

Coticule where extensive enough to be mapped separately from Ocep.

grunerite(?)-biotite granofels, in part very rusty-weathering. (Photo 4)

Amphibolite with minor calc-silicate gneiss and impure limestone.

Wilson Cove Member. Black garnet-biotite schist, garnet-plagioclase-

Peaks Island Member. Light gray plagioclase-quartz-biotite granofels and

gneiss, locally with microcline and muscovite. Locally retains original pyroclastic

Merepoint Member. Rusty weathering muscovite-plagioclase-quartz-biotite

structures including fiamme structure, volcanic breccia blocks, and phenoclasts.

UNCONFORMITY?

CUSHING FORMATION

Rusty-weathering quartz-plagioclase-biotite gneiss and granofels. Some green

Pole Island Member. Calc-silicate gneiss and granofels.

plagioclase schist with minor micaceous quartzite interbeds.

Amphibolite and calc-silicate gneiss.

gneiss and granofels interbeds and zones. (Photo 5)

BETHEL POINT FORMATION. Very rusty weathering quartz-biotite-muscovite-

YARMOUTH ISLAND FORMATION. Light gray plagioclase-quartz-biotite-garnet

granofels and gneiss, locally with gedrite, staurolite, and/or sillimanite; minor calc-silicate

Gabbro and diorite.

SPRUCE HEAD PLUTON

Sg: Granite (Photos 9 and 10).

Sgd: Diorite to granodiorite

Sgb: Gabbro and diorite.

RACCOON PLUTON

foliated hornblende gabbro.

Srgbh: Seriate to equigranular greenish gray, medium- to coarse-grained, slightly

Srgb: Fine- to medium-grained gray-green noritic gabbro with pyroxene cumulate

indicating volcanic protolith. Contains calc-silicate rocks and impure marble.

plagioclase-biotite-muscovite schist with interbeds of more quartzose granofels.

CROSS RIVER FORMATION. Exposed in the Boothbay and Pemaguid Harbor anticlines.

Highly migmatized, very rusty-weathering to slightly rusty-weathering gneiss with relict zones

of rusty-weathering biotite-muscovite-sillimanite-graphite schist; unmigmatized rafts of non-

rusty quartz-plagioclase-biotite granofels, calc-silicate granofels, and amphibolite. In the

Granofels member. Exposed at top of formation in the Boothbay anticline. Fine-

grained, salt and pepper textured, medium gray quartz-biotite-plagioclase-garnet

granofels; medium to coarse-grained feldspathic amphibolite with large anhedral

Pemaquid Harbor anticline, grades downward into non-rusty, moderately migmatized quartz-

Cambrian(?) - Ordovician(?)

Bath Quadrangle, Maine

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Cartographic design and editing by: Robert D. Tucker

Prepared in cooperation with the U.S. Geological Survey.



Geologic Map No. 02-152

for example, the plagioclase-quartz-biotite granofels of the

in an ocean basin during the late Ordovician to Silurian Periods (see

Geologic Time Scale below). Geologic processes gradually turned these

sediments into rock so that sedimentary characteristics such as layering are preserved, but in a modified form. Each of the photographs is located

northern New England was a zone of major continental collision that

were then at depth and subjected to intense heat and pressure. At this time

the original sedimentary materials were metamorphosed to the rocks we see today. In response to the great pressure of continental collision, rocks

were folded and faulted, some several times. Deformation is apparent in the folded shapes in the rocks, and layering which is inclined from the

horizontal. This deformation occurred on a regional scale, as indicated by

the inclined layering throughout the map area and by the structure shown

IGNEOUS ROCKS

either at the earth's surface (extrusive igneous rocks - also called volcanic

rocks) or within the earth's crust (intrusive igneous rocks). Rocks formed

by volcanoes or submarine eruptions are examples of extrusive igneous

rocks. Granite is an example of an intrusive igneous rock. Intrusive

igneous rocks are generally coarser grained because they cool more

Photo 2. Alternating light and dark bands of the Edgecomb Gneiss. North

Edgecomb. The dark bands are composed mostly of the minerals hornblende and biotite. The light bands are mostly quartz and

schist and granofels is well exposed at Lookout Point, Harpswell Neck.

Photo 6. Upright folds in the Bucksport Formation at Pemaquid Point Lighthouse. The spectacular exposures here reveal many such features to

the careful observer. This photograph looks directly along the crest of the fold, with layering on the left tilting to the left and layering on the right

tilting to the right. In the middle distance the form of the fold is clearly visible. On the right is a large ridge underlain with pegmatite, a very

coarse-grained, resistant rock consisting mostly of quartz and feldspar.

Photo 8. Metamorphosed pillow basalt (a dark volcanic rock) of the

unnamed metavolcanic unit, Friendship. The blobby shapes that

geologists call pillows develop when molten lava erupts from a fissure on

the seafloor. Sea water cools the lava very quickly to form the pillow

which breaks away from the fissure as more lava is forced out. These

seafloor extrusive igneous rocks are now exposed at the surface because

of several continental collision events which closed the ocean basin.

slowly, allowing crystals more time to grow larger.

Igneous rocks form by cooling of molten magma to form solid rock,

formed high mountains, long since eroded to the Appalachians that we know today. Rocks now at the earth's surface in central coastal Maine

Structure of the stratified rocks. During the Devonian Period,

The stratified rocks were originally sediments that accumulated

see Bulletin 42.

Maine Geological Survey

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For additional information

Nehumkeag Pond Formation.

on the map with a red number.

on the interpretive cross sections.

