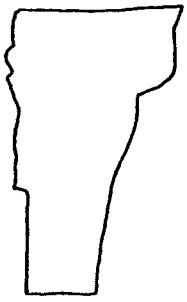
THE

GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

SPRING 1978 VOLUME 5 NUMBER 1

MEETINGS

There are a large number of activities which the members of the Vermont Geological Society may wish to know about. They are:

April 26: V.G.S. TEACHER'S WORKSHOP
This workshop is being led by Terry Thompson and is described later in this Newsletter.

April 29: V.G.S. SPRING MEETING
Everyone interested in learning more about Vermont Geology is urged to attend. Papers will be presented by students at U.V.M. and Middlebury. The meeting starts at 10 A.M. at Perkins Geology at the University of Vermont. Coffee and donuts at 9 A.M.. Bring a lunch and enjoy the day. Full announcement and abstracts start on page 6.

June 17: SOILS IDENTIFICATION WORKSHOP
Bruce Watson is providing an excellent opportunity for everyone to learn about the identification of soils and how they relate to land use.

July : V.G.S. SUMMER MEETING
The summer meeting of the Vermont Geological Society is planned for July, at Grand Isle State Park. The exact date has not yet been determined. This meeting will be held concurrently with the Eastern Federation of Mineralogical and Lapidary Societies rock swap at the State Park. Besides the business meeting, our agenda will include a picnic plus an opportunity to swap minerals and browse at some of the rock collections that will be shown at the State Park. There will be a $0.50 entrance fee per adult for the use of the Park.

August 5: MINERAL DAY AT BURLINGTON SQUARE MALL
The Society has decided to join the Burlington Gem and Mineral Club in Mineral Day to be held from 9 A.M. to 4 P.M. on August 5. There will be mineral displays, soapstone carvings, faceting, slabbing, polishing and mineral trading. We will be setting up several displays as part of the event.

SOILS

FIELD IDENTIFICATION WORKSHOP - JUNE 17

Members of the Vermont Geological Society expressed an interest in a Soils Tour and Workshop on the identification, classification and properties of soils as they relate to land use. Bruce Watson, State Soil Scientist, has agreed to conduct a tour on Saturday, June 17th. You will see a variety of soils and hear a discussion on how they formed and how they are related to surficial geology. Soil survey equipment and techniques will be illustrated and the soil properties that affect land uses will be discussed.

This field day will greatly assist those members of the Society interested in taking the certification examination by the Agency of Environmental Conservation for testing single lots for sewage disposal. Those members interested in more information and who would like to attend the workshop should contact Bruce Watson, Soil Conservation Service, Suite 205, One Burlington Square, Burlington, Vt. 05401. His phone number is 862-6501.

SOIL SCIENCE SOCIETY TO MEET

The Northern New England Soil Science Society will hold its spring meeting in the Stowe area on July 7 and 8, 1978. Members of the Vermont Geological Society are invited to attend. Tentative plans are for a banquet on July 7 and a field tour of soils and geology in the Stowe-Morrisville area on July 8. The Soil Science Society is comprised of Maine, New Hampshire, and Vermont. Members interested in attending the meeting should contact Bruce Watson, Soil Conservation Service, Suite 205, One Burlington Square, Burlington, Vermont 05401. Phone is 862-6501.

OIL

John Malter has been recently conducting field experiments in the Burlington area on the disposal of oil wastes by land spreading and the breakdown of the oil by soil organisms. John has offered to run a two hour seminar on this subject. Those who are interested should contact John so that he can determine the number interested and can schedule this seminar. His phone number is 828-2761 or write to John Malter, Department of Water Resources, Agency of Environmental Conservation, State Office Building, Montpelier, Vermont 05602.

The Hazardous Waste Transport Bill reported on in the last GMG did finally see the light of day and was passed and signed by the Governor. John Malter worked hard on this as did many other people. Fortunately for John and the Agency of Environmental Conservation, The Agency was finally include in the advisory board. This bill will go a long was to help reduce the hazard to the public and to our environment from the many substances transported over our highways, rails, and waterways.

GROUND WATER NOTES

Records of drilled water wells have reached 16,000 in the Vermont Department of Water Resources files.

Nearly 1,000 water wells and test borings are listed and located in the Rutland Area Cooperative ground water study. This study is now nearing completion by the U.S. Geological Survey and the Vermont Department of Water Resources. Almost 20 percent of the water wells shown were finished in the unconsolidated materials above the bedrock surface.

A report entitled Ground-Water Resources of the Upper Winooski River Basin, Vermont by A. L. Hodges, Jr., R. E. Willey, J. W. Ashley, and David Butterfield is available for inspection as a open file report in the Boston office of the U.S.G.S. and in the Vermont field office in Montpelier, Vt. The report will be printed in a limited number of copies as federal funds become available.

$50,000 may become available for an inventory and pollution potential assessment of Surface Impoundments in Vermont. Under the Safe Drinking Water Act the Federal E.P.A. is making grants available to all states for a nation-wide survey.

The potential for a ground water supply for North Troy, Vermont is being examined. DuBois and King of Randolph, the consulting engineer, is preparing for test drilling on property optioned by the local authorities. Money for the test drilling was advanced by the Vermont Agency of Environmental Conservation under the Water Supply grant program. Preliminary assessment of ground water favorability at four potential test sites is being delayed by the persistent snow cover.

The Salt Bill is dead. H-489 as revised by the Vermont House of Representatives and passed by that body did not make it out of Committee in the Senate. The final version of the bill called for a joint monitoring of highway deicing compound storage sites by the Agencies of Environmental Conservation and Transportation, and investigations as to the cause of sodium content exceeding 20 mg/l in public water supplies. The bill had also mandated the Vermont Department of Health to test potable water samples for sodium.

submitted by David Butterfield, Department of Water Resources.

FOR THE TEACHER

TEACHER'S WORKSHOP

Last call for those interested in attending the teacher's workshop in the Burlington Area on April 26th. This should be an excellent session with tours and workbook. To find out more about this workshop, call Terry Thompson. Evenings 802-457-3898; Daytime 603-643-3431 x60.

FILMS

The Society would like to recommend films to be considered for purchase by the Vermont State Library. If you have any suggestions for consideration, please let the Society know at Box 304, Montpelier, Vt.

VERMONT SOLID WASTE PROGRAM

With the recent development of a National Solid Waste Management Program by the Federal Government, Vermont's Solid Waste Program has been reviewing and updating it's current waste disposal guidelines and regulations. Much of the impetus and creative development for this review has come from a panel of professional people and laymen alike. I would like to review some of the more important conceptual features of our revision especially as they impact upon groundwater quality in the state.

In the past several years a number of research projects funded by the EPA have shown that solid waste disposal sites present significant hazards to groundwater resources. The States solid waste program has remained abreast of this research and has attempted a model of our regulations and guidelines after the current state of the art. We believe that one of the most significant concepts to evolve from this recent review is the so called "zone of influence." In essence the zone of influence concept requires that a geologist or engineer evaluate a potential disposal area to determine details of groundwater flow from the landfill location to a discharge point. Detailed information on subsurface conditions and groundwater flow characteristics provides information from which the Agency can evaluate the potential impact of the facility on public health and the environment.

To implement this new concept we have provided a number of specific technical qualifications which each site must attain prior to approval. These qualifications consider not only the specific technical make up of the site such as soil type, depths and groundwater conditions but also consider site operation, development, water quality monitoring, and closure procedures. At times in the past, requirements for soil types and groundwater isolation distances have been critized as to restrictive and an impediment to site development. However, we feel that the specific geologic history of Vermont permits this conservative but realistic approach for locating disposal areas. In summary, we believe that with (1) a detailed subsurface investigation, (2) the identification of an area's zone of influence and (3) stringent but realistic technical requirements, we can provide both the maximum practical protection for Vermont's groundwater resources as well as approved disposal areas.

submitted by Jeffrey Noyes, Agency of Environmental Conservation

PUBLICATIONS

A continuous effort to upgrade and expand the Society publications is being made. We hope that this current Green Mountain Geologist is better than the last and that each succeeding one will be better. The Society is also on the threshhold of initiating three new publications. The first will be the Workbook for the Teacher's Workshop. Terry Thompson is writing this one. The Bibliography of Vermont Geology should be out by the fall with the help of State Geologist Charles Ratte. And finally, we hope to initiate a yearly BULLETIN of VERMONT GEOLOGY. This would contain summary reports (2,000 to 8,000 words) of research and other activities in geology in Vermont. Do you have anything to submit? Please let us know.

MINERAL OF THE QUARTER

ACTINOLITE $Ca_2(Fe,Mg)_5(OH)_2(Si_4O_{11})_2$, Hardness 5 to 6, Monoclinic, Color - light to dark green, Specific Gravity 3 to 3.4, Perfect prismatic cleavage, Luster - vitreous to silky, transparent to translucent.

Actinolite is the high iron content member of an isomorphous series of which the low iron member is tremolite. These minerals are amphiboles found in metamorphosed dolomitic limestone and talc schists. Actinolite is considered an alteration product of pyroxenes. Tremolite and actinolite are often found in fibrous aggregates of long prismatic or bladed crystals. Actinolite derives its name from its frequent occurance in radiated groups of crystals. Nephrite jade, one of the true jade minerals, is a tough, compact, massive form of tremolite or actinolite. Tremolite is white but 2% ferrous iron replacing the magnesium converts it to green actinolite. As the iron content increases the actinolite becomes darker green in color.

An excellent occurance of dark green bladed actinolite crystals embedded in pearly, pale green talc, is at the Carleton Talc Mine in Chester, Vermont. Frederick Pough mentions this as a typical occurance in his Field Guide to Rocks and Minerals, Third Edition, 1960, Riverside Press, Cambridge, Mass. To reach the dumps of this now abandoned mine, take Route 11 west from its intersection with Route 103 in Chester for 1.8 miles to a gravel road going north. After following this road for .25 miles, you will see a broken gate leading into a wooded area to your left. Drive through the gate - turn left into the meadow and park (unless it is muddy). Climb the slippery talc covered dump carefully. In addition to being found here as long and up to ½ inch wide bladed crystals in talc, actinolite also occurs in mats of fine, very dark green (almost black) needle-like bright crystals. The later make much stronger specimens and hold up much better in a collection. The long, bladed crystals cleave very readily and should be very carefully handled. Commonly found here are clinochlor, biotite, tourmaline, pyrite, and magnetite crystals. The following have been reported as found here also - dolomite, ankerite, serpentine, albite, green apatite crystals, breunnerite, chalcopyrite and black spinel crystals.

submitted by Ethel Schuele

GEOLOGY ON DISPLAY

Under the supervison of Paul Brown, his class in Geology at Harwood Union High School has started putting together a display board on the Mining Industry In Vermont. An initial draft of the display was used by Dr. Ratte at the Vermont Sportsman Show held at the Barre Auditorium in early April. The finished display should be available for view by the public in the Burlington Mall this summer. Shortly after that this display will be put on a tour circuit to the public libraries throughout the state.

SPRING MEETING

VERMONT GEOLOGICAL SOCIETY
April 29th, 1978
University of Vermont
Department of Geology
Perkins Geology Hall, Room 101

ABSTRACTS
(in order of presentation)

EVIDENCE OF THRUST FAULTING ON THE EAST SIDE OF THE MIDDLEBURY SYNCLINORIUM

Boyce, Bradford C., and Leslie G. Klein, Department of Geology, Middlebury College, Middlebury, Vermont 05753

Field work near the village of New Haven Mills indicates the presence of a zone of imbricate thrusting just west of the Green Mountain Front. This zone, approximately 1 kilometer wide, exhibits three main styles of deformation: 1) thrust faulting; 2) numerous shear zones a few centimeters to tens of meters wide and solely intraformational; 3) truncated and rotated hinges of parallel folds that occur just below faults of major displacement.

