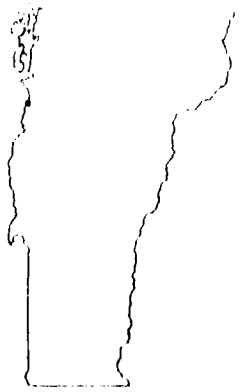
THE

GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

SPRING 1990 VOLUME 17 NUMBER 1

Vermont Geological Society 17th Annual

PRESENTATION OF STUDENT PAPERS

SATURDAY, APRIL 28, 1990, 8:30 AM

UNIVERSITY OF VERMONT

Room 004 Kalkin Building

Directions: Kalkin Building lies immediately behind the Perkins Geology Building. Both are accessed from Colchester Ave. Room 004 is one of the basement rooms. The parking lot immediately in front of Perkins Hall will be available for VGS members attending the meeting.

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PRESIDENT'S NOTE

The winter meeting, threatened by a severe winter storm, started an hour late and had some members arriving later in the morning. In spite of this, all speakers were able to get through to provide us with an exciting day of discovery and a look at tomorrow.

The program included representatives of government, academia, and the private sector. Each speaker shared his or her summary of what is happening in the field and offered a view of what might be the tasks and opportunities of the immediate future. It was most evident that there is much more activity in geology in Vermont today as opposed to ten years ago and that this activity would continue to expand.

We now turn our attention to the spring meeting to be held at UVM on April 28. The spring meeting provides an opportunity for geology students to present papers to an audience of their peers, faculty and earth science professionals. The students would appreciate your attendance.

The Executive Committee will meet during lunch on the twenty eighth, to work on details of the summer field trip. The fall field trip and meeting, and the earth science directory is one way to support our goal to extend and strengthen lines of communication and to encourage widespread participation in earth science events and opportunities within Vermont.

As always, we solicit your suggestions and requests and we look forward to seeing you at UVM on the twenty eighth.

Sincerely,

Andrew V. Raiford
Castleton State College

SPRING MEETING PROGRAM

April 28, 1990, Rm. 004 Kalkin Building, University of Vermont

8:30 Coffee

9:00 Matthew Burnham: *Surface hydrology of marine and lacustrine sediments in southern Lake Champlain*

9:20 Scott R. Calhoun: *Bottom morphology of Lake Champlain between Schuyler Island and the Four Brothers Islands*

9:40 Karen M. Hyde: *Internal cycling of phosphorus in Malletts Bay, Lake Champlain, Vermont*

10:00 Gretchen I. Van Houten: *Heavy mineral analysis of the Rockledge Formation in Highgate Springs and Georgia, Vermont*

10:20 Coffee Break

10:40 Ellen R. Butzel: *Plagioclase and white-mica relations in metamorphosed pelitic rocks from the Mt. Abraham--Mt. Grant area, Central Vermont*

11:00 Robert E. Forsberg: *Garnet zoning constraints on temperature and pressure development of pelitic schists in the Mt. Abraham area of Central Vermont*

11:20 Alison B. Bramley: *Geochemical trends in greenstones across the Green Mountains*

11:40 James Schick: *Geochemistry and tectonic significance of greenstones from the Twin Islands Group and Fire Lake pendant, British Columbia*

12:00 Lunch: VGS Executive Committee Meeting

1:20 Andrew Kepes: *A non-text approach to teaching basic principles of earth science for high school students*

1:40 Elizabeth R. Hinckley: *Downstream fining and geomorphic controls of potential salmonid spawning gravels, New Haven River, Vermont*

2:00 Stephen M. Hopkins: *The frequency and patterns of gravel tracer movement in the New Haven River, New Haven, Vermont*

SPRING MEETING ABSTRACTS

GEOCHEMICAL TRENDS IN GREENSTONES ACROSS THE GREEN MOUNTAINS

Bramley, Alison B., Department of Geology, Middlebury College, Middlebury, VT 05753

Major and trace element analyses of five Paleozoic greenstone bodies in a west to east transect across the Green Mountain Anticlinorium at the approximate latitude of Middlebury was completed to determine tectonic environments and a potential root zone of the Taconic allochthons.

The five greenstone bodies are from the Hoosac and Pinney Hollow Formations of the Camels Hump Group, and the Stowe Formation. These metavolcanics have undergone greenschist facies metamorphism that altered the mineralogy to a chlorite-albite-actinolite-epidote assemblage. In spite of this alteration, the greenstones can be classified chemically as basalts.

Geographic variations in chemistry include west to east decreases in TiO_2, Zr, V, and Zr/Y with exception of one sample area in the Pinney Hollow Formation. The variations can be explained through magmatic processes and changing tectonic environments across the west to east transect. Partial melting and fractionation trends, and source heterogeneities are indicated on Zr vs. TiO_2, Zr vs. Cr, Zr vs. Y, and Zr vs Zr/Y diagrams. Variations in tectonic environments across the west to east transect are indicated by Ti-Zr-Y, Zr vs. Zr/Y, Ti vs. V, and Y vs. Cr discriminant diagrams. The Hoosac Formation greenstones farthest west are within-plate basalts. The Stowe Formation samples farthest east are similar to mid-ocean ridge basalts. Between these formations, the Pinney Hollow greenstones have variable chemistries indicating a mixture of tectonic environments.

Geochemical comparison of the basalts at the base of the Taconic allochthons with the greenstones in this study and other metavolcanics in Vermont tentatively indicates a Taconic root zone in the western part of the Hoosac Formation.

The within-plate basalts of the Hoosac Formation and possibly the Taconic basalts were formed during early stage rifting of the proto-North American continent. The Pinney Hollow metavolcanics formed as the rifting progressed and proto-oceanic crust formed. The Stowe Formation greenstones could have been produced during later stage rifting or at an oceanic spreading center. Subsequent closing of the proto-Atlantic ocean produced the Taconic orogeny causing metamorphism and deformation of these greenstones and the emplacement of the Taconic allochthons.

