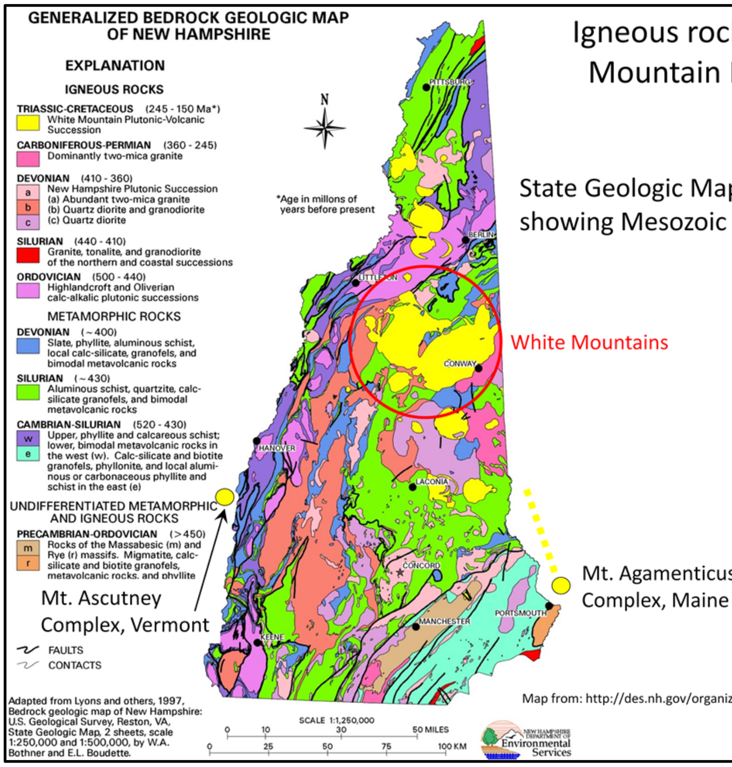
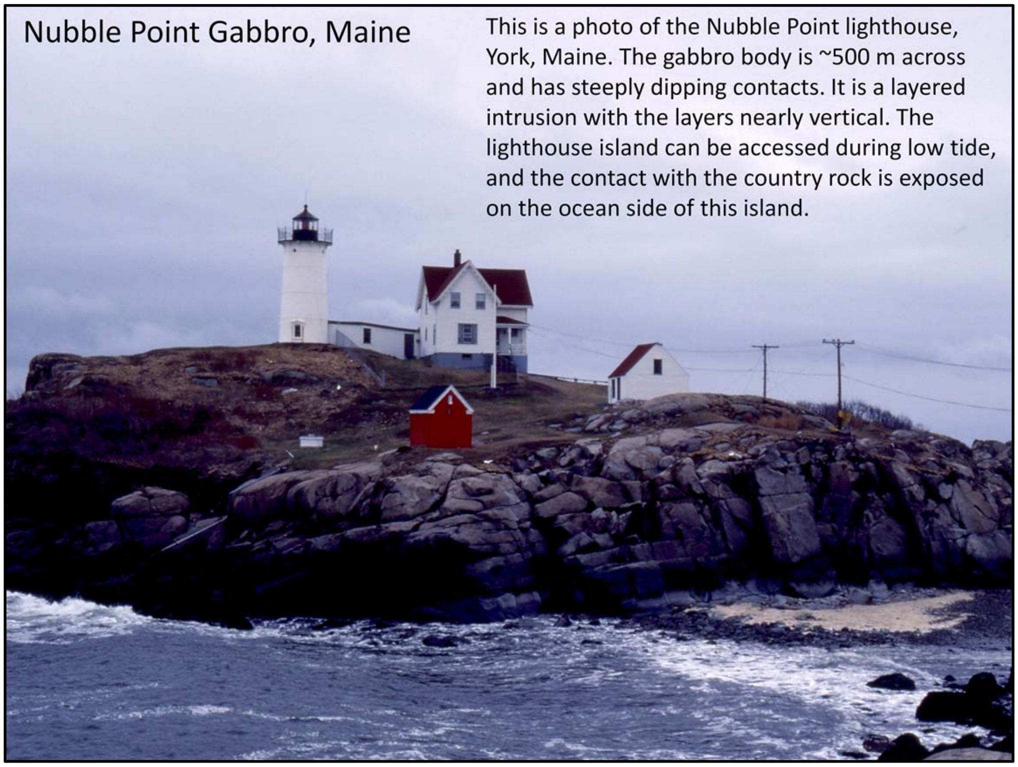
Igneous rocks of the White Mountain Magma Series

