TRIP B-3

EXCURSION TO CLIMB MT. ARAB IN THE ADIRONDACK MOUNTAINS NEAR TUPPER LAKE

William Kirchgasser,
Department of Geology, SUNY Potsdam
kirchgwt@potsdam.edu

INTRODUCTION

The easily reached summit of Arab Mountain (Mt. Arab of trail guides), near Tupper Lake in southern St. Lawrence County, with its Fire Tower and open overlooks, offers spectacular panaramic views of the Adirondack Mountains. For geologists, naturalists and tourists of all ages and experiences, it is an accessible observatory for contemplating the geologic, biologic and cultural history of this vast wilderness exposure of the ancient crust of the North American continent.

My connection to Mt. Arab began in the 1980s on the first of several hikes to the summit in the fall season with Elizabeth (Betsy) Northrop's third grade classes from Heuvelton Central School. Although the highways and waterways in these mountains can offer breathtaking vistas, to truly experience the expanse and quiet grandure of the Adirondacks, one must climb to a summit. At two miles roundtrip on a well-maintained trail and only 760 ft. (232 m) elevation change, Mt. Arab is ranked among the easiest of the fire tower trails in New York State (Freeman, 2001); at a leisurely pace the summit at 2545 ft (776m) elevation can be reached in thirty to forty-five minutes. Mt. Arab is included in many trail guides, among them one with many useful tips on hiking with children in the Adirondacks (Rivezzi and Trithart , 1997). Through the efforts of the Friends of Mt. Arab, the Fire Tower and Observer's Cabin have been restored and there are trail guides available at the trailhead. In recent years naturalist guides are on duty during summer weekdays.

ROUTE FROM POTSDAM TO MT. ARAB

The route from Potsdam up to Mt. Arab follows the valley of the Raquette River along Rte 56 South to its intersection with Rte. 3 at Sevey (or Sevey's) Corners. This leg of the trip follows Trip C of VanDiver (1976) and the notes given here of special features along the way borrow heavily from that geological guide as well as other general accounts of the geological history of the Adirondacks, including Isachsen and Fisher (1970), VanDiver (1980), Fisher et al. (1980), Rogers et al. (1990), Isachsen et al. (1991) and the Department of Environmental Conservation (DEC) Map and Guide (1999). A recently published Geological Society of America monograph (Tollo et al., 2004) summarizes recent studies on the geological evolution of the Adirondacks, much of it based on new U-Pb zircon dates on the various suites of rock and comparison of the tectonic features and mineral suites with those of modern-day mountain terranes. The metamorphic conditions under which the rocks of Adirondack formed have been compared to the continental-collision style tectonics of the Himalaya Mountains.

GEOLOGIC HISTORY OF THE ADIRONDACKS

The basement rocks exposed in the Adirondack Mountains of New York are part of the Grenville Province of the Canadian Shield, a vast continuous belt of ancient metamorphic rocks along the eastern margin of the North America Continent (Fig. 1). They are connected to the shield via the Frontenac Arch, a northwestward trending corridor, also exposed through the sedimentary cover, that crosses into Canada at the Thousand Islands . The sedimentary and igneous rocks of the Grenville Province were intensely folded, faulted and metamorphosed during the Grenville Orogeny, a complex sequence of tectonic events, during the Proterozoic Era, between about 1.3 and 1.0 billion years ago.

The Adirondack Highlands to be seen on this trip are a roughly circular-shaped landform of rugged, uplifted mountainous terrane underlain primarily by intensely deformed (granulite facies) metaigneous rocks and minor metasedimentary rock, part of the Central Granulite Terrane. By comparison, the Adirondack Lowlands of northwestern St. Lawrence and northern Jefferson Counties, is a subdued landform, underlain primarily by less intensely deformed (upper amphibolite facies) and more easily eroded variety of metamorphosed sedimentary and volcanic (metasedimentary, metavolcanic and metaigneous) rocks, part of the the Frontenac Terrane.

The boundary between the Adirondack Highlands and Adirondack Lowlands is a .67-6.7 mile (1-10 km) wide northeast-trending zone of highly strained metamorphic rocks (mylonites) comprising the Carthage-Colton Mylonite Zone (CCMZ), a shear-zone and fault boundary which extends northward beneath the sedimenary cover in New York to the Labelle Shear Zone of southern Quebec. The origin of the Grenville terranes and the CCMZ boundary are discussed in detail elsewhere in this volume and only a brief summary is given below.

The geololgical evolution of the Grenville orogenic belt comprises three major events as summarized by McLelland and Chiarenzelli (1990), McLelland et al. (1988, 1996) and Tollo et al. (2004): a. an island-arc related Elzevirian Orogeny that began about 1350 Ma. (million years ago) and ended about 1185 Ma. when outboard terranes had been accreted, the associated compression having overthickened the crust and underlying lithosphere; b. an interval from about 1175 to 1125 Ma. when the Elzevirian orogen or mountain belt foundered and magmas of the anorthosite-mangerite-charnockite-granite suite (AMCG magmatism) originating from the upper mantle and lower crust intruded (at around 10 km depth) first in the northwest and later and more profusely to the southeast in the area of the Adirondack Highlands. There are no rocks in New York dated in the interval (1125 to 1100 Ma.) but at around 1110 to 1090 Ma. hornblende granites (Hawkeye Suite) intruded in the northern Adirondack Highlands; c. the final major Grenville orogenic phase, the Ottawan Orogeny, began around 1080 Ma. and continued to around 980 Ma. This global-scale, continental collisional-event strongly deformed and metamorphosed the older rocks, most intensely the more deeply buried (17 to 20 mile; 25 to 30 km. depth) Highland rocks. The Ottawan compression approximately doubled the thickness of the crust and lithosphere, and produced a mountain range comparable in height to the modern Himalaya chain.

It was during the late or the foundering phase of the Ottawan orogen or mountain belt that the Highlands and Lowlands terranes became juxtaposed along the CCMZ. The boundary is interpreted as a post-collisional event, an oblique-to-strike slip displacement followed by dip-slip movement along an extensional fault (dipping northwest) in which part or all of the Lowlands terrane (the hanging wall) was downthrown relative to the Highlands terrane (footwall). The hypothesis is that the Lowlands rocks once capped the Highlands rocks and when the Lowlands rocks slid or collapsed downward to the northwest along the CCMZ, it exhumed or unroofed the roots of the predominently intrusive igneous rocks (AMCG suite) of the Highlands terrane. These AMCG metamorphic rocks seen today, after post-Grenville uplift and erosion, include the mangerite pluton forming Arab Mountain, and the more resistant and extensive belt of anorthosite plutons of Whiteface Mountain and the Marcy Massif of the High Peaks region.

