B4

EARLY DEVONIAN EXPLOSIVE SILICIC VOLCANISM AND ASSOCIATED EARLY AND MIDDLE DEVONIAN CLASTIC SEDIMENTATION THAT BRACKETS THE ACADIAN OROGENY, TRAVELER MOUNTAIN AREA, MAINE

BY

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(Modified from Rankin and Hon, 1987, and Rankin, 1980)

INTRODUCTION

The Katahdin-Traveler Igneous Suite consists of an exhumed magma chamber and a preserved part of its volcanic carapace. That the Acadian orogeny was short lived in this area is suggested by observations that the crystallized magma chamber (the Katahdin Granite, formerly Katahdin Quartz Monzonite) crosscuts folded Lower Devonian strata yet appears to be undeformed, whereas the volcanic carapace (Traveler Rhyolite) was erupted onto the same Lower Devonian strata while they were still poorly consolidated and was folded along with the underlying strata (Neuman and Rankin, 1980). The Traveler is unconformably overlain by the little deformed (probably post-Acadian) Trout Valley Formation of Middle Devonian age. The Trout Valley contains abundant detritus of the Traveler Rhyolite and, according to Kasper (1980), one of the richest early-land-plant deposits in the world.

The Traveler Rhyolite is mostly a series of welded ash-flow sheets preserved within a structural depression interpreted to be a caldera. Its 3,200 m (10,500 ft) thickness within the caldera, and its conservatively estimated volume of 800 km^3 (190 mi^3) based on the existing exposures, make it a world-class occurrence of ash-flow tuff. Hon argued (in Rankin and Hon, 1987) that the volcanic carapace was originally far more extensive and that the entire Katahdin pluton was subvolcanic to an immense caldera that would qualify as among the largest volcanic features known in the world. The estimated dimensions near the base are, according to Hon, about 65 km by 15 to 25 km (40 mi by 9 to 15 mi); the estimated total volume of magmatic material is on the order of 5,000 km^3 (1,200 mi^3). The present erosion level permits inspection of about half of the lower part of the complex.

The granite of the Katahdin pluton and The Traveler Rhyolite show remarkable chemical homogeneity given the large volume of both bodies. The granite is homogeneous within the limits of analytical precision; the rhyolites show a small degree of fractionation. Both are metaluminous to slightly peraluminous, and their unusually high scandium abundances suggest a distinctive petrogenetic province. The Katahdin Granite is mostly medium-grained biotite granite that shows large textural, though not mineralogical or geochemical, variations from a "normal" granitic texture in the interior of the pluton to a granophyric and miarolitic fine-grained granite near the summit of Mt. Katahdin.

TRAVELER RHYOLITE

The Traveler Rhyolite is the youngest stratified unit intruded by the Katahdin pluton. It is the northernmost and by far the largest of a discontinuous belt of rhyolitic and shallow granophyric intrusive rocks of Early Devonian age that extends 160 km (100 mi) across north-central Maine in the Moose River synclinorium and its counterpart to the northeast, the Matagamon synclinorium. They are collectively called the Piscataquis volcanic belt (Rankin, 1968), which lies northwest of a nearly coeval belt of Acadian mafic and felsic plutons, the Greenville plutonic belt (Hon, 1980). The rhyolites were erupted on shallow-water marine fossiliferous sandstone of Early Devonian age (Becraft-Oriskany), the Matagamon Sandstone and its correlatives, in or at the margin of a deeper water marine basin represented by the turbiditic Seboomook Formation (now Group). Five major volcanic centers have been identified and the rhyolites are more peraluminous (higher percentage of normative corundum) toward the southwest. Some of the rhyolites contain prominent almandine garnet phenocrysts that are, however, extremely rare in the Traveler Rhyolite.

Rankin, D.W., 1994, Early Devonian explosive silicic volcanism and associated early and middle Devonian clastic sedimentation that brackets the Acadian Orogeny, Traveler Mountain area, Maine (trip B4), in, Hanson, L.S., ed., and Caldwell, D.W., co-organizer, Guidebook to Field Trips in North-Central Maine, New England Intercollegiate Geological Conference, Wm. C. Brown Publishers, Debuque, Iowa, p. 135-146.

Little sedimentary rock and no paleosol horizons have been identified within the Traveler volcanic sequence, suggesting that the rhyolite was erupted in a relatively short time. The dominance of welded tuff argues for subaerial eruptions requiring a change from the marine paleoenvironment of the Seboomook and Matagamon (Rankin, 1960, 1965). Evidence that the Traveler Rhyolite is welded ash-flow tuff comes from both outcrop and thin section. The features preserved include flattened pumice lumps (fiamme), deformed (flattened) shards, columnar jointing, and massive units without obvious bedding. No glass remains in these Devonian rocks, and welding per se cannot be demonstrated, but flattening of shards and pumice lumps certainly can.