SURFACE HYDROLOGY OF MARINE AND LACUSTRINE SEDIMENTS IN SOUTHERN LAKE CHAMPLAIN

Burnham, Matthew, Department of Geology, Middlebury College,Middlebury, VT 05753

In the fall of 1989, a detailed bathymetric study was conducted in the Thompson's Bay area of Lake Champlain, VT. Over a period of five days, 121 transects were completed covering an area of approximately 7 square kilometers. A vertical reflection echo-sounder (28 kHz) was utilized to determine the upper sediment structure of this region. The distribution of marine and lacustrine sediments were obtained using the acoustical character of the returned signals. Within Thompson's Point, recent Lake Champlain sediments and Champlain Sea sediments can be identified. Localized areas of Lake Vermont sediments are also recognizable. Other noticeable structures imaged by the echo-sounder were ancient sediment filled channels and river deltas attributed to Otter Creek and Little Otter Creek.

Three dimensional morphology maps of the recent Lake Champlain sediments and of the upper Champlain Sea sediments were obtained from the data. This allowed for a volume estimate of Lake Champlain sediments for the Thompson's Bay area.

PLAGIOCLASE AND WHITE-MICA RELATIONS IN METAMORPHOSED PELITIC ROCKS FROM THE MT ABRAHAM GRANT AREA, CENTRAL VERMONT

Butzel, Ellen R., Department of Geology, Middlebury College, Middlebury, VT 05753

Detailed petrology of samples from the Cambrian Underhill Formation, and the Cambrian Mt. Abraham schist near Mt. Grant and Mt. Abraham show evidence of a higher grade metamorphism than that shown by the regional assemblages. The study areas lie along the Green Mountain Anticlinorium and within the Lincoln Mountain, Vermont 7.5' quadrangle. Two of the study areas are located along the western flank (Battell trail), and the summit of Mt. Abraham. The third locality is on the western flank of Mt. Grant.

All of the samples contain abundant quartz and white mica, and accessory tourmaline, zircon, and allanite. The sample assemblages from the Mt. Abraham schist at the Mt. Grant and Mt. Abraham study areas are:

chlorite+chloritoid+ilmenite±kyanite±epidote
chlorite+chloritoid+ilmenite+garnet

The sample assemblages from the Underhill Formation at the Mt. Abraham study area are:

biotite+garnet+chlorite+ilmenite
chlorite+plagioclase+ilmenite+magnetite
garnet+chlorite+plagioclase+ilmenite

Plagioclase and white micas from the Battell locality were singled out for compositional and textural analysis. Microprobe analyses reveal two coexisting white micas, and plagioclase compositions from An_6 to An_{17}. Coexisting Albite and Oligoclase have been identified by optical properties. White mica compositions fall between K/(K+Na) values of 0.1 to 0.08 for paragonite and 0.7 to 0.88 for muscovite.

White mica pairs fitted to the solvus of Eugster, Albee, Thompson, and Waldbaum (1972) give a temperature of metamorphism between 450 and 550 °C. Some plagioclase compositions fall within the peristerite gap and seem to represent averages of finely intergrown phases. Optically, the intergrown regions appear to be exsolution lamellae and suggest original plagioclase growth at temperatures above the peristerite solvus (500-550 °C). These hypersolvus plagioclase may be relicts of an earlier, higher grade metamorphism.

BOTTOM MORPHOLOGY OF LAKE CHAMPLAIN BETWEEN SCHUYLER ISLAND AND THE FOUR BROTHERS ISLANDS

Calhoun, R. Scott, Department of Geology, Middlebury College, Middlebury, Vt 05753.

A high-resolution, dual frequency (100 kHz and 500 kHz) side scan sonar system was used to survey ~40 square kilometers of the bottom of central Lake Champlain. The survey region lies to the east and south of Schuyler Island and to the north and west of The Four Brothers Islands. The side scan sonar distinguished two types of sediment: mud and sand/gravel. Four different bottom morphologies were recorded and mapped: outcrops, sediment waves, pockmarks, and features inferred to be sediment furrows. The outcrops have strikes oriented generally north-south, but the dips vary between east and west. The sediment waves range in wavelength from just a few tens of centimeters to several meters. The pockmarks (depressions) vary in diameter from around 20 centimeters to almost 8 meters. However, the vast majority are under two meters across. The furrows are located in the southeast region of the survey due north of The Four Brothers Islands. Each furrow in the group is separated from the others by as much as twenty meters. They are 1.5 meters deep and may be up to 600 meters long. Oriented northeast-southwest, they are evidence of a strong and stable bottom current in that region.

GARNET ZONING CONSTRAINTS ON TEMPERATURE AND PRESSURE DEVELOPMENT OF PELITIC SCHISTS IN THE MT. ABRAHAM AREA, LINCOLN VERMONT

Forsberg, Robert E., Department of Geology, Middlebury College, Middlebury, VT 05753

Garnets in pelitic schists from the Mt. Abraham region in Lincoln, Vermont have zoning patterns which shed light on the history of metamorphism of the rock. The rocks investigated lie in an area called the Prospect Rock Belt which lies on

the western flank of Mt Abraham on the east side of the Green Mountain Anticlinorium.

The mineral assemblages for the rocks in this area include garnet + white mica + chlorite + quartz ± chloritoid ± biotite ± ilmenites ± magnetite ± graphite. AFM relations have been modelled based on the mineral assemblages and used to deduce mineral reactions. Minerals were analyzed by electron microprobe and the zoning patterns in garnet were investigated by backscattered-electron imaging and microprobe traverses. Ternary plots of Alm-Pyr-Spess and Alm-Pyr-Gross components of garnets indicate definite zoning patterns of decreasing Mn and Ca from core to rim with a slight increase in Mg in garnets from the Underhill Formation. Rims of the garnets are estimated to have equilibrated at 6 kbar and 500 °C, consistent with Albee's (1968) estimation, by application of Garnet-Biotite exchange thermometry and the Garnet-Plagioclase-Muscovite-Quartz net transfer barometer of Hodges and Crowley (1985). Gibbs method models of garnet growth constrain the P-T-t paths of the garnets. Conditions at the core at the beginning of its growth were approximately 5.5 kbar and 450 °C and garnet grew during a clockwise, prograde path towards higher pressure and temperature.

