A Transect Through Vermont's Most Famous Volcano – Mount Ascutney

GSNH Summer 2017 Field Trip
Mount Ascutney State Park and Saint-Gaudens National Historic Site

Trip Leader: Greg Walsh, U.S. Geological Survey
(gwalsh@usgs.gov), cell: 802-522-9043

Saturday July 29, 2017. 9:00AM – 4:00PM. **Rain or shine. Please dress accordingly.**
Geological Society of New Hampshire trip organizers: Lee Wilder and Thor Smith

Meeting Point:
Blow-Me-Down Farm
Saint-Gaudens National Historic Site
231 Wilson Rd. (Route 12A)
Cornish, NH 03745
43.500443, -72.380433 (all coordinates are in WGS84 datum)

The Cretaceous Ascutney Mountain igneous complex affords a classic exposure of the White Mountain Igneous Suite. Often called Vermont's most famous volcano, Mount Ascutney (elev. 3,144 feet, 958 m) stands as a prominent monadnock in the Connecticut River Valley. The mountain often serves as an inspirational landmark, as it does when viewed from locations on the New Hampshire side of the river including the Saint-Gaudens National Historic Site. The Ascutney Mountain igneous complex (Ratcliffe and others, 2011) consists of several mafic to felsic nested plutons including gabbro-diorite exposed at Little Ascutney to the west, and the Ascutney Mountain stock composed of syenite, granite, and related volcanic rocks underlying the main summit to the east (Schneiderman, 1989, 1991). Foland and Faul (1977) and Foland and others (1985) dated the gabbro-diorite complex at 125.5 to 122.2 Ma by K-Ar on biotite and by whole rock Rb/Sr, and dated the syenite-granite complex at 123.2 to 121.4 Ma by K-Ar on biotite. During the field trip we will visit the main rocks types of the Ascutney Mountain stock exposed near the summit and on the east side of the mountain along the Mount Ascutney Parkway. Mount Ascutney is the classic location where Daly (1903) discussed the evidence for piecemeal stoping as a pluton emplacement mechanism. This theory was later modified to favor cauldron subsidence, or ring-fracture stoping, as an alternative mode of emplacement (Chapman and Chapman, 1940). Our new mapping (Walsh and others, in press), which supersedes an earlier provisional study (Walsh and others, 1996a, b), supports the cauldron subsidence model, and shows that the main Ascutney Mountain stock is a funnel shaped composite pluton in agreement with geophysical data (Daniels, 1990).

Field Trip Plan:
Please arrive and park at the meeting point at the Blow-Me-Down Farm before 9:00AM. After registration, coffee and donuts, we will consolidate into vehicles at this point for the trip to Mount Ascutney. **Bring your own bag lunch**. Cold water and fruit will be provided. From the farm, we will drive to the State Park and ascend the Mount Ascutney Parkway toll road. The fee of $4 per person will be covered by the GSNH for all registered field trip participants. The trip will involve short walks along the paved road followed by an optional 1.6 mile round-trip hike from the summit parking area around the summit. There are primitive restrooms along the

parkway and at the summit parking lot. The trip will return to Blow-Me-Down Farm meeting area in time for you to tour Saint-Gaudens on your own. Details at: https://www.nps.gov/saga/index.htm

Meeting Point:
Assembly and introduction

Mileage:
0.0 Depart the farm by turning right on Wilson Rd. Route 12A South
2.2 Optional stop to view Mount Ascutney and the Cornish-Windsor Covered Bridge
2.3 Turn right onto Bridge St. and the Cornish-Windsor Covered Bridge, enter Vermont
2.6 Continue straight at the junction of Route 5 onto Route 44 West
3.2 Bear left onto Ascutney St. staying on Route 44 West
5.1 Continue on Route 44 West and pass under Interstate 91
5.3 Turn left onto Cole Hill Rd.
5.7 Turn left onto Back Mountain Rd. Route 44A
6.9 Turn right into Mount Ascutney State Park (43.437854, -72.405686)
Pay the toll and proceed up the parkway. Watch for traffic!

Stop 1: The Waits River Formation hornfels
There is no parking here so be extremely careful pulling off to the right and mind the traffic. The country rock on the east side of the pluton is exposed at roadcuts located along the north side of the road and at outcrops exposed in the stream on the south side of the road. The hornfels becomes progressively indurated toward the intrusion. The major contact metamorphic phases in the inner zone are cordierite, spinel (pleonaste), biotite, garnet, corundum, and epidote (Daly, 1903) with minor andalusite (Nielson, 1973) and fibrolitic sillimanite (Schneiderman, 1989). Calcareous rocks contain diopside, wollastonite, and locally grossularite and scapolite (Nielson, 1973). Schneiderman (1989, 1991) calculated emplacement of the igneous complex at about 1.5 to 2 kbar and 890 to 1000 ^{o}C, yielding a depth between 6 and 15 km.
Coordinates: 43.436288, -72.410755 to 43.435794, -72.414867

Stop 2: Granite and syenite
The biotite granite (west) and the hornblende-biotite syenite (east) are exposed here at roadcuts along the north side of the road, however the contact is not exposed.
Coordinates: 43.435796, -72.418230 at outcrops
Coordinates: 43.435338, -72.419957 at parking area for Stop 2 on the left side of the road, walk 100 m back downhill

Stop 3: Granite (optional)
The biotite granite is exposed at a large roadcut located just uphill of the picnic area and hairpin turn.
Coordinates: 43.436920, -72.427902 at picnic area

Optional restroom parking area
Coordinates: 43.437628, -72.433323

Stop 4: Thin aplite dike cuts granite
The exposures of granite at the "Windsor vista" parking area on the right side of the parkway locally contain thin aplite dikes.
Coordinates: 43.434205, -72.440643 at parking area

FYI at the "Mile 3" sign:
The contact between syenite (west) and granite (east) can be located here at these roadcuts. There is no parking here, however, and the exposures are now overgrown.