The western boundary of the thrust zone is marked by Cambrian Cheshire Quartzite, thrust upon Cambrian Dunham Dolostone. West of this is a large south-plunging, west-verging overturned fold in the upper part of the Cheshire Quartzite. These features generally strike north, with truncated folds in the thrust zone showing a northwest vergence.

Microstructures adjacent to the Cheshire-Dunham thrust preserve highly sheared and stretched quartz grains that exhibit elongation ratios of up to 50:1. Farther away from the fault zone, quartz grains are less distorted, although deformation lamallae, severe strain shadows, and significant grain elongation are still present.

This evidence suggests that a complex system of distributed shear, faulting, and folding accommodated a westward displacement along the east side of the Middlebury synclinorium.

THE TECTONIC AND METAMORPHIC HISTORY OF THE STOWE FORMATION WEST OF MONTPELIER

Burns, Don D., Department of Geology, Middlebury College, Middlebury, Vermont 05753

Because of inconsistencies in published interpretations regarding the evolution of Vermont, the tectonic and metamorphic history of the Stowe Formation west of Montpelier was investigated. Its history is important because it is centrally located within the central Vermont metasedimentary sequence.

The Stowe Formation consists principally of a quartz-muscovite-chlorite schist interbedded with thick massive greenstone bodies. This has been interpreted as a unit of slope-rise sediments deposited during Late Cambrian to Early Ordovician times (Cady, 1960).

The greenstone member, characterized by an epidote-actinolite-chlorite assemblage, records a history involving the development of a schistosity followed by three successive fold generations. In thin section, the early schistosity is preserved as relict epidote and actinolite trains enclosed in albite porphyroblasts. Occurrences of blue-green amphibole and garnet reflect a high grade metamorphism that developed synkinematically during this early history.

The surrounding pelitic schist, which is characterized by a quartz-muscovite-chlorite assemblage, contains large scale west-verging, north plunging folds which developed anaxial planar schistosity. This schistosity has been transposed by a later slip cleavage, which is the predominant schistosity in the region. In thin section, the schistosity is defined by the synkinematic recrystallization of muscovite which is transposed by the later schistosity. This reflects low grade greenschist facies metamorphism which is recorded in both the greenstone and the pelitic schist. Ultimately a crenulation cleavage post-dates these events.

Garnets altered into chlorite and blue-green amphibole being replaced by actinolite are observed in the greenstone. This represents a retrograde metamorphism from amphibolite facies to greenschist facies.

Lanphere and Albee (1974) and Laird (1977) have obtained metamorphic ages around 460 m.y. for greenstones in the Stowe Formation. This would indicate that the initial high grade metamorphism was probably pre-Taconic (445 m.y.) in age. Retrograde greenschist (chlorite zone) metamorphism defined by the predominant schistosity must be Acadian since it is found continuously into the Siluro-Devonian Waits River- Gile Mountain formations. However, none of the early events experienced by the greenstone are seen in the younger Missisquoi Formation to the east. This indicates that the Stowe and Missisquoi formations have only existed as a stratigraphic sequence since the time of the last events recorded by the Stowe pelitic schist.

LARGE-SCALE FOLDING WITHIN THE MISSISQUOI FORMATION AND ITS IMPLICATIONS FOR THE STOWE-MISSISQUOI CONTACT

Radford, Geoffrey W., Department of Geology, Middlebury College, Middlebury, Vermont 05753

In the Montpelier quadrangle of Vermont, previous mapping (Doll and others, 1961)indicates a simple depositional sequence beginning with Cambrian phyllites and quartzites to the west (Ottauquechee) proceeding east (up-section) through the Ordovician formations of Stowe and Moretown and finally the Silurian-Devonian Gile Mountain and Waits River formations. Structural and metamorphic data, however, suggest that the area may have undergone major tectonic stresses producing large folds and possible imbricate slicing. This is implied, but not discussed, by Cady's mapping of the Montpelier quadrangle (1956). The Moretown, an interlayered formation of sandy quartzites and graphitic phyllites, reveals a map pattern implying a major fold (2 miles limb to limb) in which phyllite can be traced around the hinge. Strike and dip measurements of bedding (S_0) and predominant schistosity (S_1) were taken across the hinge of this probable fold. Moving across the hinge, east to west, the S_0 strike of N. 30 E. swings through an arc of 35 degrees. Beyond the hinge, the S_0 strike eventually returns to N. 30 E. It is presumed that S_1 is a product of the stress that produced the major fold. The N. 30 E. trend is axial planar to the map pattern of the fold. This trend is oblique to the Stowe-Missisquoi contact, which has previously been treated as a depositional contact. The absence of any indication that the contact is folded requires that tectonic dislocation and truncation of the Missisquoi structures occur along the contact. This deformation is probably Acadian in age.

THE CONTACT BETWEEN THE STOWE AND MISSISQUOI FORMATIONS NEAR MIDDLESEX, VERMONT

Viner, William B., Department of Geology, Middlebury College, Middlebury, Vermont 05753

Map patterns (Doll and others, 1961) show contrasting tectonic elements in the Stowe and Missisquoi formations in north-central Vermont. From published data, it is not clear whether these two units, which now lie in contact with each other, have been differentiated by sedimentary or tectonic processes. This report, which investigates the contact between the two units in Middlesex, Vermont, has found evidence that tectonic processes are responsible for the present nature of the contact.

Field study and lab work have found what appears to be a fault breccia along the mapped contact. The breccia consists of deformed fragments from the Stowe(?) Formation set in a highly altered matrix. This is consistent with the observation that fragments of the younger Moretown have been found tectonically sliced into the Stowe Formation adjacent to the contact; their presence cannot be explained by a sedimentary model.

It appears that the Stowe is accretionary prism material formed from an east-dipping subducting slab before the Taconic orogeny. (Don Burns, pers. commun., 1978). Fuchsite found in the Stowe in the study area is consistent with the accretionary prism interpretation. Due to structural relationships and age constraints, the Missisquoi is interpreted as being debris shed from the Taconic uplift and deposited unconformably on the Stowe. Tectonic movement between the two formations during the Acadian orogeny resulted in the present tectonic nature of the contact.

REINTERPRETATION OF THE DEPOSITIONAL AND TECTONIC HISTORY OF THE MISSISQUOI FORMATION

Michaelson, Caryl, Department of Geology, Middlebury College, Middlebury, Vermont 05753

The Moretown member of the Missisquoi Formation in east-central Vermont has a different tectonic history than the Stowe Formation, which lies just to the west. From structural analysis of the Moretown in the Montpelier area, three deformations and a post-kinematic recrystallization can be recognized. The sequence of events after deposition is 1) development of a weak bedding plane schistosity, defined by orientation of platy minerals; 2) development of a strong, pervasive schistosity that is axial planar to tight isoclinal folds, and accompanied by shear and low-grade syntectonic metamorphism (albite-chlorite-muscovite ±epidote); and 3) occurrence of a weak crenulation that is axial planar to open folding of all previous features. A post-kinematic recrystallization is recorded by concentrated layers of randomly oriented biotite crystals.

The protolith of the Moretown is graywacke, argillaceous quartz sandstone, siltstone and shale, deposited as proximal turbidites in a marine basin. The presence of albite-chlorite-muscovite±epidote suggests the sediments were immature, implying a volcanic source area. The "dirty" component may have been derived in part from unroofing of the Oliverian domes to the east. Radiometric dates of approximately 440 m.y. of the Oliverian domes (Naylor, 1969) imply that the Moretown was deposited during and/or after 440 m.y.

The Moretown has strikingly similar deformational history to Silurian-Devonian rocks of the Waits River and Gile Mountain formations. Woodland (1977) suggested the first schistosity in WR-GM formations was due to burial load pressure while the second and third deformations record Acadian events. The same structural sequence, style and orientation is recognized in the Moretown/Missisquoi. The Stowe Formation experienced these events but also retains evidence for earlier deformations (pers. commun., Don Burns). If these earlier events, not recorded in the Moretown, are Taconic, then this demands that the Moretown was deposited after the Taconic event (possibly in response to it) and not deformed by it as previously believed.

THE ORIGIN OF THE SHAW MOUNTAIN CONGLOMERATE - NORTHFIELD FORMATION CONTACT AND FELSIC IGNEOUS BODIES IN THE EASTERN MORETOWN FORMATION

DeVries, Andrew, Department of Geology, Middlebury College, Middlebury, Vermont 05753

A series of previously undescribed felsic igneous bodies lie along the eastern limit of the Moretown Formation in central Vermont. The Shaw Mountain conglomerate is a discontinuous unit to the east of these bodies. Phyllitic slates of the Northfield Formation which appear to grade into the calcareous Waits River Formation occurs east of the conglomerate or adjacent to the Moretown where the Shaw Mountain is missing.

Petrographic examination suggests that the igneous "dikes" of the eastern Moretown are calc-alkaline, and range in composition from basalt through andesite and rhyodacite. The Shaw Mountain conglomerate contains numerous clasts of vein quartz and felsic volcanics set in a fine-

grained phyllitic matrix. In places these clasts are cobble-sized. Some of these clasts are texturally indistinguishable from the igneous dikes. This would imply that the dikes are at least part of the source for the conglomerate.

The igneous dikes cross-cut tight isoclinal folds in the Moretown. This same fold style is prevalent throughout the "Siluro-Devonian sequence" of the Northfield, Waits River and Gile Mountain formations. The dikes are folded by open symmetrical folds which are also common in the "Siluro-Devonian sequence". This suggests that the dikes and erosional Shaw Mountain conglomerate were emplaced and deposited during the Acadian event. The Shaw Mountain conglomerate, which is assumed to be younger than the dikes, lies between rocks displaying an earlier fold event, which implies that the contact with the Northfield slate is a tectonic boundary. (Preliminary field evidence reveals only open symmetrical folds within the Shaw Mountain.)

The rock sequence described is similar to that exposed on islands in the Lesser Antilles in the Caribbean where calc-alkaline volcanics ranging in composition from basalt to dacite are overlain by conglomerates and limestones. The depositional environment for the Caribbean analog was a trench-arc gap and suggests that the older described sequence in central Vermont may have formed in a similar environment.

MARINE STRATIGRAPHY OF THE PLEISTOCENE CHAMPLAIN SEA IN ADDISON COUNTY, VERMONT

Dorwart, Robert Scott, Department of Geology, Middlebury College, Middlebury, Vermont 05753

Forty-two soil samples of late-Pleistocene glacio-lacustrine sediments from nine field exposures throughout Addison County were examined to provide data for descriptive criteria that would be useful in distinguishing sediments of marine and non-marine origin. Micro-faunal assemblages, texture, structure and color were the principle data used for determining environments of deposition.

The results suggest that the contrast between the freshwater and marine deposits is not as distinct as would be expected. This far inland, the Pleistocene marine water body was most probably an estuarine environment with typical brackish water conditions that would often closely resemble fresh water deposits.

Abundant specimens of the brackish-marine pelecypod Macoma balthica are conspicuous (.5 to 1.0 cm) in some horizons lending a simple field indicator of marine origin. Associated with these were abundant separated valves and fragments (.02-.08 cm) of the family ostracoda (fresh-brackish genus Candona(?)) and many fragments of the estuarine arenaceous foraminifera Hyperammina(?).

Samples displayed a range of faunal content from containing all the above to none. A thorough description of texture, structure and color of all the samples failed to correlate these physical criteria with the presence or nature of the fauna in a fashion useful for distinguishing the marine and non-marine sediments in the field. Based on faunal content, clays of the Champlain sea are 4 to 7 m thick.

