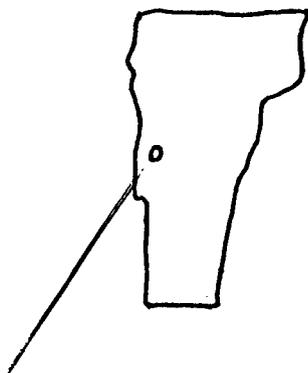


# THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

SPRING 1989

VOLUME 16 NUMBER 1

This is our 16th Annual

PRESENTATION OF STUDENT PAPERS

SATURDAY, APRIL 29, 1989

9:00 A.M.

WARNER BUILDING in the HEMICYCLE

MIDDLEBURY COLLEGE

[See Page 3 for program.]

**DIRECTIONS:** From the center of Middlebury village, drive west on VT 125. The Science Center is the first large college building on the left. Use the large parking area east of the building by the loading dock. Warner Building is a short walk northwest of the Science Center.

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## PRESIDENT'S LETTER

Dear Members:

On behalf of the Society, I thank Dave Westerman for organizing and running the very successful winter program on "The Use Of Computers in Geology". This well attended event was a good example of an activity of wide interest and applicability.

Let me briefly update you on some upcoming events, in reverse chronological order. Dr. George F. Pinder, recently named Dean of UVM's College of Engineering and Mathematics, and noted hydrologist, will be the keynote speaker at our annual fall meeting/dinner, scheduled for October 7, 1989. Dr. Pinder will speak on "The Tragedy of Woburn, Groundwater Concepts and Litigation". The daytime schedule is still under development.

The summer field trip is scheduled for August 26, and will feature a repeat of the northwestern Vermont segment of Chuck Ratte's economic geology trip, prepared for the 28th International Geological Congress. Chuck says the trip will focus on the economic and general geology of the Chazyan reef marble quarries and slates of the Isle La Motte vicinity. Watch for more details in the summer GMG.

Finally, a word of encouragement to attend the spring meeting at Middlebury on April 29. These students of Vermont geology deserve our encouragement and support.

Anyone busy in May? The National Research Council's Committee on the Solid Earth Sciences has issued a general request for comments by June 1st from individuals on a wide range of topics - see the announcement on page 13.

In response to recently proposed legislation and increasing interest from both VGS members and outside groups, I am currently working on rejuvenating the professionalism committee. At this writing, the exact composition and mission of the group is still being defined. It is likely that the committee will be asked to report to the membership on the need (or lack thereof) for certification of geologists, to review proposed and existing laws and rules, and possibly draft new legislation. Interested members who have not yet contacted me are encouraged to do so.

I hope to see you at Middlebury.

Best regards,

Eric T. Lapp

# SPRING PROGRAM

April 29, 1989

Warner Science Building, Hemicycle  
Middlebury College, Middlebury, VT

**COFFEE AND DONUTS** 9:00

Ray Coish presiding

1. Marian J. Warren: Tectonic Evolution of the Southern Lincoln Massif, Central Vermont: A Preliminary Model for the Role of "Rigid" Basement in Taconian Orogenesis 9:30
2. Thomas X. Homza: Stratigraphic Relationships of the Cambro-Ordovician Highgate and Gorge Formations at Highgate, Vermont 9:50
3. James F. Daley: Stratigraphy and Structure of the Cheshire and Dunham Formations, on the East Flank of the Georgia Mountain Anticline, Fairfax, Northern Vermont 10:10
4. Edward L. Coffey: Geochemistry and Stratigraphy of the Metavolcanics of the Tibbit Hill Formation of Northern Vermont 10:30
5. Gregory S. Dick: Geochemistry of Diabasic Dikes and Metavolcanic Rocks from the Jay Area, Northern Vermont 10:50
6. Philip A. Pugin: Geochemistry of Greenstones from the Troy Area, Northern Vermont 11:10

## LUNCH

## EXECUTIVE COMMITTEE MEETING

7. Laura L. Zink: The Extent of Glen Canyon Dam on the Sand Bars in Recirculation Zones and the History of their Change in the Colorado River in the Grand Canyon, Northern Arizona 1:00
8. Karen M. Hyde: Internal Cycling of Phosphorus in Malletts Bay, Lake Champlain, Vermont 1:20
9. R.N. Trepanier, Jr. and Wm. E. Stockwell: The Brandon Lignite: A New Perspective 1:40
10. David E. Jones: Low Relief Profile of Laurentide Ice Tongues in the Butternut Valley, New York 2:00

AWARD OF PRIZES and THE CHARLES G. DOLL AWARD PLAQUE

## ABSTRACTS

GEOCHEMISTRY AND STRATIGRAPHY OF THE META-VOLCANICS OF THE  
TIBBIT HILL FORMATION OF NORTHERN VERMONT

Coffey, Edward L., Department of Geology,  
University of Vermont, Burlington, VT 05405

Five different meta-volcanic units can be identified in the Tibbit Hill Formation of north-western Vermont. The presumed lowest unit is referred to here as undifferentiated Tibbit Hill Formation of the Georgia Mountain anticline in the Milton quadrangle. This constitutes the westernmost rift-related volcanic rock of Quebec-Vermont reentrant. A second volcanic unit of limited geographic extent in the western part of the Gilson Mountain quadrangle, and imprecise stratigraphic position is the Tibbit Hill volcanic breccia. This epiclastic breccia is composed of volcanic clasts in a matrix of broken fragments of similar composition.

The majority of the samples are taken from three volcanic horizons stratigraphically controlled by topping criteria in interbedded clastic horizons. The oldest is a feldspar-phyric basalt. Above this basalt is a calcareous greenstone readily distinguished in the field by the presence of carbonate in hand samples. The top of the section is delineated by amphibolitic greenstone which is the most prevalent unit in the area. All three units are well exposed in the Gilson Mountain quadrangle.

Previous geochemical studies of the metavolcanic units indicates a rift-related within-plate basalt setting for the Tibbit Hill Formation. The opportunity to evaluate the changes in major and trace element geochemistry with regard to the relative stratigraphic position in the ancient rift basin makes this study unique.

STRATIGRAPHY AND STRUCTURE OF THE CHESHIRE AND DUNHAM  
FORMATIONS, ON THE EAST FLANK OF THE GEORGIA MOUNTAIN  
ANTICLINE, FAIRFAX AREA, NORTHERN VERMONT

Daley, James F., Department of Geology, University of Vermont,  
Burlington, VT 05405

An approximate 750m section of the Cheshire and Dunham formations is exposed below the Hinesburg thrust along the east limb of the Georgia Mountain anticline. The sequence from the Lower Cheshire through the Dunham is folded into upright south plunging folds with axial planes striking in a more northerly orientation relative to the trace of the Hinesburg thrust. The folds appear to predate motion along the fault. Dark gray argillaceous quartzite interbedded with massive light gray horizons characterizes the lower Cheshire Formation. The light gray horizons commonly occur as discontinuous and abruptly terminated beds and pods randomly oriented in a more argillaceous matrix.

The upper Cheshire is characterized by less abundant argillaceous matrix, reflected by a lighter color and by poorly developed cleavage, and an increase in the frequency of the massive light gray horizons. Also important in the upper section is the occurrence of dolomitic rhombs which increase

in abundance toward the Dunham Formation.

The field and petrographic analyses of this sequence supports a model of transgression of more well sorted sands and carbonates (upper Cheshire and Dunham) over a high energy shallow water lower Cheshire facies. The interpretation of the "log-jam" textures in the lower Cheshire as representing disrupted dessicated sand beds is consistent with this model.

#### GEOCHEMISTRY OF DIABASIC DIKES AND METAVOLCANIC ROCKS FROM THE JAY AREA, NORTHERN VERMONT

Dick, Gregory S., Department of Geology, Middlebury College, Middlebury, VT 05753

A series of greenstone and diabasic dike outcrops in the North Troy-Jay area of north-central Vermont have been sampled and geochemically analyzed. The greenstone bodies are part of the Hazens Notch Formation and outcrop in narrow fault-bounded slivers which dip to the east. The dikes are part of the Ottauquechee and Moretown formations, and occur in sub-rounded outcrops and display coarsening toward their cores.

Metamorphism at the greenschist facies has produced an actinolite-chlorite-epidote-albite assemblage in both dikes and the greenstones. The immobile elements  $TiO_2$ ,  $Al_2O_3$ , V, Cr, Y, and Zr are here utilized to indicate possible igneous origins. Chemically, both the greenstones and the dikes are tholeiitic basalts. The variation among the samples can be explained by fractional crystallization of the same parent magma as indicated by the trends of Ti vs. V, Zr vs. Y, and Cr vs. Y.

Ti-Zr-Y, Cr vs. Y, Ti vs. V, and Zr vs. Zr/Y discriminant diagrams indicate a mid-ocean ridge basalt affinity (MORB) of both the Jay dikes and greenstones. It is suggested that the greenstones represent the latest stages of continental rifting, and the dikes mark the initial formation of oceanic crust in an environment similar to that of the Red Sea. The rocks were later incorporated into a westward thrusting accretionary wedge and were emplaced as the imbricated ophiolite sequence now found in the Jay area.

#### STRATIGRAPHIC RELATIONSHIPS OF THE CAMBRO-ORDOVICIAN HIGHGATE AND GORGE FORMATIONS AT HIGHGATE, VERMONT

Honza, Thomas X., Department of Geology, University of Vermont, Burlington, VT 05405

The Gorge and Highgate formations at Highgate, Vermont consist of a continuum of basinal debris flow and turbidity current deposits derived from a carbonate bank to the west. The section was measured and described as a stratigraphic continuum spanning the Cambrian-Ordovician time line. Five lithologies are present in each formation. Although petrologic differences exist between formations, identical lithologic nomenclature was used in each for simplification. The lithologies are: 1) Deformed Shale; 2) Sandy Breccia; 3) Dolomitic Breccia; 4) Bedded Sandstone; 5) "Ribbon Limestone". All flows are laterally discontinuous and lithofacies can be seen to grade laterally into other facies. Marker

horizons of chert and sandstone were used to correlate between Gorge Formation sediments on the upper and lower plates of the Highgate Springs thrust fault and to demonstrate that throw on the fault is minor.

INTERNAL CYCLING OF PHOSPHORUS IN MALLETT'S BAY,  
LAKE CHAMPLAIN, VERMONT

Hyde, Karen M., Department of Geology, University of Vermont,  
Burlington, VT 05405

During the summer of 1988 an assessment was made on the internal contributions of phosphorus in Malletts Bay, Lake Champlain. The results facilitate a time-depth description of phosphorus throughout the development of thermal stratification. The importance of this research was to determine whether phosphorus, a limiting nutrient, is being introduced into the bay through recycling or released from sediments during periods of oxygen depletion.

In order to access internal sources of phosphorus in Malletts Bay, ten sets of water samples were collected at a single station in outer Malletts Bay. Each set consisted of at least nine samples distributed throughout the epilimnion, metalimnion, and hypolimnion. At each depth the following were determined: Temperature; Dissolved oxygen; pH; Total suspended solids; Particulate and soluble Fe and Mn; and Total, total particulate, mineralized, adsorbed, and dissolved phosphorus. The results of this investigation indicate the following: 1) Thermal stratification of Malletts Bay did not lead to complete de-oxygenation of bottom waters. Minimum DO values, measured on 9/7/88 were .85mg/l. 2) Oxygen levels at the sediment-water interface did not diminish to values which would cause the concomitant release of P/Fe. 3) Soluble Fe was never detected while soluble Mn increased with time and depth. 4) Soluble phosphorus increases in the hypolimnion, with possible findings in the overlying waters. 5) Particulate phosphorus peaks are found near isopycnic boundaries.

Thus, it appears based on preliminary evidence, that diffusion release from sediments is not a major internal source of phosphorus. The impact of decomposition and chemical transformations within the water column seem to contribute appreciable amounts of phosphorus to Malletts Bay.

LOW RELIEF PROFILE OF LAURENTIDE ICE TONGUES IN THE  
BUTTERNUT VALLEY, NEW YORK

Jones, David E., Department of Geology, SUNY Oneonta,  
Oneonta, NY 13820

A stagnant ice lobe, with flow from the source area cut off by a drainage divide, was modeled for a valley in the upper Susquehanna drainage basin. Ice profiles using Nye's parabolic formula were made. Previous work used a value of 3.0 for A (Mathews, 1974) based on using Alpine valley glaciers as analogs to Laurentide ice tongues. Values near 1.3 for A are indicated for ice based on deformable till (Beget, 1986). This is based on conceptual work given by Boulton and

Jones (1979) for movement of ice over poorly drained and sorted glacial sediment.

Profiles based on a rock substrate are projected five miles into the valley from the divide. Those assuming a deformable substrate extend 25 miles to a deltaic landform that dammed a lake in the valley. Field evidence supports the presence of long ice tongues in these valleys during deglaciation. This interpretation could imply thinner ice over much of the glaciated areas of New York and New England where the Laurentide Ice Sheet was grounded on deformable sediments.

#### GEOCHEMISTRY OF GREENSTONES FROM THE TROY AREA, NORTH-CENTRAL VERMONT

Pugin, Philip A., Department of Geology, Middlebury College, Middlebury, VT 05753

Major and trace element analyses have been completed on early Paleozoic greenstones from the Hazens Notch Formation in north central Vermont. Between Troy and North Troy, the greenstones occur as narrow, elongate bodies dipping steeply to the east.

Metamorphism at the greenschist facies has changed the mineralogy to an actinolite-epidote-chlorite-albite assemblage.  $TiO_2$ ,  $Al_2O_3$ , V, Cr, Y, and Zr are considered immobile during greenschist facies metamorphism and can be used as indicators of igneous processes. The mobile elements  $SiO_2$ ,  $Fe_2O_3$ , MgO,  $Na_2O$ ,  $K_2O$  and Sr are used with some success.

Chemically, the greenstones are basalts. The variations in the chemistry among the different bodies can be partially explained by different amounts of fractional crystallization of the same parent magma for all the studied greenstones. This is indicated by graphs of Fe/Mg vs. Ti, Ni, and Cr, which show linear trends, similar to trends seen in pristine igneous rocks.

Ti-Zr-Y, Mg- $Al_2O_3$ -FeO, Cr vs. Y, Ti vs. V, and Zr vs. Zr/Y tectonic discriminant diagrams indicate an ocean-ridge basalt precursor for the Troy greenstones. Samples from one outcrop show an island arc affinity, which perhaps can be explained by metamorphic processes. The Troy greenstones probably formed during the final stages of rifting of the ancient North American continent, or during later open ocean conditions. The rocks were incorporated into an accretionary wedge, and tectonically emplaced to their present site during closure of the proto-Atlantic Ocean during the Taconian.

#### THE BRANDON LIGNITE: A NEW PERSPECTIVE

Trepanier, R.N., Jr., Castleton State College, Castleton, VT 05735 and Wm. E. Stockwell, Brattleboro, VT 05301

The Brandon lignite is unique for Vermont. It is a fossiliferous layer of sediment, composed mainly of plant remains of a post-Paleozoic age. The fossil types found at the site are fossil hickory (genus *Carya*) and beech (genus *Fagus*) nuts and other remains. The environment of deposition was a swampy and wetland habitat.

The thickness of the lignite bed is 30 to 60 feet, according to the source by Barghoorn (1950). The surrounding geology of the area is composed of deposits of kaolinite and silt. The original size estimation of the lignite bed is 30 to 60 feet, but there are inaccuracies in the reports by Barghoorn (1950) of this thickness, and of the 150 tons mined at the site. In my research, I have obtained a figure of 300 tons mined at the site (Horner and Crockett), so it is probable that this formation is thicker than stated in the above report(s).