This metamorphism probably occurred in pre-Silurian time and was the result of the collision of the continental margin with the arc-trench complex during the Taconian orogeny. No evidence of the 2-stage metamorphic histories reported by Karabinos (1984) in similar rocks from the Jamaica, VT area has been found.

DOWNSTREAM FINING AND GEOMORPHIC CONTROLS OF POTENTIAL SALMONID SPAWNING GRAVELS, NEW HAVEN RIVER, VERMONT.

Hinckley, Elizabeth R. Middlebury College Geology Department, Middlebury, Vermont 05753

Downstream fining of sediment in river systems has been well-documented. This study evaluated (1) the rate of downstream fining of two sedimentologic environments, riffle crests and gravel bars, and (2) the relation between downstream fining and suitability of surface and substrate material as salmonid spawning habitat. Gravel bars and related terrace deposits have been studied by geomorphologists and sedimentologists; riffle crests are common salmonid spawning habitats. The sediment size characteristics of riffle crests can affect egg survival and alevin emergence rates.

The New Haven River has a drainage area of 145 km^2 within the Green Mountains and Champlain lowlands of central Vermont; this gravel-bed river supports a resident salmonid population. Surface and subsurface samples were collected from gravel bars and riffle crests along an 18-km reach extending from the Green Mountain front to the confluence with Otter Creek. Subsurface size distributions were determined by standard sieving techniques. Surface layer size distributions were compiled from pebble count data and sieve analysis.

The mean grain size, D_{50}, of gravel-bar surface layers decreased from 92 mm to 31 mm in the downstream direction. The D_{50} of gravel bar subsurface material fined from 32 mm to 11.5 mm. Mean grain sizes for riffle crests ranged from

greater than 64 mm to 14.5 mm for surface samples, and 30 mm to 7.25 mm for subsurface samples. Surface layers were consistently coarser than subsurface samples. The D_{50} of surface layers fined at a greater rate than subsurface samples in both riffle crests and gravel bars. Riffle crest subsurface samples were finer than gravel bars.

Each site was assessed for its limitations to spawning success, based on published criteria. Point bars and riffle crests at the one study reach within the Green Mountains were only marginally conducive to spawning because the gravels are too coarse. Bars and riffle crests downstream from Pleistocene beach sands, kame terraces and related meltwater deposits have high percentages of fine material which may restrict egg survival and alevin emergence rates. Highest concentrations of fines in gravel deposits were in the middle of the study reach and may be related to local hydraulic conditions.

THE FREQUENCY AND PATTERNS OF GRAVEL TRACER MOVEMENT IN THE NEW HAVEN RIVER, NEW HAVEN, VERMONT

Hopkins, Stephen M., Geology Department,Middlebury College, Middlebury, Vermont, 05753

A tracer study was carried out on a reach of the New Haven River in central Vermont to study the patterns and frequency of gravel movement in gravel-bed rivers. Due to environmental concerns, such as salmonid spawning habitat, gravel-transport information is important in understanding local flow alterations and their effect on channel morphology.

Seven high flows occurred over the study period. Two flows were sufficient to cause entrainment and the threshold of entrainment is estimated at 85-90 percent of bankfull discharge. Typically, tracers moved in size-selective manner. However, hiding effects created by smaller particles being shielded from streamflow by adjacent larger particles also affected the sizes of particles entrained during the study. Another factor controlling entrainment of each particle is its location relative to the spatial distribution of gravel bars. Many retrieved particles showed a tendency to move in "jumps" from bar to bar during successive entraining flows. After entrainment, the particles were often deposited in environments of a similar size.

The frequency of movement established bankfull as the discharge which entrains the majority of the channel and is responsible for the majority of the bed morphologies. The gravel-bar portion of the bed is maintained by flows of about 85-90 percent of bankfull. Thus, different elements of the stream channel are maintained by flows of different frequency. Cross-sections of gravel bars showed no significant aggradation or degradation during the period of study. Although gravel moved through these bars, the forms remained approximately in place.

INTERNAL CYCLING OF PHOSPHORUS IN MALLETTS BAY, LAKE CHAMPLAIN, VERMONT

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

An investigation of the internal phosphorus cycle was made on Malletts Bay, Lake Champlain during the summer of 1988. The objective of this study was to assess the time-depth distribution 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 decomposition of particulate material within the water column or released from sediments during periods of oxygen depletion.

Eleven sets of water samples were collected at a single station in outer Malletts Bay from June 6 to November 1, 1988. At nine depths the following parameters were measured: temperature; dissolved oxygen; pH; total suspended solids; particulate and soluble Fe and Mn; and total, total particulate, acid soluble, NaOH extractable, and soluble-reactive phosphorus.

The results of this investigation indicate the following: 1) Thermal stratification of Malletts Bay did not lead to complete oxygen depletion in bottom waters. Minimum dissolved oxygen values, measured on 9/7/88, were 0.85 mg/l. 2) Dissolved oxygen in the hypolimnion did not diminish to values which would cause the concomitant release of P and Fe, but this probably did occur at the sediment-water interface. 3) Particulate Fe and Mn, and total P (mostly soluble nonreactive P) increased in the hypolimnion with low concentrations of dissolved oxygen. 4) During particle mixing in late summer, particulate Mn and Fe increased in the thermocline while total P decreased in the hypolimnion. 5) Dissolved Fe was never detected while dissolved Mn increased with time and depth. 6) Soluble nonreactive P increased in the epilimnion and showed peaks at the boundary between the epilimnion and metalimnion. 7) After turnover there was an increase in particulate P, Fe, and Mn in the water column. This is interpreted as a resuspension of particles from shear velocity at the bottom. The conclusions lead to a P cycle dominated by soluble nonreactive P being introduced into the bay both externally from allochthonous sources and internally from the sediments during the summer.

A NON-TEXT APPROACH TO TEACHING BASIC PRINCIPLES OF EARTH SCIENCE FOR HIGH SCHOOL STUDENTS.