The following description of outcrop-scale features that may be observed on a traverse up Center Ridge of Traveler Mountain is from Rankin and Hon (1987). Although that traverse crosses only welded tuffs of the Black Cat Member of the Traveler (see below), the features described probably apply equally to the Pogy Member of the Traveler. All of the features described can be seen by the time one has reached a prominent level stretch of the ridge at an elevation of about 2,000 ft (670 m).

Columnar joints are observed in many outcrops along Center Ridge. They range in diameter from a few cm (in) to 2 m (6 ft); the largest ones are as much as a few tens of meters (yards) long. Columns also may be discerned on distant cliffs. In ascending this ridge, one crosses a series of sloping terraces, which suggests the erosion of a layered sequence. Commonly, the rises of the terraces are zones of well-developed columnar joints, whereas the treads are zones of indistinct columns or no columns. In a few sequences, the size of the pumice lumps changes from one terrace rise to another, suggesting that the rises represent different flow units of a welded tuff sequence. Some outcrops along the lower part of Center Ridge are characterized by pumice lumps as large as 50 cm (20 in) across. In rare sequences it has been observed that the degree of flattening decreases upward in a terrace rise. Detailed mapping eventually may demonstrate that individual flow units are traceable.

The compaction foliation is commonly roughly perpendicular to the axes of the columns. Where this relationship holds true, the direction of compaction was roughly perpendicular to the cooling surface--by analogy with young welded tuffs, a quasihorizontal surface that may be treated as bedding. Look across the South Branch Ponds at Black Cat Mountain. Note that the terraces or benches trend northeast and are tilted to the northwest. The benches on Center Ridge trend northwest and are tilted to the northeast. Both of these directions of tilting are roughly parallel to the attitude of the compaction foliation on the respective mountains. Hence the glacial valley of the South Branch Ponds is along the axis of an open, north-plunging anticline in the Black Cat Member. Dips on the limbs of 20° to 40° are typical. The northwest trend of the ridges of The Traveler (Pinnacle, Center, and North) and Big Peaked Mountain are controlled by the attitude of the compaction foliation on the east limb of the structure.

The intrusive contact of the Katahdin Granite with the Pogy Member crosses the south side of Pogy Notch. The north-plunging anticline of the Pogy Notch-South Branch Ponds valley (South Branch Ponds anticline) may be a resurgent dome within the Traveler caldera. From Center Ridge one can look north-northwest down South Branch Pond Brook, the locus of Stop 4, and into the broad flat valley of Trout Brook underlain by the Trout Valley Formation. The gentle dips of the Trout Valley Formation do not reflect the South Branch Ponds anticline.

The Traveler is a flinty aphanitic rhyolite that contains small (1 to 3 mm) phenocrysts. Color ranges from light gray through various shades of green, greenish gray, and bluish gray to nearly black. The darkest rocks contain the least altered phenocrysts and the best preserved primary textures.

The Traveler Rhyolite is composed of the basal Pogy Member, the overlying Black Cat Member, and at least two additional members, which are at present poorly understood and are not exposed along the route of the field trip. The two additional but not named or adequately mapped members include 1) phenocryst-poor, mildly compacted welded ash-flow-tuff characterized by small fiamme that crops out on Barrell Ridge, along Dry Brook, and on Little and Big Peaked Mountains (see Traveler Mountain 15-minute quadrangle), and 2) rhyolite lava flows with convolute flow layering that crop out on Trout Brook Mountain summit and north slope, and on the western summit of Billfish Mountain. Both appear to be younger than the Black Cat Member but the age relationship of one to the other is not known.

The Pogy Member, approximately 900 m (3,000 ft) thick, is characterized by moderately compacted welded ash-flow tuff containing about 15% phenocrysts, of which one-third are quartz and most of the rest are plagioclase (with oscillatory zoning, but generally progressing from core of about An_{56} to rims of about An_{35}; Rankin, 1961). Sanidine (Or_{67}) occurs with plagioclase and quartz in a few samples. Mafic silicate phenocrysts may be absent or may constitute as much as 10% of the phenocryst population. They are generally altered beyond recognition, but clinopyroxene is present in one thin section, and the remnants of biotite phenocrysts were observed in a few. Garnet occurs in two samples. Lithic fragments, including rhyolite, diabase, sandstone, and shale, are present in most samples.

