Maine Geologic Facts and Localities
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Historical Bedrock Maps of Maine
Part II: The Keith (1933) Map

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**Introduction**

Since William Smith presented the [first modern geologic map](#) in 1815, of England and Wales with part of Scotland, geologic maps have become the standard way of portraying geologic information. There have been four significant maps showing Maine's bedrock geology, published in 1885, 1933, 1967, and 1985. Each map is a product of its time, reflecting the current status of knowledge and understanding of geologic principles by the author. So it is best to view each one as a progress report, representing an interpretation of myriad bits of information.

In using a geologic map, or any map for that matter, it is important for the reader to appreciate the purpose for which the map was made. Certain things are shown and many things are not shown. Coloration and labeling emphasize things of perceived importance. In preparing a geologic map, hundreds of decisions are made by the geologist, and scrutiny of the finished map gives insight into that thought process.

In other fact sheets we look at [Charles Hitchcock's 1885 map](#), the 1967 Preliminary Geologic Map of Maine and the 1985 Bedrock Geologic Map of Maine. This fact sheet presents the second Maine bedrock map, by Arthur Keith in 1933. In comparing the maps, you will notice obvious differences in style and content. In each case we will review the context in which the map was made (History), point out the way in which different rocks are portrayed (Lithology), discuss the geologic ages assigned to the various rocks of Maine (Age), and look at major geological relationships that can be deduced from reading the map (Regional Relationships). Selected close-up areas are presented as figures to illustrate these points.
Preliminary Geologic Map of Maine: 1933

Figure 1. Bedrock geologic map of Maine by Hitchcock (1885).
History

The 1933 Maine bedrock map was a spin-off of the U. S. Geological Survey program to publish a geologic map of the United States. Arthur Keith of the U. S. Geological Survey compiled the information for New England at a scale of 1:2,500,000 and transferred it to the 1:1,000,000 scale you see here. An abstract was published in the Geological Society of America Bulletin in 1932. The Maine map was not widely circulated, having been published as a supplement to the Leavitt and Perkins (1935) volume on the Glacial Geology of Maine. Keith published papers on earthquakes, granite intrusion, and the regional bedrock structure of the New England crust but did not publish bedrock maps based on his own field work.

Figure 2. Map title.
The geology of Maine as a whole has remained practically unknown until the present time in spite of the fact that study of it was begun nearly a century ago. Several major difficulties have caused this result; first is the omnipresent cover of glacial drift which leaves exposed less than 1 per cent of the bedrock; second, the enormous tracts of lake and swamp; third, the dense forest cover which over half the State has remained in private hands; finally, the huge areas of slate and phyllite standing on edge for many thousands of square miles.

The map shows the sedimentary rocks divided into pre-Cambrian, Cambrian-Ordovician, Silurian, Devonian, and Mississippian. The igneous rocks are divided into pre-Cambrian granite, Silurian metadiabase, Devonian granite, rhyolite, diabase, trachyte, and tuff, and Carboniferous granite.

These rocks are distributed so as to form a general belt of pre-Cambrian gneiss cut by late Paleozoic granites near the coast, and a central belt of similar granites cutting the Silurian and Devonian and dividing the State nearly in half. These two granite belts tend to coalesce at the southwest. Around the northeast end of the central granite belt are distributed many separated bodies of Paleozoic effusive igneous rocks, forming the most interesting and varied exhibition of the sort in the eastern United States.

Sedimentary rocks cover most of the State and are intensely deformed, mainly in closed vertical folds. Devonian rocks appear in two main central belts closely overlapping one another and almost crossing the State. At the northeast the synclinoria deepen, the Devonian areas widen, and small outliers appear of the Mississippian rocks that are so common just across the border in New Brunswick.
Graphic Index to the Figures

The map below displays the areas with Geological Inset Maps from Keith's 1933 Geological Map of Maine. The figure numbers correspond to those used in this text.

Areas with geological inset maps from Keith's 1933 Preliminary Geologic Map of Maine

Figure 3. Index map.
Lithology

Keith's map gives more emphasis to rock type than does Hitchcock's map, as reflected both by the Legend and by the portrayal of bedrock units. The two maps agree as to the essential character of Maine's geology, but the 1933 map shows a significant increase in complexity.

