Bowdoinham Quadrangle, Maine

Bedrock geologic mapping by
David P. West, Jr.
Joel F. Cubley

Digital cartography by:
Robert A. Johnston
Susan S. Tolman

Robert G. Marvinney
State Geologist

Cartographic design and editing by:
Robert D. Tucker
Henry N. Berry IV

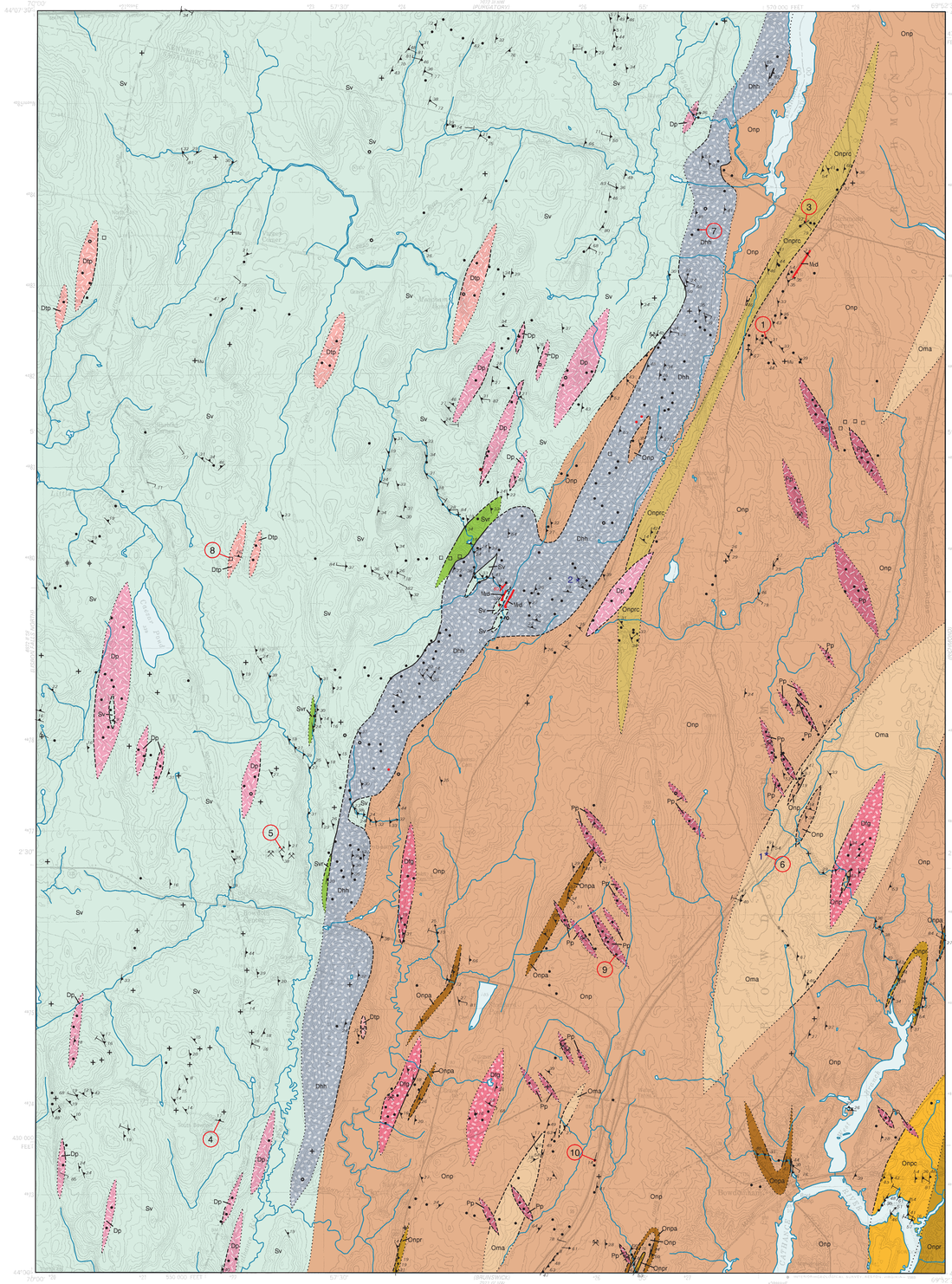
Funding for the preparation of this map was provided in part by the U.S. Geological Survey STATEMAP Program, Cooperative Agreements No. 04HQAG0035 and 05HQAG0044.