IN SUPPORT OF FRESH WATER ORIGIN OF BARREN ZONES IN THE SOUTHERN CHAMPLAIN SEA

Snyder, Shelley , Department of Geology, University of Vermont, Burlington, Vermont 05401

The Laurentide ice sheet is thought to have readvanced toward the end of the Pleistocene. Evidence supporting this hypothesis is found in the microfauna found in the Southern Champlain Sea (SCS) sediments. The foraminiferal data indicates at least one episode of freshening of the Southern Champlain Sea. Ratios of ELPHIDIINAE and Islandiella seem to indicate trends of freshening water conditions leading to zones barren of foraminifera. Significantly, fresh water ostracods are found in association with the barren zones. This strongly suggests fresh water conditions. Simpson's measure of diversity and the information function were applied to the SCS foraminifera and yielded no satisfactory results. This absense of statistical trend is believed to be the result of an incomplete assemblage which is substantiated by comparison of SCS foraminifera with arctic foraminifera from other areas. Arenaceous foraminifera are obviously deficient. However, twelve new species of foraminifera were added to the SCS fauna list, including three arenaceous forms.

THE TRANSITION FROM MARINE TO NON-MARINE SEDIMENTS IN LAKE CHAMPLAIN

Whitman, Jill, Department of Geology, Middlebury College, Middlebury, Vermont 05753

Following the retreat of the last Pleistocene glacier from the Champlain valley, three successive water bodies have occupied the basin and left their record as sediments found in the valley: freshwater Lake Vermont, the Champlain Sea marine phase, and the present day Lake Champlain. An unconformity has been identified on echo-sounder profiles near the eastern shore of Lake Champlain, north of Crown Point. This unconformity appears to show the truncation of warped beds of sediments that have since been overlain by more recent horizontal beds. The overlying horizontal beds are about 2 feet thick in the interior of the bay and up to 8 feet thick near the shoreline.

Four cores were taken in this area; analysis of the cores indicates two separate units. The lower unit of clay is denser, light gray and shows irregular laminae. This unit contains foraminifera and ostracods. The upper unit is a less dense clay, more nearly brown, with abundant organic debris; it contains freshwater diatoms and the tests of difflugia (amoebae). The transition between these two units is abrupt and suggests that the unconformity represents the transition from the marine sediments of the Champlain Sea to the overlying freshwater sediments of Lake Champlain.

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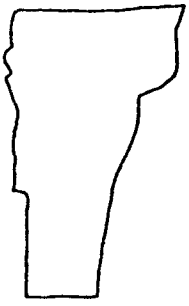


QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

SUMMER 1978 Volume 5 Number 2

M E E T I N G S

July 16 On Sunday, July 16 at 6:30 p.m. the Burlington Gem and Mineral Club is getting together with the Eastern Federation of Lapidary and Mineral Clubs for a covered dish supper and rock swap. The event will be held at the Apple Island Campground just north of the Sand Bar Bridge on route 2 in South Hero. The membership of the Society has been cordially invited to participate. There will be a 50¢ per person entrance fee to the camp ground and each family should bring a covered dish to share. This will be an excellent chance to see and swap minerals with a diverse group of collectors. The swap and dinner are under cover.

August 5 On Saturday, August 5 from 9:30 a.m. to 4p.m. the Burlington Gem and Mineral Club and the Vermont Geological Society are co-sponsoring a mineral display and sale in the Burlington Square Mall. There will be demonstrations on lapidary and soapstone carving as well as display tables and sale items. This event should give geology some good public exposure. We will need people to help set up and to man our display booth at this event - so plan on coming down. If you can help please call John Malter at 223-2637

August 19 On Saturday, August 19 plan to come to the annual VERMONT GEOLOGICAL SOCIETY SUMMER FIELD TRIP AND PICNIC BASH. This year it will be at Roger and Terry Thompson's near Woodstock. If you want to go GOLD PANNING!!! at the old gold mine near Plymouth Union, meet at Roger and Terry's at NOON. We will go from there. Bring your gold pan too. We will return to Roger and Terry's at 5:00 p.m. for a covered dish picnic. Please bring something to share. There will also be a small fee for refreshments. There will be a short meeting of the Society after the picnic. DIRECTIONS. Take U.S. Route 4 west from White River or east from Woodstock to near Taftsville. Take Route 12 south about ½ mile. Roger and Terry are the first house on the east side (left).

September 23 There will be a Soils Identification Workshop. This will be led by Bruce Watson of the Soil Conservation Service. If you want more

information, contact Bruce Watson at 862-6501.

October 6-8 NEIGC

October 14 Vermont Geological Society Fall Meeting. Please save this date. There will be a field trip to examine the very interesting work the Rolfe Stanley and his students have been doing in the Jay Peak area. This will be followed by the Banquet and Annual Meeting to be held in the Morrisville area. Plan now for this meeting.

MINERAL OF THE QUARTER - MAGNETITE

Magnetite is a common iron ore usually found as a massive deposit or in octahedral crystals.

Fe_3O_4 (ferroferric oxide) **Crystal** System - Isometric; Color - Black; Luster - Metallic; Hardness - 6 ; Specific Gravity - 5.2; Streak - Black.

Magnetite can be distinguished from Chromite by its stronger magnetic properties and the black streak. (Black Chromite has a chestnut brown streak).

This mineral is common in the metamorphic rocks of Vermont. Bright silvery octahedrons occur in the phyllites and schists of the Green Mountains. The placer gold found in streams draining the backbones of these mountains is found in the magnetite and garnet sand that collects in the low spots in stream beds because of its high specific gravity.

Magnetite can also be found in the alluvial soils in Vermont river valleys. A spade full of soil allowed to dry in a card board carton can be stirred with a magnet and a considerable amount of magnetite found and removed. The magnetite will stick to the magnet like fur. This device can be used to illustrate the concept that soil is made up of weathered rock particles.

Two notable locations are given below for collecting specimens of magnetite octahedra.

1. Chester, Vt. - Carleton Talc Mine
   Bright magnetite octahedra and pyrite cubes have been found here in a green chlorite schist.
   Directions: Take route 11 west from its intersection with route 103 in Chester for 1.8 miles to a gravel road going north, follow this gravel road for .25 miles to a gate. Dumps are to your left through a meadow.
2. Duxbury, Vt.
   Magnetite is found in bright silver octahedra in dark grey and green phyllite. Also look for serpentine, chlorite, talc,asbestos and dolomite crystals.
   Directions: Take route 100B to S. Duxbury, just south of a bridge take a gravel road going up in a NW direction. Park near a second left fork in the road and walk in a few hundred yards to the serpentine quarry.

EROSION BROCHURE AVAILABLE

An erosion control brochure for Lake Champlain, "Protect Your Shore," was recently released by the Lake Champlain Basin Study in Burlington. Co-sponsored by the New England River Basins Commission and the United States Corps of Engineers, the brochure is designed to create a better public understanding of erosion and also to provide to property owners a wide range of solutions to erosion problems. Although it is designed for Lake Champlain, it will be useful for all lakes in Vermont. Copies are available from Monty Fischer at 862-8270.

THE BULLETIN

The Vermont Geological Society has been concerned since its inception with providing its membership and the public with a significant level of communication about and concerning the geology of Vermont. The meetings of the Society fulfilled part of this function. The Green Mountain Geologist has also partly fulfilled this need. However, it was felt by many that a yearly publication of a technical and academic nature with articles on Vermont geology would be very desireable. At the spring meeting of the Society at the University of Vermont a discussion was held. Many preliminary ideas were developed. This discussion was followed up by a meeting on May 25th with Jim Ashley, Rolfe Stanley, Brewster Baldwin, and Jeanne Detenbeck present.

It was agreed that the Bulletin - the name assigned to this publication - should consist of summaries and short professional papers. That some of the other items mentioned for inclusion at the Spring Meeting should be included in an enlarged Green Mountain Geologist. The general format and character of the Vermont Geological Society Bulletin will be similar to the publications of the Geological Society of America. The Bulletin should be type-set instead of simply typed as is presently the case with the Green Mountain Geologist.

At an executive committee meeting the following week, an editorial board for the Bulletin was selected consisting of Rolfe Stanley, Brew Baldwin and Charles Ratte'. They were instructed to proceed with assembling papers for the Bulletin. A full discussion of the Bulletin will be held at the summer meeting of the Society where costs, size and other details will be discussed.

CALL FOR PAPERS

The Vermont Geological Society is initiating a yearly publication of articles concerning Vermont geology. Two kinds of articles will be published. Summaries will be articles of no more than 15 pages, including figures and references (about 3,000 words of text). Papers will be no more than 30 pages, including abstracts, figures and references. Our first issue is planned for spring 1979.

For Summaries the manuscript should be submitted by early November, and for Papers the author is asked to submit an abstract and outline by early November so that the editorial board can do advanced planning on the first issue. Manuscripts for Papers should be submitted by February 1979.

Manuscripts should be sent to the Vermont Geological Society, Box 304, Montpelier, Vermont 05602. Manuscripts should be submitted in duplicate, and should be prepared following the guidelines of GEOLOGY (Geological Society of America) in citing references and in general format. If you would like a copy of these guidelines, they will be available from the Vermont Geological Society. The publication will be 8½ X 11 inches and is not be planned for any foldout pages.

Brewster Baldwin, Rolfe Stanley, Charles Ratte'

CONSTITUTION AND BYLAWS REVISED

As a centerfold to this issue of the Green Mountain Geologist, we are including a corrected copy of the corrected Constitution and Bylaws of the Society. Seperate copies are also available.

CONSTITUTION and BYLAWS
of the
VERMONT GEOLOGICAL SOCIETY, INC.

CONSTITUTION

Article I: NAME AND FORM

The name of this organization shall be the Vermont Geological Society, Inc., a non-profit, non capital stock corporation.

Article II: PURPOSE

The purpose of the Society shall be:

1. To advance the science and profession of geology and its related branches by encouraging education, research and service through the holding of meetings, maintaining communications, and providing a common union of its members.
2. To contribute to the public education of the geology of Vermont and to promote the proper use and protection of its natural resources.
3. To advance the professional conduct of those engaged in the collection, interpretation and use of geologic data.

Article III: MEMBERSHIP

Membership in the Society shall consist of Members with full voting rights, and other membership catagories not having voting rights in Society proceedings.

Article IV: MANAGEMENT

The affairs of the Society shall be managed by the officers and board of directors elected at regular intervals from the voting membership of the Society. The officers and board of directors constitute the executive committee.

Article V: ANNUAL CORPORATE MEETING

The annual corporate meeting of the Society for the election of officers and board of directors and for such other business as may properly come before the meeting shall be held at such time and place as the executive committee may from time to time prescribe.

Article VI: BYLAWS

Bylaws not inconsistent with this Constitution or with the Certificate of Incorporation shall be adopted at the time of adoption of this Constitution and may be amended as therein provided.

Article VII: AMENDMENTS

Amendments to this Constitution may be made at any annual corporate meeting of the Society by a two-thirds vote of the members voting, due notice having been given each member of such proposed amendment at least four weeks before the annual corporate meeting.

BYLAWS

Article I: MEMBERSHIP

A. Member
Membership shall be open to any person who has a degree in geology or is professionally engaged in geology and whose application, filed in the proper manner, has been approved by the executive committee.

B. Associate Member
Associate membership shall be open to any person *or organization* interested in geology and its related branches whose application, filed in the proper manner, has been approved by the executive committee. Associate members shall enjoy the same rights and privileges as full members except that they shall have no vote in Society proceedings nor be eligible to serve as officers.

C. Student Member
Student membership shall be open to any student interested in geology, whose application, filed in the proper manner, has been approved by the executive committee. Student members shall enjoy the same rights and privileges as full members except that they have no vote in Society proceedings nor be eligible to serve as officers.