The overlying Black Cat Member, about 2,300 m (7,500 ft) thick, is characterized by highly compacted and welded ash-flow tuff containing 10% phenocrysts. Typically, 75% of these are plagioclase (with oscillatory zoning, but generally progressing from cores of An_{61} to rims of An_{33}), 20% are augite (optically determined to be about $Wo_{30}En_{28}Fs_{42}$), and 5% are magnetite (Rankin, 1961). Quartz phenocrysts are typically not present, but rarely may constitute as much as 10% of the phenocrysts. Biotite phenocrysts coexist with augite locally, and rarely, hornblende is the only mafic silicate present. Fayalite coexisting with augite and biotite is present in one thin section, and garnet phenocrysts occur in two samples. Glomeroporphyritic texture, rare in the Pogy Member, is common in the Black Cat.

To a first approximation, bulk compositions of both members fall within the synthetic, steam saturated, granite system close to the minimum melting compositions. The major mineralogic difference between the two members is that the Pogy Member contains quartz phenocrysts and the Black Cat Member typically does not. The Pogy Member contains a somewhat higher total percentage of phenocrysts, is more altered, and more commonly contains lithic clasts than the Black Cat. Pumice lumps in the Black Cat are characteristically more compacted than those of the Pogy. Length to thickness ratios of 10:1 to 20:1 are typical for the collapsed pumice lumps (fiamme) of the Black Cat. Ratios as high as 60:1 have been observed. Some Black Cat ash flows were apparently hot enough at the time of emplacement that they continued to flow during or after welding as evidenced by rotated phenocrysts and flow folds. In the Pogy, on the other hand, length to thickness ratios of the fiamme of 2:1 to 4:1 are more common.

These observations led to the following model, presented in more detail by Rankin (1968, 1980). The basal Pogy Member was erupted from the cooler and more volatile, H_2O-rich, upper part of the magma chamber and the overlying Black Cat Member followed, probably relatively quickly, from deeper, hotter, and drier parts of the magma chamber. Hon (1976) calculated that the phenocrysts of the Black Cat Member form an equilibrium assemblage at $T = 800°C$, $P(H_2O) = 1100$ bars, and $f(O_2)$ near the fayalite-magnetite-quartz buffer curve. The temperature for the Pogy Member is approximately 40° lower.

ROAD LOG

Saturday, September 24, 7:30 AM: The assembled group will leave the parking lot of Heritage Motel, Millinocket. An alternate assembly point is at 8:30 AM at the site of the former Shin Pond House at the crest of the first hill about 0.2 mi northwest of the thoroughfare between Upper and Lower Shin Ponds on Maine Route 159 northwest of Patten. Please be sure that each vehicle has a full tank of gas and a useable spare tire fully inflated. Bring lunch and be prepared to get your feet wet as well as scramble over a steep scree slope. A copy of the Traveler Mountain and Shin Pond 15-minute topographic quadrangles and road map of Maine will be useful.
Note: Stops 4 and 5 are within Baxter State Park.
Collecting permits are required to remove material from the park, and current rules disallow the use of hammers. No pets are allowed in the park.

Mileage (estimated as far as the Shin Pond Thoroughfare)

0.0 Parking lot Heritage Motel, Millinocket. Proceed east on Maine 11/157.

10.0 Enter I-95 at Medway, and head north.

30.0 Leave I-95 at Exit 58 for Sherman and take Maine 11 north to Patten.

30.5 Turn left on Maine 159 at north edge of Patten.

40.0 Cross thoroughfare between Upper and Lower Shin Pond.

40.2 Crest of hill. Site of former Shin Pond House. Alternate assembly point. Continue on unnumbered dirt (in 1980) Grand Lake Road toward Baxter State Park. Trip B-4 in 1980 also followed Grand Lake Road as far as the East Branch of the Penobscot River. Some of Neuman's road log for that trip as far as the Bowlin Pond Road is repeated here. You should refer to that road log of Neuman (1980) or Trip B-5 (this guidebook) for more detail.

40.5 Roadside ledges are thin-bedded, crossbedded quartzite of the Grand Pitch Formation and porphyritic Rockabema Quartz Diorite.

40.6 Roadside ledges are medium- and dark-gray slate and quartzite of the Grand Pitch Formation.

40.7 Very light colored and fine-grained phase of the Rockabema Quartz Diorite and slate of the Grant Pitch Formation.

41.8 Road on right to Snowshoe and White Horse Lakes.

42.1 View of Sugarloaf Mountain straight ahead. The mountain is capped by a metadiabase sill in a syncline plunging northeast. The fossiliferous Shin Brook Formation crops out on the slopes of the mountain beneath the sill.

42.8 Crommet Spring lunch ground.

43.3 Ledges to left of road are of the fossiliferous Shin Brook Formation.

43.8 Ledges on left are metadiabase of the sill that overlies the Shin Brook Formation.

45.9 Ledges on left are quartzite of the Grand Pitch Formation.

46.1 Bridge over Seboeis River.

46.9 Road on right to Scraggly Lake.

47.3 Beginning of long straight stretch of road with view down road of North Traveler and Bald Mountains, both held up by the Traveler Rhyolite.