The Lowlands terrane-over-Highlands terrane hypothesis explains some of the similarities and differences between Lowlands and Highlands rocks. The similar patterns of isoclinal folding, although differing in orientation (Fig. 1), are the result of both regions experiencing Ottawan-phase metamorphism. There are similar metasedimentary facies (ex. marbles) in both areas and alaskitic or leucogranites of metaigneous origin are found in both areas. While the Ottawan phase metamorphic

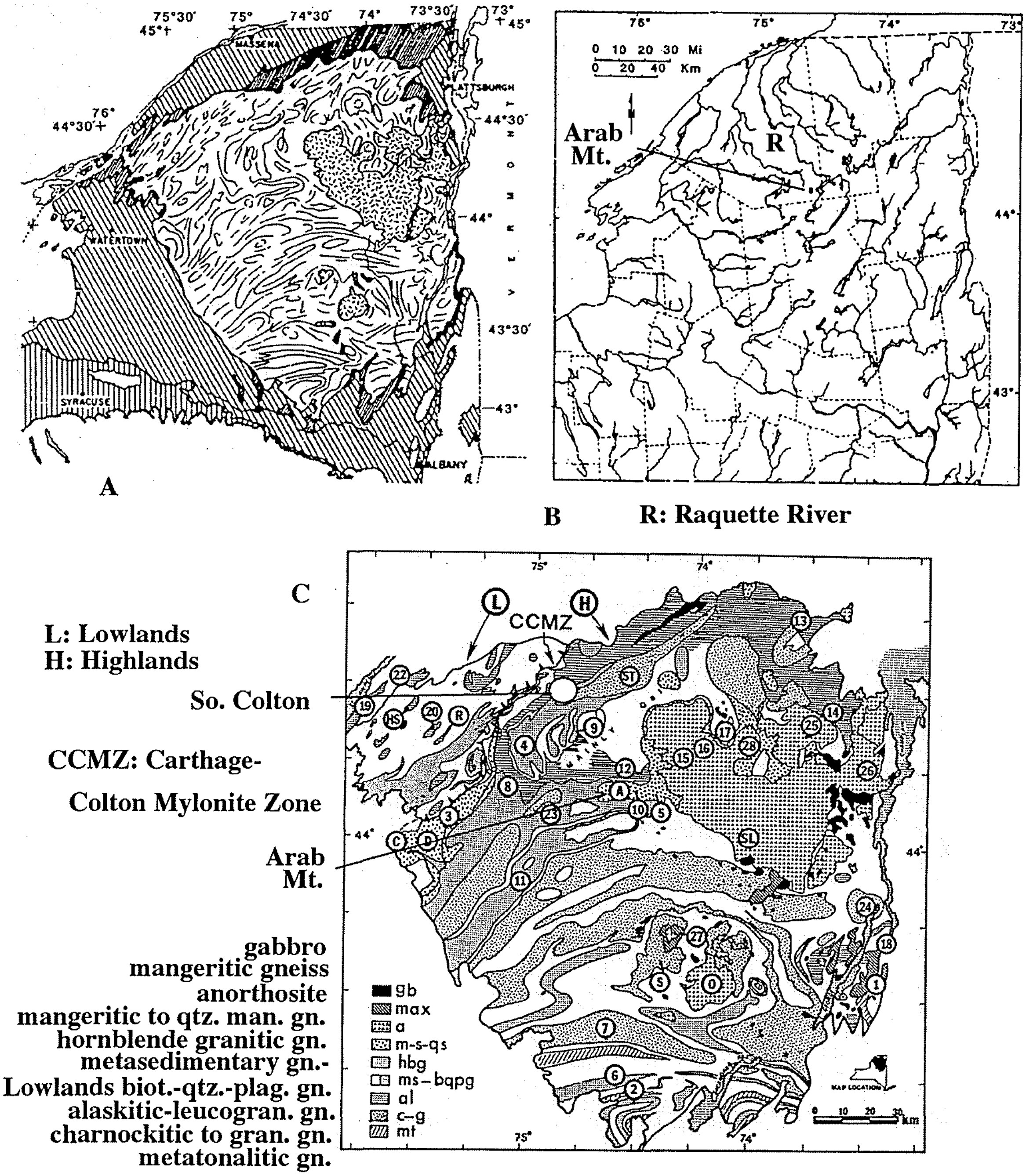

Fig. 1. Maps showing A. fold patterns and B. radial drainage of major rivers in the Adirondacks (from Isachsen et al., 1991) and C. major bedrock units and numbered locations of Zircon dated rocks (from McLelland et al., 1988).

overprint is the predominant structural and fabric signature in both terranes, the Highlands rocks, being more deeply buried in the core of the orogen, experienced the higher grade of metamorphism (granulite facies) during the Ottawan continental collision. By comparison, stromatolite fossils in some Lowland marbles survived Ottawan metamorphism. With the release of pressure following the collapse of the Ottawan orogen, late Ottawan granitic intrusions invaded locally in the Highlands (Lyon Mountain granite) and along the CCMZ. The extensive jointing and faulting and intrusion of basalt dikes in both terranes are believed to be associated with post-Grenville but Pre-Paleozoic tectonics. Following a few hundreds of millions of years of erosion, the Ottawan mountain belt was reduced to sea-level and sediments of the early Paleozoic seas covered the basement rocks across the entire region. The relatively thin, discontinuous sedimentary cover suggests that the Highlands and Lowlands areas were tectontically and topographically positive through the late Paleozoic.

The present-day relief and ruggedness of the Adirondack Highlands is the result of phases of uplift and differential erosion that began in the Mesozoic Era and continues today at around 1 mm/year. In general the individual mountains , like Arab Mountain, or ranges in the Adirondacks are underlain by more resistant metaigneous rocks than the metasedimentary rocks in the surrounding valleys. Adding to the relief and variety of the landscape are the linear valleys aligned along late or post-Ottawan faults and joints. Finally repeated erosion during Pleistocene contintental and mountain glaciation (beginning around 1.6 million years ago with the glacial maximum around 20,000 years ago) sculpted the mountains. The final recession (after 12, 000 years ago) left behind a landscape with a multitude of streams, lakes and ponds and surfaces covered with glacial debris. Many of the valleys are clogged with glacial fill and, with the accumulation of sediments and growth of plants, the ponds are at various stages of becoming in-filled and forested bogs.

STOP 1. POTSDAM SANDSTONE AT HANNAWA FALLS DAM (FIG. 2)

The section here is close to the great unconformity, the boundary between the Grenville basement metamorphic gneisses of the Proterozoic Era (1.3-1.0 billion years old) and the covering sedimentary rocks of the Paleozoic Era, here in the form of the Potsdam Sandstone of Lower Cambrian (?) age. This is the type area of the the famous red Potsdam Sandstone whose age is problematic as there are no fossils (not even trace fossils) here or farther downstream in the exposures in the river and mostly abandonded stone quarries; if Lower Cambrian in age, the "time gap" at the unconformity is in the order of half a billion years. In his correlation chart, Fisher (1977) placed the lower or red Potsdam in the Lower Cambrian and assigned the underlying intermittent occurrences of arkosic conglomerates (Allens Falls/Nicholville) at the unconformity to the Late Proterozoic.

The gneisses hereabouts are typical Lowland Adirondack metamorphosed sedimentary (metasedimentary) rocks, gneisses with light-colored bands of quartz and pink orthoclase feldspar with minor dark bands of hornblende, mica and pyroxene minerals. Good exposures of these rocks may be seen in the rapids just below the dams in the Raquette River at Potsdam.

The Potsdam Sandstone exposed here, and in the rapids and side quarries downstream, display large-scale cross-bedding which indicate deposition in either a deltaic or sand dune environment (Fig. 2). Near the base of the dam on the Mill Steet side, is a cylindrical structure of Potsdam Sandstone. These structures, known elsewhere in the lower Potsdam in the region, are believed to have formed from unconsolidated sands sinking into cavities lower down in the Potsdam or in the underlying Grenville basement (marbles?) (Dietrich, 1953).