D. Lifetime Member
A lifetime membership may be bestowed by the executive committe upon an individual who has made a significant contribution in Vermont geology.

E. Honorary Non-Voting Member
An honorary membership may be bestowed by the executive committee on an individual who has made a significant contribution to the Society.

Article II: DUES

A. Dues for members and associate members shall be $ 8.00 for each fiscal year.

B. Dues for student members shall be $ 4.00 for each fiscal year.

C. Dues shall be payable on or before the first of September of each year.

D. Changes in dues shall be recommended by the executive committee, but shall not become effective until voted by the members of the Society.

E. Any member, associate member, or student member whose dues remain unpaid for a one year period and who fails to pay said dues within 30 days after written notification of said arrears shall be dropped from membership.

F. Memberships approved after July 1 shall be effective until the annual meeting of the following year.

Article III: FISCAL YEAR

The fiscal year of the Vermont Geological Society shall run from annual meeting to the succeeding annual meeting.

Article IV: OFFICERS

A. The officers of the Vermont Geological Society shall be a president, a vice-president, a secretary, and a treasurer. These officers, together with the board of directors, consisting of 3 members, shall constitute the executive committee.
B. The officers shall be elected for a term of one year each and two members of the board of directors for a term of two years each, one being elected each year at the annual meeting. The third member of the board of directors shall serve a term of one year and shall be the immediate past president of the Vermont Geological Society. If there is no immediate past president, the third member of the board of directors shall be elected at the annual meeting.
C. No person, with the exception of charter members, shall be eligible to serve as an officer or a member of the board of directors who has not been a member for at least one full year.

Article V: COMMITTEE ON NOMINATIONS

A. A committee on nominations, consisting of three members, shall be appointed annually by the executive committee at the regular meeting following the annual meeting and shall serve until the regular meeting following the next annual meeting.
B. The committee on nominations shall:
   1. Select one nominee for each office to be filled at the next annual meeting.
   2. Report to the last regular meeting prior to the annual meeting the names of those selected, at which time additional nominations may be made from the floor.
   3. Mail a list of all nominees to all member not less than 30 days prior to the annual meeting.

Article VI: ELECTION OF OFFICERS AND DIRECTORS

A. Method of Election:
   1. Officers and directors shall be elected at the annual meeting.
   2. Voting shall be by ballot *at the annual meeting.*
   3. *Those persons who will not be able to attend the annual meeting may request an absentee ballot from the secretary and shall return this ballot in the envelope provided so as to be received prior to the annual meeting.*
   (3)*4.* Officers and directors shall assume their duties at the close of the meeting at which they were elected.
B. Vacancies in Office:
   1. A vacancy in any office shall be filled for the unexpired term by a person elected by the executive committee.
   2. Voting shall be by ballot if there is more than one nominee for the office.
   3. A two-thirds vote of the members of the executive committee shall constitute an election.

Article VII: DUTIES OF THE OFFICERS AND DIRECTORS

A. President:
The President shall:
a. Preside at meetings of the Society and the executive committee.
b. Be an ex-officio member of all committees except the nominating committee.
c. Determine the duties of the vice-president.
d. Coordinate the work of the officers and committees, in order that the objectives of the Society may be promoted.
e. Submit an annual report to the Society at the annual meeting.

B. Vice-President:
The Vice-President shall perform the duties of the President in the absence of inability of that officer to serve, and those duties assigned by the President.

C. Secretary:
The Secretary shall:
a. Record the minutes of all meetings of the Society and the executive committee.
b. Be responsible for mailing to each member of the executive committee a copy of the minutes of all meetings of the Society and the executive committee.
c. Conduct such correspondence as the Society, the officers, or the board of directors may direct.
d. Notify officers and standing committee chairmen of their election.

D. Treasurer:
The Treasurer shall:
a. Be a member of the budget committee.
b. Collect and record funds in accordance with the approved budget and/or upon direction of the executive committee.
c. Present a financial statement at the annual meeting.
d. Disburse funds and pay all bills by check when approved by the president.
e. Present a financial statement at each meeting and at other times as requested by the president.
f. Close the books at the end of the fiscal year and submit them for audit to the budget committee.
g. Send dues notices to members one month prior to the date that they are due.
h. The Treasurer shall be bonded in amounts determined by the executive committee. The expense of these bonds shall be paid for by the Society.

E. All Officers and Directors:
All Officers and Directors shall:
a. Perform the duties prescribed in the parliamentary authority in addition to those outlined in these bylaws and those assigned from time to time.
b. Deliver to their successors all official material within fifteen(15) days following the close of the annual meeting at which term of office expires.

Article VIII: REGULAR MEETINGS

A. Regular meetings shall be held four times a year.
B. A special meeting may be called in lieu of or in addition to a regular meeting.
C. The date, time and place of each meeting shall be determined by the executive committee.

Article IX: ANNUAL MEETING

A. The annual meeting shall be held in the month of October and shall be considered a regular meeting.
B. The date, time and place of each annual meeting shall be determined by the executive committee.
C. The annual meeting shall be the governing body of the Society.

Article X: VOTING BODY

A. The voting body of the meetings shall consist of the members of the Society.
B. Each member shall have but one vote.
C. *At the annual meeting,* twenty-five percent (25%) of the membership shall constitute a quorum, two of whom shall be members of the executive committee. *Business may be conducted at other duly warned meetings without a quorum. All meetings shall be warned no less than two weeks prior to the meeting.*

Article XI: EXECUTIVE COMMITTEE

A. Membership:
   1. There shall be an executive committee comprised of the officers, two (2) members elected at large, and the immediate past president of the Society.
   2. The executive committee shall meet at the call of the president or upon written request of two of its members.
   3. A majority shall constitute a quorum.
B. Duties:
   The executive committee shall:
   a. Perform the duties delegated to it here and also where under these by-laws.
   b. Transact business referred to it by the membership.
   c. Receive and pass upon plans of work of chairmen of standing committees and authorize and direct the work of each.
   d. Select the time and place of all meetings, including the annual meeting.
   e. Submit to the membership such recommendations as it deems advisable.
   f. Determine the amount and authorize payment of fidelity bonds for the treasurer of the Society.
   g. Take no action in conflict with that of the membership.

Article XII: COMMITTEES

A. Standing Committees
   1. Standing committees may be created or dissolved by the executive committee as deemed necessary to promote the purpose and carry out the work of the Society.
   2. Each standing committee shall consist of a chairman and such other persons as may be appointed by the executive committee.
B. Nominations for Chairman:
   1. Nominations for chairman of standing committees shall be made by the committee on nominations, and shall be reported by the committee on nominations at the regular meeting prior to the annual meeting.

2. Additional nominations may be made from the floor of this meeting.
3. Only a member of the Society, whose consent has been secured, shall be eligible for nomination for chairman.

C. Election of Chairman
1. The election of chairmen of standing committees shall be held at the annual meeting prior to the election of officers and directors.
2. A majority of votes cast shall constitute an election.

D. Duties of Chairmen:
The chairman of each standing committee shall submit a plan of work to the executive committee for approval.

E. Vacancies in Chairmanships:
If a vacancy occurs in the chairmanship of a standing committee, the executive committee shall be empowered to fill such vacancies.

F. Special Committees:
Special committees may be created and appointed by the president or by the executive committee

G. President Ex-Officio:
The president shall be an ex-officio member of all committee except the committee on nominations.

Article XIII: AMENDMENTS

These by-laws may be amended at any annual meeting of the Vermont Geological Society by two-thirds of the members voting, due notice having been given each member of such proposed amendment at least four weeks before the annual meeting.

Revisions:

Revisions to the Bylaws are shown in italic type. The revisions were adopted at the Annual Meetings in 1976 and 1977. These revisions were:

October 1976

Article VI
- A.2 modified
- A.3 added
- A.4 renumber former number 3

October 1977

Article I
- B. modified
- D. added
- E. added

Article II
- F. added

Article X
- C. modified

PROFESSIONALISM COMMITTEE REPORT

The Committee on Professionalism met at the home of Charles Ratté, chairman on May 23, 1978. Present were Phil Wagner and John Malter (substituting for Bill Siok). The committee deliberated for quite some time discussing such questions as:

- How many actual practicing professional geologists might be involved in a certification process?
- Are most firms now employing geologists from "out-of-state"?
- Does a professional certification imposed by a state actually insure quality work?
- Who will administer such a program?
- Who will write the legislation, develop and conduct examinations, etc. Will all of the responsibility for the program fall on a few who are interested and potentially eligible for certification?
- Is there any evidence that professional certification actually elevates standards? Would it encourage growth of the profession?
- In what areas are other professions infringing upon the geological profession?

No solid answers developed from the discussion. The committee recommends that a "professional board" be created by the Vermont Geological Society made up of those who are actually practicing professionals. The committee will be responsible to the Society's executive committee. Its charge should be to answer the following questions:

- How best can the profession be advanced in the state?
- Delineate where the profession can most effectively contribute to the needs of the state.
- Develop a strategy for raising the standards of the geologic profession in the state.
- Communicate with other states to help answer the various questions concerning the pros and cons of professional certification.

Some further consideration of Professional Registration of Geologists from experiences in other states. Generally it was noted that receprocity is a problem. This is because: a. there is no standardization of exams; b. states needs and thus requirements differ; and c. there are no interstate judicial boards. The following are specific comments.

Georgia has 516 registered geologists. Only those dealing with geologic problems affecting the health and safety of the public are required to be registered.

California has 3500 registered geologists. Registration of all professionals in California is run by the Agency of Consumer Affairs. They have recommended abolishment of professional registration for geologists for the following reasons:

1. Most geoscientists are employed by firms that insist on excellence - thus employee control is sufficient.
2. Lack of effective monitoring and control of discipline or maintanance of standards. The policing force is a registration board with only on geologist member.
3. In the entire history of registration this is not a single record of a repremand or divestiture of registration.

4. Only record of complaints are those of registered geologists complaining that non-registered geologists are still operating in the state (and at less expense to the customer).

5. Too expensive for the value received.

Cost of Program. Georgia estimates that program cost is $7,000 to $10,000/ year. It is paid for by biennial dues and exam fees.

General comment from all states:

- There is no strong record of abuse
- non-registrants will probably continue to practice unless strong enforcement practices are initiated. Most felt this could get into messy legal situations.
- no sure, comfortable method of maintaining standards, thus there was no strong record of elevating professional quality.
- examinations are gradually being replaced by academic and experience portfolio.
- registration can stand one in good stead when involved in a court of law.

Submitted by Charles A Ratté

Ed. Note: Dr. Ratté has suggested that those interested in registration or review of need, regulations, meeting together, etc. let him know.

NEWS FROM THE STATE GEOLOGIST

MAPPING PROGRAM

A State Mapping Advisory Committee has been reorganized and resanctioned by executive order. Dr. Ratte is presently chairman of the committee. David Butterfield and Dr. Rolfe Stanley, members of VGS, are also on the committee. Your desires in terms of map needs, information concerning map products and availability, or information concerning maps that you produce should be expressed and questions regarding same should be addressed to one of these persons. One of the first attempts of this committee will be to get the U.S.G.S. - State Cooperative Topographic Mapping Program financed again at a meaningful level. Your cooperation in this effort would be greatly appreciated via statements of the need and broad use of these maps to your legislators and to this committee.

URANIUM

Field investigations related to the NURE (National Uranium Resouce Evaluation) are being conducted thoughout Vermont this summer. Several companies representing DOE and private industry have indicated they will be in Vermont sometime during the summer.