49.1 Toward West end of 2-mile long straight stretch of road. Park on right side of road.

STOP 1. SEBOOMOOK GROUP. (30 MINUTES) This outcrop is typical of the Seboomook in the area of Matagamon Lake where it was characterized by Pollock (1987) as thin- to medium-bedded slate and sandstone near the eastern margin of the Lower Devonian pelite dominated basin. Excellent examples of graded bedding. Graded sets typically about 2.5 cm thick. Sandy bottoms commonly rippled. A

10 cm sandstone bed is at the top of the outcrop. Bedding strikes N0°E dips 20° east. Tops are to the east. Cleavage in the slaty tops of the beds strikes N25°E and dips 80°E but is refracted through a lower angle of dip in the sandy bottoms.

50.6 Pass side road right to Hay Lake. At the time of field work in the Traveler Mountain area in the 1950's, this Maine Forest Service station was the closest telephone and that was on a Maine Forest Service woods line. It still may be!

50.9 Side road left to Bowlin Pond.

51.3 T5R8 town line. Gradational contact between Seboomook Formation and Matagamon Sandstone crosses road near here.

52.0 Roadside ledges are of Matagamon Sandstone, as are all roadside ledges as far as the shore of Grand Lake Matagamon.

53.3 Park on left side of road in broad space. Outcrop across road to right.

STOP 2. MATAGAMON SANDSTONE (30 MINUTES) (See also description of Trip C3 by Pollock, this guidebook and Pollock and others, 1988) The Matagamon Sandstone here is in a northeast-trending structural basin, the Hay Mountain basin (Rankin, 1965). These exposures are very nearly on the axis of the basin and the sandstone dips gently northeast. Note the detrital muscovite and trough cross bedding.

Before the trees grew large enough to obscure the view one had a fine view here of the mountains to the west and south. To the southwest, Mt. Katahdin is or was visible between Turner Mountain on the left and Traveler Mountain on the right. The long mass of Traveler Mountain is across the valley of the East Branch of the Penobscot River. Although The Traveler (the highest point of Traveler Mountain) is only 3,541 feet high, it rises 3,000 feet above the river. The bare conical peak of Bald Mountain is set against North Traveler Mountain. The last mountain to the right, barely visible from here (in 1980), is Horse Mountain on the shore of Grand Lake Matagamon. Turner and Katahdin are composed of Katahdin Granite, the others, of the Traveler Rhyolite.

54.9 Cross East Branch, Penobscot River.
I spent part of the summer field season of 1957 in a now demolished cabin on a point on the lake above Grand Lake Matagamon Dam. Parts of some evenings were spent reading by Coleman lantern H.D. Thoreau's The Maine Woods (1864). It was of more than passing interest to me to learn that it was 100 years ago that summer in 1857 that Thoreau made his journey across Matagamon Lake and down the East Branch of the Penobscot River.

55.9 Enter Baxter State Park. Pause and note the 180 m (600 ft) cliffs of welded ash-flow tuff of the Pogy Member of the Traveler Rhyolite forming the east face of Horse Mountain on left. Columnar joints are prominent. Many columns are more than 1 meter in diameter. C.H. Hitchcock (1861) referred to Horse Mountain as the mountain known by an inelegant name.

56.1 Park on right and climb about 60 m (200 ft) up steep, partly wooded, hazardous scree slope. Remember others may be behind you.

STOP 3. STRATIGRAPHIC CONTACT BETWEEN MATAGAMON SANDSTONE AND OVERLYING POGY MEMBER OF THE TRAVELER RHYOLITE. (90 MINUTES)
(Fig. 1) The Matagamon Sandstone underlies the scree slope and is exposed in scattered outcrops toward the top. The sandstone strikes approximately N15°E and locally dips as much as 40°W. . Ash-flow tuffs of the Pogy Member form the cliffs above. The contact, defined as the first appearance of recognizable layers of rhyolite, is exposed in places at the top of the scree slope and dips 20°W. The top 6 m (20 ft) or so of the