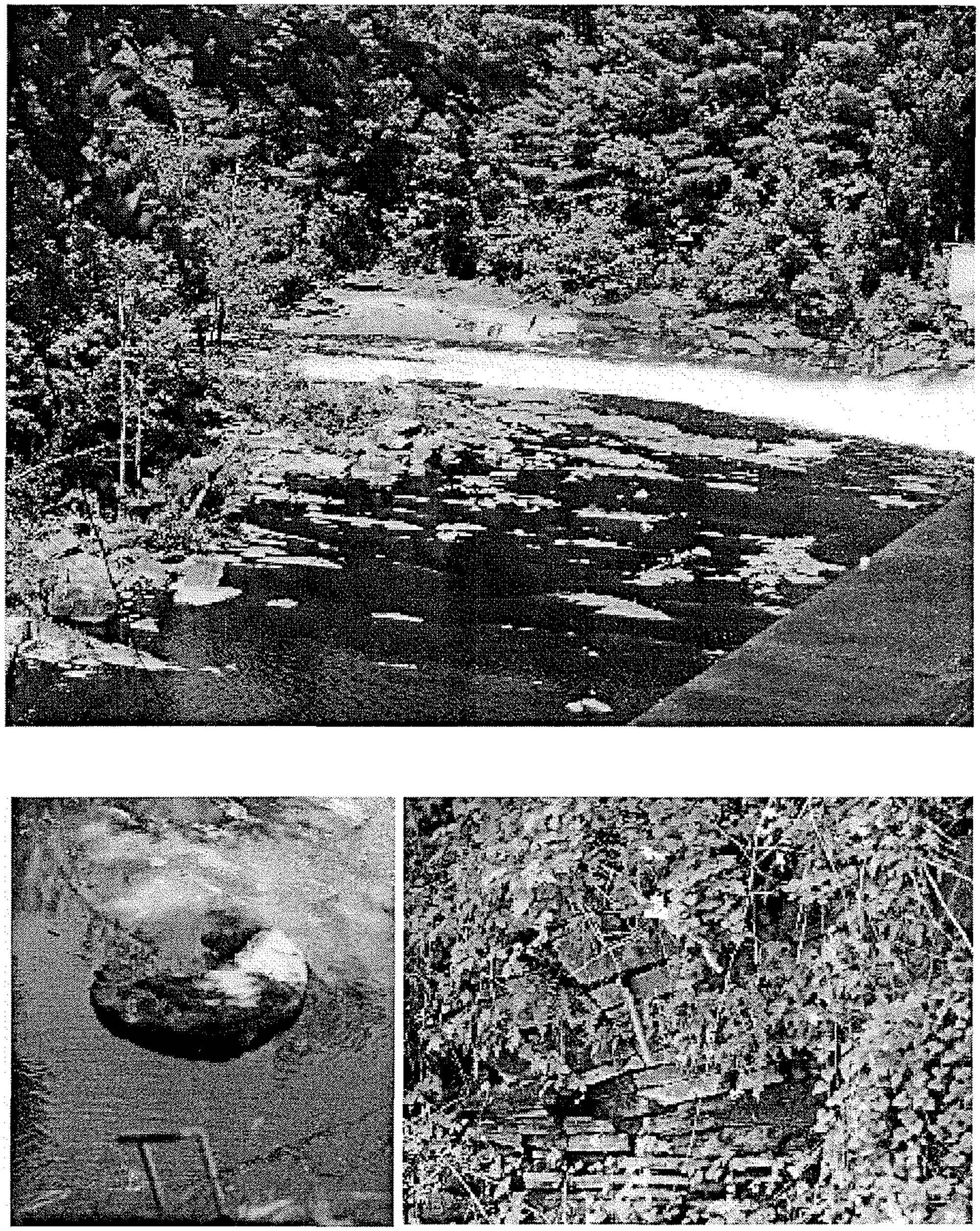

Fig. 2. Cross-bedded Potsdam Sandstone and circular structure of Potsdam Sandstone in Raquette River below Hannawa Falls Dam and exposure in embankment near base of dam on Mill Street side.

The Potsdam here is a medium-bedded, fine to medium grained, silica-cemented orthoquartzite, with hematite-stained quartz grains giving the rock its distinctive red color. Its flat-bedding surfaces, durability, and sets of vertical joints made the rock a valuable dimension stone and flagstone for use throughout the region in the 19th and early 20th centuries. Its limited use today is primarily as a red gravel for landscaping. In place samples of the Potsdam Sandstone can be readily obtained from exposures in the embankment on the Mill Street side of the river near the base of the dam.

The hydroelectric dam at Hannawa Falls is the 9th of 19 hydro-dams in the 167 mile length of the Raquette River begtween its headwaters in the Adirondacks at Blue Mountain Lake and its entry into the St. Lawrence River. The Raquette River drops some 82 feet from the dam to the powerhouse, a half-mile downstream on the east side of the river. The water at the dam is channelled to the powerhouse in a forty-foot wide, open canal, the only hydroelectric canal in the country. The Hannawa Falls powerstation, maintained by Reliant Power Corporation, generates about 50,000 mwh on average through the year.

STOP 2: SUNDAY ROCK, SOUTH COLTON (FIG. 3)

This huge glacial erratic boulder of Grenville gneiss was dropped by the ice-sheet that covered the North Country during Pleistocene Epoch sometime between 14,000 and 10,000 years ago. It is a legendary trail marker at the cultural boundary between the "civilized" life in the St. Lawrence Valley to the north and the rough and ready workday and recreational life in the great South Woods of the Adirodack Mountains to the south, the area where in the old days there was no Sunday. Through the efforts of the Sunday Rock Association, the boulder was moved from the center to the opposite side of the road in 1925 when Rte. 56 was first built and again to its present park location on the south side of the road in 1965 when the highway was widened. The inscription on the tablet next to the monument reads in part:

"THE TOWN OF COLTON STRADDLES THE NORTHERN BOUNDARY OF THE ADIRONDACK FOREST PRESERVE. ONE END OF THE TOWN TOUCHES ON THE NEAT HOMES OF ST. LAWRENCE COUNTY; THE OTHER REACHES INTO THE WOODS. IN THE MIDDLE IS SUNDAY ROCK.

PREVIOUS TO SETTLEMENT IN THIS AREA, THE INDIAN TRAIL INTO THE MOUNTAINS RAN BY HERE. IN THAT LONG TIME AGO THIS 64,000 POUND GLACIAL BOULDER WAS USED AS A LANDMARK BY THE INDIANS AND WHEN THE WHITE SETTLERS CAME, THEY USED IT FOR THE SAME PURPOSE. THE ROCK WAS A NATURAL LANDMARK AND TRAVELERS WERE GUIDED BY THE BIG ROCK IN THE MIDDLE OF THE ROAD, AND THE ROCK SEPARATED THE WOODS FROM THE WORLD.

THERE WAS NO LAW FOR DEER NOR TROUT, AND ALL OF THE WOODS WAS ONE GRAND HUNTING GROUND. IN THOSE DAYS, IT WAS SAID THAT BEYOND THE ROCK THERE WAS NO SUNDAY. CAMP LIFE WENT ON FROM DAY TO DAY WITH NO CHANGE. IT WAS ONE GLORIOUS HOLIDAY WHEN TUESDAY MIGHT JUST AS WELL AS BEEN SATURDAY, AND THURSDAY AND WEDNESDAY COULD CHANGE PLACES AND FRIDAY MIGHT BEGIN THE WEEK FOR ALL ANYBODY KNEW OR CARED. THE RIVERS, THE BROOKS, THE PONDS, THE MOUNTAINS, THE TREES, THE FLEET DEER, THE RUSHING TROUT, THE WILD CAT, THE BLACK BEAR RULED SUPREME. IT WAS THEIR LAND AND THERE WAS NO SUNDAY. THE ROAD PAST THE ROCK ALSO SERVED AS THE WAY FOR SCORES OF LOGGERS AND FOR THEM, THERE THE ROUGH AND TUMBLE FELLOWSHIP OF THE WINTER CAMP BEGAN. THUS THE BIG ROCK BEGAN TO BE CALLED SUNDAY ROCK. BY WHOM NOBODY KNOWS BUT THE REASON IS EVIDENT.

AFTER A WHILE, THE ROCK CAME TO STAND FOR SOMETHING ELSE. WHEN PEOPLE FROM THE VALLEY PASSED IT ON THEIR WAY TO THE MOUNTAINS, THEY FELT A SENSE OF ARRIVAL, OF HAVING CROSSED A DIVIDING LINE. ON THE OTHER SIDE OF

THE ROCK WERE THE WOODS AND MOUNTAINS, LIFE WAS FREER AND EASIER. SALUTING THE ROCK BECOME A KIND OF JOYFUL RITUAL TO BE OBSERVED. ELDERS MIGHT UNCORK A BOTTLE AT IT AND CHILDREN COULD CUT UP WITHOUT FEAR OF A SCOLDING. HUNTERS AND FIRSHERMEN HAD THE FEELING OF EAGER ANTICIPATION AS THE CARES OF EVEYDAY LIFE WERE LEFT BEHIND...