TECTONIC EVOLUTION OF THE SOUTHERN LINCOLN MASSIF, CENTRAL VERMONT: A PRELIMINARY MODEL FOR THE ROLE OF "RIGID" BASEMENT IN TACONIAN OROGENESIS

Warren, Marian J., Department of Geology, University of Vermont, Burlington, VT 05405

Middle Proterozoic gneisses of the Lincoln massif and their overlying rift-clastic cover are exposed within two doubly-plunging anticlines which display markedly different structural styles. The eastern Lincoln massif (ELM) experienced a greater amount of strain at more ductile conditions during Taconian deformation. The western Lincoln massif (WLM) is characterized by folding and by semi-ductile to brittle faults; the eastern "massif" is reinterpreted as a ductile shear zone, characterized by an anastomosing system of mylonitic ductile faults which imbricate basement and immediately overlying wackes and boulder conglomerates. Imbrication has occurred on a scale of meters to a few hundreds of meters across a zone one to two kilometers wide.

The ductile faults of the eastern "massif" are interpreted to have developed initially as ductile shears during early development of an anticline. Along the eastern limb of this structure, simple shear resulting from concentration of strain along the steeply-dipping basement-cover contact caused detachment of isoclinally folded cover from more rigid basement. In contrast, the core and hinge region of the ELM were characterized by pure shear; flattening enhanced the entire structure vertically with continued compression. The entire deformed eastern "massif" and its eastern cover, of biotite to garnet grade, was subsequently faulted along its overturned limb against the less ductile deformed, primarily chlorite grade syncline of cover rocks which separates the two anticlines. Some of the ductile faults to the east were progressively overprinted by more brittle fabrics, as the imbricated eastern "massif" was brought to higher crustal levels. Continued east-over-west deformation produced similar less ductile structures progressively to the west within the syncline and WLM, while out-of-sequence thrusting proceeded to the east of the ELM within the less competent eastern cover.

A retrodeformed cross-section suggests an overall tectonic shortening across the massif of 58 percent, or about 21 km. The marked similarities, however, between the eastern and western rift-clastic cover sequences, coupled with structural evidence, argue that the strain represents primarily flattening and internal imbrication of a single lithologic package, rather than juxtaposition of two very discrete packages.

The coarsest rift-clastic material consistently overlies basement within the large-scale fault zones, suggesting that the development of the Taconian structures may be largely controlled by earlier rift-related structures. The retro-deformed section supports other sedimentological evidence for an inherited change in crustal geometry across the eastern edge of the ELM, possibly representing a transition to much more thinned continental crust. This boundary subsequently provided a rigid "buttress" to westward-verging Taconian deformation that caused concentrated strain to the east, and "protected" the rocks to the west, thus producing the observed contrast in structural style.

THE EXTENT OF EFFECTS OF GLEN CANYON DAM ON THE SAND BARS IN RECIRCULATION ZONES AND THE HISTORY OF THEIR CHANGE IN THE COLORADO RIVER IN THE GRAND CANYON, NORTHERN ARIZONA  
Zink, Laura L., Department of Geology, Middlebury College, Middlebury, VT 05753

The sand bars of the Colorado River have been degrading at least since completion of Glen Canyon Dam in 1965, based on analysis of aerial and oblique photographs and replication of topographic surveys.

Detailed analysis of historical photography at selected sites shows that high elevation parts of some bars were likely degraded by the first high bypass releases of approximately 50,000 ft<sup>3</sup>/sec in 1965. Other studies have shown that bed elevation has degraded approximately 15 ft. Fluctuating flows between 1965 and 1982 continued this degradation. High releases in 1983 have been shown not to have had any effect on the bed or sand bars. High releases in 1984 deposited sand on some sand bars and eroded others. With the return to fluctuating flow in late 1985 there has been a steady degradation of sand bars up to the present time.

Analysis of aerial photographs from 1973 to 1984 confirms conclusions of previous investigations that the high discharges (approximately 100,000 ft<sup>3</sup>/sec) of 1983 had a net effect of degradation of sand bars in narrow reaches and aggradation in wide reaches. Significant numbers of bars degraded in narrow reaches downstream to mile 213 (mile 0 is at Lees Ferry). Intervening wide reaches upstream of mile 125 experienced aggradation. Beyond mile 125, aggradation was noted in narrow and wide reaches; however, stage differences between 1973 and 1984 may give misleading results. The total number of sand bars affected by high flows decreased downstream.

Analysis of aerial photographs from 1984 and 1988 shows that fluctuating flow from 1985 to present have degraded sand bars as far as mile 60. More degradation occurred in narrow reaches than in wide.

The downstream effects of dam operations do not simply decay in the downstream direction from the dam, nor do they decay with time. Degradation effects have been concentrated in narrow reaches where unit stream power is greatest following high discharges. Furthermore, sand bars have been constantly degrading since completion of Glen Canyon Dam, over 20 years ago, due to both high and fluctuating flows.

# VGS BUSINESS & NEWS

## NEW MEMBERS

New members welcomed to the Society are:

Michael B. Smith	Montpelier, VT
Jim Reynolds	Northfield, VT

## COMMITTEE ON NOMINATIONS

At the last Executive Committee meeting, Eric Lapp, Jack Drake and Tom Ray agreed to serve on the Nomination Committee. Would you like to participate in the workings of the Society and help mold its future, or do you know a member whom you would like to have represent you in the Executive Committee? Please contact one of the above members with your ideas before the end of the Spring Meeting.

## WINTER MEETING REPORT

The Society owes a great debt to Dave Westerman for arranging the winter meeting about the use of computers in geology. Although we have had talks about the application of computer programs to groundwater modeling (talk by Jeffrey Nelson in the Winter meeting, 1986, for example), we have not heard about use of programs for geological education or other strictly geological uses. Here we were treated to some real-time programming results, projected by state-of-the-art methods. The topics ranged from high school teaching methods to the Vermont GIS and applications in chemical analysis, geophysics and hydrology. The afternoon hands-on session held the attention of most of the 60 some persons attending the event. Especially fascinating was the mapping program using the Adobe Illustrator. We were fortunate to have such a relevant and practical meeting.

## HEADINGS IN THE GMG

We encourage readers to make copies of portions of our newsletter for distribution when the contents warrant. However, it has come to our attention that identification of this newsletter on the inner pages is lacking, which leads to confusion about the source of such copies. Consequently, starting with this issue, we are trying out headings on each page. We hope this remedies the situation.

## PUBLIC ISSUES

Dear Fellow Members,

In working with Eric Lapp over the last couple of months, it has been apparent that geology, especially in hydrology, is becoming an extremely public issue. A public issue not because we geologists are becoming any more vocal, but because the regulatory community and general public are becoming more aware of the importance of geology in many environmental issues of today.

This public awareness is apparent in reviewing existing as well as proposed environmental regulations. Some of the existing or proposed regulations include Vermont's: Indirect Discharge Regulations, Environmental Protection Rules, House Bill H.381 and House Bill H.43. These existing and proposed regulations cover issues ranging from sewage discharge to hazardous waste environmental assessments. The regulations may cover a wide range of issues, however they are all similar in their attempt to define or certify hydrologists, soil scientists and other environmental professionals. The definitions in each of the regulations may or may not be based on professional standards, and consistency of the definitions between the regulations is lacking. This decentralization of standards will be more apt to create confusion in parties looking toward the geologic profession for assistance in dealing with environmental issues in Vermont. We as geologists should work among ourselves and with the public to provide clearly stated unbiased standards on which either a unified definition or certification program can be developed. The unified definition or certification program could be used by the regulatory community and the general public to identify the geologist's role as professional in addressing Vermont's environmental concerns.

I am not proposing any clear answer at this point, but only that we should address the issue firmly or others will. In response to this issue it appears that reinstituting a professionalism committee within the Vermont Geological Society would be a good foot forward.

In the meantime we owe it to ourselves and the public to practice within our profession only in fields which we are specifically qualified. This is especially important in considering that much of today's work is in hazardous waste where improperly trained or unqualified people can compromise the health, safety and liabilities of themselves and the public.

Brett W. Cox

#### EXECUTIVE COMMITTEE MINUTES - March 27, 1989

Attending: Eric Lapp, Jeanne Detenbeck, Tom Ray, Jack Drake

#### Old Business:

I. Formation of nominating committee consisting of Eric Lapp, Tom Ray, Jack Drake to identify candidates for: President, Vice-President, Treasurer, Secretary, and 1 member of board of directors (2-year term).

#### II. Spring Meeting

- A. Eric Lapp will select three judges for evaluation of student papers.
- B. Ray Coish will coordinate collection of abstracts, facilities scheduling.

#### III. Summer Meeting

- A. Chuck Ratte will lead economic geology field trip.
- B. Tentative date is August 26 but needs confirmation at spring meeting.

## IV. Fall Meeting

A. Date set for October 7, 1989.

B. Eric Lapp will continue to develop groundwater/hydrology program.

V. Eric Lapp updated executive committee re current legislative issues.

VI. "Professionalism Committee": because of present and anticipated legislation affecting geology it was decided to reconstitute the Professionalism Committee. This process is now underway. Interested persons should contact Eric Lapp.

## New Business

I. "Green Mountain Geologist": The newsletter should contain name of publication and page numbers as "headers" or "footers" to facilitate citation after copying. Jeanne will determine feasibility.

II. Potential exists for publishing extended abstracts/-proceedings from Vermont-Quebec Appalachian Workshop to be held at UVM April 14-16, 1989. Discussion will continue at spring meeting when additional details are available.

Meeting adjourned at 9:00 P.M.

Respectfully submitted,

Jack Drake  
Secretary

## STATE GEOLOGIST'S REPORT

On April 12-14, 1989, the State Geologist hosted the U.S.G.S./State Geologists Eastern Regional Cluster Meeting at the Stoweflake Resort in Stowe, VT. Over 50 geologists representing 17 states and 10 divisions of the U.S. Geological Survey met to coordinate national and state goals, and to discuss federal and state programs where cooperative efforts do and can exist.

The State Geologist, in cooperation with the mineral industries of Vermont will conduct a post-Congress field trip in conjunction with the 28th International Geological Congress. The field trip will concentrate primarily on the marble, granite, and slate industries. The field trip dates are July 20-22, 1989.

Charles Ratte  
Vermont State Geologist  
103 South Main Street  
Waterbury, VT 05676

## RECENT PUBLICATIONS

The following new publications are available from the Maine Geological Survey, Department of Conservation, State House Station #22, Augusta, ME 04333. Prepayment is required and checks should be payable to "Treasurer, State of Maine". A 25% discount is available on 50 or more copies of Bulletins 38 or 41.

**A Collector's Guide to Maine Mineral Localities** (Bulletin 41), a 131 page book with detailed locality maps and descriptions, Maine mineral check list, and additional information. \$8.00 plus .40 sales tax.

**The Geology of Mount Desert Island: A Visitor's Guide to the Geology of Acadia National Park** (Bulletin 38), describes the geologic history of the Acadia National Park region with numerous locality photos and two full-color maps. \$8.00 plus .40 sales tax.

**Living with the Coast of Maine** (published by Duke University Press), a profusely illustrated 174 page book which explains the geologic history of Maine's coast and gives the basis for the regulations controlling development. Also includes a guide on where to build safely and places to avoid. \$10.95 plus .55 sales tax.

## NRC REQUESTS CONTRIBUTIONS

Deadline: June 1, 1989

Reply to: Peter J. Wyllie

Committee on the Solid-Earth Sciences  
National Research Council (HA 460)  
2101 Constitution Avenue NW  
Washington, DC 20418

This is an invitation to participate in a challenging project. The President of the National Academy of Sciences has given the solid-earth sciences an opportunity to prepare the first major assessment of the disciplines' current and potential contributions to science and the nation. Generous private foundation funding has been provided for this project.

The Committee has been charged with a number of tasks, including the following:

- (1) to identify emerging lines of research promise
- (2) to identify and address key scientific and societal issues
- (3) to identify and assess directions, changes, and contributing factors
- (4) to recommend long- and short-range research priorities.

The committee shares these charges with the solid-earth sciences community and would like to receive concise statements about the above four items from as many individuals as possible. Your comments can be incorporated most effectively in the Committee's deliberations if received by June 1st.

The Committee has not started from scratch: a most important basis for the assessment is an excellent set of reports published by the NAS/NRC and others during recent years. Another is being provided by solicitations such as this. More than 20 panels are working on topical areas and will continue through the spring. Your comments will be distributed among these panels for consideration.

I am sure you noticed item (4) and that you have been reading scientific editorials. In the absence of clear advice from this Committee, priorities will be set by others who may have little interest in the field. The Committee expects to present in this report clear evidence for dazzling scientific opportunities in and societal contributions provided by geology, geobiology, geochemistry, and geophysics.

We welcome your assistance and hope that you will share the Committee's conviction that this project has substantial potential to benefit the solid-earth sciences. Thoughtful contributions from our community of colleagues will be essential to the success of the project.

#### Excerpts from the ANNOUNCEMENT

...  
"Three decades of extraordinary discoveries have stimulated the earth sciences to a level of activity never before achieved, but much still remains to be done if the momentum of discovery is to be maintained,

For the first time, it is possible to test ideas about the way the earth has developed over the past 4.5 billion years against data from other rocky planets where evidence is more readily visible and better preserved. Although a new, dynamic view of the earth has been achieved, it is unclear which among the many possible routes will be most fruitful to pursue to further our understanding. It is even unclear what level of understanding of the earth we should seek.

Therefore, it is now timely and very important to formulate a far-reaching plan and effective agenda for the basic and applied solid-earth sciences."

...  
The report is intended to serve as a blueprint for the solid-earth sciences in the next decade and beyond. In recommending priorities, it will provide guidance for cooperative efforts in addressing the most promising lines of research with the funds available in changing budgetary climates.

The document will be issued in 1989, the year of the 28th International Geological Congress, to be hosted by the United States for only the second time in this century.

## MEETINGS

- APR VGS SPRING MEETING. See page 3 for program.  
 29 Presentation of student research papers at Middlebury.
- AUG Burlington Gem and Mineral Club Annual Show  
 5-6 See details below.
- AUG VGS SUMMER FIELD TRIP  
 26 Chuck Ratte, the Vermont State Geologist will repeat part of his economic geology field trip, which will be held earlier in the summer for the 28th International Geological Congress. Our trip will focus on the economic and general geology of the Chazyan reef marble quarries and slates of the Isle La Motte vicinity. More details in the Summer GMG.
- OCT VGS ANNUAL FALL MEETING  
 7 We will have as our dinner speaker, Dr. George F. Pinder, a noted hydrologist, and newly appointed Dean of the College of Engineering and Mathematics at UVM. Title of his talk will be "The Tragedy of Woburn, Groundwater Concepts and Litigation". The daytime program is still in the planning stage.

SPEAKER PROGRAM, DEPARTMENT OF GEOLOGY  
 MIDDLEBURY COLLEGE

Lectures held at 12:15PM, Room 420, Science Center.

- APR Katherine V. Cashman, Princeton University.  
 17 Mt. St. Helens: A Natural Crystallization Experiment.
- APR Warren W. Wood, U.S.G.S., Reston, VA.  
 18 Development of Playa Lake Basins on the Southern High Plains of Texas and New Mexico.
- APR David R. Veblen, The Johns Hopkins University.  
 21 Application of Transmission Electron Microscopy in Geology and Mineralogy.
- APR Jack Schmidt, Middlebury College.  
 27 Sedimentology and Geomorphology of Eddy-System Sand Bars in the Grand Canyon.
- MAY Dorothy J. Merritts, Franklin and Marshall College.  
 5 Geomorphic Response to Late Quaternary Tectonism, Mendocino Triple Junction, California.

The Burlington Gem and Mineral Club's 10th annual show will be held on August 5 & 6 at the South Burlington Community Library and High School on Dorset Street near Kennedy Drive. Times are 10-6 on Saturday and 10-5 on Sunday. Admission is \$2.50 for adults and \$1.75 for children 6-16 and seniors. A single ticket will be good for both days. Ample parking is available.

On Saturday at 2 P.M., Dr. Paul Desautels, retired curator of the Smithsonian's Mineral section and author of "The Mineral Kingdom" and "The Gem Kingdom" will give a slide talk on Gemstones.

Dr. Steven Chamberlain of Syracuse University will present a slide lecture about minerals. Time and title have not yet been determined. PBS earth science videos will run continuously and there will also be films, exhibits and lapidary craft demonstrations.