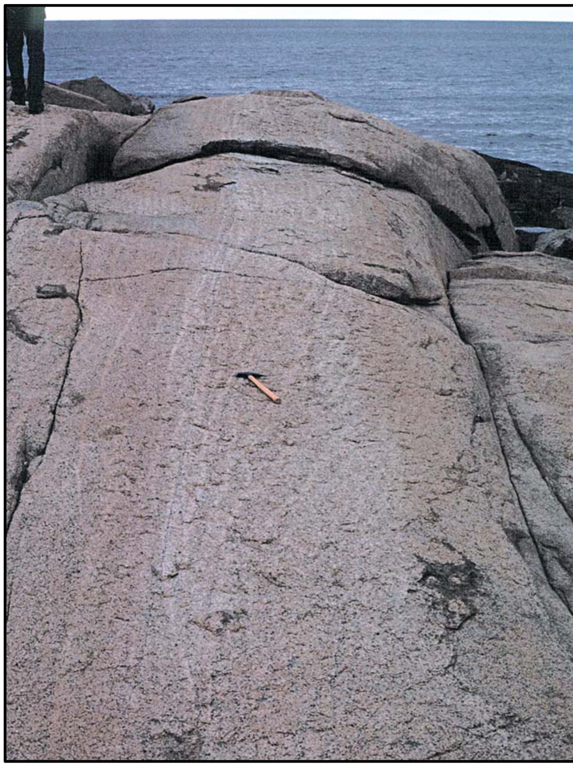
State Geologic Map of New Hampshire, showing Mesozoic plutons in yellow.



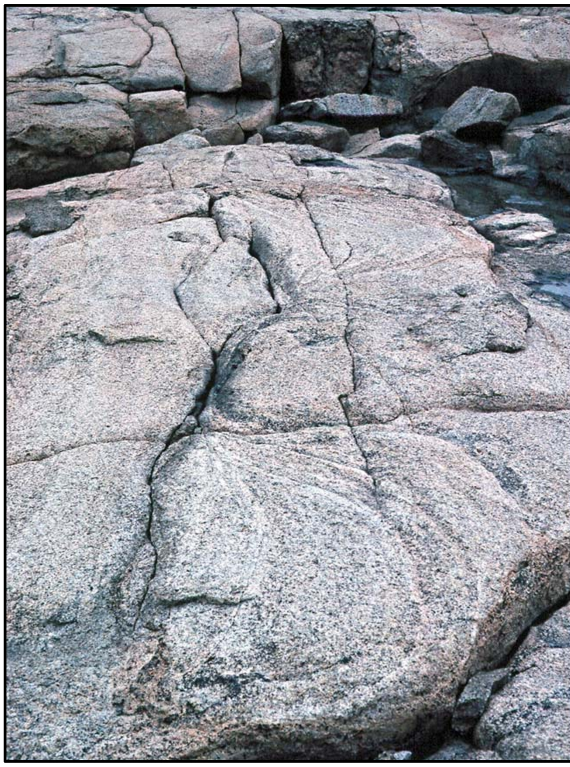
Map from: http://des.nh.gov/organization/commissioner/pip/publications/geologic/