FOR MANY WHO PASS BY HERE, THE ADIRONDACKS STILL EXERT THEIR MYSTICAL APPEAL. VACATIONISTS WHO RETURN TO THESE HILLS YEAR AFTER YEAR, PROBABLY HAVE THEIR OWN SUNDAY ROCK: A RIVER CROSSING, A TURN IN THE ROAD THAT REVEALS A FIRST GLIMPSE OF THE MOUNTAINS, SOME SIGN THAT YOU HAVE CROSSED INTO A PLACE WHERE THE CALENDAR CAN BE FORGOTTEN, WHERE THERE IS BEAUTY TO LOVE AND THE EVERLASTING HILLS TO SAVOR.

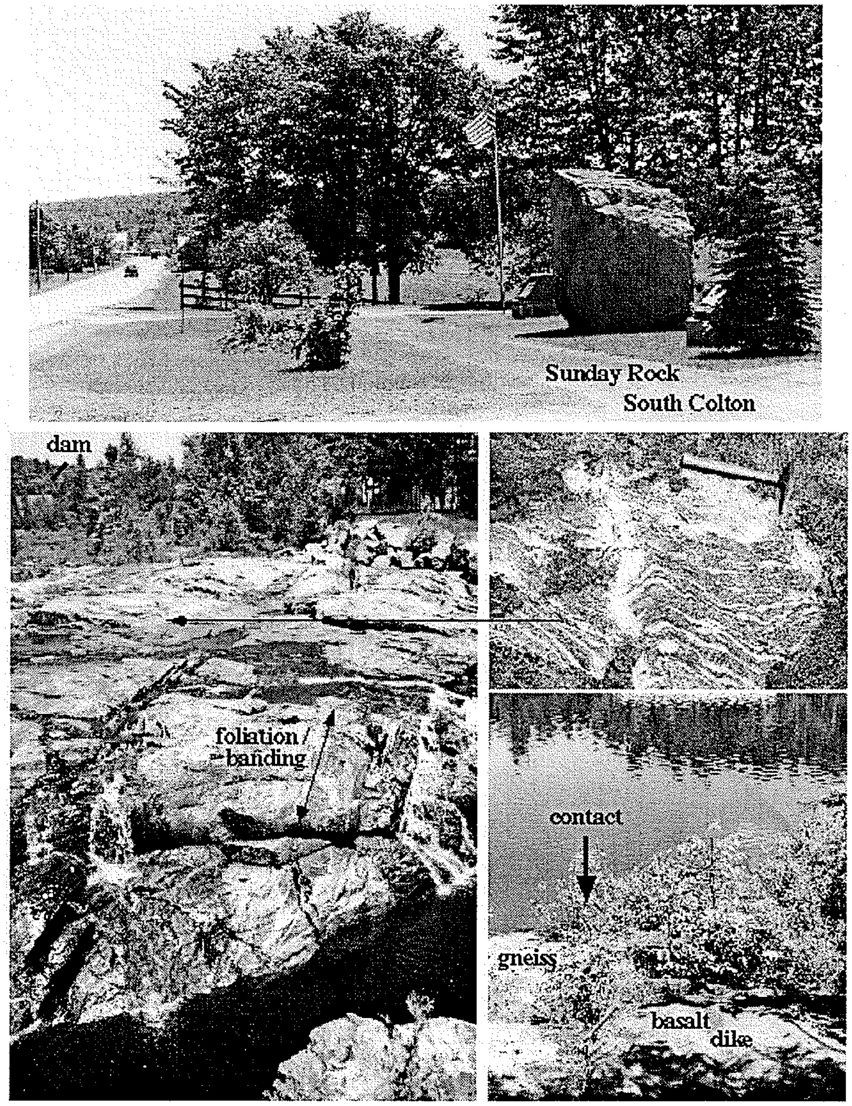

Fig. 3. Sunday Rock, NY Route 56S, at South Colton (Stop 2) and Grenville gneisses in waterfall of Raquette River below South Colton Dam (Stop 3) showing foliation banding, stream rivelets flowing parallel to joints and differentially eroded banded gneisses, small-scale ductile folding and, upstream, contact between basalt dike and banded gneiss.

THE MEANING OF THE ROCK HAS NOT BEEN FORGOTTEN...IT HAS BEEN THE CONTINUED AFFECTION OF MANY GENERATIONS WHICH HAS PRESERVED THE OLD LANDMARK AND LEGEND SURROUNDING IT. SUNDAY ROCK STILL SEPARATES THE WOODS FROM THE WORLD, AND THE MESSAGE FROM THOSE WHO PRESERVED IT IS STILL CLEAR. THE WOODS ARE BETTER.''

Allan Pospisil (1968) Colton Story of a Town. The New York Times. [extracted in part from an article by Potsdam Town Historian C. H. Leete in Potsdam Herald Recorder, September 11, 1925 (Sunday Rock-Its history and the story of its preservation-1929, Herald Recorder Press, Potsdam, N.Y., 55p.)]

STOP 3. GRENVILLE GNEISS BELOW SOUTH COLTON DAM.

Warning: Take care not to be trapped on the outcrop by water released from the dam upstream.

These well-exposed rocks display many of the structural and textual features typical of the Grenville basement rock of the northern part of the Adirondack Highlands. The variety of gneisses and minerals, and the predominantly banded fabric, suggest an orginal sedimentary sequence that was metamorphosed deep within the roots of a mountain belt under the extreme conditions (granulite facies) associated with continental collision and consequent tectonic burial. Included are pyroxene and hornblende granitic gneisses with subordinate leucogranitic gneisses, amphibolites (dark colored hornblende-rich gneisses) and migmatites (mixed igneous and metamorphic rock) in which coarse pods of pegmatitic crystals of pink K-feldspar indicate partial melting during metamorphism.

Notable are the complex ductile folds and broken layers isolated as fragments or 'tectonic' xenoliths. The fold patterns and the predominant NE-SW strike of the foliation or banding are typical of the basement rocks of the region.

At low discharge, the rivelets of water flowing across the surface of the outcrop and the orientation (facing) of the waterfall is a fine example of local structual control of drainage, a microcosm of patterns seen in the Adirondacks as a whole. The broadly radial stream courses (outward from the center of the Adirondack Dome) are locally controlled by differential erosion of the banding, foliation and folding in the various metamorphic facies and the intersections of faults, joints or fractures. Other notable erosion features include potholes at various stages of development.

A hundred yards or so upstream on the west bank of the river, a tabular basalt (diabase) dike (2.3 m across) is well exposed along the shore. The dike is nearly parallel to the steeply inclined foliation or banding of the gneisses. Its dark color and uniform mineralogical texture and higher resistance to weathering contrasts with the lighter colored and banded gneisses. The dike is clearly younger than the host rock and was intruded after the gneisses were metamorphosed but before the tectonic development of the joints. The dike is probably late Proterozoic in age (around 570 Ma.), based on its similarity to pre-Potsdam dikes elsewhere in the region. At high water the dike can be reached by the dirt tract that parallels the edge of the river upstream from the waterfall.

The rock forming the hill to the south of the outcrop, which can be reached along the Allen Hill Road, is a quartz-rich granite-gneiss with prominent pink orthoclase and minor dark mineral (leucogranitic gneiss) that retains its igneous (pluton) texture, and although the contact is not exposed, it probably cross-cuts the banded gneisses at the waterfall and is thus younger than the gneisses and older than the basalt dike.