GREEN MOUNTAIN GEOLOGIST  
VERMONT GEOLOGICAL SOCIETY  
BOX 304  
MONTPELIER, VERMONT 05601

The GREEN MOUNTAIN GEOLOGIST is published quarterly by the Vermont Geological Society, a non-profit educational corporation.

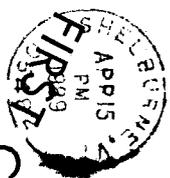
President	Eric Lapp
Vice President	Andy Ralford
Secretary	Jack Drake
Treasurer	David Westerman
Board	Ray Colsh '89
of	Jeffrey Pelton '89
Directors	Tom Ray '90

Permanent Committees

Advancement of the Science	Rolfe Stanley
Geological Education Committee	Sharon O'Loughlin
Public Issues Committee	Brett Cox
Publications/Editorial Committee	Jeanne Detenbeck
Editor	Jeanne Detenbeck

ADDRESS CHANGE? Send it to the Treasurer at the address above, please.

PLEASE NOTE OUR NEW ZIP CODE, 05601.



CLASS



Charles A. Ratté  
4 Chestnut Hill  
Montpelier, VT 05602

# THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

SUMMER 1989 /

VOLUME 16 NUMBER 2

This field trip is on dry land,  
so leave your scuba gear at home  
and join us for an exploration of the

← CHAZYAN REEF, ISLE LAMOTTE

SATURDAY, AUGUST 26, 1989 9:30 A.M.

Meet at Sand Bar State Park.

[See page 3 for more details.]

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Please consider contributing a field trip to a new guidebook intended for teachers and laymen. See page 4 for the details and send your reply to Sharon.

# PRESIDENT'S NOTES

Greetings to all:

First, a thank you to all the students, their advisors, and host Ray Coish for contributing to a successful spring program at Middlebury.

To catch up on some old business, my work on the fall daytime program or trip and the professionalism committee/registration issue has been slow - probably should have delegated more of it! Thus, I will be calling on fellow members again shortly to assist with these tasks. As of publication time, a fall afternoon field trip is being developed relating to contaminant hydrogeology and surficial geology. This is in addition to our guest speaker (Dr. Pinder) at the annual banquet.

Regarding the Professionalism Committee and the issue of geologist registration, it is now time to formally develop the VGS's position on the issues. Hopefully, this would include development of a ballot question for vote at the fall meeting, prior to start-up of legislative activity. Below is a brief workplan for the committee:

<u>TASK</u>	<u>DATE</u>	<u>TIME</u>	<u>PLACE</u>
1. Meet to review all issues and detail workplan	8/26/89	2 PM	UVM Geology
2. Correspond with non-members and Rep. O'Brien	by early Sept.		
3. Submit findings to VGS Executive Committee	by mid-Sept.		
4. VGS vote on ballot question?	Oct. 7	Annual Meeting	

Note: VGS members who would like to have input to the committee, but who cannot attend the initial meeting should call or write me at the Society's address (or 223-0328 eves, 244-8702 days).

A word of thanks to those members who have accepted officer nominations for next year. Your term of office will begin after elections at the annual (fall) business meeting. VGS's existence and continued future success hinges on the active participation of all members, especially those who have not yet contributed.

Thanks to Chuck Ratté, on August 26th we will have the opportunity to retrace the recent steps of international geologists on a historic field trip through our own "back yard".

Hope to see you on the summer trip!

Sincerely,

Eric T. Lapp

## SUMMER FIELD TRIP PROGRAM

**TOPIC:** The Geology of the Chazyan Reef, Isle LaMotte

**LEADER:** Chuck Ratté, State Geologist

**DATE:** Saturday, August 26, 1989

**TIME:** 9:30 A.M.

**RENDEZVOUS POINT:** We will gather at the Sand Bar State Park, U.S. Route 2 at 9:30 A.M. If desirable we can "carpool" from this point. We will return to Sand Bar State Park in the afternoon for a swim. There is a \$1.00 day use fee.

**INFORMATION:** This will be a "WORKING" field trip. There will be a brief introduction to the geologic setting, the various types of fossil organisms, and an attempt to recreate the 450 million year old "living" reef from the evidence gathered at the scene. We will then work in pairs, covering the entire reef in search of "prize" specimens that best illustrate both the fossil types and the details of the structure. We will then mark these locations with flagging and map their positions by tape and compass techniques.

Come prepared with plenty of cold drinks, lunch, sun tan lotion, good substantial footwear, shorts, T-shirt and a hat. **NO HAMMERS, PLEASE.** Fossil collecting will be limited to existing **BROKEN SLABS OF ROCK.** It should prove to be a fun, productive field trip.

## VGS BUSINESS & NEWS

### NEW MEMBERS

Welcome to these members new to VGS:

Peter Beblowski	Manchester, NH
Arlen Bloodworth	Pittsford, VT
Joel Blumenthal	
David Buttle	Quechee, VT
David Elbert	Middlebury, VT
Lindley Hanson	Salem, MA
Michael Landsman	Burlington, VT
Seth Pitkin	Montpelier, VT
Jeffrey Prewitt	South Burlington, VT
Robert Ross	Stowe, VT
Gordon Sturgeon	Lynnfield, MA

## A CALL FOR FIELD TRIP GUIDES FOR NON-GEOLOGISTS

In the past year, a number of people in VGS have approached me with ideas for the creation of a compilation of self-guiding field trips for areas of geologic interest across the state. Teachers of earth science have been especially interested in guides of this nature. The Executive Committee of VGS has suggested that I attempt to compile written field trip guides that are aimed toward use by teachers and non-geologists. VGS is willing to publish this compilation as a volume of Vermont Geology.

So ...

Does anyone have any written field trip guides that we can publish? Know of anyone who might be willing to write a short guide for their favorite spot? Anyone willing to submit their notes on a particular site so that we can write up a guide from the information?

Anyone wish to suggest a spot to be included? Anyone wish to help out in gathering guides, coercing authors, or with the compilation work? For this to work, I will need help from people who know the good locations in their areas of the state.

The compilation, when completed, will be published as a volume of Vermont Geology. Credit for authorship will be given in a format similar to that used in previously published volumes of Vermont Geology.

Areas for field trips should be readily accessible to the public. If the site is limited to a maximum number of people, please note the limit. If permission to visit the site is required, the address and telephone number to contact should be included in the guide.

Guides should be geared toward non-geologists. A format that includes a listing and description of features visible at the site as well as diagrams and sketches or black and white photos, would be especially useful. A short blurb on the background geology of the site may also be helpful.

Guides for locations around the state are needed. Some locations in the Burlington area already have a few versions of field guides in existence. It would be really nice to cover areas in all parts of the state.

Here's your chance to become a published author and to have people from across the state read your work. The broad appeal of this type of compilation should mean that lots of people will read your work.

If there are any questions of guides to be submitted, I can be reached at:

Office of the State Geologist  
103 South Main Street - Center Building  
Waterbury, VT 05676  
(802) 244-5164

Sharon O'Loughlin  
Geological Education Committee

## A MAGNETIC ANOMALY IN NORTHERN VERMONT

Charles G. Doll  
Emeritus Professor of Geology  
University of Vermont

### ABSTRACT

A small-area Magnetic anomaly has been located and mapped at an igneous-metasedimentary contact in the town of Albany, Vermont.

### INTRODUCTION

In the line of a pace and compass traverse down Lamphear Brook, a tributary to the Black River, it was noticed that the Brunton compass needle suddenly began to reverse itself, reaching a maximum of 180 degree reversal for a short distance before gradually again coinciding with the earth's regional magnetic field. The anomalous area was accordingly mapped with a dipping needle on a contour interval of 20 degrees. Zero or outermost contour on magnetic contour map is at 0-dial on the dipping needle (Fig. 1). The completed magnetic anomaly contour map has been found to cover an area of approximately 1143 square feet, the long axis of the ellipsoidal map in line with the brookbed and near parallelism with the igneous-metasedimentary rock contact. The anomalous area is localized in the streambed with the exception of a small overlap beyond the streambed's margin on the west.

### LOCATION

The anomaly is located in the bed of Lamphear Brook a short distance upstream from a waterfall and apparently in the map-area of the Northfield Formation, north of the village of Albany and in the section of town known locally as Shuteville (Fig. 2). In a more recent publication of mapping studies in the general area it is reported that the Moretown Formation, underlying the Northfield Formation, is distinguished from the latter by the absence of "limestone interbeds" and that the latter's distinguishing characteristic is the presence of limestone (Cady and others, 1963, p. B-33), which corroborates the writer's original determination of the Northfield Formation - granite contact at the site of the magnetic anomaly.

### THE ANOMALOUS LOCALE

Bedrock is well exposed both in the bed of the brook and on the adjacent slopes, a favorable base for this study. Toward the top of the bedded sequence there is an increase in thickness of the impure crystalline limestone relative to the slates and phyllites. Locally massive layers of limestone are rich in sulphide grains crushed and drawn out into glossy streaks in the plane of the foliation.

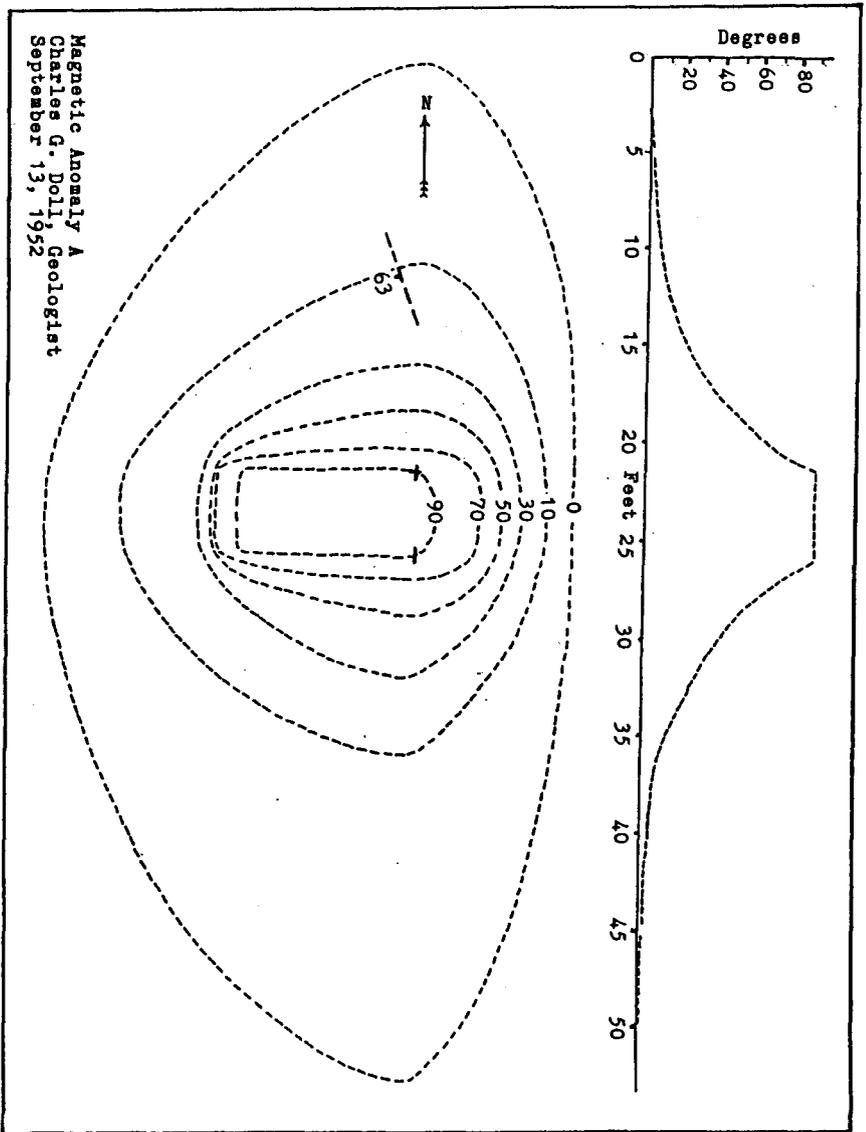


Figure 1. Dip needle deflections defining the magnetic anomaly in the Town of Albany, Vermont.

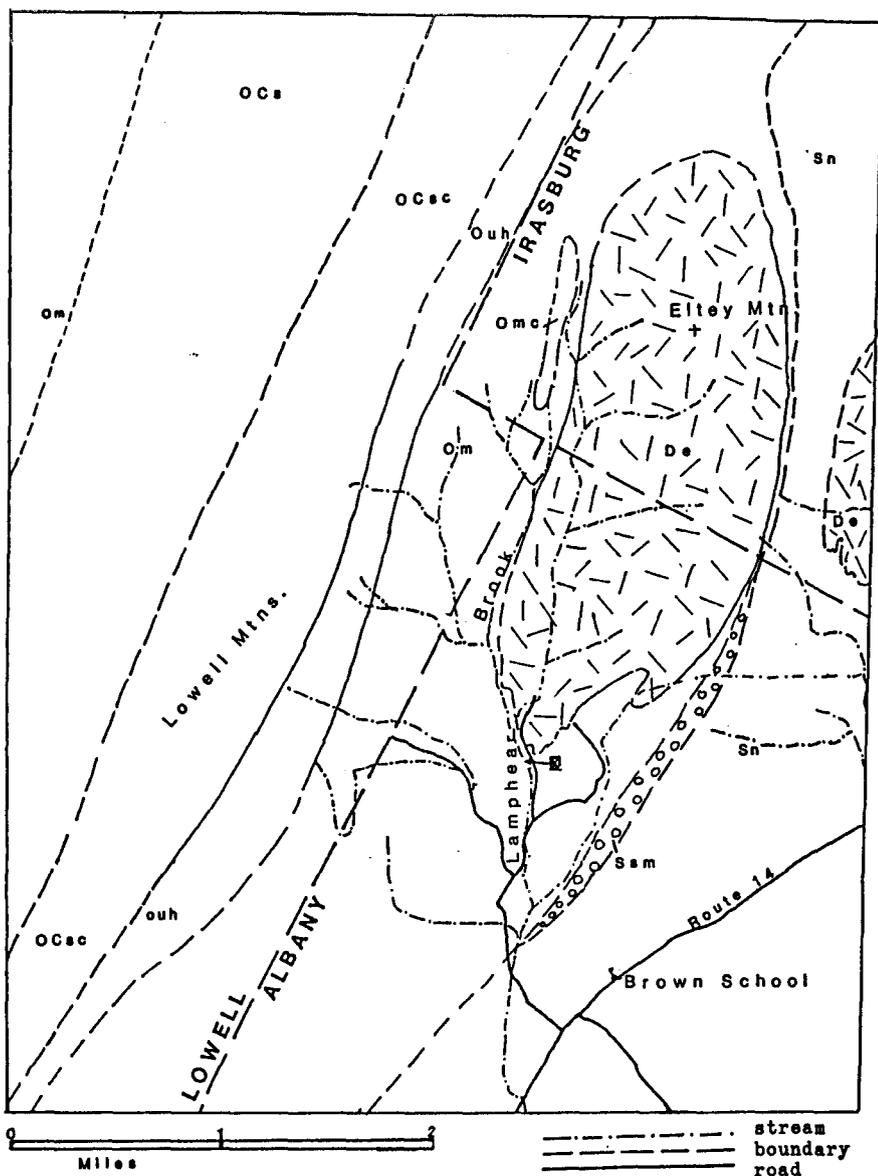


Figure 2. Location map of the magnetic anomaly. In town of Albany, 1.25 miles north of Route 14 road intersection (see map). Geology modified after Cady, Albee and Chidester (1963). OCs, OCsc, Stowe Formation; Ouh, Umbrella Hill; Om, Missisquoi Formation; Omm, Moretown Member; Ssm, Shaw Mountain Formation; Sn, Northfield Formation; De, granite.

The pattern in the high-reading portion of the magnetic contour map (i.e., 90-degree contour line of Fig. 1) suggests a steeply inclined dike-like structure or lode possessing a strongly attractive concentration of a magnetic mineral, possibly magnetite (Fig. 1). The copious spread of iron stain in the bedrock in the brookbed is especially prominent in the area of high magnetic readings, which might be indicative of a relatively shallow deposit.