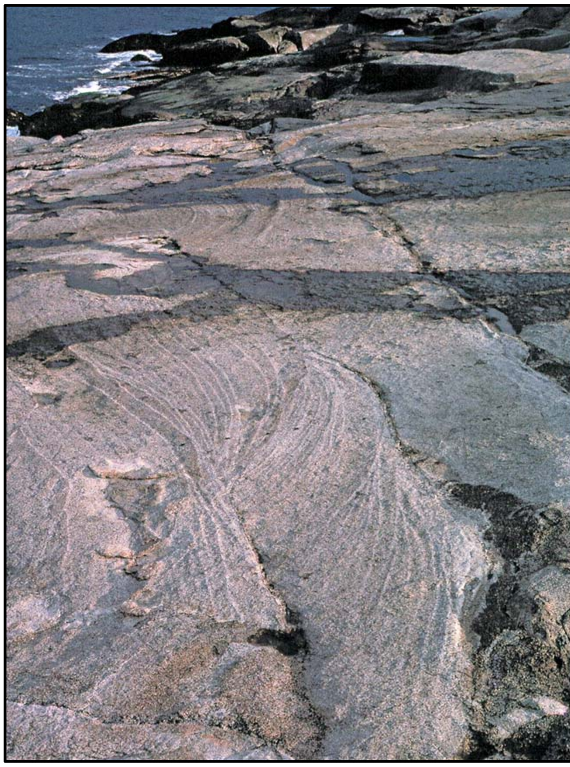
This is a photo of the Nubble Point lighthouse, York, Maine. The gabbro body is ~500 m across and has steeply dipping contacts. It is a layered intrusion with the layers nearly vertical. The lighthouse island can be accessed during low tide, and the contact with the country rock is exposed on the ocean side of this island.



This gabbro is a layered intrusion. In this photo, thin layers (~3 cm) that make up thicker crossbed-like layers (1 m) that extend away toward the ocean.



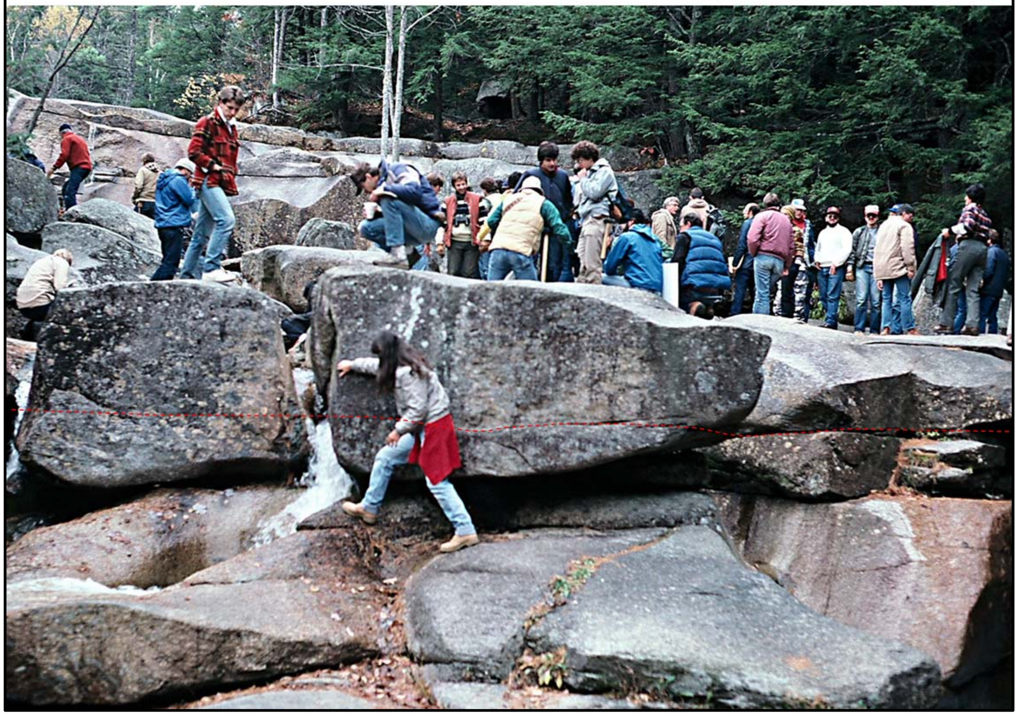
Trough-and-ridge structures with cross bed-like features that formed on the walls of the intrusion. Layering is vertical.



Prominent trough structures and crossbed-like features that formed on the intrusion walls. These are indicative of strong currents running down the magma chamber walls, depositing and sometimes eroding modally variable layers.

