slate, and volcanic rocks in central coast.

Cambrian - Gabbro and related rocks in central coast.

Silurian - Limy marine shale in north grading to lime-bearing gneiss and schist in southwest. Some volcanic rocks in central coast.

Cambrian - Volcanic and related rocks in northwest. Gabbro and related rocks in central coast.

Precambrian - Gneiss and marbles in northwest. Limestone, marble, sandstone, slate, and volcanic rocks in central coast.

Cambrian - Gabbro and related rocks in northwest.


Cambrian - Volcanic and related rocks in north and west. Gneiss, schist, and marble along central coast.

Precambrian - Gneiss and marbles in northwest. Limestone, marble, sandstone, slate, and volcanic rocks in central coast.

Cambrian - Volcanic and related rocks in northwest. Gabbro and related rocks in central coast.

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A Summary of the Geologic History of Maine

Maine’s bedrock records more than half a billion years of geologic history. Over this period of time, geologic processes such as erosion and sedimentation, mountain-building, deformation (folding and faulting), metamorphism, and igneous activity produced the complex pattern of bedrock geology that we see today. The large geologic wall map of the state by Osberg and others (1985) shows hundreds of bedrock formations and igneous intrusions distinguished on the basis of age and rock type. On this simplified map, these rocks have been grouped into units of similar geologic age. The theory of plate tectonics describes the interactions of large, mobile, semi-rigid plates that comprise Earth’s crust. The movement of these plates is responsible for Maine’s complex geology. Where plates collide, mountains are built. Volcanic island arcs form where one section of oceanic crust slides beneath another. Fracture zones, mountain ranges such as the Appalachian Mountains are often composed of multiple, small plate fragments, both continental and oceanic in composition, which are distinctive and have had separate histories. While ongoing research continues to refine the nature of these exact boundaries, it is generally accepted that the geology of Maine is composed of a mosaic of such terranes (e.g. Osberg, 1978; Zen, 1983; Berry and Osberg, 1989; Robinson and others, 2001). These were once widely scattered microplates in Iapetus, an ocean which preceded the modern Atlantic Ocean. The geologic history recorded in Maine’s bedrock spans several major cycles of deposition, deformation, and igneous activity related to plate tectonic movements. The simplified chart below recounts the histories of the various terranes that were later to become Maine’s bedrock. In the chart, while the terranes have separate histories, they are shown in separate blocks. Laurentia refers to the ancient eastern margin of North America. The Iapetus terranes comprise a composite island arc, formed in Iapetus, that collided with Laurentia during the Ordovician Period. Avalon is a microplate which collided with early North America in the Devonian to form eastern North America as we know it today. Refer to the inset map of the northern Appalachians on the reverse side for the distribution of these terranes today. For a more detailed discussion of these events, see Marvinney and Thompson (2000). This chart is best read from the bottom to the top (from the oldest to the youngest events).

**Geologic Time** | **Age** | **Maine and Vicinity**
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Cenozoic Era | Present - 66 | Continued uplift and erosion of the Northern Appalachian Mountains. Stress release during uplift and erosion produces numerous fractures in the bedrock. Erosion by glacial ice shapes the landscape. Maine became ice-free about 11,000 years ago.
| | | Early Mesozoic: Pangaea breaks up. Combined Europe and Africa rift away from North America, opening the modern Atlantic Ocean. Faulting and fracturing of existing bedrock. Intrusive and volcanic activity, intrusion of basalt dikes (prominent in southwestern coastal Maine).
| | 248 - 290 | Continued uplift and erosion of the Northern Appalachian Mountains gradually bring deep rocks toward the surface. North America drifts north of the equator.
| | 290 - 354 | Intrusion of Sbego granite. Last regional metamorphism and deformation. Deposition of sandstone and related sedimentary rocks, only remnants of which remain in eastern Maine. All Earth’s crustal plates were joined as one continent, Pangaea.
| | 354 - 417 | Late Devonian: Sedimentary rocks deposited in northern and eastern Maine following the last major mountain-building event.
| | | Middle and Late Devonian: Mountain building (called the Acadian event by geologists) – Major deformation of the Earth’s crust caused by collision of the microcontinent of Avalon with early North America. Assembly of the varied terranes of eastern and coastal Maine and the Central Maine basin. Many significant faults develop during this period. Burial of sediments in southwestern Maine to depths greater than 9 miles transforms them into metamorphic rock.
| | 443 - 490 | Final development of ancestral Northern Appalachian Mountains. Rocks at depth melt, producing widespread igneous activity during and after mountain-building event. Almost all of this occurred while the eastern margin of early North America remained south of the equator.
| | 417 - 443 | Early Devonian: Youngest sediments deposited in major basins as precursor to major mountain-building event.