Although gabbros, basalts and ultrabasic rocks are very likely to affect the compass readings a pull strong enough to completely reverse the compass needle at this locality suggests an anomaly worthy of future exploration in order to evaluate the economic possibilities of the anomalous locality. Two such possibilities are: 1) directly detectable minerals such as iron oxides, and 2) nonferrous minerals such as copper, nickel, etc., indirectly detectable with magnetic minerals as accessories.

#### ACKNOWLEDGMENTS

Forrest Goodyear, field assistant, on line of the traverse, initially noted the reverse swing of the compass needle and assisted in mapping the anomaly. Critical reading of the manuscript by Professors Barry L. Doolan and John C. Drake is appreciated.

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**REPORT OF THE NOMINATION COMMITTEE**

The Committee on Nominations, Eric Lapp, Jack Drake and Tom Ray, has submitted the following slate of officers for 1990:

President:	Andy Raiford
Vice-president:	Chris Stone
Treasurer:	Brad Jordan
Secretary:	Susan Oppenlander
Board of Directors:	Randy Spydell
2-year term	
Public Issues Committee:	Bill Spitzel

Election will be held at the annual meeting on October 7, 1989, at which time officers will assume their duties.

**GRANT-IN-AID OF RESEARCH**

At the Spring meeting, the award of the grant-in-aid to Steve Gurney, a graduate student at the University of Vermont, for his project "Variation in the Bioavailability of Trace Elements in Kilburn Brook, Hartford, VT" was announced. This is the third award that has been granted.

**SPRING MEETING - THE WINNERS**

Winners of the cash prizes at our annual Presentation of Student Papers were Gregory Dick, undergraduate from Middlebury College, and Marian Warren, graduate student from University of Vermont. The Charles G. Doll Award Plaque will reside at Middlebury College for this year. Thanks to our judges Sharon O'Loughlin, Eric Lapp and Jeffrey Pelton and all the students who participated.

**EXECUTIVE COMMITTEE MINUTES - April 29, 1989**

In attendance at Middlebury College were Eric Lapp, Andy Raiford, Jeanne Detenbeck, Dave Westerman, Jeff Pelton, Ray Coish and Sharon O'Loughlin.

**OLD BUSINESS**

Items covered in this part of the meeting are reported elsewhere in this issue of the GMG.

**TREASURER'S REPORT as of 4/28/89**

\$2378.85	on deposit
34.02	petty cash
-45.95	debt owed to Dave Westerman
\$2366.92	net worth*

\*Not included: approximately \$90.00 in invoices to be sent for payment on 1 May 1989; \$40.50 in bad debts; and several thousand dollars worth of physical holdings (currently unsold volumes of Vermont Geology).

[Continued on page 7.]

# STATE GEOLOGIST'S REPORT

New Topographic Mapping: Preliminary, 7.5 minute (1:24,000 scale) maps are available for most of the areas previously covered only by 15 minute (1:62,500 scale) maps. Four 7.5 minute maps are NOT yet available - the NW and NE quadrant of the Island Pond 15 minute map and the NW and NE quadrant of the Averill 15 minute map. All other areas of the state are available in either 7.5 minute format (feet or meter contours) or 7.5x15 minute (1:25,000 scale) format (contours in meters).

New 7.5 minute maps      quadrant      previous 15 minute maps

Island Pond VT	SW	Island Pond VT
Spectacle Pond VT	SE	Island Pond VT
Tinkerville NH-VT	SE	Averill VT-NH
Stratford NH-VT	NE	Guildhall VT-NH
Groveton NH-VT	SE	Guildhall VT-NH

One additional 7.5 minute map is available as a 1987 Photo-revision of a previously issued map - Hinesburg VT.

All topographic maps are available from the U.S. Geological Survey in Denver CO. New topographic maps are available from the Office of the State Geologist.

New Open-File Reports from U.S.G.S.: Two open-file reports on Vermont bedrock geology have recently been made available by the U.S. Geological Survey. These are:

Ratcliffe, Nicholas M. and William C. Burton, 1989, Preliminary bedrock map of the Stratton Mountain quadrangle, Vermont. U.S. Geological Survey Open-File Report 89-200.

Hatch, Norman L. Jr., 1989, Reconnaissance bedrock geologic map of the South Royalton quadrangle, Vermont. U.S. Geological Survey Open-File Report 89-288.

Copies of these open-file reports are available from the Office of the State Geologist for \$3.00 each. Each open-file report consists of a blue-line print of the map and a photocopy of the accompanying text.

International Geological Congress Field Trip: The 3 day field trip (19-22 July 1989) on the "Marble, Granite and Slate Industries of Vermont", lead by Charles A. Ratté (Vermont State Geologist) and Duncan C. Ogden (Vermont Marble Company), was a great success. The trip was attended by 10 geologists from across the United States and from the Soviet Union and the Peoples Republic of China. Numerous geologists and industry people in Vermont donated their time and efforts to help to make the trip a success. Our thanks to everyone involved.

Charles A. Ratté', State Geologist  
Office of the State Geologist  
103 South Main Street - Center Building  
Waterbury, VT 05676  
(802) 244-5164

[Minutes continued from page 5.]

#### NEW BUSINESS

1. Questionnaire to be included with Fall dues statement.

Eric Lapp suggested that the inclusion of a questionnaire to the members, located on the reverse of the fall dues statement, would be a good way of obtaining comments from the membership. Questions would be oriented toward finding out what the members would like to see more of from the Society. The responses would be a guide toward future meeting topics and events. Eric will work on drawing up this questionnaire.

2. Quebec-Vermont Appalachian Workshop volume.

Approval was given to re-publishing the Appalachian Workshop volume as Vermont Geology Volume 6.

3. Reimbursement of expenses

Tom Ray is working on a policy to reimburse members of the Executive Committee for expenses incurred as a result of work done for the Society.

Submitted by  
Sharon O'Loughlin, Secretary Pro tem

## RECENT PUBLICATIONS

Two recent publications contain articles by Chuck Ratté, our state geologist. The first, The State Geological Surveys - A History contains a chapter for each of the 50 state surveys, telling its history, organization and function. Published by the Association of American State Geologists, it is edited by Arthur Socolow. It may be ordered from the Geological Survey of Alabama, P.O. Box 0, Tuscaloosa, AL 35486.

The second is one of a myriad of field trip guidebooks (126 to be exact) for the 28th International Geological Congress held this summer in the United States. Of particular interest to Vermont geologists is Marble, Granite, and Slate Industries of Vermont (T362), \$13.00 for non-GSA or AGU members. Send remittance to AGU-Orders, 2000 Florida Avenue, N.W., Washington, DC 20009.

## MEETINGS

AUG VGS SUMMER FIELD TRIP  
26 See page 3 for details.

OCT VGS ANNUAL FALL MEETING

7 We will have as our dinner speaker, Dr. George F. Pinder, a noted hydrologist, and newly appointed Dean of the College of Engineering and Mathematics at UVM. Title of his talk will be "The Tragedy of Woburn, Groundwater Concepts and Litigation". An afternoon field trip is being developed relating to contaminant hydrogeology and surficial geology.

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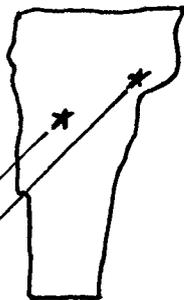
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FIRST CLASS

Charles A. Ratté  
4 Chestnut Hill  
Montpelier, VT 05602

# THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

FALL 1989

VOLUME 16 NUMBER 3

A fall doubleheader with the hydrogeologists

SATURDAY, OCTOBER 7, 1989

## \*1. A FIELD TRIP

"Groundwater Remediation at a Site in Northeastern Vermont"

Chris Stone, trip leader

1:30 P.M. AT ST. JOHNSBURY

[See page 2 for details.]

## \*2. BANQUET, KEYNOTE ADDRESS, ANNUAL MEETING

"The Tragedy at Woburn, Groundwater Concepts and Litigation"

Dr. George Pinder, speaker

The evening activities start at

5:00 P.M. AT N.E.I.C. IN MONTPELIER

[See page 3 for details.]

**MAKE YOUR RESERVATION NOW!**

[See page 11.]

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## PRESIDENT'S LETTER

Dear Members:

I thank Chuck Ratte for leading us on a very pleasant and informative summer field trip in the "islands". My only remaining question is how did he arrange such marvelous weather?

It has been a busy and productive year for VGS. We have gained many new members and many of this year's events have been well attended. This trend will likely continue with the upcoming fall program, whose emerging theme appears to be contaminant hydrogeology.

In working with the executive committee over the past couple of years, I have noticed interest in getting more active membership participation and in better determining what members' interests are. In addition to the standing invitation for GMG contributions, if any of you have informal suggestions on any aspect of how the Society is run, please pass them along. Even jot a few notes on your absentee ballot if you like - we will read them! Even little things are helpful.

To close, thank you for the opportunity to serve you this year, and I hope to see you at the annual meeting, banquet, field trip or all of them!

Sincerely,

Eric Lapp

## FALL PROGRAM

### FIELD TRIP

**TOPIC:** Groundwater Remediation at a Site in Northeastern Vermont

**LEADER:** Chris Stone, Vice President Hydrology and Earth Sciences, The Johnson Co., Inc.

**DATE:** Saturday, October 7, 1989

**TIME OF DEPARTURE:** 1:30 PM. We will end the trip by 3:30, leaving enough time to follow the leaf peepers to Montpelier.

**ASSEMBLY POINT:** Parking lot of the Fairbanks Motor Inn on Route 2 on the east side of St. Johnsbury.

**CARPPOOLING SUGGESTION:** Those traveling through the Montpelier area are suggested to meet at the Exit 8 commuter lot shortly after noon.

**TRIP SUMMARY:** Along the Sleepers River in St. Johnsbury, VT, a groundwater pump and treatment system has been in operation since 1986. Approximately 4000 gallons of fuel oil have been recovered. This field trip will show the basic concepts of a free phase groundwater recovery system. The particular focus will be how remedial systems must be designed based on a complete knowledge of local geologic conditions.

**BANQUET, KEYNOTE ADDRESS, ANNUAL MEETING**

**PLACE:** New England Culinary Institute, 250 Main Street,  
Montpelier, VT (see map pages 6-7).

5-6 P.M.: Social Hour / Cash Bar

6-7:30 P.M.: Dinner. Reservations must be made (see below).

**MENU**

Cream of seasonal vegetables soup

Tossed salad, rolls and beverage

Entree - choice of:

1. Baked stuffed chicken breast in port wine sauce
2. Roast leg of lamb with garlic and rosemary
3. Chef's white fish selection in white wine sauce  
with purple shallots ("Heart Healthy" selection)

All entrees served with vegetable, and rice, pasta or  
potato

Dessert - choice of:

1. Cheesecake with fruit
2. Fruit dish

**COST:** \$16.50. VGS will cover the tax and gratuity. Payment  
will be due at the banquet.

**RESERVATIONS:** Must be made before TUESDAY, OCTOBER 2nd. Send  
the reservation form (page 11) to Eric Lapp, Vermont  
Geological Society, P.O. Box 304, Montpelier, VT 05601  
OR

Call (802)+223-0328 during the evening.

7:30 P.M. Keynote Address: "The Tragedy of Woburn, Groundwater  
Concepts and Litigation" by Dr. George Pinder

8:30 P.M.: Annual Business Meeting and Election of Officers.  
NOTE: Members and their friends who prefer to attend only  
the address and meeting are welcome to come at 7:30 P.M.

**ABSENTEE BALLOT:** If you cannot attend, mail your absentee  
ballot (see page 9).

# VGS BUSINESS & NEWS

## NEW MEMBER

Welcome to Leslie Kanat at Johnson State, a new member since the last GMG.

## PROFESSIONALISM COMMITTEE UPDATE

The newly rejuvenated Professionalism Committee held an initial meeting at UVM on August 26, 1989. In attendance were Bruce Wilson, Bill Spitzel, Jeff Prewitt and Eric Lapp. We began reviewing the responses to last year's proposed "certification" legislation (see GMG v. 15, no. 4) and we are currently reviewing a packet of information on recent developments in other states, sent to us by the chairman of the AAPG Division of Professional Affairs. One of the fundamental issues emerging from this and related debates in other states and Vermont is the existing regulatory definition and use of the terms "certified", "qualified", "hydrogeologist" and "consultant".

Our committee, in general agreement with the opposition to the certification bill (H.43) as introduced, noted several areas of general concern, including: lack of legislative findings section to give purpose to the proposed bill, apparent duplication of intent with existing regulations and a need to detail the "qualifying" requirements/standards which might be proposed for specific tasks. To assist our committee in its continued work on this issue we will be polling the membership on some very general questions at the Fall Annual Meeting. They are also listed as absentee ballot questions.

Submitted by Eric Lapp

## STATE GEOLOGIST'S REPORT

New Topographic Mapping: Four 7.5 minute topographic quadrangles have been photorevised (1988 dates) and are available for purchase.

Barre West VT

Barre East VT

Rutland VT

Quechee VT

All topographic maps are available from the U.S. Geological Survey in Denver CO. New topographic maps are available from the Office of the State Geologist.

Legislation: New legislation is being prepared by the State Geologist for introduction in the next legislative session. The purpose of this new legislation is to redefine the role of the State Geologist and to create a Division of Geology and Mineral Resources within the Agency of Natural Resources.

New Offices: The Office of the State Geologist has moved. Our new offices are now located on the SECOND floor of the Center Building in the State Office Complex in Waterbury. Our mailing address and phone number remain the same as before.

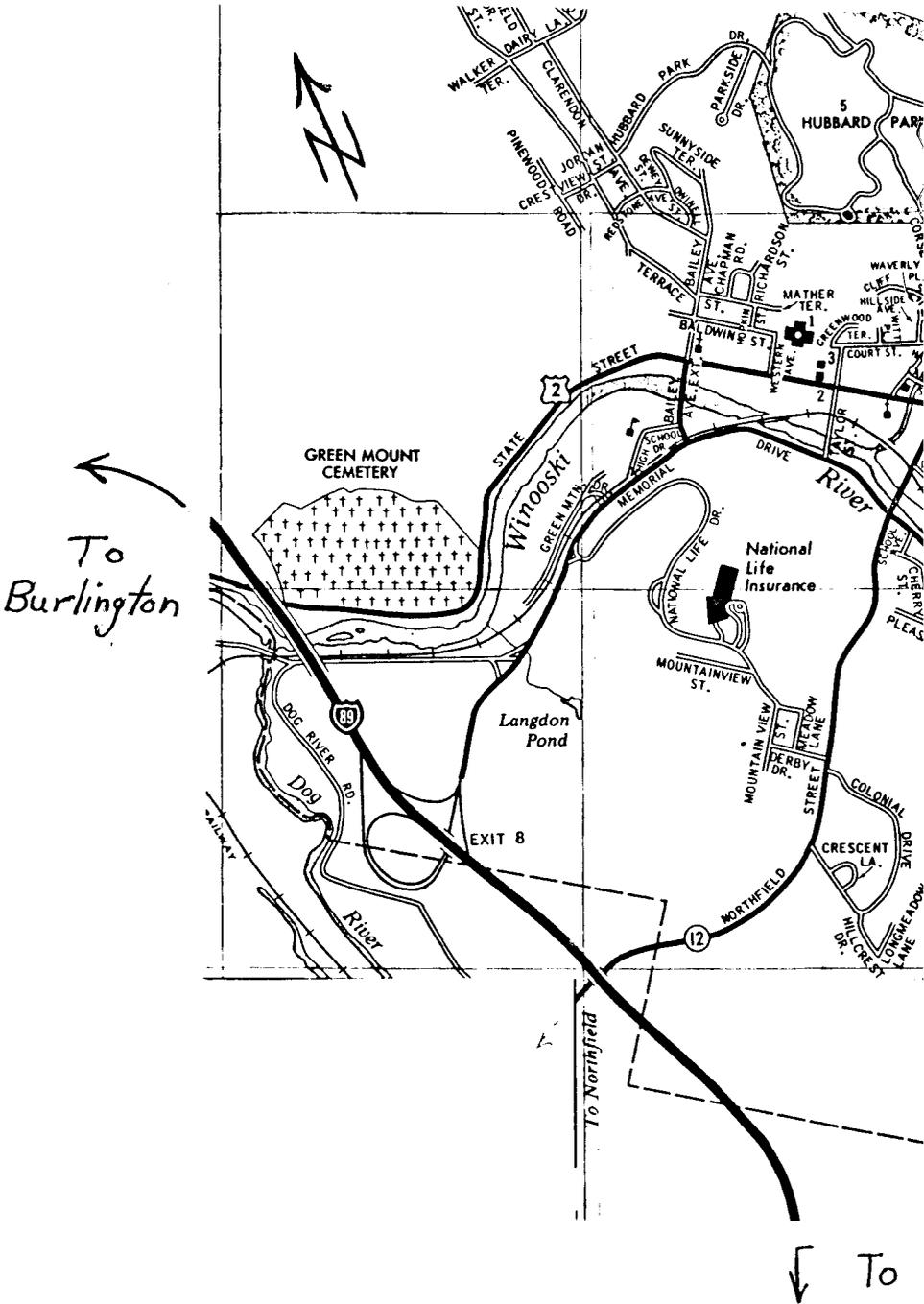
Charles Ratté  
State Geologist  
103 South Main Street  
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Waterbury, VT 05676  
(802)+244-5164

## RECENT PUBLICATION

A new publication is available from the Maine Geological Survey. Studies in Maine Geology: Volume 1 - Structure and Stratigraphy is available for \$10.00 plus .50 tax. Your prepayment check should be made payable to "Treasurer, State of Maine" and request mailed to Maine Geological Survey, Department of Conservation, State House Station # 22, Augusta, Maine 04333.