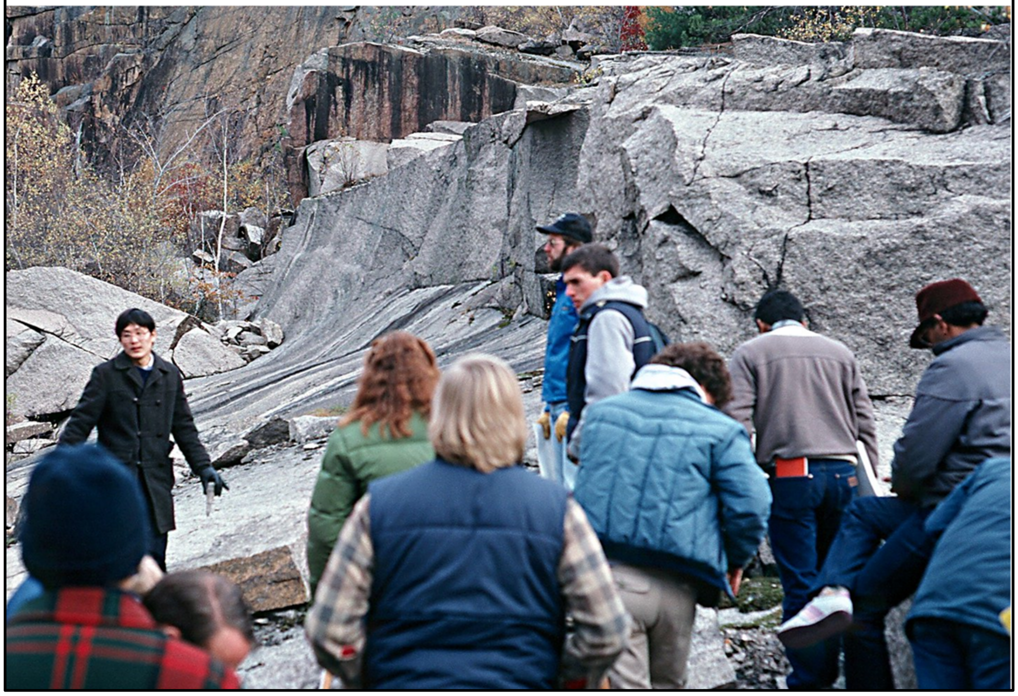
Composite dike in the Nubble Point gabbro. The outer, earlier margin of the dike has fine-grained basalt ~1 cm thick. Presumably soon after emplacement, the lighter magma was injected. I do not recall what the lighter material is, but I suspect it is granite.

White Mountain Batholith, New Hampshire



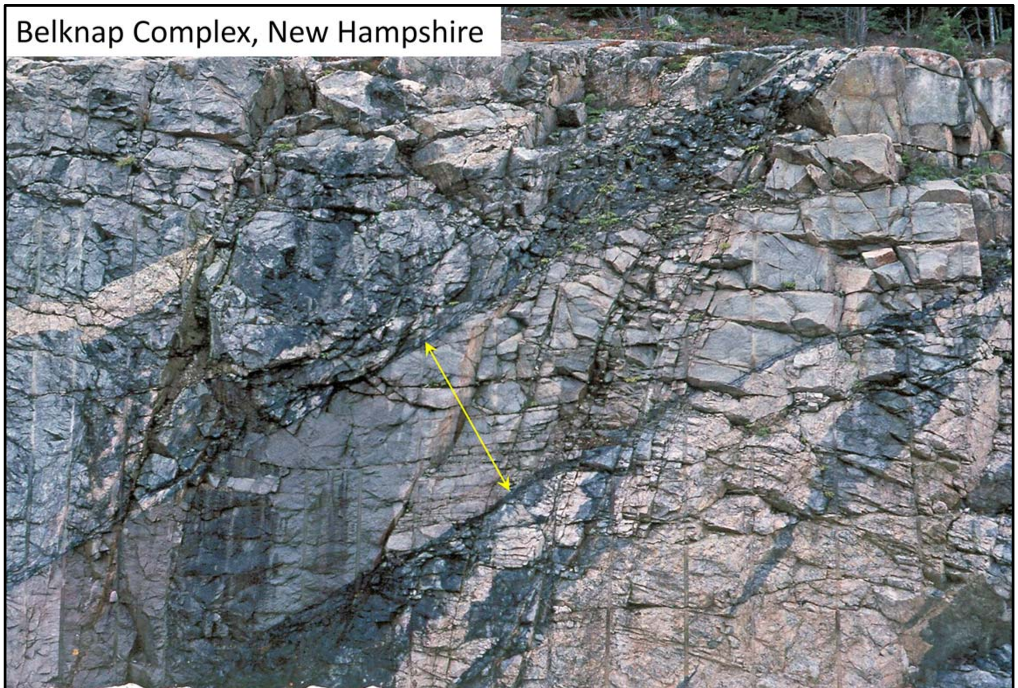
This locality is called "Diana's Baths", on Lucy Brook. The Conway Granite becomes porphyritic near its margin and intrudes overlying Moat Volcanics. Porphyritic Conway is NEIGC86-B2-3B; Moat Volcanics is NEIGC86-B2-3A; Osceola Granite, collected from nearby, is NEIGC86-B2-4.