DOE sponsored organizations (Bendix Field Engineering, U.S.G.S., and Chiasma Inc.) will be ground proofing earlier aerial radiometric surveys conducted by U.S.G.S. (Geophysical Map GP 358) and Texas Instruments report for ERDA (May 1976 - on open file at the State Geologists Office). The responsibilities are:

Bendix - Albany 1^{o} X 2^{o} sheet
Chiasma - Glens Falls 1^{o} X 2^{o} sheet
U.S.G.S. - Lewiston 1^{o} X 2^{o} sheet
Bendix - Lake Champlain 1^{o} X 2^{o} sheet (summer 1979)

Private mineral exploration is also being conducted by several firms with the main emphasis being on uranium.

GREEN MOUNTAIN GEOLOGIST

Printed quarterly by the

VERMONT GEOLOGICAL SOCIETY
BOX 304
MONTPELIER, VERMONT 05602

FIRST CLASS MAIL

Charles Ratte'

THE

GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

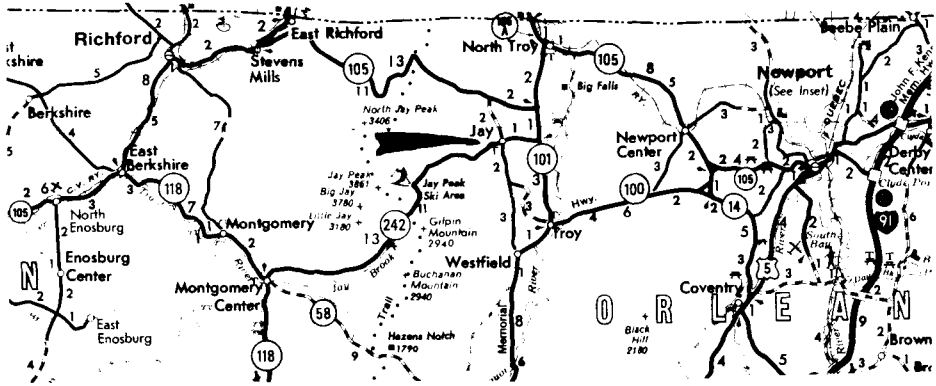
FALL 1978 Volume 5 Number 3

ANNUAL MEETING AND FIELD TRIP: October 14, 1978

Field Trip: Jay Store, Jay, Vermont 9:30 AM
Subject: The serpentinite belt in north central Vermont and its plate tectonic interpretation.
Rolfe Stanley and Barry Doolan will lead us on the field trip to see the tectonic Stratigraphy within and adjacent to the ultramabic rocks in the Warren Hill-North Troy area.

Banquet and Meeting: Schneehutte, Jay, Vermont 6:30 PM
Menu: broiled chicken (1½ lbs)
potato, vegetable, salad
bread, coffee, desert
Cost: $6.00 (includes gratuities) per person.
Prices slightly higher west of Logan's Line.
Meeting and election to be held after dinner.

IF YOU CAN ATTEND THE BANQUET - PLEASE CALL RICHARD WILLEY TODAY AT 828-2761(office) or 476-6050 (home).



SOILS IDENTIFICATION WORKSHOP

A very successful Soils Identification Workshop was held on saturday September 23rd. Leading the workshop was Bruce Watson. About 14 members and guests participated in the session. Starting with some basics in the classroom at the University Of Vermont farm barn, the group then went outside to examine four different soil profiles in soils ranging in rock hard dry clay to a fine sand with a water table only 18 inches from the surface. Everyone agreed it was important for geologists to develop a better understanding this weathered and altered upper surface of geologic deposits.

TREASURER'S REPORT 1977 - 1978

EXPENSES

Communication		
Printing Green Mountain Geologist		175.87
Postage		28.40
Post Office Box Rental		16.00
Secretarial		18.73
		239.00
Education		
Student Award (spring meeting)		25.00
Burlington Gem and Mineral Club		50.00
Earth Science Teachers Field Trip		70.22
		145.22
Meetings		
Executive Committee		13.00
Miscellaneous Meeting Expenses		30.00
Spring Meeting Catering		23.96
		66.96
	TOTAL	$451.18

INCOME

52 Membership Dues		416.00
3 Associate Membership Dues		24.00
2 Student Membership Dues		8.00
Earth Science Teachers Field Trip		74.00
	TOTAL	$522.00

Respectfully submitted
J. Charles Fox, Treasurer
September 28, 1978

DUES ARE DUE !!!

That time has come again when dues are due. The dues year runs from September 1st to the next August 31. The dues are $8.00 for members, $8.00 for Associate Members and $4.00 for student members. Please send you dues to Treasurer, Vermont Geological Society, Box 304, Montpelier, Vermont 05602, or bring them to the Annual Meeting.

PRESIDENT'S REPORT

As we close the fifth year of the Vermont Geological Society, I am pleased to report that many of the goals which we set out to achieve are much closer to realization. Dr. Ratte' has been very active in the office of State Geologist as shown by his report which follows. His budget is also increasing - which is an indication of increasing support from the legislature. The Society played a significate role in persuading the legislature to retain the Office of State Geologist several years ago. The Society continues to work closely with the Survey.

We have also had some excellent meetings and activities. Special thanks must go to Dick Willey for organizing the meetings and to Fred Larsen, Rolfe Stanley, and Terry and Roger Thompson for hosting the winter, spring and summer meetings respectively. There were many very interesting papers both at the winter and spring meetings, and it was a lot of fun to look at some old gold mines this summer. Terry deserves special thanks for the excellent Teacher's Workshop she ran in April. John Malter and Ethel Schuele ran a display at the mineral display and sale at Burlington Square Mall on August 5th. An estimated 3,000 people went by the display. And then Bruce Watson ran an excellent Soils Identification Workshop just a couple weeks ago. All of these events have not only provided better communication within the geologic community but also with the public.

The communications have also been improved through the continued development of the Green Mountain Geologist and the development of plans for a major yearly publication - Contributions to Vermont Geology. We need every member's help to make this publication a success. If you have something to contribute, please let us know TODAY!! Terry Thompson has also published the first of a series of field guides. This was a termendous effort! Paul Brown and his class at Harwood Union has started development of a travelling display which will be on the mining industry of Vermont. When finished this display will be used in libraries and in many other places. We also support the tremendous effort of Dr. Ratte' in developing and printing the first comprehensive Bibliography on Vermont Geology. We hope to make the Bibliography available to each member. Even the draft version is getting heavy use.

The Society's Executive Committee has worked hard to reach these goals and while each Exec. Committee deserves special thanks, we functioned a lot better as a result of the excellent minutes taken by Jean Detenbeck and the sharp eye Charlie Fox kept on the finances. Brew Baldwin's red pencil also helped keep us on the track and John Malter's Chocolate Chip Cookie Factory was a much appreciated operational headquarters for the Exec staff.

However, I can not close this report without asking that each one of you become more involved in the Society. It may be letting us know your feelings, or helping to get the job done. Each Standing Committee can use some real help. Can you help in sign lettering, do you have an article to submit, what do you feel about professional registration? Your participation is <u>important</u>.

Respectively submitted,

James W. Ashley

WINTER MEETING SET FOR EARLY FEBRUARY

The winter meeting is tentatively scheduled for early February, 1979 to be held at Norwich University. Like our winter meeting held at Norwich last year, we will again be devoting the entire session to papers by professionals on Vermont geology and related fields. Any and all individuals wishing to give papers at this meeting should contact V.G.S. at Box 304, Montpelier, Vt. 05602 or call Richard Willey at 828-2761 (office) or 476-6050 (home).

EDUCATION COMMITTEE ESTABLISHED

At an Executive Committe meeting held on September 13, 1978, a motion was made and carried to establish a standing committee on Education and Ballard and Sandria Ebbett were appointed co-chairpersons. One of their primary tasks will be to set up the third annual Teacher's Workshop. They would appreciate any suggestions which teacher members may have. Please let Sandria and Ballard know if you have any suggestions about the Workshop or other activities for the Education Committee.

CONTRIBUTIONS TO VERMONT GEOLOGY

In the last Green Mountain Geologist we announced plans for a yearly Society "Bulletin". This bulletin has now officially be entitled Contributions to Vermont Geology. The Society would like to see a good first issue. If you have something which you would like to contribute, please let us know today. Two types of articles will be published. Summaries will be articles of no more than 15 pages, including figures and references (about 3,000 words of text). Papers will be no more than 30 pages, including abstracts, figures and references. We would like Summaries as soon as possible and abstracts for Papers also as soon as possible. Send them to the Vermont Geological Society, Box 304, Montpelier, Vt 05602.

If you have questions call Dr. Brewster Baldwin, Geology Department at Middlebury College at 388-7959.

NOMINATING REPORT

At the Summer meeting of the Society on August 19th, the report of the nominating committee was accepted. No other nominations were made from the floor. The following were the nominees.

President	Richard Willey
Vice President	Jean Detenbeck
Secretary	Paul Brown
Treasurer	Stewart Clark
Director for 2 years	Charles Fox
Membership chairperson	Dorothy Richter
Meetings chairman	Robert Cushman
Professionalism	Charles Ratte'

Election of officers will be held at the Annual Meeting in Jay on October 14th. Members of the nomination committee were Brewster Baldwin, David Butterfield and Charles Fox.

ANNUAL REPORT OF THE STATE GEOLOGIST

The following is a report of the State Geologist:

RARE II

The RARE II process is a nationwide review of federally-controlled public lands in the National Forest to identify areas that qualify for potential WILDERNESS designation. This means the land would remain roadless and underdeveloped. However, land designated as wilderness by law is single use land which essentially means only able bodied types "who want to get away from it all" can enjoy these lands. Others may simply take comfort in knowing such untouched, undisturbed lands exist. The serious question is "is it in the greatest interest of all people to tie up large acreages of land with greater than recreational resource potential?"

The RARE II process should be of concern to all that might be affected in the future. For instance - air quality standards in a wilderness area may require serious imposition on "off property" business upwind of the wilderness area. State and national energy and mineral resource concerns may require serious exploration and environmentally compatible exploitation of such resources as are likely to be found in wilderness areas. Does an enlightened society to on the one hand seeks and encourages good management of forest and water resources and then to turn around and set aside large acreages as untouchable land?

At the recent Association of American State Geologists meeting the following resolution was developed and sent to Senator Jackson (Natural Resources Committee), Representative Udall, D.O.I. Secretary Andrus, John McGuire (U.S. Forest Service), Frank Gregg (BLM) and Frank Press (President's Science Advisor):

> Whereas, the Association of American State Geologists believes that the wise use of America's resources is of preeminent concern and that a continuing strong national economy depends on this, and
> Whereas, there is a deep national interest in public land policy, and
> Whereas, it is important to insure that our nation's public lands will bring maximum benefit to all citizens of our nation,
> Therefore, be it resolved that the Association of American State Geologists favors multiple use of our public lands over single use wherever possible, and,
> Be it further resolved that there is an urgent need that further single-use classification of public lands be withheld until there is obtained for each subject area a total assessment of resource values based on balanced scientific studies and appropriate review of all factors, including timely demonstration that the action taken is in the highest public interest, and
> Be it further resolved that provision should be made for a viable mechanism to return single use classification lands to multiple use when changing priorities or significant new developments warrant it.

If you have concerns about RARE II, you may wish to write with comments to:

Regional Forester (RARE II)
Eastern Region, U.S. Forest Service
633 W. Wisconsin Avenue
Milwaukee, Wisconsin 53203

SURFACE MINING AND RECLAMATION ACT OF 1977 PL 95-87

The present law affects only the coal mining industry, however, a federally sponsored committee is now looking into the potential affect this law would have if extended to "other than energy related" mining operations. Virtually all of Vermont's mining industries involve surface mining. Such a law could have serious affect on Vermont's mineral industries. It is recommended that those concerned should write their congressmen for a copy of this law to familiarize themselves with its content.