Kepes, Andrew, Middlebury College, Geology Department, Middlebury, Vermont 05753

High school teachers are continually faced with the problem of keeping a student's interest on the subject being taught. A set of three multi-media teaching units have been developed in an attempt to address this problem. These teaching units are designed to be hands on and visually oriented. Students will study units based upon narrowly focused study areas.

Each unit will have a regional focus upon which all areas to be studied will be referenced. These foci include: Hawaii, for the study of igneous processes; the Grand Canyon, for sedimentary processes; and local Vermont marble mining for the study of metamorphic processes. Classes are composed of a combination of visual aids, hands-on work, and discussion. Visual aids include videos, slides, maps, and overheads. Hands-on work concentrates on rock samples, demonstrations, and experiments. Discussion will be part of every unit, students will be encouraged to ask questions and raise points of interest at any point within the unit. Other basic geological skills will be incorporated within each unit. Units contain map work, rock work, and the learning of geologic terminology.

The goal of these units is to be more interesting and personal so that students will become more involved with the learning process and obtain a better understanding of the topics covered. By exposing students to real-life examples the material covered will become less abstract and more easily understood. It is the hope that students' interest will be maintained by increasing the interactive nature of the learning process.

GEOCHEMISTRY AND TECTONIC SIGNIFICANCE OF GREENSTONES FROM THE TWIN ISLANDS GROUP AND FIRE LAKE PENDANT, BRITISH COLUMBIA

Schick, James, Department of Geology, Middlebury College, Middlebury, Vermont, 05753

The western margin of North America records a history of crustal shortening that began in late Triassic to early Cretaceous. Most of the margin consists of various allocthonous terranes. The history of accretion has been obscured by complex faulting and intrusion. Part of the Coast Plutonic Complex is a collection of assemblages between two major accreted terranes, Super Terranes I and II. Two of the assemblages are the Cretaceous Fire Lake Pendant and Triassic Twin Islands Group. Their stratigraphy indicates that they are both parts of island arc complexes. Although it is suspected that they evolved from the same island arc system, the Twin Islands Group has been thrust over the younger Fire Lake Pendant obscuring their relationship. To further assess their affiliation, basaltic greenstones from both sequences were collected and their chemical composition determined. The two sequences have low absolute Ti, Zr, and Zr/Y ratio which is typical of island arc volcanics. Compositions within each group are uniform. The chemical fingerprints between assemblages consistently overlap on plots of Zr/Y vs Ti, V vs Ti and have identical calc-alkaline trends on an AFM diagram. Chemical variation among samples can be explained by fractionation of olivine, clinopyroxene and magnetite within the magma chamber. Based on these results, the Fire Lake Pendant and the Twin Islands Group appear to be from the same arc complex. There is chemical overlap with analysis of what are believed to be correlative basalts collected by others just to the north and south. However, the Twin Islands Group and Fire Lake Pendant are significantly depleted in Ti, Zr and Y relative to volcanics from Super Terrane I. These differences imply a separate source of magmatism for Super Terrane I.

CHARLES G. DOLL (1898-1990)

The award we give each year to the best undergraduate paper presented at the Annual Spring Meeting of the Society is the Charles G. Doll award in recognition of Dr. Doll's many contributions to the advancement of Vermont geology. This year's award is a special tribute to the memory of Charles Doll who passed away last month at the age of 92.

Charles Doll was fascinated with geology; his enthusiasm of Vermont geology, in particular, never waned even in his last years. Readers of the *Green Mountain Geologist* and *Vermont Geology* have seen regularly submitted articles by Charlie. Charles Doll's contributions are to the point, and based on field observations of geologic phenomena which spanned geologic time and disciplines. More fundamental than the wide variety of geological research efforts that Charlie conducted (fossil preservation, paleo-environments, geophysical anomalies, mineralogy, structure, and geologic history of Vermont to name a few) was an incessant curiosity. His love of the natural world and the continued attempts to understand geologic features of all scales earned the respect and admiration of his many friends both in and out of the geologic community.

Those of you who did not know Charles Doll should understand that he was a strong supporter of alternative viewpoints. Charlie was not afraid to pose questions which did not follow accepted theory and was ready to enthusiastically defend his positions with detailed description and interpretation. Neither in speech nor in writing did he strengthen his position by negative arguments of the views of others. He did, however, make it clear to friends the adverse effects of close mindedness in the sciences.

For undergraduates who are presenting your first research projects to the Society at the Spring Meeting, you should remember the long and distinguished career of Charles Doll. May your future endeavors, both in geology and in other aspects of life, be enlivened with the excitement of natural curiosity and by enthusiastic communication of your views presented clearly, openly and without malice of the interpretations of others. These endeavors will be your tribute to Charlie Doll.

To all friends, associates, and students of Charles Doll please note the announcement of a celebration service in his honor scheduled for May 5, 1990 at the Ira Allen Chapel on the University of Vermont Campus (see below). At the request of the family, a research fund for geology students at the University of Vermont is being established in the name of Charles G. Doll. Those wishing to contribute should do so by contacting Judith Hannah, Chair, Department of Geology, University of Vermont, Burlington, VT 05405 (802 656-0245).

Barry Doolan
Department of Geology
University of Vermont

THE CHARLES DOLL CELEBRATION SERVICE AT THE UNIVERSITY OF VERMONT

On May 5, 1990, a celebration of the life of Charles Doll will take place at the Ira Allen Chapel at the University of Vermont. The service will start at 3:00 PM. with playing of some of Charlie's favorite music. Friends and family, joined with past associates, former students and colleagues will share and enjoy the joyous experiences of Charlie's life. The service will be followed by a reception downstairs in the Martin Luther King Lounge of the Billings Student Center. All are invited. Those wishing to participate in the service, or those with questions regarding the celebration should contact me at your earliest convenience.