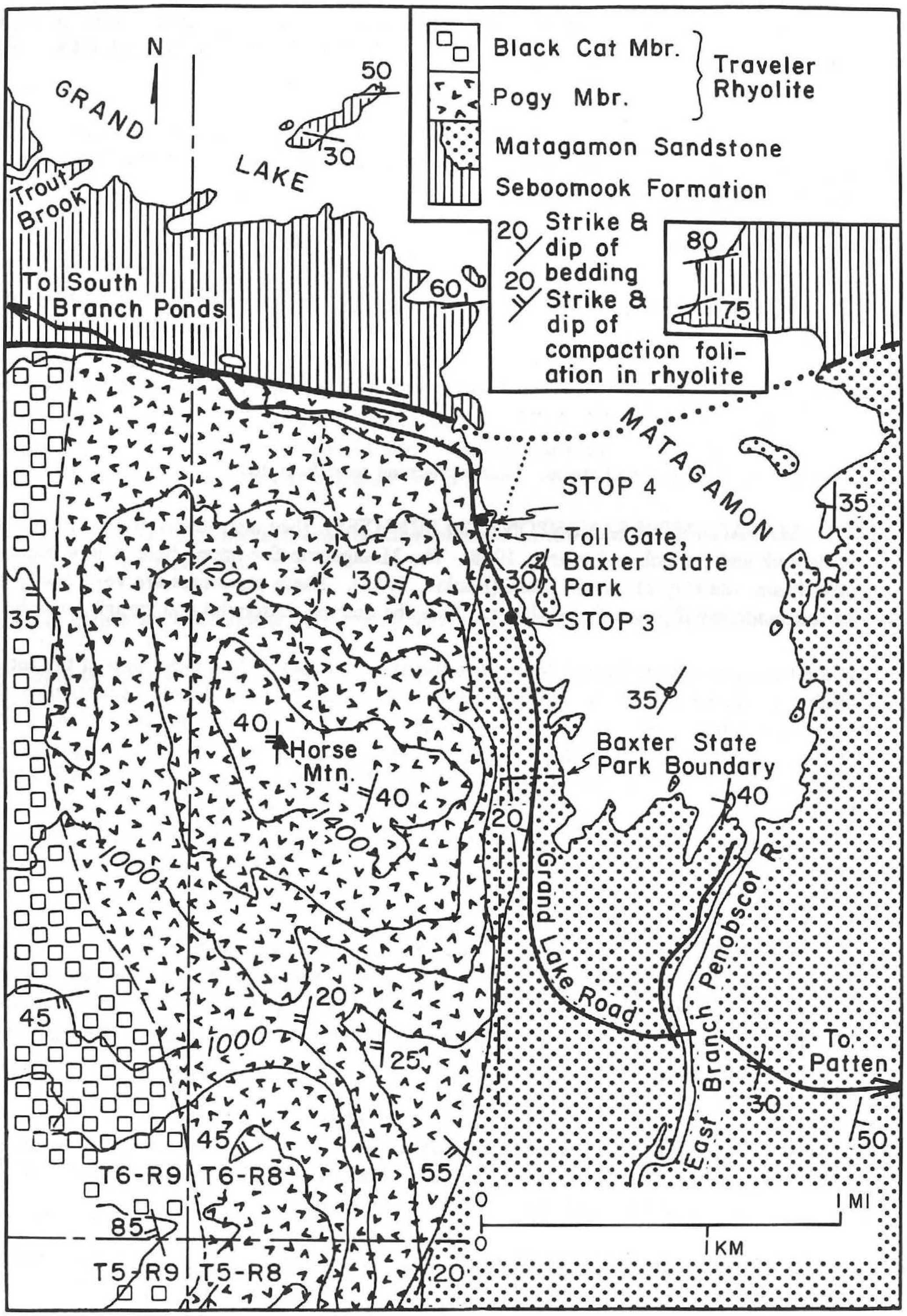

Figure 1. Geology of the Horse Mountain area, Stops 3 and 4. Topography from the U.S. Geological Survey Traveler Mountain 15-minute Quadrangle. Contour interval 200 ft (61 m). Geology by D.W. Rankin. Modified from Rankin and Hon (1987).

Matagamon contains scattered pebbles of felsite and beds of tuffaceous sandstone, indicating that some volcanic activity preceded the main body of rhyolite. In the vicinity of Stop 3, an irregular layer of sandstone up to 0.5 m (1.6 ft) thick was observed within the lower several meters (feet) of rhyolite roughly parallel to the compaction foliation in the ash-flow tuffs. Elsewhere sandstone dikes, some anastomosing and some as thick as 2.5 m (8 ft), have been observed in the base of the rhyolite indicating that the sand was unconsolidated at the time of the first major ash flows. The contact as seen along the base of the cliffs is an irregular surface with relief of as much as 5 or 6 m (16 or 20 ft). This irregularity may be due to scouring by ash flows.

The basal 0.6 to 1.2 m (2 to 4 ft) of the massive-appearing rhyolite is composed of nonwelded tuff in which devitrified but nondeformed shards are clearly visible (Rankin, 1980, Fig. 1A). This nonwelded tuff grades up into welded ash-flow tuff that makes up most of the rhyolite of the Horse Mountain cliff. Fragments of collapsed pumice are visible in the rhyolite about 1 m (3 ft) above the base. Flattened and deformed shards are visible in a thin section collected from this station 1.5 m (5 ft) above the base (Rankin, 1980, Fig. 1B).