A portion of the law provides money to establish a "mining and mine reclamation" curriculum in a qualified mineral industries department of a college or university in every state. Perhaps a geology department that is interested should contact their college administrators if they are interested in developing such a program of study.

FRAGILE AREAS REGISTRY H-8-1977

This bill passed by the Vermont legislature in 1978 is intended to incorporate geological sites. The National Heritage Conservation and Recreation Service has developed a (draft) classification system which I think is quite comprehensive (I have a copy if you'd like to see it). I think it would be an appropriate function of the Vermont Geological Society to establish criteria and selection methods and become an official guiding force in this program as regards geological sites. The reaction of the membership to this proposal is strongly requested.

GROUND WATER GROUP

In response to the Agency of Environmental Conservation's strong interest in advancing its efforts in the area of ground water geology, an Interagency-University of Vermont group composed of representatives working directly or indirectly in ground water oriented disciplines was formed under the sanction of Acting Secretary Reginald LaRosa. Secretary Brendan Whittaker, at a recent meeting of this group, reconfirmed the Agency's desire to become involved in a more meaningful ground water program and voiced his strong support of the group's charge.

The group is charged with the following duties and responsibilities:

1) To examine and document the ground water protection situation throughout the state by means of reports by each of the members and the discussions thereon.
2) To assist the Secretary to develop a state ground water policy statement compatible with 10 V.S.A. §1278 and 1279.
3) To assist the Secretary to develop a state ground water protection plan.
4) To provide assistance to several members with ground water problems by means of review and comments upon projects and situations with ground water impact.

BIBLIOGRAPHY OF VERMONT GEOLOGY

Approximately 2000 entries have been compiled in the trial copy of the "Bibliography of Vermont Geology". This penultimate copy has been sent to numerous readers for comment, suggestions, corrections and additional entries. Fifty copies have been printed. If you are willing to be a critical reader of this document please write to my office requesting a trial copy. They will be sent on a first come, first serve basis until the 50 copies are depleted.

THE SECOND ANNUAL V.G.S. TEACHER'S WORKSHOP

The Second Annual V.G.S. Teacher's Workshop was held on April 26, 1978. The field trip consisted of stops in the Burlington area which illustrated the structural features and the bedrock formations associated with the Champlain Thrust.

The first two stops were in Burlington: The Geology Museum at the University of Vermont and Redstone Quarry to see the structural sedimentary features of the Monkton Quartzite. Mt. Philo in North Ferrisburg was another Monkton Quartzite stop. In addition, the group visited an Iberville Shale outcrop in Charlotte and finally viewed the actual fault zone of the Champlain Thrust at Lone Rock Point in Burlington.

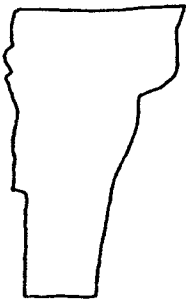
There were 62 participants; most of them were teachers from various parts of Vermont. The trip leader was Terry Thompson who was assisted by Brew Baldwin of Middlebury College and Jeanne Detenbeck of U.V.M.

The Field Trip Guide can still be obtained from V.G.S. for $1.00 for non-members and Free to any member who would like a copy. The 21-page booklet includes background information on the bedrock units and structural features, descriptions of each stop, laboratory exercises for each stop, a glossary, and a bibliography.

The Society would like to offer additional field trips in the future. In order to do this we need input and ideas from the members. Please send your thoughts to the V.G.S. Education Committee, Box 304, Montpelier, Vermont 05602.

GREEN MOUNTAIN GEOLOGIST
VERMONT GEOLOGICAL SOCIETY
BOX 304
MONTPELIER, VERMONT 05602

THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

WINTER 1978 Volume 4 Number 4

The Vermont Geological Society is now entering its fifth year with an impressive string of accomplishments. They include the effort which saved the Vermont Geological Survey and which saw Dr. Charles A. Ratte appointed as State Geologist (his first annual report follows). The Society put on a very successful exposition on Vermont Geology, has had many excellent meetings and field trips and has a steadily growing membership. The Society has also been recognized by the Vermont Legislature.

Starting this fifth year will be the winter meeting of the Society at Norwich University on January 28th with the presentation of 11 professional papers and reports. It is anticipated that this will become a regular event. Every member is urged to attend and bring a friend, student or anyone who might be interested in hearing these very interesting papers and the discussions which follow. This will be an opportunity to learn about the most current activities in Vermont geology.

I also expect that in this fifth year of the Society a standing committee will be established to maintain an overview of man's effect on special geologic features. This effort is an outgrowth of the Nebraska Valley controversy. Monty Fischer is heading up the effort to develop working recommendations for the executive committee.

Finally, I expect that in addition to the Society's quarterly newsletter, that a number of other publications will be undertaken. These will include the Bibliography of Vermont Geology reported earlier, an Annual Bulletin containing short papers on Vermont geology and finally the first in a series of guidebooks.

I hope all of you will participate in all of the Society's activities, and I hope to see all of you on January 28th in Northfield.

James W. Ashley

President

ANNUAL REPORT OF THE STATE GEOLOGIST

The following are some of the projects and accomplishments of Dr. Charles Ratte during his first year as State Geologist.

1. Initiated a cooperative research agreement with the U.S. Bureau of Mines with the following projects underway:
   Research of the Use of Vermont's Waste Slate
   Chemical analyses of Vermont's Limestones
2. Initiated a cooperative project with the Vermont Department of Highways to study the Potential Rock Slide hazards along Vermont's Interstate Highway System.
3. Participated in cooperative program with the Soil Conservation Service to assess Natural Resources in the Whetstone Brook (Brattleboro-Marlboro) watershed flood control project.
4. Technical advisor to the Windham-Windsor 208 project.
5. Working with Darlington Brick and Ceramics Co., Darlington, Pa. to reopen kaolin industry in Bennington, Vermont.
6. Investigating research being conducted at Sherbrooke University, P. Q. Canada to find uses for Vermont's waste from the asbestos quarrying industry.
7. Continuing to communicate with all of the principals of Vermont's Mineral Industries with the intent of learning their problems as they relate to Vermont's geology and Vermont's Environmental Laws.
8. Member of the Association of American State Geologists, and member of the Associations Review Group to the ERDA (DOE) program of High Level Nuclear Waste Disposal.
9. Member of:
   a. State Task Force on Nuclear Waste
   b. Agency of Environmental Conservation E-Team
   c. Agency of Environmental Conservation Act 250 Club
   d. Map Advisory Committee
10. Technical advisor to Vermont Natural Resources Council.
11. In cooperation with the Department of Water Resources, I will be conducting the first phase of a groundwater base-line chemical quality study of Vermont's bedrock aquifers.
12. Investigating Vermont's Oil and Gas potential by developing a "Status Report" on the research and investigations conducted to date.
13. Cooperating with Federal Agencies as follows:
    a. U. S. Geological Survey
       i. re-established cooperative topographic mapping program
       ii. literature survey of Vermont's crystalline rock formations with a potential for deep burial of High Level nuclear waste.
    b. U.S.E.R.D.A. NURE (National Uranium Resource Evaluation) Prime contractor = Bendix Field Engineering - geological search for uranium in Vermont.
14. Geological services and consultation to various state agencies, municipalities, planning commissions, and private citizens.
15. Public appearances on Vermont television and radio, and presented talks to local organizations, service clubs, etc. throughout the state.
16. Compiled a bibliography on Vermont geology publications.
17. Member of the Geological Society of America. Presented paper to Northeastern Sectional Meeting on "Dorset Mt. Debris Avalanches of August 10, 1976."
18. Sponsored with U.V.M. Geology Department a seminar on groundwater problems and potential solutions in Vermont.

LEGISLATIVE LOG

Each year the Vermont legislature consider and possibly enact laws which directly or indirectly effect geologists or the related natural resouces of the State. It presently appears that a number of programs will be reasonably funded this year, such as the soils mapping program which had been dropped a few years ago.

Listed below are a few of the new bills which may be of interest to the members of the Vermont Geological Society.

H-489 Reduces and regulates the use of road salt.
H-492 Provides protection of Vermont's wetlands.
H-498 Relates to timber and mineral rights.
H-512 Establishes a water resources task force and seeks to protect future water supplies.
H-530 Authorizes sale of land and gravel by towns.
H-543 Provides for state sponsored soil testing for subdivisions and review of on-site sewage facilities.
H-549 Gives the State authority over transportation of hazardous materials.

This is a partial list at best and does not include bills submitted last year and those added after this list was compiled. Copies of some of these bills will be available for examination at the Winter Meeting at Norwich University on January 28th. Should you wish to get future information on these or any other bills you can also contact your local representative. A number of these bills can directly affect the geologic profession in Vermont, and more important, can help protect the natural resouces of the state.

Topics discussed in fall 1977 executive committee meetings:

1) What part should the society play in distributing the Vermont bibliography and other Vermont publications in the future? This activity meets the goals of the society and is therefore worthy of some financial sacrifice. This discussion will be pursued with C. Ratte.

2) It was decided that books which might be of interest to the membership would be reviewed in the G. Mt. G. and that we would not become involved as a sales agent.

3) C. Fox is looking for someone to help with the budget and to break in as treasurer for next year.

4) Five new members were accepted.

5) T. Thompson is working on plans for a teacher's workshop of field trips in the Burlington area to be held in April under the sponsorship of V.G.S.

6) The summer meeting is being planned in conjunction with the Gem and Mineral Club at Burlington Mall. We would have some kind of display there and a field trip associated with it.

V.G.S. WINTER MEETING

DATE: Saturday, January 28, 1978

TIME: Registration open at 9:00 A.M.

PLACE: Cabot Science Annex
Norwich University
Northfield, Vermont

Cabot Science Annex is the southernmost brick building at Norwich University. The building is on the west side of Route 12, 0.7 of a mile south of the Northfield post office. Park adjacent to the building or in the student parking lot to the south. Look for VGS signs and enter south entrance.

It is recommended that you bring a bag lunch if possible. Coffee and soft drinks will be available. The Norwich University snack bar will be open in the basement of Harmon Hall.

INFORMATION FOR SPEAKERS: One Kodak Carousel projector and one overhead projector will be available for use in Room 45. Speakers should bring their own Carousel slide tray if possible.

A CALL FOR STUDENT PAPERS FOR THE SPRING MEETING

The spring meeting of the Vermont Geological Society will be held in late April or early May (probably April 29th) at Perkins Hall at the University of Vermont. This meeting will be devoted to the presentation of student papers on Vermont geology. A $25.00 prize will be awarded for the best paper presented. Both graduate and undergraduate students are invited to participate.

Abstracts should be submitted by April 3 to Dr. Rolfe S. Stanley, Department of Geology, University of Vermont, Burlington, Vermont 05401. Each abstract should be typed with small type in the same manner as the abstracts in this issue. The typed line should not exceed 6 inches in length and the abstract should not exceed 250 words.

All persons interested in learning more about some very interesting research into geology are urged to set April 29th down in their calender and to attend.

DUES ARE DUE!!

If your address label is in red and if this item is circled, your 1978 dues are due. Members - $8.00, Students - $4.00. Send to Treasurer, V. G. S., Box 304, Montpelier, Vt.

PROGRAM

VERMONT GEOLOGICAL SOCIETY
WINTER MEETING
Rooms 45, 48, 148, Cabot Science Annex
28 January 1978

Registration (no fee), Room 48 0900-1000
Coffee and doughnuts (donation)

TECHNICAL PAPERS, Room 45 Brewster Baldwin and Fred Larsen presiding

1. B. Baldwin: Sedimentation rates for the Taconic sequence 1000
2. F. Larsen: Rapid lateral movement of the Winooski River, Marshfield, Vermont. . . 1020
3. A. Hunt: Geological studies of Lake Champlain 1040
4. R. Fischer: The role of geology in the Lake Champlain Basin Study. 1100
5. C. Ratté: Rock slide hazards project for Vermont's interstate highway system. . . 1120
6. D. Butterfield: Review of the Vermont Ground Water Program 1140
7. B. Watson: Soil - that dirty four-letter word . 1200

Lunch break - Brown baggers in Room 148, coffee and soft drinks available.