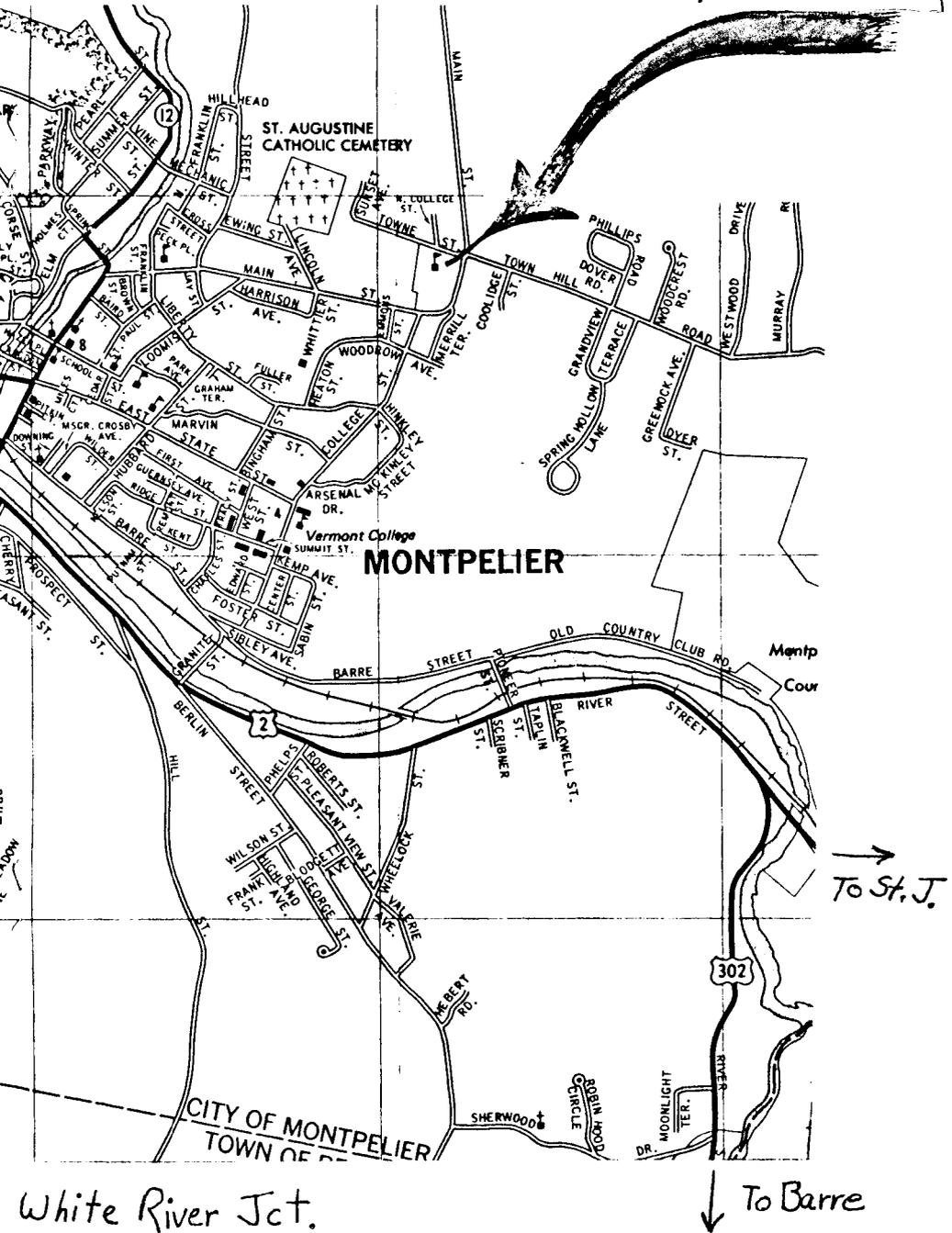
This 156 page technical publication is the first in a series of six volumes celebrating the 150th anniversary of C.T. Jackson's reports on the geology of Maine. The volume contains papers on C.T. Jackson, the lithotectonic stratigraphy of the Casco Bay region, early premetamorphic faults in western Maine, the shale-wacke sequence in south-central Maine, a Silurian unconformity at Flanders Bay, Devonian deltaic sedimentary environments of the Matagamon Sandstone, the occurrence of the crinoid Rhodocrinites nortoni (Goldring) in north-central Maine, plant paleontology in Maine, an electron microscope study of Vassalboro Formation, and the seismic structure of the earth's crust underlying Maine.

# LOCATION MAP FOR FA



ALL BANQUET

NEW ENGLAND  
CULINARY INSTITUTE



## MEETINGS

- OCT VGS FALL FIELD TRIP AND ANNUAL MEETING BANQUET  
7 See Pages 2 and 3 for details
- OCT NEW ENGLAND INTERCOLLEGIATE GEOLOGICAL CONFERENCE  
13- Hosted by the Department of Sciences and  
15 Mathematics of the University of Maine at Farmington.  
For information about the field trips to be held contact:  
A.W. Berry, Geology, UMF, 120 Main Street, Farmington, ME  
04938-1990.

The following lectures are presented by the University of Vermont Department of Geology Fall Seminar Series. They are held in Room 200, Perkins Geology Building at 4:00 PM except as noted. For more information contact: Dr. Charlotte Mehrtens, (802)+656-0243.

- OCT Dr. Robert Berner, Yale University:  
9 A Model for Atmospheric Oxygen in Phanerozoic Time.  
NOON
- OCT Dr. Steven Leatherman, University of Maryland:  
16 Global Warming, Sea Level Rise and Coastal  
Resources.
- NOV Dr. Robert Badger, Virginia Polytechnic Institute:  
13 Late Precambrian Volcanism in the Central Appala-  
chians: Characteristics and Tectonic Implications.

The Lecture Series presented by the Department of Geology at Middlebury College this fall follows. Lectures will be held in Room 420 of the Science Center at noon unless otherwise indicated. Call (802)+388-3711 x5429 for more information.

- SEPT Dr. Dorothy Merritts, Franklin and Marshall College:  
29 Geomorphic Response to High, Intermediate and Low  
Uplift Rates; Mendicino Triple Junction, Northern  
California.
- OCT Dr. Margaret Rusmore, Occidental College:  
11 Tectonics in Western British Columbia.
- OCT Dr. Scott Bogue, Occidental College:  
12 Reversals of the Earth's Magnetic Field: Evidence  
from Hawaii and Oregon.
- OCT Dr. Margaret Rusmore, Occidental College:  
12 Women on Annapurna: Triumph and Tragedy. 7:30 PM
- NOV Dr. J. Philip Kern, San Deigo State University:  
10 Marine Terrace Deformation and Rates of Tectonism,  
San Diego County, California.
- NOV Dr. J. Michael Rhodes, University of Mass. Amherst:  
17 How Mauna Loa Works.
- DEC Dr. Edwin Roedder, U.S.G.S., Reston:  
1 Nuclear Waste Disposal - Where Do We Put It?

# ABSENTEE BALLOT

(Vote for one for each office.)

President	Andy Raiford	<input type="checkbox"/>
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Please answer the following questions:

Question 1: Do you think Vermont needs legislation to formally certify geologists and hydrogeologists? \_\_\_yes \_\_\_no

Question 2: Do you think existing environmental protection rules should be amended to better define geologists and hydrogeologists? \_\_\_yes \_\_\_no

If you will not be attending the VGS Annual Meeting on Saturday, October 7, 1989 at about 8:30 P.M. at the New England Culinary Institute in Montpelier, Vermont, please complete this ballot and return it in an envelope with the word "BALLOT" in the lower left hand corner and your name and address in the upper left corner to:

Jack Drake, Secretary  
 Vermont Geological Society  
 Box 304  
 Montpelier, VT 05602

This must be received before OCTOBER 5.

ABSENTEE BALLOT

# BANQUET RESERVATION FORM

Please reserve \_\_\_\_\_ dinners for me at the VGS Annual Banquet at the New England Culinary Institute, Montpelier, VT, on October 7, 1989, at 5:00 PM.

My choice of Entree(s):  
[See page 3 for complete description.]

Baked stuffed chicken

Roast leg of lamb

Chef's fish selection

My choice of Dessert(s):

Cheesecake

Fruit dish

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

\_\_\_\_\_

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Mail this form before OCTOBER 2 to:

Eric Lapp, Vermont Geological Society  
P.O. Box 304, Montpelier, VT 05601

OR

Call (802)+223-0328 evenings

Do you plan to attend the field trip?  
 yes  no

GREEN MOUNTAIN GEOLOGIST  
VERMONT GEOLOGICAL SOCIETY  
BOX 304  
MONTPELIER, VERMONT 05601

The GREEN MOUNTAIN GEOLOGIST is published quarterly by the Vermont Geological Society, a non-profit educational corporation.

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ADDRESS CHANGE? Send it to the Treasurer at the address above, please.

MAKE YOUR BANQUET RESERVATION BEFORE  
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# THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

WINTER 1989

VOLUME 15 NUMBER 4

VGS'S 12th Annual Winter Meeting

THE USE OF COMPUTERS IN GEOLOGY

SATURDAY, FEBRUARY 18, 1989 9:00 A.M.

NORWICH UNIVERSITY, NORTHFIELD, VERMONT

## DIRECTIONS TO 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 miles 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 the south entrance.

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## PRESIDENT'S LETTER

Dear Friends,

A dinnertime snowstorm accompanied banqueters at East Burke's Cutter Inn after Bud Ebbett's glacial tour of the Passumpsic Valley on October 8th. The following weekend, "New England Intercollegiate Geologists" were treated to the 80th Conference, which featured many fine field trips in southern Vermont. Fall did not end peacefully, as an earthquake in eastern Canada on November 25th, felt by many in the Northeast, was soon overshadowed by the tragedy in Armenia.

Geologic events and resources touch our lives in so many ways. At a Sand and Gravel Extraction Conference in Rutland on December 1st, one of the most important points made was that open and early communication is the only way to successfully address differences between those wishing to develop resources and those affected by development. We all have the opportunity to learn about "public issues" and to communicate our knowledge. For 1989, I encourage the membership of VGS to express their views during this year's legislative session, when bills relating to the certification of hydrogeologists and likely the low-level radioactive waste issues are discussed.

Finally, as the Society enters its 15th year, it is interesting to think about how much computers and their science have also evolved since 1974. Thanks to the efforts of Dave Westerman (recently winner of the VGS "best idea" award for the use of stamped, addressed return envelopes for dues notices) we have a state of the art program set for the winter meeting. I hope to see you in Northfield.

Sincerely,

Eric J. Lapp

P.S. Anyone with ideas for VGS activities - field trip / meeting, etc. - focusing on hydrogeology, please send them to me at the Society's address: P.O. Box 304, Montpelier, VT 05602.

# WINTER PROGRAM

## THE USE OF COMPUTERS IN GEOLOGY

February 18, 1989  
 Cabot Science Annex  
 Norwich University, Northfield, VT

COFFEE and DONUTS: Room 48 - - - - - 8:30

### MORNING SESSION Room 45

David Westerman, Moderator

1. P. Bluhm: The Development of a Statewide Geographic Information System in Vermont: A Status Report - - - - - 9:00
2. J. T. Thomas: IGPEP, CENTAM, and IGBA - - - - - 9:20
3. R. Eliot: The use of Computer Databases in High School Earth Science Teaching - - - - - 9:40
4. W.T. Fox: Waves and Tides - - - - - 10:00
- COFFEE - - - - - 10:20
5. D. Franz: Unit Hydrograph Applications for Undergraduate Laboratory Instruction in Hydrology Using Microcomputer Spreadsheets - - - 10:40
6. L. Marcus and G. Boudette: Interactive Color Graphic Comparison of Volcanogenic Massive Sulfide Deposits on an IBM PC - - - - - 11:00
7. R. Detenbeck and B. Doolan: Modeling Ocean-Floor Magnetic Anomalies: Computer-Based Student Projects in Geophysics - - - - - 11:20
8. H.R. Burger: Macintosh Applications for Exploration Geophysics - - - - - 11:40

LUNCH: Will be provided for speakers and poster presenters. Sandwiches will be available for purchase by all others, or bring your own brown bag lunch.

### AFTERNOON POSTER SESSION

(plus demonstrations by morning speakers)  
 12:30 to 3:00 PM

- J.R. Albanese and W.M. Kelley: Using AutoCAD in Mapping Mineral Resources in the New York State Offshore
- A.I. Benimoff: DSCOMP: A Computer Program That Calculates d-Spacings from Debye-Scherrer Film Data
- D.C. Elbert: Geologic Applications of the Postscript Page Description Language
- J.D. Eusden and D.C. Elbert: Making Geologic Maps with Adobe Illustrator
- F.A. Revetta, D. Snyder and A. Johnson: Computer Applications of Geophysical Software to Geologic Applications
- J.H. Reynolds: Uplifting the Andes with the Click of a Mouse
- EXECUTIVE COMMITTEE: Meet following the afternoon session.

# ABSTRACTS

## USING AUTOCAD IN MAPPING MINERALS RESOURCES IN THE NEW YORK STATE OFFSHORE

Albanese, J.R. and W.M. Kelly, N.Y.S. Geological Survey,  
3140 CEC, Albany, NY 12230

Our program to map sand, gravel, and heavy mineral resources in New York State waters is focused on Long Island Sound and on the continental shelf south of Long Island. The exploitation of terrestrial deposits of aggregate, coarse and fine, for use in concrete and as fill has become critical in the New York City Metropolitan area and is being restricted for various reasons including overbuilding, zoning and environmental regulations, and increasing real estate values. The need for new sources is critical. A New Jersey-based producer is currently sand and gravel mined in New Jersey waters supplies this market. Plans to permit mining of similar resources in New York waters are well advanced. Heavy minerals such as titanium minerals, zircon, monzanite, aluminosilicates, staurolite, garnet, can be economically important in marine placers, although these minerals are usually found in only trace concentrations.

We use AutoCAD, running on an IBM AT, to plot data derived from analysis of vibracores, on maps that display both the amount and the locations of gravels and the economically important heavy minerals. The data, comprised of core locations in latitude and longitude, weight and composition of the gravel fraction of the aggregate, and weight percent of twelve species of heavy minerals, are captured using a spread program. Using the programming language AutoLISP, these data are read from the files into a program that calculates appropriate scaling factors and issues drawing commands to a plotter. The plotter can generate maps of different scales and view angles. This eliminates the need for the manual compilation of the data, scaling each of the fractions to be displayed, and above all, having to repeat these processes each time new data become available. The program plots a cylinder at each core location. The height of each segment of the cylinder is proportional to the sample fraction present, either mineral or coarse aggregate. Updated maps are generated easily and reports prepared without much drafting.