The geologic map at left shows the features of the bedrock, the solid rock that makes up the earth's crust. Although in many areas the bedrock is not exposed due to thick overlying sediments, this map depicts the geologists' interpretation of the bedrock, even in places where it cannot be seen. Symbols on the map show locations where bedrock is exposed at the land surface. Closely related or distinctive rock types are grouped together into formations and other rock units (see map explanation). At this scale of mapping many thin units must be grouped into formations (see, for example, the Cape Elizabeth Formation in the map explanation). Several different types of boundaries are shown on the map (see map explanation). The cross sections illustrate the inferred relationship among rock units that would be seen along vertical slices through the earth.

STRATIFIED ROCKS The stratified, or layered, rocks of the Bath quadrangle are metamorphic rocks, primarily schist and granofels, although gneiss and phyllite are also important. Schist is a rock composed of small, flat

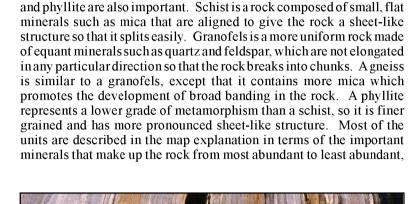




Photo 1. Typical thin-bedded granofels in the Bucksport Formation at Pemaquid Point. The thin dark bands are biotite rich and the thicker, lighter color bands are calc-silicate granofels. The calc-silicate was derived from limy sediments and contains calcium-rich minerals like like the one below the hammer.

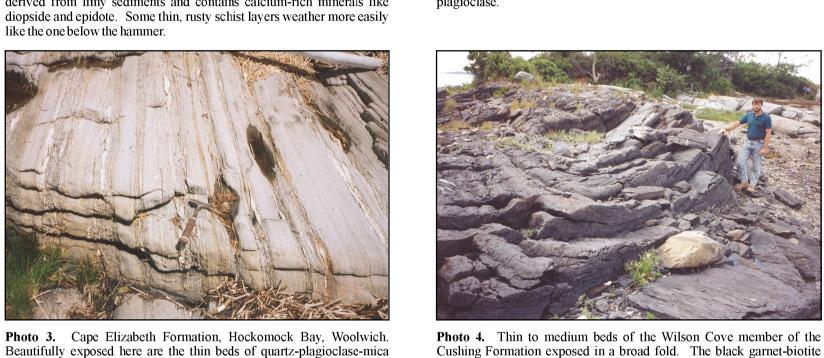


Photo 3. Cape Elizabeth Formation, Hockomock Bay, Woolwich. Beautifully exposed here are the thin beds of quartz-plagioclase-mica granofels (solid gray beds) and mica schist (thin wavy beds) typical of the



Photo 5. A broad fold in the Yarmouth Island Formation on Yarmouth Island, Harpswell. To the left of geologist Arthur Hussey the layering tilts to the left; to his right the layering tilts steeply to the right. He is standing at the crest of the fold where layering is nearly horizontal. This is a surface exposures of units of the East Harpswell Group.

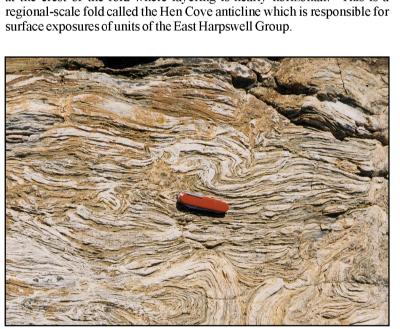


Photo 7. Wildly contorted quartzite and schist layers in the Mosquito Harbor Formation at Marshall Point Lighthouse, Port Clyde. The complicated layering and folding in the thin, light-colored quartzite layers is the result of several events. Probably some of the layers of sand and mud, originally deposited in an ocean basin, slid down the slope and became contorted before they hardened into rock. Some of the folding resulted from the heat and pressure of later mountain building events and



Photo 9. Spruce Head Granite, Rackliff Island, Spruce Head. This is a medium-grained granite that has interlocking, randomly arranged crystals of feldspar (white), quartz (gray), and biotite (black). The ellipsoidal speckled area above the knife is a piece of granofels from the surrounding rock units that fell into the molten magma at the time of intrusion and partially melted. Geologists call these features xenoliths.

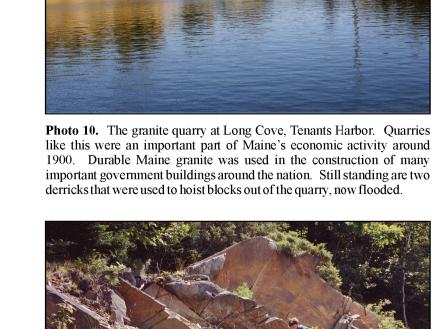


Photo 11. Granite dike with mafic enclaves, Marshall Point Lighthouse, Port Clyde. Magmas were forced through a fracture in the surrounding metamorphic rocks to form a dike. Within the dike are blobs or enclaves of dark basalt surrounded by lighter colored granitic rock. The scalloping or cuspate nature of the edges of the basalt indicates that the separate magmas that became the basalt and the granitic rock were both molten at the same time but, like oil and water, did not mix very well. Because basalt solidifies at a higher temperature than granite, it formed the enclaves first and granite filled in all around. Some fantastic shapes form

Photo 12. Christmas Cove dike exposed on Mountain Road, Great Island, Harpswell. The youngest of the rock units exposed in the area, the Christmas Cove dike was intruded during the Mesozoic Era and spans the length of the map sheet. Outcrops of this unit are often blocky, as shown in this photograph, because of several orientations of spaced fractures. At

this place, the dike dips moderately to the north (left), while the fractures

GEOLOGIC TIME SCALE Absolute Age*

Geologic Age Cenozoic Era Mesozoic Era Paleozoic Era Permian Period Carboniferous Period Devonian Period Silurian Period Ordovician Period Cambrian Period

66-245 245-545 245-286 286-360

Precambrian time

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360-418 418-443 443-495 495-545 Older than 545

* In millions of years before present.