STOP 4. MT. ARAB (FIGS. 4-6)

Friends of Mount Arab

Introduction

The trail to Arab Mountain is approximately 1 mile (1.6 km.) long and rises 760 ft. (232 m.) to a summit elevation of 2545 ft. (776 m.). The summit is about 2115 ft. (645 meters) above the elevation of downtown Potsdam 430 ft. (131 meters).

Follow the red Department of Conservation (DEC) markers and stay on the designated trail. The restoration and maintenance of Mt. Arab is under the care of Friends of Mt. Arab, Inc. with the cooperation of the Laurentian Chapter of the Adirondack Mountain Club (ADK). Please register for your safety and help the Friends of Mt. Arab determine the frequency of trail use; the Interpretive Information Brochure in the registration box is a guide to sixteen locations of features of biological interest.

Basement rock

The gravel covering the lower part of the trail is crushed anorthosite, the blue-gray feldspar-rich rock that underlies the region of high mountainous terrane to the east, including Whiteface Mountain and the Marcy Massif of the High Peaks region. At about midway, the trail surface is mainly on mangerite, the principal bedrock of Mt. Arab. Mangerite is an intrusive or plutonic igneous rock, like a granite, but with less quartz and containing the mineral pyroxene. A few hundred yards from the summit, the mangerite bedrock is exposed in a large outcrop. The broad, subhorizontal fractures seen here and at the summit are sheeting or exfoliation structures, formed by the release of pressure on the rock by the tectonic unroofing, and uplift and erosion of overburden rock during the Proterozoic and later times, and most recently following the final melting of the mile-thick Pleistocene glacier. These fractures and the glacial scour are what account for the smooth and broadly rounded shape of many Adirondack summits.

The mangerite exposed here and at the summit is a metamorphosed igneous intrusive (plutonic) rock whose color, composition and texture contrast strongly with the variety of banded metasedimentary gneisses seen at South Colton and the intrusive anorthosites of Whiteface Mountain and the Marcy Massif to the northeast, east and southeast (Fig. 1-C). The mangerite, which contains only minor quartz, consists of cream colored intergrowths of feldspars (mainly potassium feldspar) with dark mafic minerals (pyroxene) oriented subparallel to the long axes of the feldspar crystals (anastamosing, perthitic texture), giving the rock a strongly planar foliation. The contrast with banded hornblende gneisses seen at South Colton is striking. On the outcrop surfaces (west of the Observer's Cabin) sheared quartz veins (Fig. 6) give evidence of plastic (ductile) deformation and the high intensity of metamorphism (granulite facies with temperatures of 675-800 degrees C and pressures of 7-8 kilobars) in the roots of a mountain range, comparable to some 25-30 km. (17-20 miles) depth below the surface.

A Uranium (U)-lead (Pb) radiometric date on the mangerite of 1134 +/- 4 million years at Tupper Lake (McLelland and Chiarenzelli, 1990) gives the time of crystallization of the magma intrusion. The mangerite in the Tupper Lake region shows a spatial relationship with the anorthosite, the great mass of plutonic rock that underlies the Whiteface Mountain region and Marcy Massif of the High Peaks region; the contact between these units is just east of Tupper Lake. The anorthosite is composed predominantly of the blue-green-gray crystals of the plagioclase feldspar andesine and the small fragments of the anorthosite can occassionally be seen "floating" in the mangerite at Mt. Arab. The age of emplacement of the anorthosite plutons is around 1155 Ma., which is close to the time of emplacement of the mangerites.

Fire Tower

The 35 foot high steel Fire Observation Tower at the summit, installed in 1918, replaced wooden structures dating from 1911 and 1912. This "survivor that still stands guard" (Laskey, 2003) is one of only two remaining fire towers in St. Lawrence County; the other is on Catherdral Rock in Wanakena (Freeman, 2001, p. 44). The network of observeration towers was established after the disasterous fires in the Adirondacks in 1903 and 1908; at one time there were 57 towers in the Adirondacks. No longer in service, the Mt. Arab Tower and Observer's Cabin were last staffed in the 1980s in the final stages (accelerated during and after WWII) of the systematic dismantleling of the fire tower observation system in Adirondack and Catskill Mountains. After decommission, the Mt. Arab Tower deteriorated and was condemned for public use in 1993.

The restoration of the tower and access trail dates from 1997 and the founding of the citizens's group Friends of Mt. Arab (FOMA), an organization that has coordinated endorsements and financial support from state, county and local government agencies as well as several Adirondack Mountain Club (ADK) chapters, school groups, camp owners and local residents. The Observer's Cabin has been restored as a small museum and base for a summer interpreter, thus completing the functional evolution of the tower and cabin from fire observation to education and recreation. Supported by the Adirondack Architectural Heritage (AARCH), the Friends of Mt. Arab can be contacted at P.O. Box 185, Piercefield, NY, 12973.

Adirondack Landscapes (Figs. 5-6)

Among the features that can be seen from the top of the the Fire Tower: north- northeast, Mt. Matumbla (2700 ft.; 823 m.), the highest point in St. Lawrence County ; northeast, in far the distance beyond Tupper Lake and Tupper Lake Village, Whiteface Mountain (4867 ft.; 1483 m.) with its distinctive white landslide scars; southeast Mt. Morris (3163ft.; 964 m.) with its Big Tupper ski-trail clearings, and in the distance, the rounded profile of Blue Mountain (3759 ft.; 1146 m.) near the center the Adirondack Dome and the headwaters of the Raquette River; far to the east-southeast, the High Peaks , which include Algonquin Peak (5114 ft.; 1559 m.), Mount Colden (4714ft.; 1437 m.) and Mount Marcy (5344 ft.; 1629 m.), the highest point in New York State. Nearby to the southwest, Mt. Arab and Eagle Crag Lakes; and south-southeast, the south end of Tupper Lake.

With modern technology, changes in elevation and geographic position of features on the surface of the earth can be monitored remotely by satellite and laser. Attached to the bedrock on the summit are three small metal disks, the United States Geological Survey bench marks that were used in surface surveys to determine the geographic position and elevation of Arab Mountain.

One of three U. S. Geological Survey bench marks on the summit of Arab Mountain.

Earthquakes

Earthquakes are not uncommon within the Adirondacks but most events are small (less than 3.0 magnitude), relatively shallow (2-10 km; 1.2-6.2 mi. depth), and are not felt in this sparsely populated region. The seismic events are generated from reactivation of faults in the basement rocks which throughout the region are under compressive stress. None appear to be associated with the uplift of the dome which continues at a rate of about 1mm per year. Notable recent events are the 1983 Goodnow Earthquake, a 5.1 magnitude event near Blue Mountain in the center of the dome which was felt from Maine to Michigan and New Jersey to southern Ontario, and the the 2002 Ausable Forks Earthquake in the eastern Adirondacks, 15 miles southwest of Plattsburgh, also a 5.1 magnitude event, which was felt from Maine to Maryland.

To better monitor earthquakes in the Adirondac region, a seismic field station was installed this year on the summit of Arab Mountain.; the antenna can be seen north of the trail leading to the Observer's Cabin. The Arab Mountain Station is the 8th seismic station located in Northern New York that comprise the SUNY Potsdam Seismic Network, since 1972 under the directorship of Professor Frank Revetta of the SUNY Potsdam Geology Department (revettfa@potsdam.edu).

Glacial erratic

On the edge of the cliff overhang west of the Observer's Cabin is a fine example of a glacial erratic. The boulder, set down during the final recession of the Pleistocene glacier between 14,000 and 10,000 years ago, is a banded gneiss not unlike the Sunday Rock boulder and the country rock seen at South Colton, and a common bedrock facies in the Adirondack Lowlands. The erratic boulder at the summit of Mt. Arab is sitting on top of the glacially smoothed surface of the Proterozoic-age mangerite. The contact between the bedrock and the erratic thus represents a 'gap" or break in the rock record of earth history of more than 1 billion years.