Massive Conway Granite, near the contact with a large body of Osceola Granite. Sample NEIGC86-B2-1A.



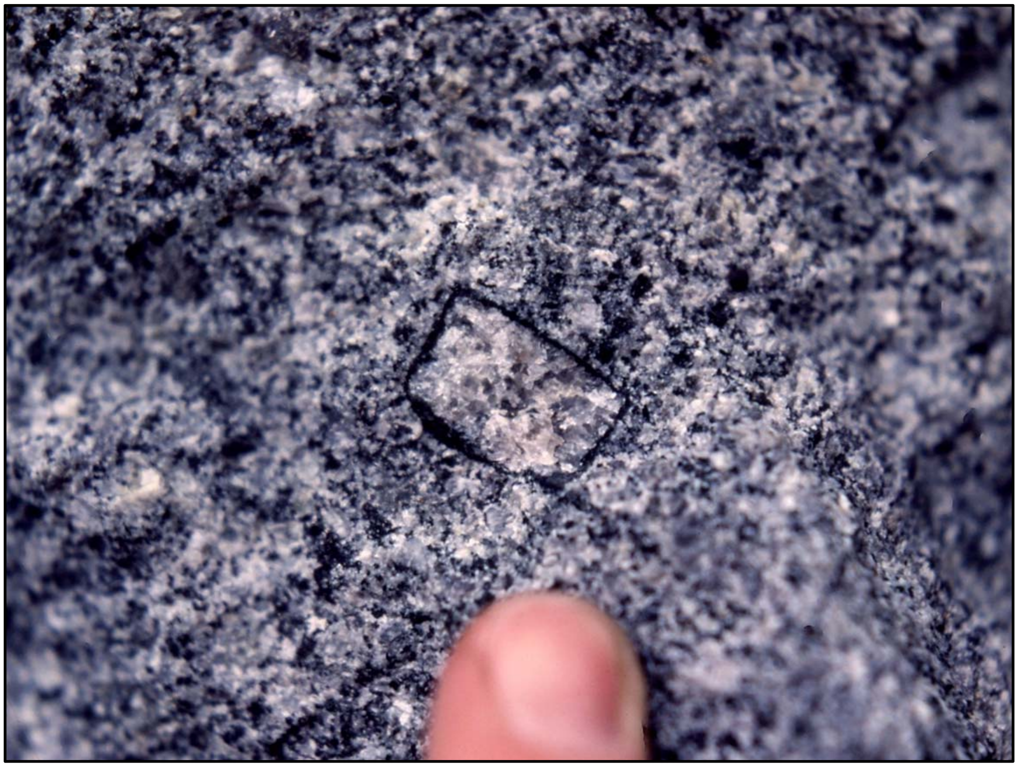
Dikes of light-colored granite cutting darker dioritic rock in Franconia Notch, New Hampshire. The granite contains numerous diorite xenoliths.