## DSCOMP: A COMPUTER PROGRAM THAT CALCULATES THE d-SPACINGS FROM DEBYE-SCHERRER FILM DATA

Benimoff, Alan I., Department of Applied Sciences,  
College of Staten Island, Staten Island, NY 10301

DSCOMP, a computer program that calculates the d-spacings from Debye-Scherrer film data is written in Microsoft Quick Basic 4.0, and compiled into an executable file for use on an IBM compatible PC utilizing MS DOS. Distances (in mm) between arcs of symmetrical pairs are measured on a powder photograph as described in Azaroff and Buerger (1958). These data for the forward and back reflection regions are entered into an input file that also includes the respective relative inten-

sity for each pair of arcs, the wavelength of the radiation, and camera diameter. Film centers  $\theta_1$  and  $\theta_2$  are calculated and utilized in the film shrinkage correction. The d-spacing for each symmetrical pair of arcs is calculated from the Bragg equation (Azaroff and Buerger, 1958). A table is produced listing all entered forward and back reflections, corrected and uncorrected values for S,  $\theta$ ,  $\sin \theta$ ,  $2 \sin \theta$ , d, and  $I/I_0$ . The table can be printed, and an ASCII output file of the table can be created.

Azaroff, L.V. and Buerger, M.L., 1958, "The powder method in x-ray crystallography", McGraw Hill, NY, 342 p.

#### MACINTOSH APPLICATIONS FOR EXPLORATION GEOPHYSICS

Burger, H. Robert, Department of Geology, Smith College,  
Northampton, MA 01063

A total of ten Macintosh applications have been developed for an undergraduate exploration geophysics course. A consistent user interface, pull-down menus, and mouse-driven inputs make these programs easy to learn and to use. Programs include forward and inverse modelling for reflection seismology, refraction seismology, gravity, magnetics, and electrical resistivity. Data input is consistent from application to application and is relatively quick. Output is in the form of tables, graphs, and diagrams and may be sent to an Imagewriter or Laserwriter or can be transferred to other Macintosh applications. This ease-of-use, quick data input, and quality output encourages utilization by students in investigating course concepts, solving problem sets, and analyzing field data.

#### MODELING OCEAN-FLOOR MAGNETIC ANOMALIES, COMPUTER-BASED STUDENT PROJECTS IN GEOPHYSICS

Detenbeck, Robert W., Department of Physics and  
Barry Doolan, Department of Geology,  
University of Vermont, Burlington, VT 05405

In an assigned project, each student in an undergraduate geophysics course at the University of Vermont compares published measurements of magnetic anomalies, recorded in a traverse over an ocean ridge, with the prediction of his/her own model. Each student is assigned one set of measurements and given a floppy disk with programs and files suitable for an AT&T PC-6300 (or IBM-PC/clone with CGA graphics). The most important contribution to the enthusiasm with which students have attacked this project seems to be the comparison of real data with their model.

A student's model, residing in a single disk file, includes geometric and magnetic characterizations of the magnetic ocean-floor crust, as well as descriptions of the local geomagnetic field and the traverse. The magnetic crust is modeled as a sequence of infinitely long, magnetized "blocks", lying parallel to the ridge. For simplicity, each block has a uniform thickness and vertical boundaries.

The main program, MAGNET, calculates and displays a graph of the predicted magnetic anomaly (total/vertical/horizontal) versus position above a picture of the magnetic seafloor. When an interesting result is obtained, it can be printed with the Prt-Sc key to a dot-matrix printer. A companion program is a graphic block editor, which simplifies making changes to the model file. The graphic presentation of seafloor geometry in the block editor helps students produce physically reasonable models of the ocean floor. The block editor can provide from a special file a simple startup model, the details of which are up to the instructor. In order to simplify the student's task the block editor has been limited to produce only models with mirror symmetry across the ridge. However, an ordinary text editor can create or modify model files to produce more exotic versions. A simple, public-domain text editor AHED is provided on the floppy disk to use by adventuresome students. Other files on the disk include text files of instructions, and a couple of educational single-block models not especially relevant to ocean ridges.

The two major programs MAGNET and BLOCKED were written for compiled Turbo-Basic (v1.0), because at the time it had the most convenient graphics. The computational speed is satisfactory if a math coprocessor chip is present, but the more complex models require waiting a few minutes if the coprocessor is unavailable. The program will be rewritten this year in Turbo-Pascal (v5.0).

#### GEOLOGIC APPLICATIONS OF THE POSTSCRIPT PAGE DESCRIPTION LANGUAGE

Elbert, David C., Geology Department, Middlebury College, Middlebury, VT 05753

The PostScript high-level, interpreted, page-description language has emerged as the most implemented of a series of computer languages designed to facilitate the description and printing of graphic objects. Postscript graphics are a significant advance beyond bit-mapped graphics where resolution can never exceed that of the actual data. High resolution bit-mapped graphics are not feasible for many geologic applications because of the inability of the user to enter data at high enough resolution as well as the inability of computer systems to store and process the vast amounts of data that high resolution bit maps require. In contrast, PostScript graphics are described as mathematical objects without regard to resolution. This allows work at commonly available resolutions (70-90 dpi screen resolutions and 300 dpi laser printer resolutions) to be followed by high-quality printing at resolutions determined by the final output device (1270-2540 dpi imaged directly on film or paper in graphic typesetters). Controlling complex images at screen resolutions still equals or exceeds the working resolutions of traditional drafting methods.

Several aspects of the language make PostScript of particular interest to geologists. PostScript contains over 240 primitive operators that modify graphics. A particularly important part of PostScript is the representation of all curved paths as Bézier cubic sections. The Bézier cubic curve is derived from a pair of parametric cubic equations and

allows precise description of any curved path as a sequence of points along the curve ("anchor points") each of which is associated with two control points that specify the direction of the curve at the "anchor points".

Standard graphic primitive operators in PostScript directly allow graphic transformations of interest to geologists. The scale operator allows complete control of scaling of any portion of a graphic independently in either coordinate direction. This allows both uniform scaling (appropriate when finalizing a figure for a particular journal's page size requirements) and non-uniform scaling (which readily models homogeneous strain for structural geologists). In addition, scaling parallel to a fold-axis direction by a factor of sin (plunge of the fold axis) produces a down-plunge projection by Wegmann's method. A definable shear operator allows complete control over shearing of graphics in either coordinate (readily modeling simple shear strain for the structural geologist).

A final advantage of PostScript is that the language is completely composed of ASCII characters. This allows simple manipulation of files in a word-processing environment and easy file transfer over communication channels such as standard modem connections or networks like BitNET.

#### THE USE OF COMPUTER DATABASES IN HIGH SCHOOL EARTH SCIENCE TEACHING

Eliot, Richard, Lyndon Institute, Lyndon Center, VT 05850

Database Management is a powerful tool in the teaching of earth science. It offers many ways to analyze, sort, organize, and display data, ways to test hypotheses of search for new relationships. In addition to being helpful in data analysis, the use of a database is a good way to integrate technology education into the curriculum. Students gain direct experience in using a computer as a tool for scientific investigation.

The presentation will demonstrate how dBASE IV can be used to study data collected by students during their study of a local river system, and data collected during a study of plate tectonics and the formation of the Appalachian Mountains. DBASE IV has a user friendly "Control Center" which provides easy access to all dBASE commands. Data entry forms can be produced quickly. Student data is then sorted and indexed: two ways to group, organize, and view the data. It is easy to search for specific relationships by using the dBASE "Query by Example" method of asking questions. As a conclusion students use the "Report Writer" feature to select relevant data and print it in data table format. Advanced users can export the formatted data table directly into their own wordprocessed document to add support to their summary conclusions.

Instant graphs will be demonstrated using the ram resident "Graph-In-The-Box". "IBM Storyboard" will be used to demonstrate the potential of Presentation Software.

MAKING GEOLOGIC MAPS WITH ADOBE ILLUSTRATOR

Eusden, J. Dykstra, Department of Geology, Bates College, Lewiston, ME 04240 and David C. Elbert, Department of Geology, Middlebury College, Middlebury, VT 05753

Adobe Illustrator, and its latest version, Illustrator '88, is a Macintosh-compatible, resolution-independent graphics package capable of producing publication-quality figures. The high resolution available with Illustrator comes from its use of PostScript, a page description language. This is a powerful programmable language capable of complete mathematical description of graphic images. PostScript graphics can be printed by many popular laser printers (300-600 dots per inch (dpi) dry-toner process printing) as well as higher resolution imagesetters (1270-2540 dpi direct laser to film exposure).

To make a map using Illustrator, one may either draw freehand or, more commonly, trace artwork from a previously scanned image called a template. The template is a 72-300dpi, bit-mapped image incorporated by Illustrator as a non-printing background. Complete mathematical description of lines as composites of Bezier cubic segments is accomplished by tracing appropriate parts of the template. The program includes a menu of graphic operators which may reduce, enlarge, rotate, shear, crop, shade, and/or pattern any text or region in the document. Patterns may be defined by the user and incorporates four color processing.

The advantages in using Illustrator for drafting geologic maps are numerous. Artwork can be scaled to any size. Editing of Illustrator figures for manuscripts is rapid and produces pristine output. The resolution of the printed documents may exceed that of detailed pen and ink figures. Portions of existing figures are easily used again through digital cut-and-paste techniques; outlines of states, a series of plutons, legends, and scale bars no longer need redrafting when producing related figures. Illustrator figures of an explanation, title, and index map may be printed on drafting applique film and readily attached to other figures (eg. larger mylar maps of figures not produced directly using Illustrator). Although the maximum size of an Illustrator figure is currently 18" x 18", direct manipulation of the PostScript code allows unlimited enlargement of figures using a simple word processor. However, practical considerations of available printer sizes and addressable random access memory limit output dimensions to 11" x 17".

Illustrator also supports direct production of color separation negatives. The potential to significantly reduce the publication cost of color maps by an order of magnitude may represent the most important by-product of the desktop publishing revolution to geologists. We will display many examples of Illustrator-generated geologic maps and outline the procedures involved in creating them.

## WAVES AND TIDES

Fox, William T., Geology Department, Williams College,  
Williamstown, MA 01267

A series of programs have been developed to simulate wave refraction and tidal action along coasts for Oceanography classes. A grid of bottom depths from bathymetric charts provide the data base for the wave refraction program. Different wave patterns are plotted for different wave periods, heights, and angles of approach. Wave rays converge and diverge in different coastal configurations resulting in increased and decreased wave heights along the shore. Wave rays and crests are computed and plotted for Provincetown, Massachusetts; Cape Ann, Massachusetts; Soco Bay, Maine; and Monterey, California. The programs are written in FORTRAN and BASIC for the IBM PC compatible computers and are available for the VAX with a TEKTRONICS scope.

Previously developed programs including the "Tides Tutorial" and "Seafloor Spreading" model will also be demonstrated and available on the IBM PC compatible computers.

## UNIT HYDROGRAPH APPLICATIONS FOR UNDERGRADUATE LABORATORY INSTRUCTION IN HYDROLOGY USING MICROCOMPUTER SPREADSHEETS

Franzi, D.A., Center for Earth and Environmental Science,  
State University of New York, Plattsburgh, NY 12901

The unit hydrograph for a drainage basin is the outflow hydrograph produced by one inch of surface runoff generated uniformly over the basin by a rainstorm of uniform intensity and specified duration (Sherman, 1932). Unit hydrograph analysis can be used 1) to predict the time-distribution of runoff for the design of hydrologic structures, 2) to determine the effects of land-use changes on the rainfall-runoff relationship, and 3) in conjunction with storage-routing methods, determine flood-wave attenuation through a channel segment or reservoir.

Microcomputer spreadsheet software was used in undergraduate hydrology laboratory exercises to solve specific design problems using unit hydrograph and hydrologic routing methods. Spreadsheets are easily adapted to such analyses which involve repetitive calculation and graphical display of tabulated data. The spreadsheet software frees laboratory time and creates a more active learning environment. Students are able to spend more time on the interpretation and presentation of the results and consequently develop a better understanding of the applications and limitations of the methods.

Sherman, L.K., 1932, Streamflow from rainfall using the unit-graph method: Engineering News-Rec., v. 108, pp. 501-505.

## INTERACTIVE COLOR GRAPHIC COMPARISON OF VOLCANOGENIC MASSIVE SULFIDE DEPOSITS ON AN IBM PC

Marcus, Leslie F. (Queens College),  
 Eugene L. Boudette (New Hampshire State Geologist),  
 Lawrence J. Drew (U.S. Geological Survey), and  
 Phillippe K. Lampietti (New York University)

An interactive graphics system has been developed for comparing and classifying volcanogenic massive sulfide deposits. Field maps containing deposits throughout the world are digitized and displayed in high resolution (Enhanced Color Graphics - 640x350 pixels and 16 colors). The software was mainly written in C and runs an IBM PC XT, AT (or compatibles) or PS 2 with 640K. The program is run using a mouse to make selections from pull-down menus. The geologist user can interactively construct, display, edit and store interpreted stratigraphic columns of the rocks found in the vicinity of ore deposits; as well as edit the dictionary of available rocks.

Data bases of digitized maps, constructed columns and a rock dictionary are maintained within the system. A column constructed for a prospective region may be compared to columns already in the data base, and closely related columns are displayed for identification of similar tectonic frameworks. Measures of similarity between columns can be processed by a clustering routine which produces a heirarchical classification of the deposits in the form of a dendrogram. The system can be adapted to other types of stratified deposits by substituting an appropriate rock dictionary and data base of suitable maps.

## COMPUTER APPLICATIONS OF GEOPHYSICAL SOFTWARE TO GEOLOGIC PROBLEMS

Revetta, Frank A., Dave Snyder and Allan Johnson,  
 Geology Department, State University of New York,  
 Potsdam, NY 13676

The purpose of this poster session is to provide information on how computers are being used by geology faculty and students in teaching and research at the Geology Department at State University of New York at Potsdam, New York. The primary use of the computer is in the application of geophysical software to the solutions of geological problems. Applications of computer software in seismology, seismic prospecting, gravity, magnetics and electrical resistivity surveying are presented. Computer graphics programs that produce contour maps, three dimensional surface representations and XY graphs are used to display the data.

In seismology we use a computer program for the location of hypocenters of local and regional earthquakes. This program (FASTHYPO by Hermann) is run on a Burroughs mainframe computer and a Zenith microcomputer with a hard disk drive. The program offers the ability for us to locate earthquakes quickly that are detected by our seismic network of six stations. A second program called QUAKE displays earthquakes distributed around the world according to magnitude, depth and time and enables various relationships to be studied including the distribution of earthquakes relative to plate boundaries.

Two programs are used in seismic prospecting. One program SEISMIC creates a two dimensional model from seismic refraction data. The input includes distances between stations and shot points and observed travel times. The program will compute velocities, thicknesses and dips of refracting horizons from calculated regression lines. The time-distance curve and geologic cross sections are displayed and printed.

A second program SEIRFR is used to illustrate modeling of seismic refraction time-distance data by entering velocities and intercept times. A geologic cross section is calculated giving time velocity, depths, thicknesses and dips of various layers.

Applications of the computer in gravity include reduction of gravity data and the construction of geologic models. We use microcomputer programs to calculate the gravity anomalies over buried spheres, vertical and horizontal cylinders and two-dimensional models of arbitrary shape. Three-dimensional bodies of arbitrary shape are also constructed and their gravitational effect computed by computer. Gravity data collected in the field is computer contoured to construct gravity maps. These gravity maps are compared with computed gravity maps based on three dimensional models. A program GRAVITY TEACHING is used to teach concepts about gravity anomalies by allowing the student to input his own set of parameters for models.

In magnetics, we apply the microcomputer to the construction of two-dimensional models of arbitrary shape. An example of this model is illustrated by computing the magnetic profile over a dipping dike. Other computer applications in magnetics include the calculation of remanent magnetization, field and bedding corrections and the paleopole position with an Epson HX 20 laptop portable computer.