56.6 Gatehouse Baxter State Park. Park on right side of road. Outcrops are on right below road.

STOP 4. (Optional) **POGY MEMBER.** (30 minutes) The Pogy Member is well exposed along the lake shore from the gate house out to a small point. Crude columnar joints about 0.3 m (1 ft) in diameter plunge steeply southeast into the lake behind the gate house. Compaction foliation here strikes N15°E and dips 35°W. The ash-flow tuff is unusually highly compacted for the Pogy Member. Outcrop of the Pogy on west side of road in the 1950's exposed thin anastomosing dikes of sandstone from the underlying Matagamon Sandstone in the welded tuff. This part of the outcrop has been subsequently removed by blasting.

57.0 Road turns left away from lake and crosses ledges of rhyolite of the Pogy Member.

58.1 Cross unexposed, high-angle fault between Traveler Rhyolite and Seboomook Group.

59.2 Trout Brook Farm, first cleared in 1837, is now a Baxter State Park campground. It produced hay for horses used in logging operations until the 1940's. C.H. Hitchcock stayed here in 1861. I spent parts of the summers of 1956 and 1957 in the now demolished very large farm/bunk house that stood on the far edge of the field near Trout Brook. At that time, there was a bridge over Trout Brook and one could drive on what was known locally as the Burma Road to Webster Brook at the head of Grand Lake Matagamon, crossing enroute some well-exposed open folds in the Seboomook Group.

59.7 Trout Brook on right parallel to road.

60.2 Sharp turn left. Ledges of Seboomook Group in woods to left. Excellent exposures of the Seboomook Group just upstream from the adjacent right-angle turn of Trout Brook. Graded bedding, refracted cleavage, and many small folds have been observed in these exposures.

60.4 Parking area left for trail to the delightful lakes of theDeadwater Mountains (the local name for the mountains between Traveler Mountain and Matagamon Lake).

60.7 Old road right leads 0.1 mile to site of old K.P. wooden dam on Trout Brook. The dam was built on ledges of brecciated Black Cat Member, Traveler Rhyolite. The high-angle fault bounding the rhyolite on the north crosses the stream just below the dam. A thin wedge (9 to 12 m) of highly fractured Matagamon Sandstone is north of the fault. Beyond this is the Seboomook Group.

63.1 Crossing of Dry Brook. Spectacular columnar jointing in the unnamed ash-flow unit above the Black Cat Member about a mile upstream. The columns are about 8 cm in diameter and are deformed into an open z-fold by a normal fault of about 0.5-m displacement.

63.6 The Crossing. STOP. Leave appropriate number of cars so that drivers may later be ferried to South

Branch Ponds to retrieve remaining cars. Considerable doubling up will be necessary, but it is a short drive and no one wants to walk both ways. Take lunches with you. After leaving some cars, proceed up side road left to South Branch ponds Campground.

65.8 South Branch Ponds Campground. Lunch. Park cars in parking area at entrance to campground and carry lunches to shore of pond.

STOP 5. BLACK CAT MEMBER, TRAVELER RHYOLITE AND TROUT VALLEY FORMATION. (3 1/2 HOURS). Traverse from South Branch Ponds Campground over the ledges and down South Branch Ponds Brook to The Crossing on Grand Lake Road.

The one-way distance is about 5 km; there is no trail beyond the ledges and the traverse requires repeated crossing of the stream. It is imperative to stay with the leader. This traverse offers excellent stream exposures of the ash-flow tuff of the Black Cat Member, the basal rhyolite conglomerate lentil of the Trout Valley Formation, numerous exposures of the main body of the Trout Valley containing land plant fossils, and altered diabase of unknown age, intrusive into the Trout Valley and probably of intermediate composition.

Before starting along the trail to the ledges, walk down to the shore of the pond. Loose cobbles and pebbles of the Black Cat Member along the shore offer some of the best examples of the crude planar fabric (eutaxitic texture) typical of welded tuffs. This fabric is thought to be caused by the collapse of hot pumice lumps (fiamme) after the ash flow had largely come to rest. Notice the high length-to-thickness ratios of the fiamme in many of the samples indicating extreme compaction and implying a high emplacement temperature. You may be able to spot rotated phenocrysts and small folds of the fiamme in some samples.

From the campground, follow to the park trail north to The Ledges which are about a kilometer away. The Ledges are held up by welded tuff of the Black Cat Member, which here contains unusually large fiamme. The view south over the South Branch Ponds is of Mt. Katahdin. Note the northwest trending ridges of Traveler Mountain. These are held up by northeast dipping ash-flow tuffs of the Black Cat Member.

Continue along the trail west, cross the South Branch Ponds Road, and descend steep slope through open woods (no trail) to South Branch Ponds Brook. Turn right and walk downstream. The station numbers below refer to the numbered points on Figure 2. This sketch map is traced from an aerial photograph; the scale is approximate.