Belknap Complex, New Hampshire

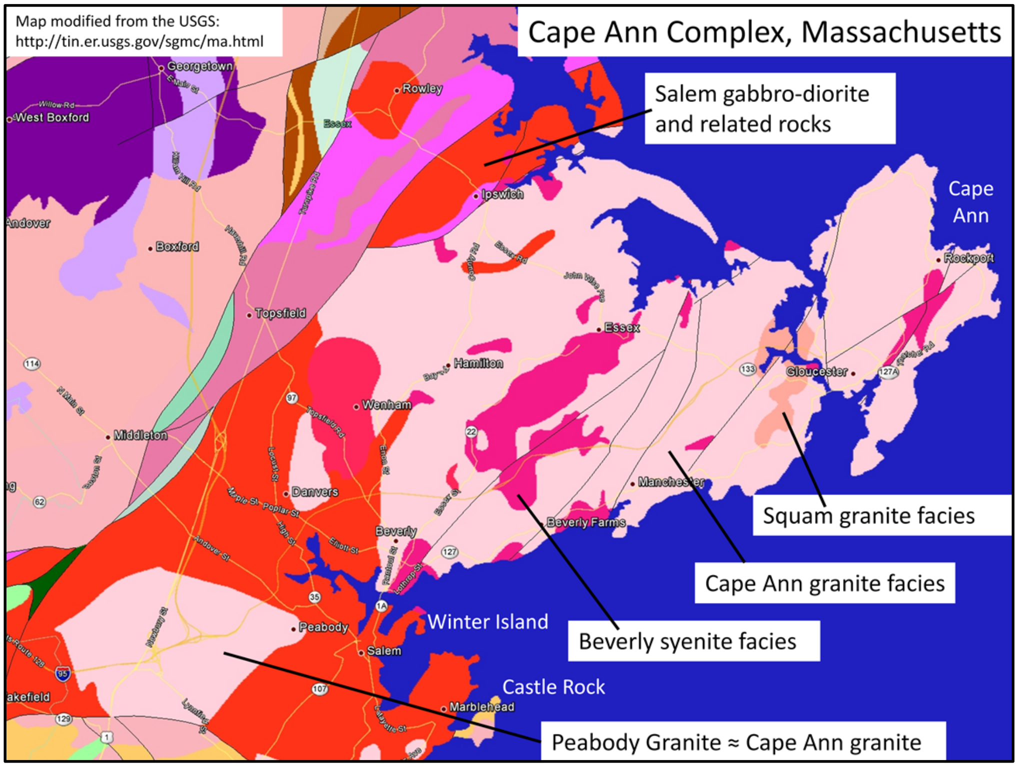


Main ring dike on the SE side of the intrusion. The ring dike is indicated. Sample 4.8.84J is the ring dike rock from this locality.

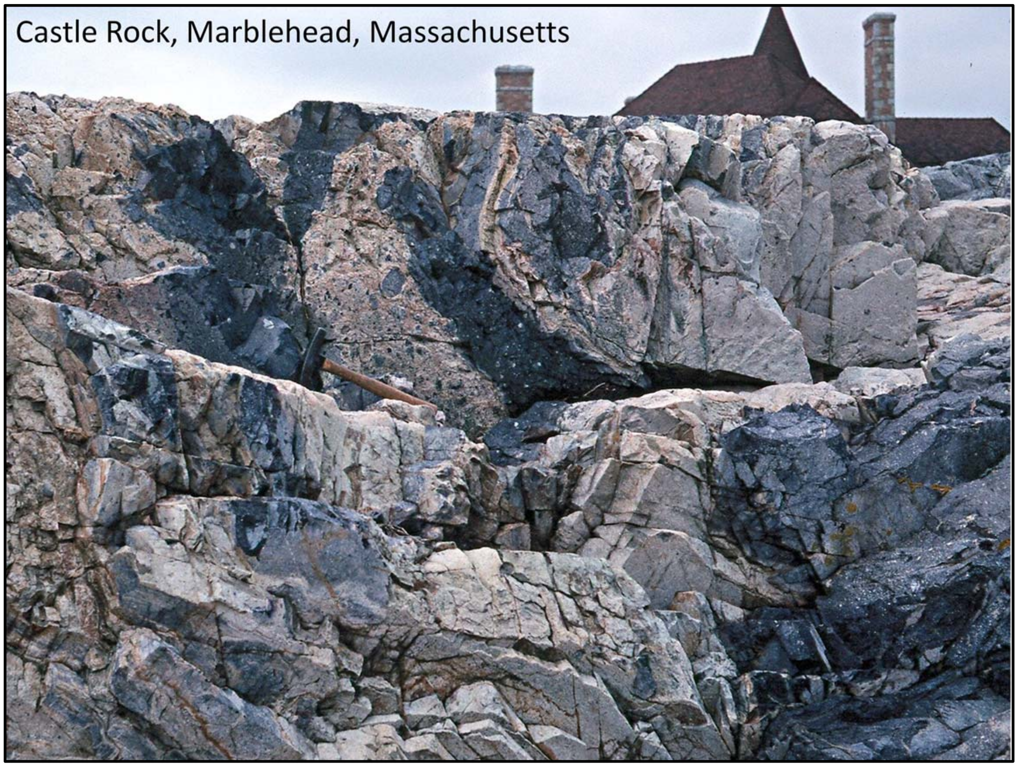
Ring dike on the north side of the intrusion, where the dike is much wider and less altered. These are two fine-grained mafic enclaves (pillows or xenoliths) encased in the alkali granite ring dike host rock. This outcrop has iridescent orthoclase, caused by exsolution of fine-scale albite lamellae in the orthoclase host. Samples 4.8.84L and 4.8.84P are from the interior of the Belknap Complex. Sample NH-2 is of the margin between an enclave and the host felsic rock from the Belknap Complex interior. Sample 4.8.84Q is of a mafic pluton close to the Belknap Complex to the south.