Applications of the microcomputer to electrical resistivity modeling is demonstrated by running programs that calculate the apparent resistivity of a layered Earth by the Schlumberger and Wenner techniques. One program (KINVERSE) by Davis starts with a trail model supplied by the user then successively modifies the layers and resistivities to improve the agreement between model and observed data.

Finally, applications of computer graphics are illustrated by displaying computer contour maps of geophysical data, three-dimensional surface displays and X-Y graphs.

UPLIFTING THE ANDES WITH THE CLICK OF A MOUSE  
Reynolds, James H., Department of Earth Science,  
Norwich University, Northfield, VT 05663

Application of in-house, public domain, and commercially available Macintosh™ software has streamlined chronostratigraphic analysis using magnetic polarity stratigraphy in the Central Andean foreland basin of north-central Argentina. Samples are collected at approximately 30 m intervals from sections of Neogene continental strata. A minimum of three samples is collected at each site. Paleomagnetic analyses of samples are done on a Schronstedt SSM-1™ flux gate spinner magnetometer connected to a Macintosh Plus™ through a Taurus One™ interface. The magnetometer is driven and paleomagnetic vectors are calculated by the program MacPMAGZ; data are stored in sample-specific files.

A series of file manipulation programs sorts the data and solves a number of paleomagnetic statistical calculations including: the Virtual Geomagnetic Pole Latitude (VGP Latitude) and Watson's (1956) "R" statistic to determine statistical significance of the mean declination and inclination of each site. The accuracy of statistically significant data is tested with a reversal test using SteroNet (by Richard Allmendinger) and Fisher's (by David Douglass). The precision ( $\alpha_{95}$ ) of the data is determined with Fisher's (by David Douglass). Using MacStrat (by Richard Allmendinger) and MacDraw<sup>TM</sup> to display the final results, the VGP latitude of each site is plotted against the stratigraphic level of the site and abstracted to the standard black and white bar diagrams used on paleomagnetic time scales. The local column is then correlated to the sea floor magnetic polarity time scale (Berggren and others, 1985). Stochastic modeling of the expected time intervals for the paleomagnetic sections is done using the program Johnson-McGee. Rates of sediment accumulation are then derived by plotting the stratigraphic level of all magnetic reversals vs. the position of each reversal on the paleomagnetic time scale using MacDraw<sup>TM</sup>.

Increases in the rate of sediment accumulation are interpreted to reflect an increase in the rate of basin subsidence resulting from crustal loading due to overthrusting in the sediment source areas. Timing of the initiation of source area uplift is read directly from the plot. Comparison of paleomagnetic columns and their corresponding sedimentary facies from thick sections in widely separated parts of the basin allows an interpretation of the evolution of the paleogeography through time.

#### IGPET, CENTAM, AND IGBA

Thomas, John J., Geology Department, Skidmore College,  
Saratoga Springs, NY 12866

IGPET is a program by Michael J. Carr of Rutgers University for the analysis of igneous rock data. The program includes: Harker Diagrams as X-Y and X-Y-Z plots, projects analyses onto various planes within C-M-A-S, some standard mineral diagrams, least-squares petrologic mixing calculations, Chondrite-normalized REE diagrams, normalized trace element diagrams, CIPW norms, and some canned plots.

IGPET can be used as both a teaching and research tool. The program allows one to examine data sets by displaying diagram after diagram in rapid succession on the computer screen.

Applications of IGPET will be demonstrated with the author's data from the Proterozoic of the Mid-continent and a variety of other data sets available in the public domain: CENTAM which contains over 1000 modern analyses of volcanic products from Central America and IGBA the Igneous Petrological Data Base of NOAA with 12,000 specimen descriptions from more than 1,000 data sources world wide.

Article VII: AMENDMENTS

Amendments to this Constitution may be made by a vote of two-thirds of the members of the Society at a regular meeting or by a vote of a majority of the members at a special meeting called for that purpose. Any amendment must be approved by a majority of the members at a meeting called for that purpose before the annual corporate meeting.

CONSTITUTION

Article I: NAME AND PURPOSE

# VERMONT GEOLOGICAL SOCIETY

## CONSTITUTION

### AND

## BYLAWS

ADOPTED  
FEBRUARY 1974

REVISED  
OCTOBER 1976  
OCTOBER 1977  
SEPTEMBER 1979  
OCTOBER 1980  
OCTOBER 1984  
OCTOBER 1988

**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 categories 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 able 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 committee 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 \$10.00 for each fiscal year.

B. Dues for student members shall be \$5.00 for each fiscal year.

C. Dues shall be due during the month of January.

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. The fiscal year shall be divided into quarters and initial dues for new members reflect the period remaining in the fiscal year.

### Article III: FISCAL YEAR

The fiscal year of the Vermont Geological Society shall be the same as the calendar year.

### 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, and one representative from each of the four Permanent Committees 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 executive committee one month after the spring meeting, the names of nominees. Additional nominations should be submitted by members to the secretary by 31 August so that names can be published in the Fall Green Mountain Geologist.
  3. Mail a list of all nominees to all members 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 should return the absentee ballot printed in the Fall Green Mountain Geologist to the secretary so as to be received prior to the annual meeting.
  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:

1. Preside at meetings of the Society and the executive committee.
2. Be an ex-officio member of all committees except the nominating committee.
3. Determine the duties of the Vice-president.
4. Coordinate the work of the officers and committees, in order that the objectives of the Society may be promoted.
5. 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 the ability of that officer to serve, and those duties assigned by the President.

### C. Secretary

The Secretary shall:

1. Record the minutes of all meetings of the Society and the executive committee.
2. 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.
3. Conduct such correspondence as the Society, the officers or the board of directors may direct.
4. Notify officers and standing committee chairmen of their election.

### D. Treasurer:

The Treasurer shall:

1. Be a member of the budget committee.
2. Collect and record funds in accordance with the approved budget and/or upon direction of the executive committee.
3. Present a financial statement at the annual meeting.
4. Disburse funds and pay all bills by check when approved by the President.
5. Present a financial statement at each meeting and at other times as requested by the President.
6. Close the books at the end of the fiscal year and submit them for audit to the budget committee.
7. Send dues notices to members one month prior to the date they are due.
8. 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:

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

## Article VIII: REGULAR MEETINGS

- A. Regular meetings shall be held three times a year. Normally these will be held during the academic 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 within 30 (thirty) days of 15 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, those voting members present shall constitute a quorum, four 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, the chairpersons of the four permanent committees 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:

- 1. Perform the duties delegated to it here and also elsewhere under these bylaws.
- 2. Transact business referred to it by the membership.
- 3. Receive and pass upon plans of work of chairmen of standing committees and authorize and direct the work of each.
- 4. Select the time and place of all meetings, including the annual meeting.
- 5. Submit to the membership such recommendations as it deems advisable.
- 6. Determine the amount and authorize payment of fidelity bonds for the treasurer of the Society.
- 7. Take no action in conflict with that of the membership.

## ARTICLE XII: PERMANENT COMMITTEES

### A. Permanent Committees of the Society:

1. Four permanent committees are established to promote the purposes and carry out the work of the Society. These permanent committees are:
  - Geological Education Committee
  - Advancement of the Science Committee
  - Public Issues Committee
  - Publications/Editorial Committee
2. Each permanent committee shall consist of a chairperson and his/her appointees.
3. Any permanent committee may be dissolved or an additional permanent committee established only through 2/3 vote of members voting at any annual meeting of the Society.
4. A report summarizing the work and findings of each permanent committee must be made by the chair on or before the annual meeting of the Society.

### B. Chairpersons of Permanent Committees

1. Nominations:
  - a. Nominations for chair of each permanent committee 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.
  - b. Additional nominations may be made from the floor of this meeting.
  - c. Only a member of the Society, whose consent has been secured, shall be eligible for chair.
2. Election:
  - a. The election of chairpersons of permanent committees shall be held at the annual meeting prior to the election of officers and directors.
  - b. A majority of votes cast shall constitute an election.
3. Term of Office:

The term of office for chair of each permanent committee shall be three years.
4. Vacancies:

Vacancies will be filled by a person elected by the executive committee following procedures outlined in Article VI B. This person will serve until the next annual meeting of the Society.
5. Duties:

The chair (or delegate) of each permanent committee is also a member of the executive committee and performs duties as outlined in Article XI B of these bylaws.

## Article XIII: 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 chairperson and such other persons as may be appointed by the executive committee.
- B. Nominations for Chairpersons:
  1. Nominations for chairpersons 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 chairperson.
- C. Election of Chairpersons:
  1. The election of chairpersons 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 Chairpersons:

The chairperson of each standing committee shall submit a plan of work to the executive committee for approval.
- E. Vacancies of Chairs:

If a vacancy occurs in the chair 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 committees except the committee on nominations.

## Article XIV: AMENDMENTS

These bylaws 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.

# VGS BUSINESS & NEWS

## TREASURER'S ANNUAL REPORT

Vermont Geological Society - Treasurer's Report

January 1, 1989

Balance as of 1/1/88 \$1972.62

### Income

Interest	114.54	
Dues	1425.00	
Publication Sales	751.20	
Reimbursement for GSA Booth	<u>77.62</u>	
	2368.36	<u>2368.36</u>
		4340.98

### Expenses

Postage	310.37	
Printing/Copying	1485.13	
Office Supplies	341.42	
GSA Booth	155.25	
Meeting Expenses	25.00	
Engraving	3.00	
Doll Student Prizes	50.00	
P.O. Box Rent	28.00	
Phone	9.49	
Money Order	<u>1.00</u>	
	2408.66	<u>2408.66</u>
		1932.32

Balance as of 12/31/88

Respectfully submitted,

David S. Westerman  
Treasurer

### NEW MEMBERS

At this time we want to welcome two new members,:

Julie Hackbarth, Plainfield, VT  
Don Maynard, Montpelier, VT

### NEWS ABOUT MEMBERS

Charles Fox has moved to Silver City, NM. Hope you are enjoying your retirement there, Charlie!

Paul Washington will be teaching Bennington College's first geology course this semester as a sabbatical replacement in the physics department.

## MEET THE NEW OFFICERS

Our new Vice President, Andy Raiford, is from New Orleans, Louisiana where he received a B.S. in Geology Geophysics from Tulane University. He did additional graduate work at University of Mass. while teaching at Castleton State College. He is an Associate Professor at C.S.C. and has been there since 1970 with the exception of a short, three semester period of employment in Houston with Gulf Research and Development and Conoco exploration.

His main interest has been developing and maintaining a geology program at C.S.C., where 2 or 3 majors graduate each year. Andy has been taking short courses in groundwater with the goal of adding a basic hydrology course to the program.

Jack Drake is the new Secretary. He came to UVM's Geology Department in the fall of 1970. His B.S. degree was earned at Dennison in 1962 and an M.S. and Ph.D. from Harvard in 1968. That was followed by two years of postdoctoral work with lunar samples.

Jack's geological interests are mineralogy and geochemistry with a specific interest in environmental geochemistry with applications to Lake Champlain. Of outdoor sports, sailing and fishing are among his favorites.

## PUBLIC ISSUES

### Report of the Chair

1989 promises to be a more active year for the Public Issues Committee and all members are welcome to contribute. Brett Cox has agreed to serve as chair during my year as president; however, I will coordinate VGS efforts to track and comment on bills during the early part of the legislative session.

Bills expected to be considered this session, but which have not at this writing been published, will relate to low-level radioactive waste; water well / monitor well regulation; and property transfer / site assessment.

Early in January, Representative Herbert O'Brien (R) of Stowe introduced a bill (H.43) that proposes to establish a mechanism for certifying hydrologists and soil scientists who design soil-based sewage treatment and disposal systems. Rep. O'Brien is a registered professional engineer (mechanical) and an engineering consultant employed by the State of Vermont, Department of State Buildings. A copy of the bill can be found following this report.

Bill H.43 is, at this writing, in the House Natural Resources Committee (see below). In order to gather and communicate to the Legislature our Society's opinion / position on this bill, I would like to hear your views as soon as possible. As the time frame for action and pathways through committees can be difficult to track, another effective action would be for you to directly contact the chair or members of committees considering the bill, or your own legislator. I have provided a list of the House Natural Resources Committee below, but you can find out much more about the current status of any bill by contacting the Legislative Council (828-2228) or the Lt. Governor's office (828-2226), both in Montpelier.

Please call or write if you have questions.

Eric Lapp  
VGS, P.O. Box 304  
Montpelier, VT 05602  
Day: 244-8702  
Night: 223-0328

House Natural Resources Committee

Timothy Burke (D) Putney (chair)  
Charles Ross (D) Hinesburg (clerk)  
Alice Emmons (D) Springfield  
Alice Bassett (D) Burlington  
Doris Lingelbach (D) Thetford  
Herbert O'Brien (R) Stowe  
Harry Pickering, Sr. (D) Arlington  
Igne Schaefer (R) Colchester  
Ann Seibert (D) Norwich  
Carolyn Yarnell (D) Colchester

H.43

Introduced by Representative O'Brien of Stowe  
Subject: Conservation; ground water; certification of hydrologists and soil scientists.

Statement of purpose: This bill proposes to establish a mechanism for certifying hydrogeologists and soil scientists who design soil-based systems for sewage treatment and disposal.

AN ACT RELATING TO CERTIFICATION OF  
HYDROGEOLOGISTS AND SOIL SCIENTISTS

It is hereby enacted by the General Assembly of the State of Vermont:

Sec. 1. 10 V.S.A. chapter 48, subchapter 4 is designated "Subchapter 5. Ground Water Cause of Action"

Section 2. 10 V.S.A. chapter 48, subchapter 4 is added to read: Subchapter 4. Certification of Hydrogeologists and Soil Scientists

§1405. DEFINITIONS

As used in this subchapter,

(1) "Hydrogeologist" means an individual who has specialized training and experience satisfactory to the department in bedrock geology, glacial geology, geomorphology and ground water hydrology, including well hydraulics and contaminant hydrogeology.

(2) "Soil Scientist" means an individual with specialized training and experience satisfactory to the department in the areas of soil genesis, soil morphology, soil mineralogy, soil physics, soil chemistry and the examination and evaluation of soils for sewage treatment and disposal.

§1406. APPLICATION

An individual who desires to be certified as a hydrologist of soil scientist shall file an application for certification with the department of environmental conservation. Applications shall be in the form required by the department and shall contain the information required by the department.

§1407. CERTIFICATION; RENEWAL

(a) The secretary shall grant certification as a hydrogeologist or soil scientist to individuals who meet the minimum level education and training requirements established by the secretary, by rule.

(b) Certifications issued under this subchapter shall expire on June 30 in odd-numbered years and may be renewed upon payment of the application fee required under 3 V.S.A. §2822.

§1408. DENIAL, REVOCATION OR SUSPENSION OF CERTIFICATION

Certification or renewal of certification may be denied, suspended or revoked, by the secretary on his or her own investigation and motion or upon written complaint of others, if after notice and an opportunity for hearing, the secretary finds that the applicant or certificate holder:

(1) obtained certification through fraud or misrepresentation;

(2) made a false statement in the application for certification or renewal of certification; or

(3) committed gross negligence or incompetency in connection with a hydrogeologic study or specialized soil evaluation performed in connection with a soil-based system designed for sewage treatment and disposal.

Sec. 3. 3 V.S.A. §2822(e)(19) is added to read:

(e) The secretary shall require the following fees to be paid at the time of application for the designated permits and licenses for the fiscal year beginning July 1, 1987. Beginning July 1, 1988 and thereafter, permit and licensing fees shall be set by rule of the secretary which shall be reasonably related to the costs associated with administering the permit programs of the department of environmental conservation. The secretary shall not process an application for which the fee has not been paid. Fees shall be charged to municipalities beginning July 1988 only for those permit fees collected under this subsection in subdivisions (3)(A), (10) and (11) for which a municipality may recover its costs by charging a user fee to those who use the permitted services.