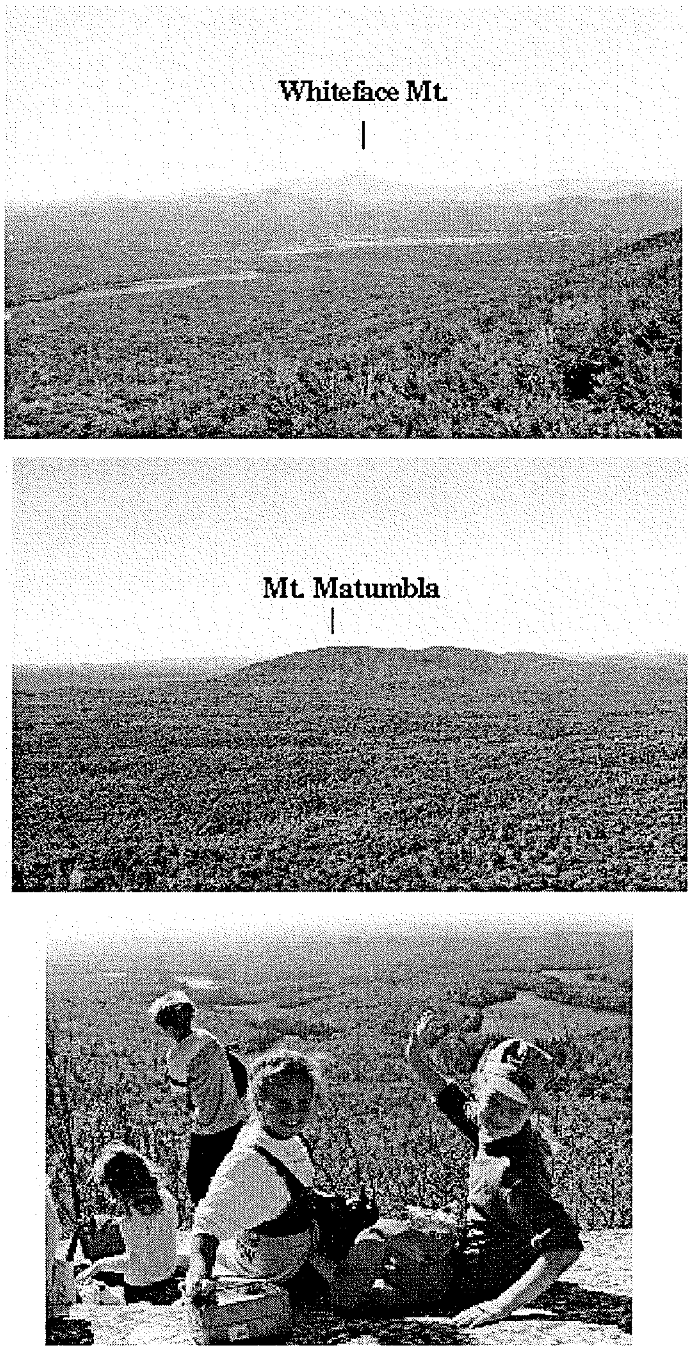

Fig. 4. Views from summit of Mt. Arab. From the Fire Tower: Northeast-Whiteface Mt. (4867 ft.), with prominent landslide scars, beyond north end of Tupper Lake and Tupper Lake Village; North-northeast-Mt. Matumbla (2700 ft.), highest point in St. Lawrence County; Heuvelton Central third-graders sitting on mangerite bedrock, Sept. 1990, overlook crags on southwest side-Mt. Arab Lake (upper-right foreground) and Eagle Crag Lake, beyond; bogs and bog ponds along Bridge Brook, upper left.

PRESERVATION OF ADIRONDACK PARK

The Adirondack Park was established by the State Legislature in 1892, and of the nearly 6 million acres within the "Blue Line" nearly half are privately owned. It remains the largest complex of wild public lands in the eastern United States. The vast still largely undisturbed territory includes 46 mountain peaks over 4,000 feet high, more than 3,000 lakes and ponds, and 6, 000 miles of rivers and streams.

To preserve and manage the Forest Preserve, the Adirondack Park Agency (APA) was established in 1971, under the Deparment of Enviromental Conservation (DEC), with a mandate to "promote appropriate public use ... and to encourage the types of growth and economic development on private lands that will allow the unique character of the park to be manintained" (DEC Adirondack Forest Preserve 1999 map and guide). The APA's Adirondack Park State Land Master Plan divides the state-owned lands within the park into several classifications, among them Wilderness (about 1 million acres in 17 areas) in which motor vehicles and bicycles are not allowed, and Wild Forest (about 1.3 million acres), the "forever wild" areas with limited access by motor vehicles and bicycles.

Nature's defenses have long kept the Adirondacks in a largely wilderness state: the terrane is remote and rugged, the winters can be extremely cold, ice and snow make travel hazardous , and insects (such as black flies) effectively control outdoor activity for parts of the rest of the year. Despite these natural barriers, the Adirondack environment is increasingly effected by human activities from outside the park boundaries. Foremost among these is the adverse effect on vegetation and aquatic life by acid rain from industrial and powerplant emissions. The solitude of the Adirondacks is impacted by low altitude overflights of private, commercial and military aircraft. There is the visual intrusion of communication towers on Adirondack summits. A new and serious problem is the introduction of alien species of plants and animals into the Adirondacks with their potential to crowd out and replace elements of the native flora and fauna. The conservation of the Adirondacks as a unique wilderness area for the enjoyment of future generations has thus become truly the responsibility of the national and international (global) community. **"Out of the woods we came, and to the woods we must return, at frequent intervals, if we are to redeem ourselves from the vanities of civilization."** (Thoreau, quoted by Paul Jamison, 1982, Preface to The Adirondack Reader).