Barry Doolan
Department of Geology
University of Vermont
Burlington, VT 05405
802 656-0248 (office)
802 849-6344 (home)

VERMONT GEOLOGICAL SOCIETY BUSINESS AND NEWS

New Members

We want to welcome the following new members who have joined the Vermont Geological Society since the last issue of this newsletter was published:

Jennifer L. Brown	Evergreen, CO
Bernard J. Franks	Burlington, VT
Samuel R. Haydock	Burlington, VT
Patricia L. Manley	Middlebury, VT
Layne W. Millington	Castleton, VT
Peter Partch	Fair Haven, VT
James E. Purdy	Rutland, VT
Sally A. Tacy	Hinesburg, VT
Tracey L. Ziegler	Richmond, VT

Library of the American Museum of Natural History-New York

Dues Report

As of March 10, 1990, 119 out of our 170 members (70%) have paid their dues.

Future Field Trips and Meetings

There will be a lunch-time meeting of the Executive Committee during the April 28 meeting. All members are invited. A second Executive Committee meeting is scheduled for Thursday, June 14, 7 PM at Norwich University to discuss the summer and fall field trips.

Plans are underway for the summer and fall field trips and details will be published as soon as plans are finalized. Tentative dates for these trips are August 18 and October 20 respectively.

Editorial Notes

Off with the Old

After 10 years as editor, I have resigned. It is time for some new ideas, and we are fortunate to have Stephen Wright interested to step in and carry on. My hope is that the membership will give him the same satisfying cooperation that they have given me (and maybe even a little more!). I look forward to seeing my VGS friends at meetings the same as always, but in between times, I can be found at Quiltsmith in Shelburne a lot of the time.

Take Care,
Jeane Detenbeck

In with the New

With this issue the *Green Mountain Geologist* becomes a fully desktop-published journal. I would like to encourage all contributors to the *Green Mountain Geologist* to submit both a paper copy and a computer disk of news notes, abstracts, reports, and articles. Members using IBM PC's and clones should send files formatted as "Text Only", preferably on the low-density 5.25 inch disks. I can also transfer text and data from the IBM 3.5 inch disks, although at present it is less convenient. This document is currently being formatted using MS-WORD on a Macintosh computer. I can read text files in most of the commonly used word processing programs. If you have any questions, save the file as "Text Only". In addition to the printed word, graphics such as maps, figures, graphs, tables, and soon photographs will all be much easier to publish in this journal or in *Vermont Geology*. I look forward to your comments and suggestions regarding changes you would like to see in the format and content of of the *Green Mountain Geologist*.

Stephen Wright
Cambridge, VT

Executive Committee Minutes

February 24, 1990 Meeting
Castleton State College

Present: Brad Jordan, Tom Ray, Stephen Wright, Andy Raiford, Jeanne Detenbeck

The meeting was held at Castleton College after the winter meeting. No secretary's minutes. Brad reported a balance of $3,109.77. 55% of dues have been paid for 1990.

Old Business

The spring meeting is set for April 28 at UVM. Andy needs to appoint judges.

Tom Ray presented Executive Committee Expense Reimbursement guidelines (see next section). They answer the need to reimburse personal expenses incurred especially by officers, and complies with the vote of the membership.

New Business

Jeanne Detenbeck tendered her resignation as editor and chair of the publications/editorial committee. Stephen Wright was appointed as the editor and chair of the publications/editorial committee. Arlen Bloodworth was appointed chair of the geological education committee.

Andy would like to see us sponsor a forum for the fall meeting, such as on landfills. VGS could bring the "fringes" of geologists together for an informational meeting. We are the logical organization in the state. Our goals would be:

1) To bring ground water consultants, academics, teachers, and planners together for a common purpose;
2) To show and interest in "fringe" diversity; and
3) To have a steering committee to plan this forum comprised of all "fringes".

Executive committee will meet again on March 29 at Norwich, 7--9 PM, to discuss the summer field trip, fall program, new forum, and nominations committee.

The next two publications of Vermont Geology were discussed. We are to publish a second edition of the Quebec-Vermont Appalachian Workshop of 1989 and a field trip guide for non-professionals especially for the use of teachers.

The treasurer will provide address labels for the editor in the future.

It was moved and approved that a $2.00 page charge be paid to the editor for publications which he produces.

Meeting adjourned at 4:50 PM.

Respectfully Submitted,
Jeanne Detenbeck

March 29, 1990 Meeting
Norwich University

Present: Andy Raiford, Chris Stone, Brad Jordan, Tom Ray, Stephen Wright, Arlen Bloodworth, Jeanne Detenbeck, Susan Williford

The meeting was held at Norwich University, commencing at 7 PM.

Old Business

Andy Raiford requested names of potential judges for the student papers at the Spring Meeting, April 28, 1990. Several possible people were mentioned and will be asked.

New Business

A lunch meeting was scheduled for the Executive Committee during the Spring meeting.

Future planning: Ideas for the summer meeting field trip and for the fall meeting field trip and speaker were discussed. Tentative dates were suggested for the summer meeting---August 18, 1990 and the fall meeting---October 20, 1990.

Several names were suggested for the nominating committee.

Andy Raiford proposed that the VGS assemble a "Directory of Geoscientists in Vermont". Everyone agreed; Brad Jordan, Stephen Wright, and Arlen Bloodworth will begin work on the directory.

A review of the goals of VGS followed.

Meeting adjourned at 8:50 PM.

Respectfully submitted,
Susan L. Williford

Executive Committee Expense Reimbursement Guidelines

I. Statement of Authority and Intent

The membership of the Vermont Geological Society voted on 7 October 1988 to reimburse expenses of the Executive Committee members. The V.G.S. Board of Directors was asked to draft the details of this policy. The intent is to refund expenses such as mileage, telephone calls, postage, and other expenditures specifically approved by a majority vote of the Board of Directors. Refund requests must be in writing and be well documented. The Vermont Geological Society is a small nonprofit scientific organization with a modest treasury. Society officers serve as volunteers. This policy is implemented to lessen the financial hardship that particularly active officers may incur. The policy goes into effect as of 8 October 1988.

II. Eligibility

Members of the V.G.S. Executive Committee or their designees.