Station 1. Exposures of Black Cat Member. Note the pattern of concentric joints in outcrop on corner at stream level. Actually the joints are concentric about more than one center, giving rise to a pattern of intersecting curving joints. Distinctive columnar joints of small diameter are present above the stream on the east bank. Higher and slightly downstream is another flow unit having columnar joints of larger diameter. The very thin fiamme, most easily visible on weathered surfaces indicate that this is a very compacted unit. Compaction foliation strikes N80°E and dips 30°N.

Station 2. First of a series of sloping joint surfaces across which the stream flows. The cover photograph of the GSA Centennial Field Guide-Northeastern Section is of one of these. Close examination shows that these are dip surfaces of ash flows. Compaction foliation is roughly parallel to the surfaces, and, in places, crude columnar joints are roughly perpendicular to the surfaces. The ash flows strike about N70°E and dip 30°N. Local areas of crosscutting breccia are also present in this outcrop on the left bank of stream.

Station 3. Falls of South Branch Pond Brook. A trail leads from South Branch Ponds Road to the falls. Last of the series of dip slopes. Compaction foliation is visible on a number of steep joint surfaces and on water polished surfaces at upper end of falls. Compaction ratios of 20:1 are common.

Station 4. In stream bed on east bank just upstream from steep gravel bank at corner. This is the lowest exposure of conglomerate of the Trout Valley Formation, which forms a lentil, probably a deltaic deposit