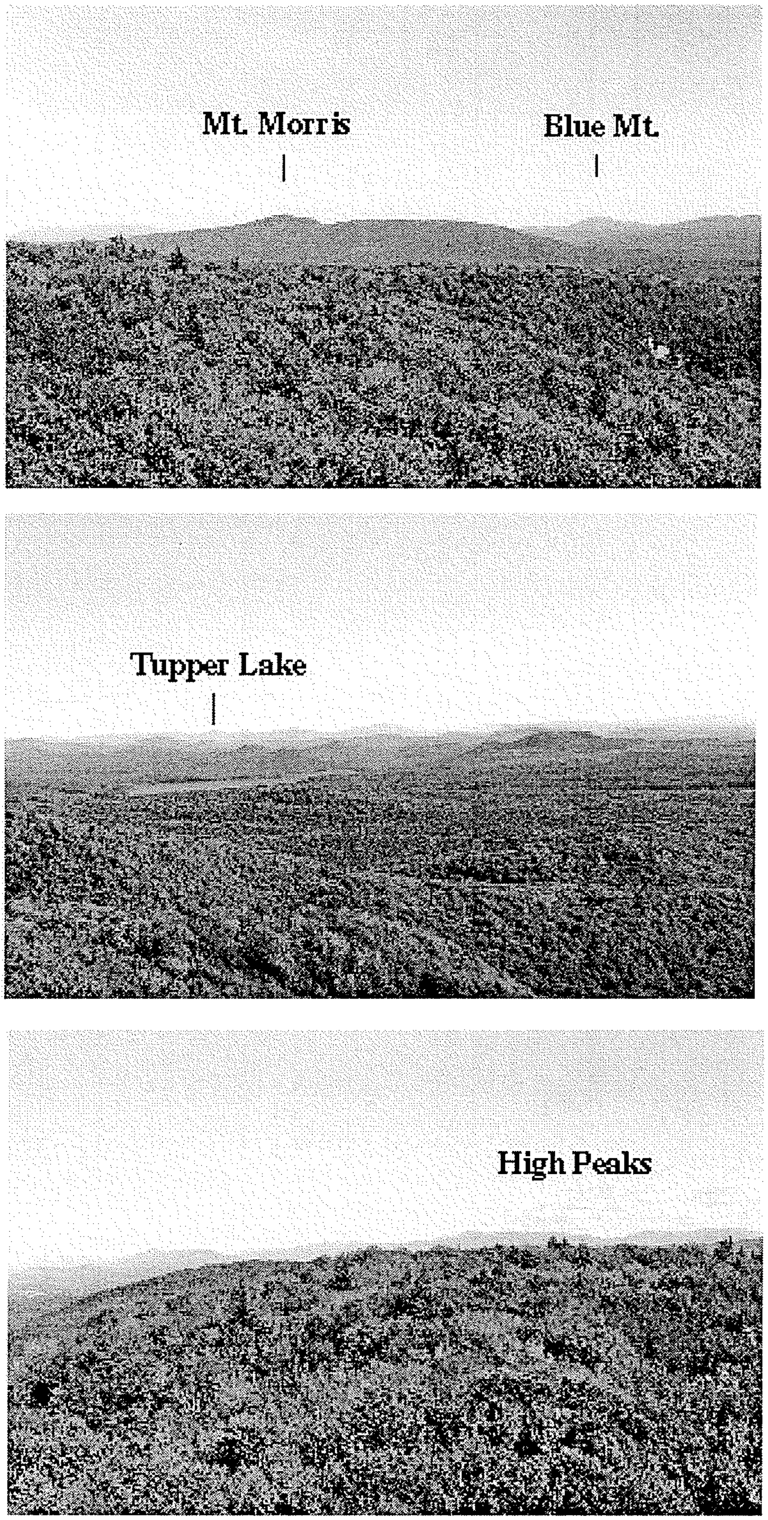

Fig. 5. Views from Mt. Arab Fire Tower: Southeast-Mt. Morris (3163 ft.) with Big Tupper ski-trail clearings, Blue Mountain (3759 ft.) near center of Adirondack Dome; South-southeast-south end of Tupper Lake; East-southeast-High Peaks (Algonquin, 5114 ft., Mt. Colden, 4714 ft., Mt. Marcy, 5344 ft., highest point in New York State.

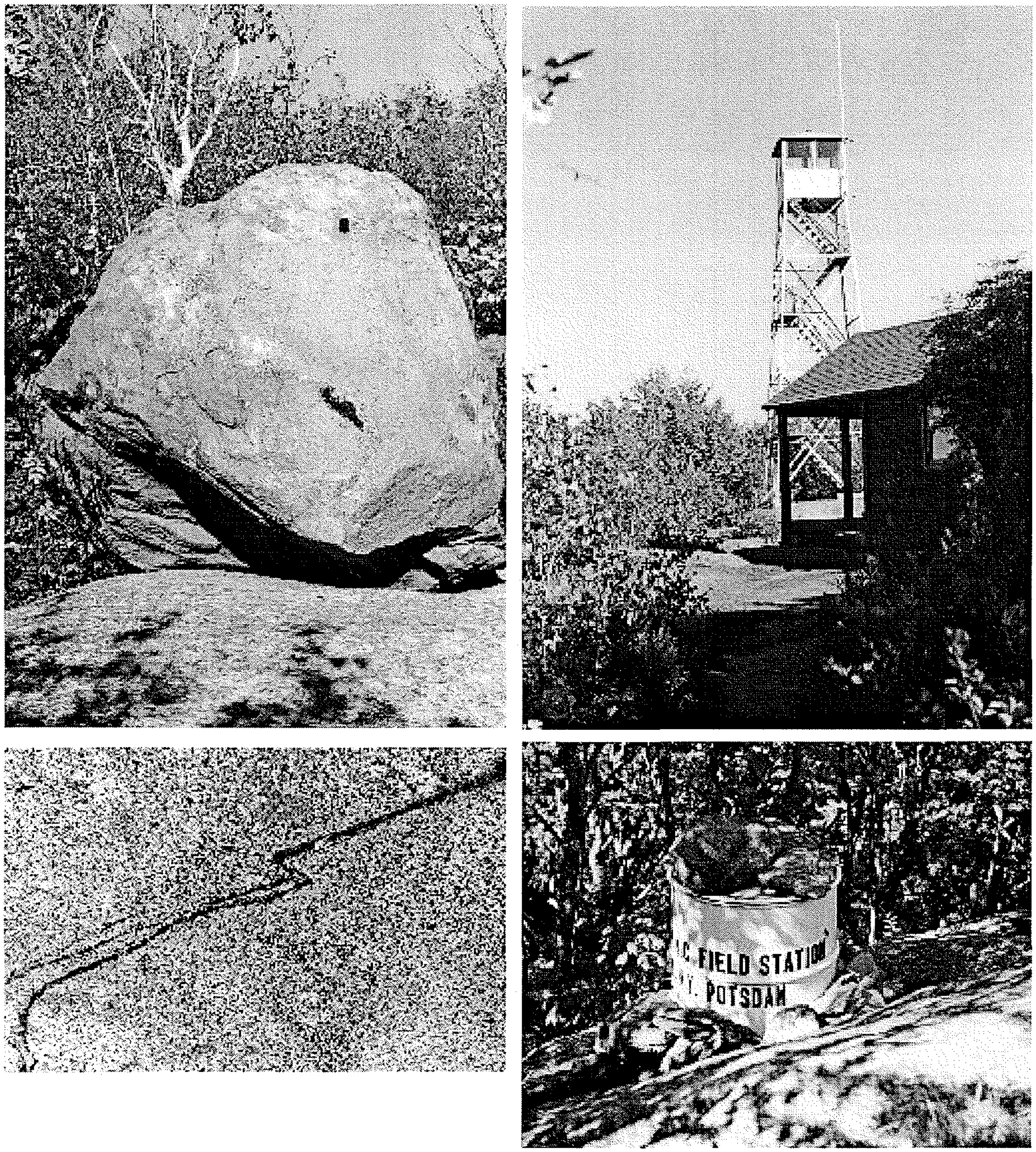

Fig. 6. Pleistocene glacial erratic of banded gneiss (with large hornblende crystals) sitting on mangerite bedrock, west side Mt. Arab summit; Mt. Arab Fire Tower and Observer's Cabin; ductily folded and sheared quartz vein in mangerite, northwest side, Mt. Arab summit; SUNY Potsdam Seismic Station at Mt. Arab summit, installed summer 2004.

REFERENCES CITED

Dietrich, R.V., 1953, Conical and cylindrical structures in the Potsdam Sandstone, Redwood, New York: New York State Museum, Circular 343, 19p.

Fisher, D.W., 1977, Correlation of the Hadrynian, Cambrian and Ordovician rocks in New York State: New York State Museum, Map and Chart Series No. 25.

Fisher, D.W., Isachsen, Y.W. and Whitney, P.R., 1980, New mountains from old rocks: the Adirondacks-The Geology of the Lake Placid region: New York State Geological Survey and New York State Museum and Science Service, Educational Leaflet 23.

Freeman, J. P., 2001, Views from on High: Fire Tower Trails in the Adirondacks and Catskills: Adirondack Mountain Club, Inc. (ADK), Lake George, New York. 155p.

Isachsen, Y. W. and Fisher, D.W., 1970, Geologic Map of New York (1:250,000): Adirondack Sheet: New York State Museum and Science Service, Map and Chart Series No. 15.

Isachsen, Y.W., Landing, E., Lauber, J.M., Rickard, L.V. and Rogers, W.B., eds., 1991, Geology of New York: A simplified Account: New York State Museum/Geological Survey, Educational Leaflet No. 28, 284p.