III. Eligible Expenses

1) Mileage will be paid at the rate of $0.25 per mile for trips to Executive Committee meetings and other official trips approved by the President.
2) Postal Expenses will be repaid at cost.
3) Telephone calls will be repaid at cost.

4) Other Expenses: Expenses not discussed above may be submitted to the Treasurer. The Treasurer will approve reimbursement on a case by case basis.

IV. Application for Expense Reimbursement

Expense claims should be sent to the Treasurer in writing not more than four times a year. Claims will be itemized and will include a brief description. Committee members are encouraged to check with the President prior to activities for which significant expenses may be claimed.

V. Guideline Review

The Board of Directors will retain oversight authority on all facets of the expense reimbursement policy. the Treasurer is to maintain detailed records and is to include the total amount of expense reimbursement as a line item in the yearly budget summary. These guidelines will be periodically reviewed and modified as deemed necessary by the Board of Directors.

MEETINGS & SEMINARS

April 20 Dr. Jay Namson, Davis and Namson Consulting Geologists: *Active fold and thrust belt of the California Coast Ranges and Western Transverse Ranges: Implications for earthquake hazards, oil exploration, and lithospheric kinematics.* 4 PM, 200 Perkins Geology Building, University of Vermont.

April 20 Dr. Christopher Chalokwe, Auburn University: *Magma dynamics in the Duluth Complex, northern Minnesota.* 12:15 PM, Rm. 420 Science Center, Middlebury College.

April 28 Vermont Geological Society Spring Meeting
Presentation of Student Papers

August 18 Tentative Date VGS Summer Field Trip

October 20 Tentative Date VGS Fall Field Trip

GREEN MOUNTAIN GEOLOGIST
VERMONT GEOLOGICAL SOCIETY
P.O. 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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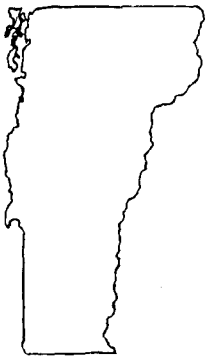

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

SUMMER 1990 VOLUME 17 NUMBER 2

Vermont Geological Society's

ANNUAL SUMMER FIELD TRIP

SATURDAY, AUGUST 18, 1990

RIFT AND COLLISIONAL HISTORY OF THE SOUTHERN LINCOLN MASSIF

Marian Warren

Meet in East Middlebury Village Center 9:00 Am
Details inside

Table of Contents

PRESIDENT'S NOTE

The VGS is entering the fourth quarter of year 1990 with the summer field trip in August. Marian Warren will lead the group through her thesis area in the Green Mountains, near East Middlebury, Vermont. This is an important section and certainly one location that has provided new insights for the new state geologic map. Details of the trip can be found on the following page.

On October 20, the annual meeting and banquet will be held. Dr. George Davis, geologist and new president of the University of Vermont, has been invited to attend the field trip and to speak during the banquet. George Davis is the author of a best selling textbook on structural geology.

Already, looking back on the year, we can see some agenda objectives moving along to completion and others not quite off the block. One initiative that members will participate in soon is the comprehensive directory of Geoscience personnel in Vermont. A questionnaire will be coming your way soon. We hope to include as many people and their areas of interest as we can in order to make the directory a valuable resource for teachers, consultants, business and professional people, and those in the government sector.

Volume 6 of Vermont Geology has been published (see note on page 9) and the Geological Education Committee will be putting together a field trip volume for public school teachers (Vermont Geology No. 7). Meanwhile the nominating committee is preparing a slate of officers for your approval in October.

Sincerely,

Andrew V. Raiford
Castleton State College

SUMMER FIELD TRIP

RIFT AND COLLISIONAL HISTORY OF THE SOUTHERN LINCOLN MASSIF

Saturday August 18, 1990

Marian J. Warren
Department of Geology, University of Vermont
Burlington, Vermont 05405-0122

Meeting Place and Schedule

We will meet in the East Middlebury Village center at 9 AM and pool cars. The church parking lot will be available for cars that are not used during the day. There will not be any easy place to buy food during the trip so participants are urged to bring their lunch and plenty of liquids with them. Bug dope or some other method of fending off the mosquitos is highly recommended. Swimming holes are part of the itinerary so bring suits and towels.

A SUMMARY OF THE BEDROCK GEOLOGY OF THE SOUTHERN LINCOLN MASSIF AND RIFT-CLASTIC COVER SEQUENCE, CENTRAL VERMONT

Marian J. Warren

Introduction: The Lincoln massif, located in west-central Vermont, marks the northernmost exposure of para-autochthonous basement within western New England/southern Québec. The basement is critically situated between shelf sediments of the Champlain Valley foreland and slope-rise sediments of the pre-Silurian hinterland. Detailed (1:12,000) mapping across the massif contributes to an improved understanding of regional structural and stratigraphic relationships in several ways: 1) the pre-shelf stratigraphy of the western sequence can be correlated with a similar stratigraphy and assemblage of facies within the basal sequence east of the massif; 2) it is possible to construct models for both the early rift history and later Taconian deformation of the Lincoln massif and its rift-clastic cover within the context of plate tectonic theory; 3) more detailed mapping reveals relationships among rock units in the area which affect the map pattern and which help to resolve several ambiguities shown on earlier maps.

The present study is located immediately west of the topographic crest of the Green Mountains, approximately 80 km (50 miles) southeast of Burlington. Middle Proterozoic gneissic rocks of the Lincoln massif are exposed in two north-south trending doubly-plunging anticlines; basement rocks are unconformably, and locally tectonically, overlain by eastern and western metasedimentary cover sequences. A syncline of western cover rocks separates

the two basement anticlines in the southern part of the area. Evidence of three, perhaps four, orogenic events are recorded in the Lincoln massif and its cover sequence: The Grenville orogeny; the opening of the Iapetus (proto-Atlantic) ocean, and the Taconian orogeny. Although the effects of the Acadian orogeny are believed to be minimal, Acadian deformation may have contributed to some of the late structures observed in this area.