Stop 5: Syenite with mafic xenoliths (Lunch stop)
This is the upper parking lot located below the summit. Outcrops occur at the northwest corner of the parking lot, at the summit trailhead, and at exposures along the road just downhill from the dirt access road to the radio tower on south peak. After examining the outcrops and blasted blocks here, we will proceed up the mountain on foot. We will follow the relatively flat Hang Glider Trail to West Peak for 0.5 miles. From there we will follow the Weathersfield Trail steeply uphill to the summit observation tower for 0.4 miles. Finally we will steeply descend to the parking lot along the Slab Trail for 0.7 miles. If you decide to opt out of the summit traverse, we plan to return to the parking lot within about 2 hours.

Stop 6: Volcanic rocks along the Hang Glider Trail
Fine-grained, tan-weathering, gray to purple trachyte and rhyolite tuff and volcanic breccia occur here in the syenite.
Coordinates: 43.442988, -72.457442

Stop 7: Syenite with volcanic rock xenoliths at the West Peak hang glider platform
Coordinates: 43.458812, -72.458812

Stop 8: Syenite with abundant mafic xenoliths at the observation tower
Coordinates: 43.444128, -72.454320

Return to Stop 5 and then towards Saint-Gaudens.

Stop 9: Waits River Formation on Route 12A (optional)
The roadcuts located along the east side of the highway just south of Saint-Gaudens Road show strongly deformed interbedded gray phyllite, quartzite, and impure brown-weathering marble of the Waits River Formation. These outcrops are typical of the bedrock that underlies the Saint-Gaudens National Historic Site and much of the syenite-granite complex at Mount Ascutney.
Coordinates: 43.491360, -72.377848

References Cited

Chapman, R.W., and Chapman, C.A., 1940, Cauldron subsidence at Ascutney Mountain, Vermont: Geological Society of America Bulletin, v. 51, p. 191-212.

Daly, R.A., 1903, Geology of Mount Ascutney, Vermont: U.S. Geological Survey Bulletin No. 209, 122 p.

Daniels, D.L., 1990, Magnetic and gravity expression of Cretaceous alkalic plutonic complexes at Cuttingsville and Mount Ascutney, Vermont: U.S. Geological Survey, Bulletin 1887-C, 8 p.

Foland, K.A., and Faul, H., 1977, Ages of the White Mountain intrusives- New Hampshire, Vermont, and Maine, USA: American Journal of Science, v. 277, p. 888-904.

Foland, K.A., Henderson, C.M.B., and Gleason, Jim, 1985, Petrogenesis of the magmatic complex at Mount Ascutney, Vermont, USA, I. Assimilation of crust by mafic magmas based on Sr and O isotopic and major element relationships: Contributions to Mineralogy and Petrology, v. 90, p. 331-345.

Nielson, D.L., 1973, Silica diffusion at Ascutney Mountain, Vermont: Contributions to Mineralogy and Petrology, v. 40, p. 141-148.

Ratcliffe, N.M., Stanley, R.S., Gale, M.H., Thompson, P.J., and Walsh, G.J., 2011, Bedrock geologic map of Vermont: U.S. Geological Survey Scientific Investigations Map 3184, 3 sheets, scale 1:100,000, https://pubs.usgs.gov/sim/3184/

Schneiderman, J.S., 1989, The Ascutney Mountain breccia: field and petrologic evidence for an overlapping relationship between Vermont sequence and New Hampshire sequence rocks: American Journal of Science, v. 289, p. 771-811.

Schneiderman, J.S., 1991, Petrology and mineral chemistry of the Ascutney Mountain igneous complex: American Mineralogist, v. 76, p. 218-229.

Walsh, G.J., Armstrong, T.R., and Ratcliffe, N.M., 1996a, Preliminary bedrock geologic map of the Vermont part of the 7.5 x 15 minute Mount Ascutney and Springfield quadrangles, Windsor County, Vermont: U.S. Geological Survey Open File Report 96-719, 38 p., scale 1:24,000.

Walsh, G.J., Armstrong, T.R., and Ratcliffe, N.M., 1996b, Digital bedrock geologic map of the Vermont part of the 7.5 x 15 minute Mount Ascutney and Springfield quadrangles, Vermont: U.S. Geological Survey Open File Report 96-733, scale 1:24,000.

Walsh, G.J., Valley, P.M., Thompson, P.J., Ratcliffe, N.M., Proctor, B.P., and Sicard, K.R., in press, Bedrock geologic map of the Mount Ascutney 7.5 x 15-minute quadrangle, Windsor County, Vermont and Sullivan County, New Hampshire: U.S. Geological Survey Scientific Investigations Map, scale 1:24,000.