Jamieson, P., ed., 1982, The Adirondack Reader: The Adirondack Mountain Club, Inc. Glens Falls. 525p.

Laskey, P., 2003, The Fire Observation Towers of New York State: Survivors that still stand guard: MKL Publishing, Balston Spa, NY. 129p.

McLelland, J., Chiarenzelli, J., Whitney, P. and Isachsen, Y. W., 1988, U-Pb zircon geochronology of the Adirondack Mountains and implications for their geologic evolution: Geology, v. 16, pp. 920-924.

McLelland, J. and Chiarenzelli, J., 1990, Isotopic constraints on the emplacement age of Marcy anorthosite massif, Adirondack Mountains, New York: Journal of Geology, vo. 98, pp. 19-41.

McLelland, J., Daly, J.S. and McLelland, J. M., 1996, The Grenville Orogenic Cycle (ca. 1350-1000 Ma): an Adirondack perspective: Tectonophysics, v. 265, pp. 1-28.

Rivezzi, R. & Trithart, D., 1997, Kids on the Trail-Hiking with children in the Adirondacks: Adirondack Mountain Club, Lake George, NY., 175pp.

Rogers, W.B., Isachsen, .W., Mock, T.D. and Nyahay, R.E., 1990, New York State Geological Highway Map: New York State Geological Survey and New York State Museum, Cultural Education Center, Albany, NY, Educational Leaflet 33.

Tollo, R. P., Corriveau, L., McLelland, J. and Bartholomew, M.J., eds., 2004, Proterozoic tectonic evolution of the Grenville orogen in North America: The Geological Society of America Memoir 197. 820p.

VanDiver, B.B., 1976, Rocks and Routes of the North Country New York. Geological Guide for tours, minerals, rock climbing and whitewater: W.F. Humphrey Press Inc., 205 pp.

VanDiver, B.B., 1980, Upstate New York: Field Guide: K/H Geology Field Guide Series, Kendall/Hunt, 276p.

Field Trip Roadlog (miles)

Total	**-Interval**	**Route Description (SUNY Potsdam to Mt. Arab).**
00.0	0.0	Left turn onto NY Rte. 56 South from Barrington Drive
00.2	0.2	Athletic fields: proglacial lake bottom plain (clays and silts).
00.5	0.3	Glacial-till plain (ground moraine) on left
01.0	0.5	Junct. Rte. 56 and 72: slope of Rte. 72 hill is north-facing front of proglacial-lake delta, the lowest of a series marking stages in the lowering of Lake Iroquois.
01.7	0.7	Golf Course on left.
01.9	0.2	On right: Meander cutoff (oxbow) in Stafford Brook.
02.4	0.5	On left: Large active sand and gravel quarry in kame-moraine-delta complex. Greymont- Potsdam Stone & Concrete.
02.9	0.5	Village of Hannawa Falls. Clean sands at top of proglacial-lake delta (about 550 ft. elevation), marking a static level stage of Lake Iroquois.
03.4	0.5	Church Street. (left turn to Postwood Park, Town of Potsdam).
03.5	0.1	Chip's Place Deli-on right.
03.6	0.1	Rte. 56 Bridge, Hannawa Falls (Hannawa Falls Pond on left, hydroelectric dam and canal on right).
03.7	0.1	**Turn right** onto Mill Street and park across the road from the Hannawa Falls Firestation Walk about 100 yards along side of road to dirt track* and follow footpath down and back towards the base of the dam. **Stop 1. Potsdam Sandstone at Hannawa Falls Dam**. (*dirt track is at the south end of the 3.5 mi. Red Sandstone Trail, a nature trail which leads to excellent exposures of the Potsdam Sandstone in quarries and rapids along the Raquette River). **Return to Rte. 56 S**.
04.0	0.3	Hannawa Pond or Flow on left.
04.1	0.1	Far left across pond: Postwood Park Town Beach.
05.7	1.6	Road climbs to flat surface at top of a delta at about 650 ft. elevation marking another static level in proglacial Lake Iroquois. Dunes on right are wind-blown delta sands.
06.0	0.3	County Road 24 (Brown's Bridge Road): left turn leads to bridge over Raquette River and trailhead parking for northen access to Stone Valley Recreational Area (see below). Road begins climb to upper Hannawa Delta at about 680 ft. elev.
06.8	0.8	At crest of hill, view south of St. Lawrence Valley and Adirondack Lowlands.
07.3	0.5	Dune sands on left.
07.4	0.1	Village of Colton sign.
07.9	0.5	Outcrop of Grenville gneiss in front of Colton-Pierrepont Central School.
08.4	0.5	Mill Street Colton. Left turn and follow signs to Stone Valley Recreational Area, a 7 mile-long trail along the Raquette River which gives access to rocks of the Colton-Carthage Mylonite Zone (CCMZ).
08.7	0.3	Bridge over Raquette River: Higley Flow Reservoir.
09.3	0.6	Bog on left.
10.3	1.0	Bog on right.

11.3	1.0	On left: large exposure of pink alaskitic-leucogranitic gneiss.
12.1	0.8	South Colton; dune sands on left.
12.3	0.2	**Turn right** into parking area. **Stop. 2. Sunday Rock,** glacial boulder marking cultural boundary between "civilized" life in the St. Lawrence Valley and the rougher life in the Adirondacks, where in the old days there was no Sunday. Return to Rte. 56 S.
12.6	0.3	**Turn left** onto Wind Mill Road, South Colton and **right** onto Mill Street and continue on dirt road to parking area. Cross old concrete sluiceway and proceed to top of waterfall.
13.3	0.7	**Stop. 3. Grenville gneiss at waterfall below South Colton Dam.** Return to Rte. 56 S.
13.4	0.1	Bridge over Raquette River.
13.5	0.1	Cold Brook Drive-right turn to Higley Flow State Park.
13.7	0.2	Allen Hills Road on left: granite-gneiss outcrops at top of hill.
14.7	1.0	Caution: entering "zig-zag" in highway (watergap cut through glacial-delta sediments by Cold Brook).
15.2	0.5	Cold Brook DEC Freshwater Management Area-former St. Lawrence University Snow Bowl ski area.
16.4	1.2	"Blue Line" Sign on right marking boundary of 6 million acre Adirondack Park.
17.6	1.2	"The Plains"-top of proglacial-lake delta at about 1210 ft.
19.4	1.8	Joe Indian Pond Road-on left.
20.5	1.1	Bog pond on right.
21.9	1.4	Catamount Lodge-on left.
23.1	1.2	"Fraternity Rock"-huge, painted glacial erratic on left.
24.7	1.6	Large bog on right.
28.6	3.9	Ham's Tavern-on right.
29.6	1.0	Bog on right.
30.1	0.5	On right-turnoff to Sevey Corners Bog (take left fork and follow dirt road for 0.1 mile).
31.6	0.5	**Turn left (east)** onto NY Rte. 3 at Sevey (or Sevey's) Corners at intersection of Rtes. 56 and 3. Ham's Mini Mart. Rest stop.
31.8	0.2	**Right turn (east)** on Rte. 3 from Ham's Mini Mart.
32.8	1.0	Outcrops of Grenville gneiss on left.
34.5	1.7	Village of Childwold
37.4	2.9	Massawepie Lake-Scout Camp
38.0	0.6	Sand pit on left
39.4	1.4	Mt. Arab Fire Tower visible-straight ahead
41.6	2.2	**Turn right** onto County Road 62 at sign for Mt. Arab and hamlet of Conifer.
41.8	0.2	**Turn right** at "Y" intersection onto Conifer Road.
43.3	1.5	**Turn left** onto Eagle Crage Lake Road at sign for Mt. Arab.
43.9	0.6	Railroad tracks (Remsen-Lake Placid RR).
44.2	0.3	**Park on right side of road** opposite signs at trailhead. **Stop 4. Mt. Arab.**