Middle Proterozoic rocks: The basement of the southern Lincoln massif is composed largely of felsic gneisses of varying texture and composition. Basement lithologies are more difficult to identify and compare toward the east, as greater Taconian deformation has progressively destroyed older textures and mineral assemblages. The **western Lincoln massif** (WLM) is characterized by 1) abundant fine- to medium-grained "granular" or weakly foliated quartz-plagioclase-microcline-(biotite) granitic gneiss, grading into; 2) well-foliated quartz-plagioclase-chlorite-epidote-biotite-microcline gneiss; 3) distinct microcline augen gneiss characterized by 1-5 cm kspar megacrysts within a fine-grained quartz-biotite-plag-(kspar) matrix; 4) coarse-grained microcline-biotite-quartz megacrystic gneiss; 5) thin quartzites with associated discontinuous dolostones or dolomitic marbles; and 6) minor amounts of chlorite-(biotite)-epidote-quartz-(actinolite)-(plagioclase)-calcite schistose amphibolite. Finally, outcrops of blue quartzite are observed at a few localities.

The **eastern Lincoln massif** (ELM) is characterized primarily by a coarse-grained white quartz-plagioclase-(biotite) gneiss, often intruded by tourmaline-bearing pegmatite. A sequence of microcline megacrystic gneiss, foliated qtz-plag-bio gneiss and gneissic plagioclase-hornblende amphibolite is observed within the eastern part of the ELM. Contacts between these lithologies are sharp. Finally, sheared (Paleozoic deformation) mafic schist or amphibolite, perhaps similar to the amphibolite of the WLM, is observed along the eastern boundary of the ELM. Similar suites of basement rocks, with a similar distribution across the massif, are also reported in the northern Lincoln massif, where they are generally better exposed (DelloRusso and Stanley, 1986).

These gneissic rocks experienced, at least locally, granulite facies metamorphism and accompanying deformation during the Grenville orogeny. The Grenville fabric is everywhere best identified by the presence of biotite, either as anastomosing seams, or as a compositional layering within quartzo-feldspathic gneisses; the Paleozoic fabric is characterized by muscovite and quartz in the retrograded felsic basement. At two localities in this study area, and also within the northern Lincoln massif (DelloRusso and Stanley, 1986), the biotite Grenville fabric is clearly truncated by the basement-cover unconformity, while the Paleozoic muscovite fabric cuts the unconformity. The Grenville fabric typically strikes NW-SE, in contrast to the more N-S striking Paleozoic fabrics. Only one Grenville fabric has been recognized at any one locality in the basement. However, East/West-plunging isoclinal folds, believed to be of Grenville age, are coplanar with this fabric at two localitites in the WLM; it is not clear whether the fabric is deformed by or axial planar to these folds.

Post-Grenville dikes: Several-meter-wide intermediate to mafic dikes or mafic schists are observed within the basement. Their contacts cut the Grenville fabric, but appear to be truncated by the basement-cover unconformity. The Paleozoic lineation is clearly observed in amphiboles in hand sample. At one locality within the WLM, igneous textures (phenocrysts) are still preserved, although the mineralogy is significantly altered. These features are similar to those of mafic dikes interpreted by DelloRusso and Stanley (1986) as possible rift-volcanic feeder dikes. In addition, several mafic rocks previously mapped as retrograded Grenville amphibolite are located along newly identified Paleozoic fault zones which also involve coarse clastics of the lower cover sequence; these rocks should also be considered as volcaniclastic material of possible younger age.

Rift-clastic cover: The rift-clastic cover sequences, although deformed by folds and faults, represent coherent sequences deposited on the basement of the Lincoln massif. To the west, this sequence includes all lithologies beneath the Cheshire Quartzite, whereas to the east, a similar rift-clastic sequence has been mapped east to the topographic crest of the Green Mountains. The syncline of cover rocks separating the two basement anticlines contains lithologies of the western sequence.

Despite differences in style of deformation and metamorphic grade, it is possible to match several lithologies from west to east across the massif. The eastern and western sequences are both characterized by a lower section of coarse arkosic wackes and pebble conglomerates which commonly contain cobble or boulder conglomerates at or near the base. The "basal" conglomerates are of two distinct types: 1) a more common, typically clast-supported cobble conglomerate with well-rounded, well-sorted clasts of quartzite, several gneissic lithologies, and metasediments, and 2) a less common, matrix-supported conglomerate containing a small percentage of poorly sorted, subrounded boulders of the immediately underlying basement lithology. The type 2) matrix is variable, consisting of interfingering arkosic wackes, mafic schist (interpreted as possible volcaniclastic sediment), and layered dolostone or dolomitic marble.

The wackes become poorer in biotite and feldspar and richer in quartz and muscovite upwards in the section, although the local heterogeneity of these deposits should be stressed. The wackes grade upwards into A) finer-grained meta-sandstone, meta-siltstone, laminated quartz-muscovite schist, or quartzite (west) or laminated quartz-muscovite schist or micaceous quartzite (east). This fine-grained quartz-rich material grades upward into B) phyllite with silty laminae or locally graphitic dark phyllite (west) and aluminous schist commonly characterized by quartz laminae, also locally graphitic (east). An important feature within both eastern and western sequences is the presence of lenses of dolostone and/or overlying dolostone-clast/rounded quartz pebble to cobble conglomerates at several stratigraphic horizons, with a major horizon between the quartzose and more fine-grained, aluminous metasediments.

Relative amounts of feldspars, quartz, and micas change vertically, but do not appear to change significantly from west to east.

Significance of the basement-cover unconformity: In several locations, the "basal" boulder conglomerate does not rest directly on basement, but instead overlies discontinuous lenses of relatively well-sorted sandy quartzite or wacke meters to tens of meters thick. This lithology commonly contains volcaniclastic material. Clasts of similar fine-grained sandy material are found within the overlying conglomerates and wackes, indicating recycling of cover lithologies. Mafic dikes in the basement are truncated by the unconformity, and there is no apparent preservation of actual metavolcanic flows (greenstones) in the rocks immediately overlying the Lincoln massif. These observations suggest that rift-related erosion of the massif and its initial rift-clastic or pre-rift cover took place before deposition of the currently preserved sequence, which is itself characterized by evidence for periodic erosion.