Maine Geological Survey
Address: 22 State House Station, Augusta, Maine 04333
Telephone: 207-287-2801 **E-mail:** mgs@maine.gov
Home page: http://www.maine.gov/doc/nrimc/mgs/mgs.htm

Open-File No. 06-54
2006

For additional information, see accompanying 17 p. report.

Bedrock Geology



SOURCES OF INFORMATION

Field work conducted by D. P. West (2004-2005) and J. F. Cubley (2004).

Quadrangle Location

SCALE 1 : 24,000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

CONTOUR INTERVAL 10 FEET

TRUE NORTH

Topographic base from U.S. Geological Survey Bowdoinham quadrangle, scale 1:24,000 using standard U.S. Geological Survey topographic map symbols.

The use of industry, firm, or local government names on this map is for location purposes only and does not impute responsibility for any present or potential effects on the natural resources.

EXPLANATION OF UNITS

Intrusive Rocks

Mesozoic

Md — **Diabase.** Thick dikes (>5 meters across) and closely-spaced thinner dikes are shown on the map by a red line. Thin dikes too small to map are indicated by individual red symbols.

Permian(?)

Pp — **Muscovite granite and pegmatite.** Very coarse-grained granite and pegmatite characterized by graphic texture. Commonly found on small hill tops in areas of otherwise poor bedrock exposure in the eastern part of the quadrangle.

Devonian(?)

Dtp — **Tourmaline granite and pegmatite.** Small bodies that seem to be restricted to the Central Maine sequence. Black tourmaline is characteristic.

Dp — **Biotite granite and pegmatite.** Moderately foliated to non-foliated.

Metamorphosed Intrusive Rocks

Devonian(?)

Dfg — **Foliated granite.** Strongly foliated granite to granitic gneiss. Xenoliths of felsic gneiss or quartz-plagioclase-biotite granofels are locally abundant.

Devonian

Dhh — **Hornbeam Hill gneiss (new name).** Deformed, metamorphosed pluton containing the following rock types, in order of decreasing abundance: Light to medium gray, feldspar-quartz-biotite-garnet ± hornblende tonalitic to granodioritic gneiss, characterized by poikilitic garnets; light gray, granitic gneiss, including some porphyritic varieties; and dark gray, plagioclase-hornblende-biotite-quartz gneiss, interpreted to be metamorphosed diorite.

Stratified Rocks

Central Maine Sequence

Silurian(?)

Sv — **Vassalboro Formation.** Medium gray to purplish-gray, fine-grained to medium-grained, quartz-plagioclase-biotite granofels and schist, with subordinate layers of greenish-gray calc-silicate granofels. Layers range from 3 to 25 cm in thickness. Outcrops are typically slabby-weathering with rusty foliation surfaces. Pegmatite dikes and sills are common.

Svr — **Rusty schist and granofels.** Moderately to deeply rusty-weathering, quartz-plagioclase-muscovite-biotite ± graphite ± sillimanite schist and granofels. Minor amounts of light gray, plagioclase-quartz-biotite granofels. Locally contains medium gray, quartz-plagioclase-biotite-garnet ± sillimanite gneiss and granofels with coticule.

Falmouth-Brunswick Sequence

Ordovician(?)

Oma — **Mount Ararat Gneiss.** Interlayered light gray, quartz-plagioclase-biotite gneiss; and dark gray, plagioclase-hornblende ± biotite gneiss and amphibolite. Layers are generally 2 to 15 cm thick, but are thicker in some places. Subordinate rock types include calc-silicate bearing amphibolite, and rusty-weathering biotite ± garnet ± sillimanite schist. Relationship to Nehumkeag Pond Formation is uncertain (see report).

Onp — **Nehumkeag Pond Formation.** The predominant rock type is light gray, medium to coarse-grained, non-rusty to slightly rusty-weathering, plagioclase-quartz-biotite gneiss. This felsic gneiss is commonly migmatitic, and pegmatite dikes, sills and boudins are common. Subordinate rock types include amphibolite, and slightly to moderately rusty-weathering, quartz-plagioclase-biotite schist and gneiss that locally contain coarse-grained garnet.