**EARLY NORTH AMERICA**

| | | Deposition of limestone and shale on the continental shelf of Laurentia. Laurentia was located much closer to the equator than North America is today, allowing for accumulation of large volumes of warm-water sediments. The sea bottom off the eastern coast of North America is now exposed just south of Quebec City, in western Vermont, and in eastern New York state.

**LAURENTIA**

| | | Deposition of limestone and shale on the continental shelf of Laurentia. Laurentia was located much closer to the equator than North America is today, allowing for accumulation of large volumes of warm-water sediments. The sea bottom off the eastern coast of North America is now exposed just south of Quebec City, in western Vermont, and in eastern New York state.

**IAPETUS TERRANES**

| | | Sedimentation in the Connecticut Valley basin of northwestern Maine. Deposition of large quantities of sediment in central Maine as the Avalon terrane approached, closing Iapetus. Much sediment was delivered during this period. Burial of sediments in southwestern Maine to depths greater than 9 miles transforms them into metamorphic rock.

**LAVALON**

| | | Considerable deformation in the Avalon composite terrane due to microplate collisions that formed the composite terrane. Continued deposition of sediments and increased volcanic activity. Some explosive volcanism related to crustal extension and intrusion now exposed in eastern coastal Maine. Intrusion of Silurian granite bodies in what is now central and eastern coastal Maine.

**EARLY ORDOVICIAN**

| | | Additional sediment deposition following deformation and uplift.
| | | Mountain building (called the Taconic event by geologists) – Deformation, uplift, and igneous activity related to the collision of several (?) offshore volcanic island terranes and terranes of Avalon. This was part of an Ordovician composite terrane called Avalon. Remnants of this arc are now present in the Quabbin Mountains.

**MIDDLE ORDOVICIAN**

| | | Mountain building (called the Taconic event by geologists) – Deformation, uplift, and igneous activity related to the collision of several (?) offshore volcanic island terranes and terranes of Avalon. This was part of an Ordovician composite terrane called Avalon. Remnants of this arc are now present in the Quabbin Mountains.

**LATE ORDOVICIAN**

| | | Mountain building (called the Taconic event by geologists) – Deformation, uplift, and igneous activity related to the collision of several (?) offshore volcanic island terranes and terranes of Avalon. This was part of an Ordovician composite terrane called Avalon. Remnants of this arc are now present in the Quabbin Mountains.

**CAMBRIAN**

| | | Mountain building (called the Penobscottian event by geologists) – Episode of deformation and metamorphism of rocks now found in southwestern Maine to depths greater than 9 miles attributed to microplate collision within ancestral Iapetus Ocean.

**PRECAMBRIAN**

| | | Early Ordovician: Continued deposition of sediments and volcanic activity.
| | | Mountain building: Mountain building (called the Taconic event by geologists) – Deformation, uplift, and igneous activity related to the collision of several (?) offshore volcanic island terranes and terranes of Avalon. This was part of an Ordovician composite terrane called Avalon. Remnants of this arc are now present in the Quabbin Mountains.
| | | Late Cambrian: Mountain building: Mountain building (called the Penobscottian event by geologists) – Episode of deformation and metamorphism of rocks now found in southwestern Maine to depths greater than 9 miles attributed to microplate collision within ancestral Iapetus Ocean.
| | | Early to Late Cambrian: Deposition of sediments and volcanic activity produced rocks now exposed in uplifted features in north-central and northeastern Maine.

**References**


* Age in millions of years before present. The calibration (in years) of the geologic time scale is continually under revision. The ages listed in this column are taken from Palmer and Geissman (1999) and Tucker and McKerror (1995).