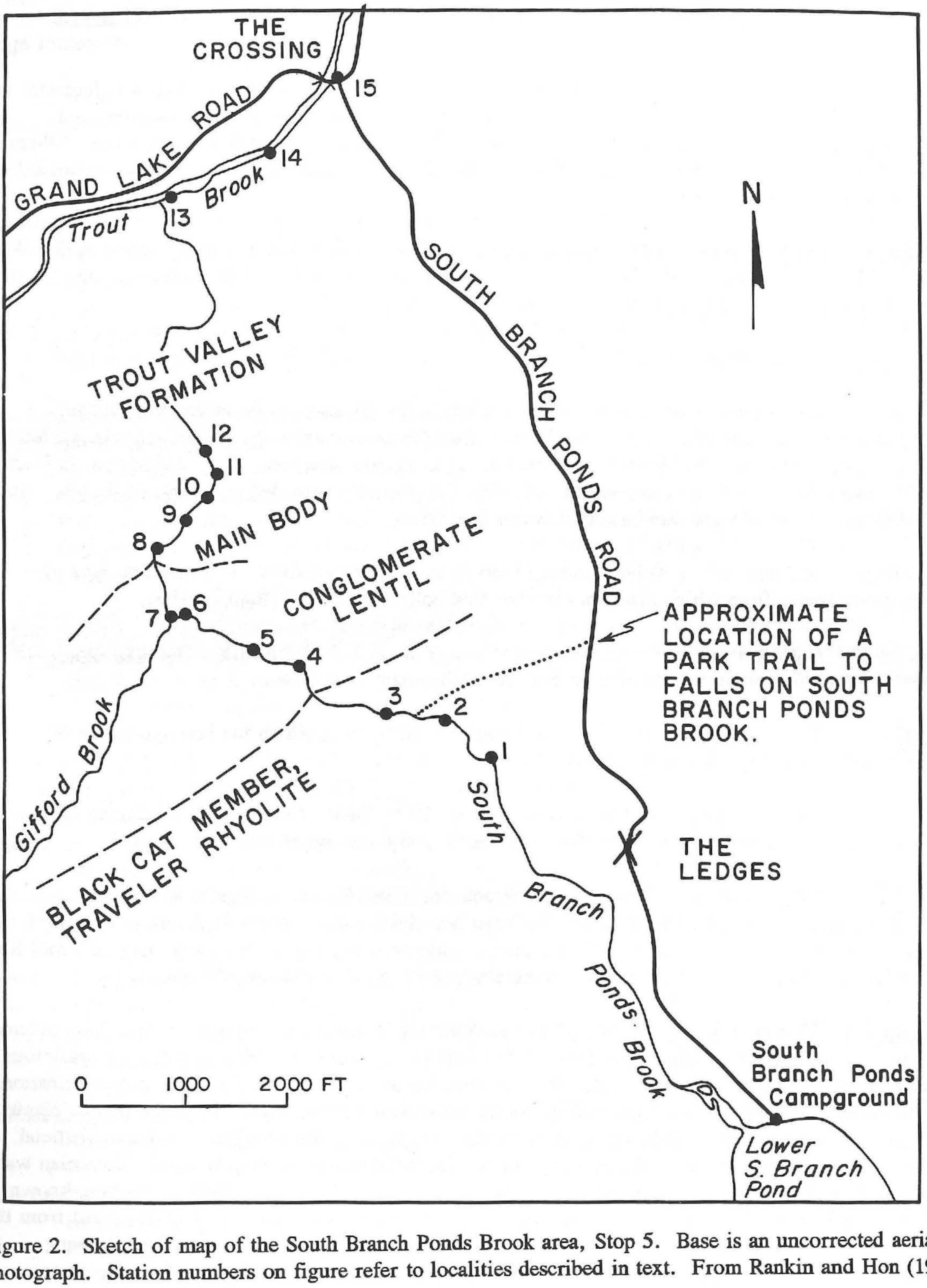

Figure 2. Sketch of map of the South Branch Ponds Brook area, Stop 5. Base is an uncorrected aerial photograph. Station numbers on figure refer to localities described in text. From Rankin and Hon (1987).

at the base of the Trout Valley.

Station 5. Joints cut cobbles in conglomerate: first clue that this poorly consolidated conglomerate is not a Pleistocene till. Some cobbles are offset along the joints. Note that clasts (pebbles, cobbles, and boulders) are well rounded and that all of them are rhyolite. The clasts are so weathered that many of them can be broken apart by hand. The weathering may date from the Devonian. The conglomerate is cross-bedded and dips gently north, away from the volcanic rocks.

Station 6. About 10 m (33 ft) of conglomerate of the Trout Valley exposed in the canyon wall. Where is the contact with the overlying Pleistocene till? Note the sandstone bed in the conglomerate near the top of the exposure and lenses of black sandy carbonaceous shale near the bottom.

Station 7. Junction with Gifford Brook.

Station 8. Large exposure at curve of stream on left bank. Coarse conglomerate is no longer dominant. You are now in the main body of the Trout Valley Formation above the basal conglomerate lentil. Numerous black chert lenses are visible and some have a vague internal structure. E.S. Barghoorn, in Dorf and Rankin (1962), identified one of these as *Prototaxites*, which is generally regarded as of algal affinities. Also present are siderite concretions and thin beds of sideritic ironstone.

Station 9. Upstream: sill of diabase and a 15 cm (6 in) bed of ironstone. Downstream: lens of carbonaceous black shale, from which plant fossils were first collected in 1955 (Rankin, 1961).

Station 10. Light gray-green fine-grained diabase dike about 1 m (3 ft) thick. The dike trends N30°W and dips 40°N. Note the chilled dike margin against the sedimentary rocks.

Station 11. This is "Locality 4" of Dorf and Rankin (1962), from which the best specimens of flattened spiny stems of *Psilophyton* were collected.

Station 12. Gently dipping sill of diabase about 3 m (10 ft) thick. Note the net veining by more silicic material within the sill. Plant remains can be found in nearly every outcrop of sedimentary rock.

Station 13. Junction of South Branch Ponds Brook and Trout Brook. If time is short and water is not high, Trout Brook may be forded here. Grand Lake Road is a short distance north of the north (far) bank of Trout Brook. Turn right (east) on road for The Crossing. Alternatively, stay on the south bank of Trout Brook and turn right (east). Follow a faint fisherman's track along the right (south) bank of Trout Brook.

Station 14. This is "Locality 1" of Dorf and Rankin (1962) and Kasper (1980). Here a long outcrop of gently dipping sandstone and shale of the Trout Valley Formation is present. The sandstone is calcareous and current-bedded. Kasper (1980) reports that this has been the most productive fossil site in the formation. The megafossils of land plants in the Trout Valley Formation include several species of naked plants (plants without leaves) that were formerly included under the name *Psilophyton*, now considered to be an artificial taxon (Kasper, 1980). On the basis of these, an age of late Early Devonian or earliest Middle Devonian was suggested by Andrews and others (1977). More recently, a lycopod, *Leclerqia complexa*, elsewhere known only from the Middle Devonian (Hamilton, or Givetian of European terminology) has been described from the Trout Valley, but not from this station (Kasper and Forbes, 1979). Kasper (1980) reports the following assemblage from this site: *Psilophyton dapsile* (the best preserved plant at this location), ?*Psilophyton* sp., *Kaulangiophyton akantha, Taeniocrada* sp., *Taeniocrada* sp., *Thursophyton* sp., and *Sciadophyton* sp. Eurypterid scales were also found at this outcrop. A fault of unknown displacement cuts the southwest end of the exposure. Please remember that collecting permits are required to remove material from the park.

<u>Station 15</u>. The Crossing. Poorly preserved but large plant fossils occur in the outcrops beneath the bridge abutments.

End of field trip. Drivers will retrieve cars from South Branch Ponds Campground and pick up field trip participants at The Crossing. After that you're on your own.

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