Onpc — **Cathance River member (new name).** Impure marble and amphibolite. The marble is medium-grained to coarse-grained, and may contain Mg-rich biotite, diopside, calcic amphibole, epidote and sphene. The amphibolite characteristically contains greenish gray calc-silicate granofels or light gray impure marble. Rusty and non-rusty weathering biotite ± garnet schist is also present locally.

Onpr — **Rusty schist and granofels.** Deeply rusty weathering, sulfidic, quartz-muscovite-biotite ± sillimanite schist and granofels.

Onpa — **Amphibolite.** Fine-grained to medium-grained amphibolite and hornblende gneiss, locally containing biotite. Discontinuous thin layers of calc-silicate rock are locally abundant.

Onprc — **Richmond Corner member.** Heterogeneous unit which includes garnet-bearing feldspathic gneiss, sulfidic schist, and garnet amphibolite. Lesser amounts of diopside calc-silicate granofels and gneiss, and granitic gneiss are also present.

REFERENCES

Hussey, A. M., II, 1985, The bedrock geology of the Bath and Portland 2-degree map sheets, Maine: Maine Geological Survey, Open-File Report 85-87, 82 p., 2 maps, scale 1:250,000.

Newberg, D. W., 1984, Bedrock geology of the Gardiner 15' quadrangle, Maine: Maine Geological Survey, Open-File Report 84-8, 30 p. report and map, scale 1:62,500.

West, D. P., 1988, (40)Ar/(39)Ar mineral ages from southwestern Maine: evidence for Late Paleozoic metamorphism and Mesozoic faulting: M.S. thesis, University of Maine, Orono, Maine, 199 p.

West, David P., Jr., Lux, Daniel R., and Hussey, Arthur M., II, 1988, (40)Ar/(39)Ar hornblende ages from southwestern Maine: evidence for late Paleozoic metamorphism, *in* Lux, D. R., and Barr, S. M. (editors), Geology of coastal New England and New Brunswick cost of the Kearsarge central Maine Synclinorium: Maritime Sediments and Atlantic Geology, v. 24, no. 3, p. 225-239.

GEOCHRONOLOGY INFORMATION

Locations of analyzed samples are shown on the map.

Location	Method	Mineral	Age (Ma)	Reference
1	Ar-Ar	Biotite	244 ± 3	West, 1988
1	Ar-Ar	Hornblende	282 ± 4	West and others, 1988
2	U-Pb (SHRIMP)	Zircon core	393 ± 4	unpublished (see report)
2	U-Pb (SHRIMP)	Zircon rim	380 ± 4	unpublished (see report)

EXPLANATION OF SYMBOLS

- Outcrop of mapped unit.
- Outcrop of pegmatite. Mu indicates muscovite-bearing.
- Mafic dike. (Inclined, Isolated outcrop)
- Large or abundant float blocks, presumed to represent underlying bedrock.
- Float block of mafic dike
- Blasted rock, presumed to represent underlying bedrock.
- Blasted rock, of pegmatite.
- Rock quarry (Active, Inactive).
- Foliation in metamorphic rock (Inclined, Vertical).
- Mineral lineation, on foliation surface.
- Fold axis.
- Joint (Inclined, Vertical).
- Minor, late brittle fault. (Inclined)
- Location of photo shown in sidebar.
- Location of sample analyzed for geochronology (see table).

EXPLANATION OF LINES

Contact between mapped units (Well located, Approximately located, Inferred).

GEOLOGIC TIME SCALE

Geologic Age		Absolute Age*
Cenozoic Era		0-65
Mesozoic Era		65-253
Paleozoic Era	Permian Period	253-300
	Carboniferous Period	300-360
	Devonian Period	360-418
	Silurian Period	418-443
	Ordovician Period	443-489
	Cambrian Period	489-544
Precambrian time		Older than 544

* In millions of years before present. (Okulitch, A. V., 2002, Échelle des temps géologiques, 2002: Commission géologique du Canada, Dossier Public 3040 (Série nationale des seiences de la Terre, Atlas géologique) - REVISION.)