8. R. Stanley, R. Gillespie, E. Rosencrantz, A. Friedman, P. Agnew, C. Carter: The Hinesburg thrust zone in west-central Vermont 1330
9. P. Gale, B. Doolan: The Bolton Igneous Group and its plate tectonic significance in north-central Vermont and adjacent Quebec 1345
10. W. Glassley, D. Burns, A. Devries, C. Michaelson, G. Radford, W. Viner: Imbricate thrust sheets in central Vermont: A reinterpretation of mapped "Formations" 1400
11. R. Stanley, B. Doolan, P. Gale, R. Hoar, M. Hollis: Plate tectonic interpreation of the Cambrian and Ordovician rocks in north-central Vermont 1415
12. Discussion of papers 8-11 1430

Executive Committee meeting

SEDIMENTATION RATES FOR THE TACONIC SEQUENCE

Baldwin, Brewster, Department of Geology, Middlebury College, Middlebury, Vermont 05753

A 418-meter section of black argillite with distal turbidite interbeds was measured along Poultney River northwest of Fair Haven, Vermont. The 188 m of exposure is in 4 glacially polished outcrops. The beds of this part of the Taconic sequence are of Early Cambrian through Early Ordovician age (90 million year (m.y.) interval). Turbidite interbeds total 70 m of the 418-m section, and the remaining 350 m is deep-water argillite. Sedimentation rate of the argillites is about 4 m/m.y., much less than the 20 m/m.y. for platform sediments of the Middlebury Synclinorium and a fraction of the 200 m/m.y. rate for Iberville-Stony Point shales that were deposited on the collapsing platform in later Ordovician time.

In the middle portion of the black slate sequence, abundant turbidite interbeds progress upsection from dolomite interbeds, through dolomites with scattered quartz grains, to quartz sandstones with dolomitic and then siliceous cement. Within this middle portion, a 22-m interval includes thick sandstones with abundant clasts of dolomite and quartzite; this and other sedimentologic evidence indicate that the turbidites came from a stable continental platform. In the part of the Taconic sequence that has abundant interbeds, turbidite frequency ranges from 40 to 15 events per meter of argillite for an average of one event every 6,000 to 17,000 years.

REVIEW OF THE VERMONT GROUND WATER PROGRAM

Butterfield, David, Vermont Department of Water Resources, Montpelier, Vermont 05602

The present status of ground-water law in Vermont can be traced to 1855 when the State Supreme Court declared that, "The secret, changable and uncontrollable character of underground water, in its operations, is so diverse and uncertain that we cannot well subject it to the regulations of law, nor build upon it a system of rules, as is done in the case of surface streams." The law has not been changed since that time. At present, Vermont common law holds that ground water is owned by the property owner under whose land the ground water is located. However, the Vermont Agency of Environmental Conservation is charged by statutory law with protecting the state's ground-water resources. A conflict arises because the state lacks the legal authority to regulate ground water under privately owned land.

The drought of the mid-1960's prompted the state government to initiate a program of cooperative ground-water studies with the U. S. Geological Survey. These studies resulted in a state-wide reconnaissance of ground-water availability and several detailed studies in the Barre-Montpelier, White River Junction and Rutland areas. More re-

cently, emphasis has been shifted from ground-water availability studies to studies related to water quality and legal aspects concerning protection of ground water. A Ground Water Protection and Pollution Control Program is due to be presented to the legislature for approval and funding during January, 1979.

THE ROLE OF GEOLOGY IN THE LAKE CHAMPLAIN BASIN STUDY

Fischer, R. Montgomery, Lake Champlain Basin Study, New England River Basins Commission, Burlington, Vermont 05401

There is a long history of concern in New York and Vermont about the management of Lake Champlain waters and related land resources. Programs have been devised to address water quality, navigation, fish and wildlife, flooding, and numerous other problems. In the past these programs have viewed Lake Champlain in political terms with state boundaries rather than as a natural basin defined by hydrologic boundaries. Management programs reflect this approach, and, in many cases, terminology, map scales, or classification systems differ on each side of the Lake.

The States of Vermont and New York have recently joined with the New England River Basins Commission in a two-year study of lake-related natural resource use and management problems. Several critical issues to be addressed by the Study will call on geologists for their knowledge and help in understanding them. Task forces will examine shoreline erosion, shoreland natural resource mapping, criteria for power-generating facility siting, and criteria for disposal sites for oil-saturated debris. In each case, involvement of geologists is essential. One of the products resulting from the Study will be a brochure for property owners on erosion control of the Lake Champlain shoreline.

THE BOLTON IGNEOUS GROUP AND ITS PLATE TECTONIC SIGNIFICANCE IN NORTH-CENTRAL VERMONT AND ADJACENT QUEBEC

Gale, Peter N. and Barry L. Doolan, Department of Geology, University of Vermont, Burlington, Vermont 05401

The 25 km^2 area of Ordovician rocks west of Lake Memphremagog contain quartz diorite, gabbro, and diabase in complex comagmatic relationships intruded in a stratified sequence of pinstriped granulite, pillow basalt, rusty gray slate, black carbonaceous slate, and breccia.

The quartz diorite, previously designated the Eltey Mountain granite and assigned a Devonian age, is here tentatively redefined as the Newport granodiorite and reassigned to the Ordovician. This unit is more plagioclase rich than typical Devonian granites, it displays, in places, a strong foliation, only cuts pre-Silurian rocks, and differs from the New Hampshire intrusives by its elongate outcrop pattern. The field relationships indicate this pluton and associated dikes are genetically related to the rocks of the

Bolton Igneous Group (Clark and Fairbairn, 1936) which consists of gabbros, diorites, and basalts of Ordovician age. Zircon from the quartz diorite are presently being processed for radiometric age by H. Gaudette (University of New Hampshire) and R. Naylor (Northeastern University).

We believe the Bolton Igneous Group represent products of a partially developed ophiolite sequence not developed beyond initial rifting stages in a Lower Ordovician marginal basin. According to this model the basin is coeval with active arc volcanism along the Stoke Mountain anticline represented by the Ascot-Weedon Formations (Laurent, 1975; St. Julien and Hubert, 1975) and a westward-dipping subduction zone located east of the arc. Closure of the arc against the continental margin near the International Border resulted in an incipient ophiolite as isolated intrusions whereas a more fully developed ophiolite sequence developed to the north where back-arc spreading continued unabated. The study area may then represent igneous products from two quite different tectonic environments, a spreading or incipient ridge in a marginal basin and an island arc. The volcanics and intrusive rocks are interfingered with marginal basin sediments.

IMBRICATE THRUST SHEETS IN CENTRAL VERMONT: A REINTERPRETATION OF MAPPED "FORMATIONS"

Glassley, William, Don Burns, Andrew Devries, Caryl Michaelson, Geoffrey Radford, Will Viner, Department of Geology, Middlebury College, Middlebury, Vermont 05753

Intraformational structures in central Vermont, as shown on the Vermont state geologic map, are not consistent with the interpretation that formation contacts are depositional. Examination of published reports suggests that large scale structures are often truncated at formation contacts, implying that the formations are tectonically juxtaposed.

Middlebury College has initiated a student-faculty research program which is evaluating this suggestion. Preliminary results confirm the existence of profound contrasts in metamorphic facies and structural style between Hazens Notch, Ottauquechee, Stowe, Moretown, and Gile Mountain-Waits River formations. Tectonic mixing of units along formation contacts, large scale intraformational folds terminated at formation contacts, and contrasts in tectonic histories for various units can be documented. For example, the twice-deformed, chlorite-zone Ottauquechee Formation is adjacent to biotite- or garnet-grade Hazens Notch rocks which have experienced at least three recognized deformations. Although more work is necessary for adequate documentation of these observations, the preliminary results imply that central Vermont is a zone of tightly folded imbricate thrust sheets which define a Paleozoic suture zone between the North American craton and an eastern volcanic terrane. Furthermore, the present formation definitions are clearly inadequate, and are in need of substantial modification.

GEOLOGICAL STUDIES OF LAKE CHAMPLAIN

Hunt, Allen S., Department of Geology,
University of Vermont, Burlington, Vermont 05401

Prior to the 1960's, geological studies were primarily of the Champlain Basin and not of the Lake itself. Geological research on Lake Champlain was initiated in 1964. Early work, including drainage and bathymetric studies, described the area. Investigation of the properties of surficial sediments including grain size, mineral composition, organic content, and chemical composition followed. Stratigraphic studies using coring techniques were undertaken in 1968 and have been in progress since that date. In 1972 geophysical methods were employed and have proven successful in tracing stratigraphic horizons that were recognized in coring. These methods have also been used to determine the thickness of sediments to bedrock. In addition, since 1974 shoreline erosion studies have been underway to investigate the causes and present extent of erosion along the Lake's shore.

Future areas of interest include the biostratigraphy and paleoecology of lake sediments, shoreline erosion and related processes, and short-term sedimentation rates useful in the study of sediment input since habitation by man.

RAPID LATERAL MOVEMENT OF THE WINOOSKI RIVER, MARSHFIELD, VERMONT

Larsen, Frederick D., Department of Earth Science,
Norwich University, Northfield, Vermont 05663

Two meanders of the Winooski River were mapped at the Brimblecombe farm, Marshfield, Vermont, on several occasions between November, 1973, and May, 1977. A comparison of maps and transverse profiles indicates that, at one point, the cutoff slope retreated 22.0ft (6.7m) in 3.5 years for a rate of 6.29 ft/yr (1.9m/yr). Concurrent deposition on the point bar maintained a nearly constant stream width. Rapid retreat of the cutoff slope was apparent at the time of high spring runoff with the slumping of large blocks that had been undercut during the cold winter months. The fact that the cutoff slope was undercut was discovered on April 15, 1975, when the ground was still frozen and the amount of overhang was 17in (0.43m). The amount of overhang was observed to increase from 5in (0.13m) on February 9, 1976, to 26.5in (0,67m) on March 22, 1976. On April 19, 1975, at time of high spring runoff and bankfull stage, large blocks up to 6ft (1.8m) wide slumped into the river. The main reason for the undercutting, and hence for the rapid lateral migration of the river, appears to be related to the production of electric power at Marshfield where water is released between 8AM and 12N and between 4PM and 8PM each weekday. This process causes the water level in the Winooski River near Marshfield to rise and fall twice each day that power is produced. The result is an inordinate number of exchanges of water between the stream and the ground-water table compared to a normal stream. The undercutting appears to result from rapid sapping by ground water as it returns to the stream.

ROCK SLIDE HAZARDS PROJECT FOR VERMONT'S INTERSTATE HIGHWAY SYSTEM

Ratté, Charles A., State Geologist, Agency of Environmental Conservation, Montpelier, Vermont 05602

Presently a cooperative study of rock fall - rock slide potential associated with bedrock cuts along Vermonts' Interstate highways is being conducted by the state geologist and the chief geologist of the Highway Department. The goal of this project is to select those sites that present the greatest rock slide - rock fall hazard in terms of safety to the motoring public, to geologically analyze these sites sufficiently to document the seriousness of the hazard and to recommend remedial measures for abating the problem. Further, recommendations will be made concerning new design criteria for highway cuts for bedrock situations likely to be encountered in Vermont, and what type of geological information is needed (and how to obtain it) and how much geological input is required in the pre-design and design stage.

The study is a three phase project:

Phase I. Assessment of all bedrock cuts over 20' in height. The cuts will be evaluated and given a hazard rating (1 to 10) based on seven criteria.