**Figure 4. Map legend.**
Lithology

New field study in the Rangeley-Jackman area greatly improved knowledge of that part of Maine (Figure K1, Left). Note also the convoluted contact between Silurian and Ordovician-Cambrian rocks in central Maine (Figure K1, Right).

Figure K1. (Left) Complex pattern of greenstones north of Rangeley. (Right) Convoluted structure of rock units in Bingham area.
Lithology

Excellent detailed studies published by the U. S. Geological Survey for Penobscot Bay (1907) and Eastport (1914) make those parts of the 1933 map comparable to the current (1985) map (Figure K2).

Figure K2. (Left) Penobscot Bay (after Smith, Bastin, and Brown, 1907). (Right) Eastport area (after Bastin and Williams, 1914).
Lithology

The most significant new information on Keith's map is the distribution of igneous rocks. Volcanic rocks - rhyolite, tuff, and greenstone - are shown to comprise a northern Maine belt from Rangeley to Presque Isle and a coastal belt from Penobscot Bay to Eastport (Figure K3).

Figure K3A. Part of the northern Maine belt, north of Mt. Katahdin. Volcanic rocks are in red (rh) and bright green (md).
Lithology

Even though they occur mostly in small patches, their importance is emphasized by the bright colors on the map.

Figure K3B. Part of the coastal volcanic belt in the mid-coast area. Volcanic rocks are in orange (tf) and bright green (md).
Lithology

Even though they occur mostly in small patches, their importance is emphasized by the bright colors on the map. Intrusive rocks are shown carefully as well. The many small plutons south of Moosehead Lake (Figure K4) can be readily recognized on the current state map (Onawa, Hartland, Old Point, e.g.). Curiously, the Androscoggin Lake pluton, which was shown by Hitchcock, is omitted from the 1933 map.

Figure K4. Recognizable individual granite bodies.
About the only new age information since the 1860's came from new fossil finds in Penobscot Bay and Eastport which corroborated earlier information. The age assignments of Hitchcock are adopted, with a few notable exceptions. A patch of rock in southern Maine is assigned to the Pennsylvanian by erroneous correlation with fossiliferous Pennsylvanian rocks in Massachusetts. Rocks near Presque Isle and Perry are shown as Mississippian, although subsequent work has proved them to be Devonian as Hitchcock had shown. The conventional assignment of New England metamorphic rocks to the Precambrian is followed here for the last time, as a 1934 paper by M. P. Billings and A. B. Cleaves was about to show that fossils near Littleton, New Hampshire, (originally discovered by C. H. Hitchcock in 1870) indicate that metamorphic rocks in central New Hampshire are Paleozoic.

Ages of the igneous rocks are deduced from their relationships to the sedimentary rocks. The Red Beach Granite in eastern Maine is assigned to the Devonian, because it cuts across Silurian strata and is overlain by "Mississippian" strata. Granites of southernmost Maine that intrude "Pennsylvanian" strata are interpreted to be Carboniferous. Granites, pegmatites, and migmatites of western Maine are purported to be Precambrian because of their intimate relationship with the metamorphic schists and gneisses assigned to the Precambrian. Although these relative geologic relationships are reasonably deduced, they gave incorrect results in many cases because the presumed ages of the sedimentary rocks were not correct.
Regional Relationships

According to the Legend (Figure 4), the greenstones are mostly Silurian and the rhyolites are Devonian. This implies a change in the nature of volcanism over time. It also indicates that there are regional variations in the types of rock being formed at any one time. During the Silurian, for example, sandstone and shale were being deposited over much of Maine, whereas volcanic rocks were being erupted in certain areas of the Down East coast and northern Maine. This gives a more dynamic and varied picture of Maine’s geologic history than Hitchcock's map implies. The upper contact of the Precambrian mimics the upper contact of the Cambrian-Ordovician unit near Farmington, suggesting that a regional folding event affected all the rocks together (Figure K5). A profound unconformity above the Precambrian rocks is prominently displayed.

**Figure K5.** Implied Structural Relationships.
Conclusions

The differences between the bedrock maps of Maine derive partly from the amount of information available at the time of publication, but depend more importantly on the perspective of the author. Keith's map includes more detail than Hitchcock's, and a more ambiguous geologic history. Each map emphasizes a different aspect of Maine's bedrock geology, and both maps had their place in the progress of scientific thought.
References and Additional Information