Belknap intrusive complex, New Hampshire Hornblende reaction rim on a quartzite xenolith in the northern ring dike. This feature can also be seen in thin section. Sample 4.8.84K is from this locality.



Geologic map of the Cape Ann area. Rocks to the northwest are part of the Nashoba Terrane and have nothing directly to do with development of the Cape Ann suite.



This mass of volcanic rocks (Lynn Volcanics) includes a possible volcanic plug. It is made up of fine-grained rhyolite and breccias. The dark parts visible are fine-grained, porphyritic rhyolite. The lighter materials are essentially the same, but more hydrothermally altered. The light-colored rocks may have been more porous soon after formation.

Closeup of the Castle Rock rhyolite. The rock is made up of fine-grained rhyolite matrix and breccia fragments. lasts mostly include more rhyolite and rhyolite pumice.

Contact between some darker rhyolitic material containing breccia fragments, and lighter, possibly more clast-rich breccia to the left. In thin section the two are pretty much the same, except for alteration.

Cape Ann granite, here cut by basaltic dikes.

Closeup of the granite, which contains quartz, perthite, and Fe-rich biotite, amphiboles, pyroxene, and olivine. The Cape Ann granite suite varies mostly with quartz content, except for the Squam Granite facies, which is a two-feldspar granite unlike the rest of the Cape Ann and may not in fact be part of the suite.

Pegmatite of perthite and blue quartz cutting the Cape Ann granite.

Euhedral blue quartz crystals with perthite in a pegmatite. Other minerals include fayalite and the Fe biotite annite.

Playground dike in Beverly syenite. This is a basaltic dike that intruded the host Beverly syenite. The basalt intruded quickly, fracturing the syenite, which was apparently still partially molten but rheologically brittle on short time scales. After the basalt dike quenched, the syenite flowed somewhat, breaking the dike and separating the broken ends. There is no apparent difference between the granite away from the dike and between the two dike ends.

Mafic pillows, in granite, Salem, Massachusetts. Note that the topping directions of this pillow mass can be determined.

The host rock is the Salem gabbro-diorite. It was initially cut by a dike of felsic magma, which was closely followed (while the felsic magma was still partially liquid) by basaltic magma. The result is a composite dike with felsic margins and a central core of basaltic rock that is cut by felsic mini-dikes and contains mini-pillow-like structures (left). The dike was later disrupted by flow of the host gabbro-diorite.

Salem gabbro-diorite intruding felsic Cape Ann-like granitic magma, forming pillow lavas. Samples NEGSA07-F4-3b and 4.7.84C are from these rocks.

Closeup of the pillow margins, showing fine-scale lobate firms on the pillow margins, and fragmentation of pillow and inclusion into the felsic magma.

Clear examples of hybridization between felsic and mafic magmas, indicated by different shades of gray.

Basaltic dike chilled margin against granitic rock, downtown Salem. This mafic complex hosts a large positive magnetic anomaly. Samples NEGSA07-F4-5-1 and -2 are from here.