(19) Certification of hydrogeologists and soil scientists under subchapter 4 of chapter 48 of Title 10:

(A) initial certification	\$50.00
(B) renewal	\$25.00

**Vermont Landfill Assessment Program - Status Update**

The Vermont legislature, in 1987, passed a solid waste law which required the State Solid Waste Division to, among other things, perform environmental assessments of landfills in the state. The assessment is primarily geological in nature and will occur at 47 landfills. The work is to mostly be performed by private environmental consulting firms.

In November 1988 the division issued a request for proposal for phase 1 of the assessment, consisting of geological, geophysical, and hydrogeological data collection. The dead-

line for proposals was in early January. The response from the consulting community was very good, with over 100 proposals received from firms throughout Northeastern states.

Currently the technical staff is evaluating the proposals using an objective numerical rating system. The selection process will be completed in time for work to be performed this field season. We anticipate phase 1 work to be completed by the end of the year. An RFP for phase 2 work will be issued by the division later in 1989.

For further information contact me at 244-7831.

Submitted by Alan R. Liptak  
Vermont Solid Waste Division

#### CALL FOR PAPERS - SPRING MEETING

The 16th annual Vermont Geological Society Spring Meeting for the presentation of student research papers will be held APRIL 29, 1989 at Middlebury College. Students from any college or university who are engaged in research on Vermont or Vermont-related geology are encouraged to participate. Undergraduate or graduate students should submit abstracts NO LATER THAN APRIL 8, 1989 to:

Dr. Ray Coish  
Geology - Science Center  
Middlebury College  
Middlebury, VT 05753

Abstracts should be limited to 300 words. Fifteen minutes will be allotted for each talk, followed by a 5 minute question period. The Society awards a cash prize to each of the best undergraduate and graduate papers and the name of the undergraduate winner(s) will be inscribed on the Charles G. Doll Award plaque, which will reside at the student's department until the next spring.

#### FORM FOR JUDGING STUDENT PAPERS

NAME OF SPEAKER: \_\_\_\_\_

	1	2	3	4	5
	WELL BELOW AVERAGE	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	WELL ABOVE AVERAGE
Introduction (How well is the problem stated?)	_____	_____	_____	_____	_____
How well is the solution to the problem stated?	_____	_____	_____	_____	_____
General level and quality of presentation.	_____	_____	_____	_____	_____
How well are visual aids used?	_____	_____	_____	_____	_____
Responses to questions.	_____	_____	_____	_____	_____
				TOTAL	_____
				FINAL SCORE	_____

## GRANT-IN-AID FOR RESEARCH

Although there was no winner of this award at the fall meeting, our "angel" will again offer funds. Announcements will be sent out soon and the deadline for submitted applications is APRIL 14, 1989. Any student who has not had access to the proposal requirements by March 1 should contact David Westerman at Norwich University (802)+485-2337 for a copy of the announcement.

## EXECUTIVE COMMITTEE MINUTES - January 18, 1989

The meeting was called to order at 7:30 PM by president Eric Lapp.

Members attending: Tom Ray, Eric Lapp, Sharon O'Loughlin, Jeanne Detenbeck, Rolfe Stanley, Andy Raiford, Dave Westerman, Jack Drake

## Items of Business:

I. Minutes from the Annual meeting on October 8, 1988 at the Cutter Inn, Burke, VT.

- A. The proposed slate of officers was elected
- B. It was announced that Margaret Ottum received a 2.5 year grant for the development of educational programs and will be in contact with the Society regarding a position for school liason.
- C. Changes in the bylaws as reported in the GMG were approved
- D. No application has been received for the annual grant-in-aid
- E. Field trip participation at the meeting was estimated at 25 persons with approximately 18 members attending
- F. Leslie Malter won the door prize consisting of bound copies of Vermont Geology
- G. The treasurer reported a balance of about \$1800
- H. A hearty "THANK YOU" is extended to Bud and Sandy Ebbett for their efforts in making the day a success.

II. Treasurer's report: The balance at the end of 1988 was \$1932.00. On January 18, 1989, the society had a balance of \$2094.17 which does not include recently received dues. Although there are no new memberships, the sale of Vermont Geology continues at approximately 6 copies per month.

The treasurer's report was accepted as presented.

III. Winter Meeting: The revised schedule is now firm with an excellent program in effect with Dave as convenor. The afternoon schedule is open format and runs from 12:30 to 3:00 followed by an executive committee meeting. Dave will contact dealers regarding potential display of hardware at the meeting. The society will provide lunches for the speakers and will have food available to purchase for other attendees.

## IV. New Business:

- A. Deadline for receipt of material for next GMG is Jan. 27, 1989. This issue will contain seminar schedules for UVM and Middlebury College.

- B. Tentative date for the spring meeting, which will be held at Middlebury this year, is April 29, with the deadline for the preceding GMG on April 8, 1989.
- C. The calendar for remaining events during 1989 can be established at a later date. However dates for the summer and fall meetings should be selected before the spring meeting. The possibility of Chuck Ratte leading a summer field trip focusing on economic mineral deposits was suggested and enthusiastically endorsed. Andy suggested the possibility of having a "hands-on" ground water program for the fall meeting and this was followed with the suggestion of a keynote speaker for this event. Dr. George Pinder, the new dean of Engineering and Mathematics at UVM was mentioned as a potential speaker for the fall meeting. Eric agreed to work on the program for this meeting. A potential date selected was October 8, 1989 which should be one week before NEIGC.
- D. Eric brought to the attention of the executive committee, House bill H.43 which calls for the certification of hydrogeologists and soil scientists. It is currently being discussed in committee and the text of this bill is included in the present issue of the GMG. The executive committee is soliciting input from the membership in order to determine what type of response from the society is appropriate. If the legislative time framework necessitates an immediate response the executive committee endorsed communicating to the legislative committee considering this bill specific questions, factors and concerns which should be addressed.
- E. The executive committee appointed Brett Cox, pending his acceptance, chair of the public issues committee. This was necessitated by the election of Eric, the previous chair, to presidency of our society.
- F. Discussion took place regarding the utilization of society funds. The executive committee agreed to reimburse, subject to executive committee approval, legitimate, society associated expenses such as telephone calls, expenses associated with official representation of the society at regional meetings, transportation, etc. Other possible uses of society funds include subcontracting editorial responsibilities to expedite the preparation of an educational field trip guide or the preparation of another society publication.
- V. The meeting was adjourned at 9:30PM

Respectfully submitted  
Jack Drake, Secretary

## WANTED

Adventurers: Several boat seats available for a 5-day Colorado River/Grand Canyon raft trip from Lee's Ferry to Phantom Ranch/Bright Angel Trail. Hike out to the South Rim. Trip participants include geologists and a naturalist. Pre-trip seminars on geology and natural history being presented in Geology Department, University of Vermont. Cost \$625; dates May 24, 1989 - May 29, 1989, including orientation in Flagstaff, Arizona. For additional information call: Dr. Jack Drake, Geology Department, (802)+656-0244.

## MINERAL OF THE QUARTER

## TITANITE (SPHENE)

The ideal chemical composition of titanite is  $\text{CaTiSiO}_5$ . By analysis it is composed of 28.6% CaO, 40.8%  $\text{TiO}_2$ , 30.1%  $\text{SiO}_2$ .

Physical properties of titanite:

**Crystal structure** is monoclinic, prismatic. It is usually found in crystals with wedge shaped cross section, commonly twinned so that the edge of the crystal shows a sharp reentrant angle. Also in disseminated grains and lamellar masses.

**Color** varies from nearly colorless to yellow to green to brown and black. Iron ions which can replace some of the titanium cause the mineral to be darker in color. As little as one percent of  $\text{Fe}_2\text{O}_3$  in titanite will give it a brown color and more ions of iron will cause the color to become black.

**Luster** is adamantine. Clear yellow-green titanite found in Minas Gerais, Brazil, is cut into gemstones prized for their great brilliance and fire.

**Hardness:** 5 - 5 1/2

**Specific gravity:** 3.45 - 3.55

**Cleavage:** fair, prismatic, **Fracture:** conchoidal  
some parting

Transparent to translucent.

#### Vermont Titanite Location

Take Route 103 to where it crosses the Williams River north of Ludlow. Pull off the road north of the bridge on the east side of 103. Walk down an old road that winds to the west and look in the ledges that outcrop on the north side for a calcite and diopside vein. Along with these minerals you will also find actinolite and pyrite crystals in the calcite. Look for yellow crystals of titanite in this vein. Some titanite crystals 1 1/2 inches long have recently been found at this location. This mineral assemblage is the result of contact metamorphism of dolomitic limestone.

In contrast to this, just across the bridge, on the east side of Route 103, you will find a massive outcrop of silvery mica schist with a high concentration of garnet crystals. This is the site of the old McGurry Garnet mine which worked this source of almandine garnet for the production of garnet paper until put out of business by competition with the richer garnet deposits on Gore Mountain in New York State.

The other crystalline minerals in the sericite schist are massive smoky quartz, clear light blue blades of kyanite, brown narrow prisms of staurolite and black needles of tourmaline. This suite of minerals illustrates its production by high temperature and pressure from acid composition rocks such as shale. The close proximity of such different rock materials seems to point to the fact that faulting is responsible for their juxtaposition.

## STATE GEOLOGIST'S REPORT

Bedrock Geology Mapping Program: This program continues as a Cooperative Geologic Mapping Program with the U.S. Geological Survey. Three 7.5 minute quadrangle maps and preliminary reports were completed by U.S.G.S. personnel during the 1988 field season. These quadrangles were Jamaica, VT, Stratton Mountain, VT, and Sunderland, VT. Vermont counterparts mapping projects with expected completion dates on or before June 30, 1989 are as follows:

- Gilson Mountain 7.5 minute quadrangle
- \*Northfield 7.5 minute quadrangle
  - East Fletcher-Bakersfield area
  - Lincoln massif (South Mountain area)
- \*Winooski River Valley Transect
  - Colchester Brittle Fracture Study
  - Mount Ellen - Appalachian Gap - Stark Mountain area
- \*Readsboro - Heartwellville - Stamford area (completed)
  - Warren - Granville Notch area      Northfield Mountains
  - Rochester (North) area              Rochester (South) area
  - Fayston area                              Roxbury area

Surficial Geology Mapping Program: Two pilot projects have completed preliminary reports and maps. These are:

- \*Pownal 7.5 minute quadrangle and vicinity
- \*Bristol - Starksboro area

Preliminary bedrock and surficial maps and reports indicated by an asterisk (\*) are available for inspection at the Office of the State Geologist in Waterbury.

Topographic Mapping: The U.S. Geological Survey has published 50 new provisional maps for the state of Vermont. These maps are 1:24,000 scale, 7.5 minute quadrangles with elevations and contours in meters. The maps are dated 1986 or 1987. Ten additional maps (for a total of 60) will be available in the coming months. Maps available since the last listing in the Green Mountain Geologist (Winter 1988, vol. 14, no. 4) are:

New 7.5 minute maps      quadrant      previous 15 minute maps

West Burke VT	NW	Burke VT
Burke Mountain VT	SW	Burke VT
Seneca Mountain VT	NE	Burke VT
Gallup Mills VT	SE	Burke VT
Maidstone Lake VT-NH	NW	Guildhall VT-NH
Bloomfield VT-NH	SW	Averill VT-NH

Photorevised mapping (1987 dates) for 12 previously issued, 7.5 minute quadrangles is currently available. These maps are:

Burlington VT	Essex Junction VT	Milton VT
Colchester VT	Georgia Plains VT	Mount Philo VT
East Alburg VT	Highgate Center VT	St. Albans VT
Essex Center VT	Hinesburg VT	St. Albans Bay VT

Publications Account: Storage and sales of the State Geologist's publications (Vermont Geological Survey publications) have now been in place for six months. Total sales receipts to date are approximately \$2500.00. The State Geologist's Office has adjusted the price of its publications in response

to the inventory. Look for special sales and many free copies (with charges only for postage and handling).

Slope Stability Programs: This cooperative program continues with the U.S. Geological Survey. A new 5-year plan calls for site specific monitoring of critical areas known to have active conditions threatening to human life and property. Automatic monitoring equipment has been installed and is recording continuously two rock fall - rock slide sites at Smuggler's Notch. Detailed mapping and computerized analysis is underway in the Clay Brook - Slide Brook areas near the Sugarbush / Sugarbush North Ski Resorts.

Charles Ratte  
Vermont State Geologist

## PROJECT GEO

Johnson State College, under the direction of Margaret Ottum, has received NSF funding for Project GEO: Earth Science in the Middle Grades. It will reach 25 4th, 5th and 6th grade teachers in each year of the two year grant. Teachers will be chosen from the six northern Vermont counties. They will attend a two week graduate level Earth Science / Curriculum Development course at JSC during the summer prior to their participation. A support network from JSC, Vermont Department of Education, the State Geologist's Office, VNRC and our VGS will provide follow-up visits in the schools to help with further development of the individual curriculum.

## MEETINGS

### GROUNDWATER QUALITY SEMINAR

This Seminar is designed to help Vermont citizens to gain a deeper understanding of Vermont's groundwater resources and how they work. The seminar will be repeated around the state in five locations. It is cosponsored by Vermont Association of Realtors, Vermont Natural Resources Council, Vermont Department of Environmental Conservation, and Vermont Department of Health. Four sessions which postdate this GMG will be held as follows:

FEB 6 at Putney in Putney, VT  
FEB 27 at The Landing, Newport, VT  
MAR 6 at Vermont Technical College, Randolph, VT  
MAR 13 in Memorial Lounge, Waterman Building,  
University of Vermont, Burlington, VT.

Registration fee is \$10.00. Registration is at 8:00AM.  
Topics and speakers are:

Welcome and Introductory Remarks: William Spitzel;  
Groundwater: Overview and Strategies for Protection: David Butterfield or Michael B. Smith; Wellhead Protection Program: Winslow Ladue or Ken Bannister; and Radon: Sources, Screening and Mitigation: Raymond McCandless or Paul Clemons.

- FEB Well Driller's Workshop.  
11 Vermont Technical College. Call Jim Ashley at 244-5638 for details.
- FEB VGS WINTER MEETING  
18 "The Use of Computers in Geology", at Norwich University. See page 3 for details.
- APR Tentative date for VGS SPRING MEETING.  
29 Presentation of student research papers at Middlebury.
- OCT Tentative date for VGS FALL MEETING.  
7 This is still in the planning stage, look for more details in spring GMG.

UNIVERSITY OF VERMONT GEOLOGY DEPARTMENT  
SPRING SEMINAR SERIES

Lectures will be held in Perkins Building, Room 200 at 4:00PM. For further information contact Barry Doolan, Geology Department, UVM, Burlington, VT 05405, (802)+656-0248.

- FEB \*Thomas Hearns, Cornell University:  
6 Crustal Tomography: CATscan of the Earth.
- FEB \*Walter Pitman, Lamont-Doherty Oceanographic Inst.:  
13 The effect of sea-level changes on the stratigraphic development of passive continental margins.
- FEB Charlotte Mehrtens, University of Vermont:  
27 Comparison of the Cambrian Platform Sequence in Scotland and Vermont.
- MAR Barry Doolan, University of Vermont:  
6 The Role of Backfolding in the Taconide Zone of the Quebec-Vermont Appalachians.
- MAR Rolfe Stanley, University of Vermont:  
13 The Taconic Suture in New England.
- MAR 20 Hugh Rose, MS Thesis Proposal
- APR\* Ann Hawley, MS Thesis Proposal
- APR \*Marie Morisawa, State University of New York,  
10 Binghamton: The Impact of Humans on Rivers.

Quebec-Vermont Appalachian Workshop\*

- APR 14 7:30PM Opening reception and registration in Kalkin Hall, UVM Campus.
- APR 15 8-12:00 and 1-5:00 Workshop sessions and poster presentations in Kalkin Hall.  
7:30 Social gathering and poster sessions.
- APR 16 8:30-12:00 Workshop sessions and concluding remarks.
- APR 17 Steve Gurney, MS Thesis proposal
- MAY 1 Adam Balogh, MS Thesis Proposal  
\*These lectures are part of the UVM Geology Department Spring Colloquium Series for 1989.

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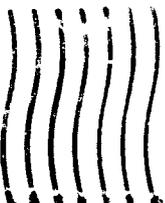
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