Phase II. Detailed geological analysis of bedrock cuts deemed to present the most severe hazard to public health and safety.

Phase III. Recommendations for remedial maintenance, protective measures, continued monitoring, new design criteria, etc.

In practice, rock-slide geometry is sufficiently complex so as to not lend itself to mathematical analysis. Analysis of geologic parameters and good common sense can provide an accurate picture of the degree of rock-slide certainty for any potentially hazardous situation.

In theory, however, a loose block perched on a glide plane of 45° with an open face toward the highway presents the greatest hazard. All things being equal, as the glide plane angle decrease toward 0° greater and greater tangential (shear) forces will be required to overcome the vertical force of gravity produced by the weight of the block. As the angle of glide increases to 90° the vertical forces become more influential in progressively stabilizing the open face until at 90° (vertical) when no sliding can occur.

Steep-angled glide planes directed away from the open face introduce problems of "fold out" failure.

THE HINESBURG THRUST ZONE IN WEST-CENTRAL AND NORTHWESTERN VERMONT

Stanley, Rolfe, R. Gillespie, E. Rosencrantz, A. Friedman, P. Agnew, and C. Carter, Department of Geology, University of Vermont, Burlington, Vermont 05401

During the last ten years we have been systematically remapping (1:24,000) the Hinesburg thrust from Starksboro northward to the Quebec border. These studies indicate: 1) The Hinesburg thrust consists of a major thrust slice of Cheshire, Underhill and Pinnacle Formations with several minor slices of Cheshire and Dunham north of the Winooski River (Rosencrantz, Agnew). 2) The trace of the major slice occurs along the western edge of the Fairfield Pond Member of the Underhill Formation where Booth (1950) essentially mapped it in contrast to its incorrect location in the Geologic Map of Vermont north of Colchester, Vermont (Agnew, Carter). 3) The minor thrusts and carbonate slivers are interpreted as failure of a major fault step that probably formed at the eastern edge of the Lower Cambrian carbonate bank (Gillespie, Agnew, Rosencrantz). This step failed as the Hinesburg slice carrying older Eocambrian (?) rocks cut upward to the west. 4) Displacement is estimated to range from 15 km to 60 km depending upon methods and regional correlation (i.e. does the Hinesburg cross the Green Mountains and join with the thrust zones east of the Green Mountain and Berkshire massifs?) 5) The Georgia Mountain anticline appears to fold the Hinesburg thrust and may be due to a major fault step in the Champlain thrust (Carter). 6) Emplacement by gravity sliding seems untenable. 7) The apparent folded geometry in the Colchester-Hinesburg area is largely due to Mesozoic extension on the St. George-Indian Brook fault system (Rosencrantz, Friedman, Agnew).

PLATE TECTONIC INTERPRETATION OF THE CAMBRIAN AND ORDOVICIAN ROCKS IN NORTH-CENTRAL VERMONT

Stanley Rolfe, Barry Doolan, Peter Gale, Robert Hoar, and Margie Hollis, Department of Geology, University of Vermont, Burlington, Vermont 05401

During the last two years selected parts of the Cambrian and Ordovician rocks between the Green Mountain axis and the Silurian and Devonian unconformity have been remapped at scales of 1:20,000 or larger with the main purpose of understanding the plate tectonic geometry and sequential development during the Taconic Orogeny. In 1976 Doolan proposed a margin basin configuration for this part of Vermont and Quebec in which a west-dipping subduction zone east of the Bronson Hill-Ascot-Weedon belt developed a thermal plume during Ordovician time which generated mafic and ultramafic suites in the back-arc region (Gale, Doolan, this session). In Vermont this suite was greatly abbreviated by an apparent eastward-directed irregularity in the Grenville plate margin. The Taconic Orogeny in north-central Vermont would then involve a gradual collapse of a marginal basin perhaps beginning as early as the Cambrian with

the tectonic emplacement of fragmented ocean floor as alpine serpentinites and culminating in Middle Ordovician times with the westward thrusting of the marginal basins ophiolites and island arc complex. The implications of plate tectonic theory in orogenic geology is revolutionary. The classical stratigraphy of eastern Vermont, and for that matter New England, may well be a lithotectonic stratigraphy in which the sequence of rock units result from their thrust emplacement rather than their time of sedimentation. Future work will focus on accurate constraints so that this and other models can be evaluated, refined or substantially modified.

To date our work has concentrated on the Missisquoi Formation and associated intrusives near Lake Memphremagog (Gale and Hoar), the Umbrella Hill Formation (Badger, 1976), the serpentine belt between the Quebec Border and Troy (UVM Field Geology course, 1976, 1977), the Hazen's Notch Formation (Woodward), and the Belvidere Mountain Amphibolite (Hollis). Future financial support will be provided by the United States Geological Survey and the National Science Foundation (?).

SOIL - THAT DIRTY FOUR LETTER WORD

Watson, Bruce, U. S. Soil Conservation Service, Suite 205, 1 Burlington Square, Burlington, Vermont 05401

Soil connotes different things to different people depending on a person's background and perspective. It is to some just plain "dirt"; to the farmer a valuable resource; to the engineer a material to manipulate and build with, and to the geologist - a clue to the surficial geology and history of an area.

Soil scientists have recognized and mapped about 160 different soil series in Vermont. They have classified each soil into a nation-wide classification system and have described each soil in detail. The character of each different soil in Vermont is the result of the five soil-forming factors: (1) parent material, (2) climate, (3) topography, (4) vegetation, and (5) time. Of these five factors, parent material affects the ultimate character of a soil the most. This is especially true in a geologically young area.

The purpose of this paper is to demonstrate the ways that soils and soil surveys can be interpreted in terms of surficial geology in Vermont. Whereas soils are classified and described in terms of their physical and chemical properties, and whereas the kind of parent material is identified in the definition of each soil, it therefore is possible to identify, classify, and locate different surficial glacial deposits by an interpretation of the detailed soil survey.

MINERAL OF THE QUARTER

At this time only one mineral looms of sufficient importance to be highlighted. It belongs to the hexagonal system and occurs in masses, granular aggregates and crystals. Its skeletal crystals are best known and admired for their intricate beauty. Physical Characteristics are: Hardness-1½, Specific Gravity-0.916, Color- colorless to white, blue when thick, Luster- vitreous, Fracture- conchoidal, Cleavage- none, exhibits basal gliding, Occurrence- abundant in Vermont in its various forms. It is blessed by skiers and motel owners and cursed by ordinary motorists. Farmer's know their summer's supply of water depends on an adequate accumulation of this mineral at higher elevations. Most city dwellers wish it would stay only on the mountains and not need to be shoveled from driveways and pavements.

By now you surely suspect that the mineral is ice. The lovely snowflake is a skeletal ice crystal. Ice occurs in Vermont as snow, frost and hail as well as ice on ponds, rivers and lakes. It is very much a part of the Vermont scene.

Man has pondered the beauty of snow crystals since ancient times. Aristotle commented on the intricate form of the snowflake in the 4th Century B.C. A book on natural phenomena, published in 1555 by the Archbishop of Upsala, Olaus Magnus, included crude pictures of snowflakes. Ten years later Robert Hooke, the famous English physicist, included a page of drawings of snowflakes in his "Micrographia". He made his drawings outdoors after catching the specimens on a black cloth. The most famous and probably most dedicated student of snow crystals was W. A. Bentley of Jericho, Vermont. He spent almost 50 years capturing and photographing snowflakes, working out-of-doors with a plate camera. During his lifetime he recorded the image of more than 5000 different crystals and found no two alike. From his study he identified five general types of ice crystal structure.

A. Hexagonal columns (often called needles)
B. Hexagonal right pyramids
C. Hexagonal plates, ten or more times broader than thick (many with elaborate extensions on the corners)
D. Triangular plates
E. Twelve sided plates

The needles and plane hexagonal plates form at high altitudes, where the amount of water vapour in the air is small. These forms occur in cirrus and cirrostratus clouds in which they are responsible for the striking halos sometimes seen around the sun or moon. The most intricate crystals with branching extensions form at higher temperatures in the presence of more moisture. These forms are more abundant in the front portion of a snowstorm, where the snow is heaviest and the clouds are greater.

It is possible to permanently record the shapes of these fleeting crystals by a method developed by V. Schaefer* in 1940. The total supplies needed are: 2 square feet of black velvet cloth tacked to a board. A card table. A flashlight. A whisk broom. A thermometer. Several clean microscope slides. A pointed glass rod or wire. A 1% solution of polyvinyl formal resin in ethylene dichloride.

All equipment is set outside to reach air temperature. The velvet covered board is set where it can catch the falling snow crystals. When several good specimens have been noticed the board is brought to the table. The end of the glass rod is dipped into the resin solution and about half a drop of solution placed on a glass slide. While the end

of the rod is still wet, it is touched to a crystal, and the crystal is brought to the drop on the glass slide. The solution will envelope the crystal. If it is a large crystal another small drop may be needed to completely cover it. Several specimens can be placed side-by-side on one slide. Place the slide in a protected place when it is complete so that the solvent can evaporate. After evaporation is complete, the slide can be studied at leisure, in a warm room, with a microscope or good hand lens. What better winter field trip can there be?

* "How to Fingerprint a Snowstorm", Vincent J. Schaefer, Illustrated Library Of The Natural Sciences, Amer. Mus. Nat. Hist., Simon and Schuster, N. Y. 1958.

Submitted by Ethel Schuele

NEWS FROM THE GEOLOGICAL SOCIETY OF MAINE

Our counterparts in Maine have been active recently. They held a special meeting with the Corp of Engineers on the proposed Dickey-Lincoln power dam. They had about 50 persons in attendance and were given presentations on remote-sensing, dynamic testing of soils, foundations and embankments, seismological studies, bedrock and surface studies and the general plans and scheduling for the project.

As a result of their meeting, they formed a special review committee and developed a statement which they released to the news media, and sent to their congressional delegation. The concern of the Society in such a development is important. In this particular instance they had some negative comments on the project.

The Maine Geological Society has also announced plans for a winter meeting on March 17th. Their evening program will be on the "Groundwater Planning in the Maine Coastal Zone" by Brad Caswell. Exact location for the meeting has not been chosen yet.

And like V G S, the Maine Geological Society is planning publication of a Bulletin which would contain short papers on Maine geology.

Vermont Geological Society
Second Annual
Teachers' Workshop

Topic: Champlain Thrust
Activity: A visit to six localities in the Burlington area. The participants will be asked to complete a field exercise which can be adapted for junior or senior high school students.
Date: Wednesday, April 26, 1978
Time: 8:00 AM to 3:30 PM
Leader: Terry Thompson, General science Teacher at F.C. Richmond School, Hanover, New Hampshire
Price: Free for V.G.S. members; $2.00 for non-members

Schedule

8:00-8:45 AM: Registration and coffee, Rm. 101, Perkins Geology Hall, University of Vermont
8:45-9:00 AM: Introduction to field trip by Terry Thompson
Stop 1: Geology Museum, University of Vermont
Stop 2: Redstone Quarry
Stop 3: Iberville Shale Outcrop, Charlotte
Lunch on top of Mt. Philo
Stop 4: Mt. Philo
Stop 5: Shelburne Access
Stop 6: Lone Rock Point
3:30 PM: Return to Geology Museum

Equipment Needed: Clipboard or notebook
pencil or pen
ruler
Brunton compass (or magnetic compass)
hiking boots
bag lunch and beverage
camera (optional)

Participants: The trip is open to all V.G.S. members; geology and earth science teachers; and college and university students.

GREEN MOUNTAIN GEOLOGIST
Vermont Geological Society
Box 304
Montpelier, Vermont 05602

FIRST CLASS

Dr. C. Ratte'

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