Paleozoic deformation: The field area is characterized by a metamorphic and strain gradient which increases from west to east. Detailed mapping at 1:12,000 has shown that the ELM is in fact primarily a ductile shear zone of imbricated wackes, schists, and boulder conglomerates. This conclusion is in marked contrast to the interpretation of the geologic map of Vermont (Doll and others, 1961). Imbrication has occurred on a scale of meters to hundreds of meters within a zone one to two kilometers wide. Mylonitic fabric is pervasive within the basement slivers, and is observed progressively to overprint the earlier Grenville fabric toward fault contacts.

The ductile faults of the eastern "massif" are interpreted to have developed initially as ductile shears along the limbs of minor folds associated with the eastern basement anticline. This deformation was probably preceded and accompanied by multiple "phases" of continuous deformation within the more ductile and earlier-affected cover further to the east. Continued strain is interpreted to have partitioned along the basement-cover contact in response to mechanical "buffering" by the developing rigid basement structure. Severe flattening of the massif in the hinge region produced an anastomosing system of ductile shear zones and minor imbrication of basement and cover along faults of both synthetic and antithetic senses of motion. Along the eastern limb of the massif, simple shear was a greater component of strain, due to a steeply east-dipping zone of rheologic contrast. Strain in the eastern cover was locally concentrated along this contact, resulting in local detachment of cover from basement.

The eastern "massif" and its immediate eastern cover, of biotite to garnet grade, was subsequently juxtaposed along its overturned western limb against the less ductilely deformed, primarily chlorite grade syncline of cover rocks which separates the ELM from WLM. Material west of this boundary, including basement of the WLM, is characterized by a much simpler strain style, documented by 1) the development of a bedding-parallel schistosity; 2) a

pervasive schistosity axial planar to the large-scale folds; and 3) sporadically developed late cleavage(s). Tight folds, rather than faults, characterize the western rocks, although late- to post-metamorphic faults are more commonly observed than previously documented (DelloRusso and Stanley, 1986).

The late stages of deformation were characterized by out-of-sequence thrusting immediately east of the ELM when flattening in the eastern massif and westward-younging thrusts in the western massif (Warren, 1989), were not able to efficiently accommodate strain. The westward-younging structures are probably associated with motion on the Champlain thrust (Stanley, 1988), and may be, in part, Acadian.

Several conclusions of this study, germane to the overall geologic history of this region, are 1) although poorly exposed, basement rocks reveal relationships similar to those in the northern Lincoln massif; Grenville lithologic packages exist in this region at or beyond the scale of the entire Lincoln massif; 2) the rift-clastic cover rocks immediately overlying the Lincoln massif represent sedimentation which post-dates initial rifting in this region and which was not characterized by dramatic subsidence or volcanism; 3) the rift-clastic sequence east and north of the massif reflect a basin characterized by much greater subsidence; 4) the ELM behaved as a rigid mechanical buttress between the highly deformed eastern cover and the "protected" rocks of the WLM and western cover sequence during collision-stage Taconian deformation, but was forced to accommodate significant strain via ductile deformation; 5) despite the contrast in structural style, however, comparison of eastern and western rift-clastic rocks, coupled with structural analysis, suggest that tectonic shortening across the Lincoln massif as a whole is limited to less than 20 km; 6) occurrence of coarsest rift-clastic rocks and possible rift-volcanic dikes along the major Taconian fault zones suggests that some of the Taconian structures may result from reactivation of rift-related structures; 7) the Taconian foreland-hinterland boundary corresponds well at this latitude to an earlier rift-related "hinge zone" which separated unsubsided from attenuated continental crust.

MISSING ABSTRACT: SPRING 1990 MEETING

HEAVY MINERAL ANALYSIS OF THE ROCKLEDGE FROMATION IN HIGHGATE SPRINGS AND GEORGIA, VERMONT

Van Houten, Gretchen I., Department of Geology, University of Vermont, Burlington, VT 05405

The Rockledge Formation is an Upper Cambrian unit located in northwestern Vermont. The rocks collected for this research project are from Rockledge outcrops in Highgate Springs and Georgia Vermont. The Rockledge Formation consists of sedimentary facies that represent high and low density turbidity currents. This research project originally began as an effort to find conodonts within the Rockledge at these two areas. None were found in this unit which

suggests that the rock is older than the first appearance of the conodonts (older than the Trempealeauan stage or 540 million years before the present).

The next step was to analyze the residue of the rock sample to try and identify the source rock on the ancient carbonate platform. The residue was found to consist of quartz, feldspar, dolomite, and accessory minerals. The most abundant accessory minerals were opaque grains, most of which appear to be hematite. The remainder of the accessory mineral suite is being compared to other suites of rock, for example the Rugg Brook Formation. These suites are similar in age and when compared to Rockledge will help us to determine if the two units were derived from the same platform material.

VERMONT GEOLOGICAL SOCIETY BUSINESS AND NEWS

New Members

We want to welcome the following new members who have joined the Vermont Geological Society since the last issue of this newsletter was published:

Robert P. Ackert, Jr.	Waterville, VT
Rachel M. Barker	Arlington, VT
Kent S. Koptiuch	Essex Junction, VT

Is there a red dot on your address label?

No you don't win a prize, but its my way of reminding you to pay your back dues. If you have a red half-circle on your label it means that the treasurer's records show that you still owe your 1990 dues. If you have a red dot it means that you still owe for both 1989 and 1990 and will be dropped from the membership list at the end of the year.

Geoscience Directory for Vermont

The Vermont Geological Society plans to put together a geoscience directory for Vermont and surrounding regions. We would like to include as many Earth Science personnel, companies, organizations and educational institutions as we can, and intend for this to be used as a guide for those persons seeking geological information or services in Vermont. If you wish to be included in the directory, please return the questionnaire as soon as possible. Also, if you know of other people or institutions who may wish to be included, please distribute a copy of the questionnaire to them so that they may respond directly.

Future Field Trips and Meetings

An Executive Committee meeting is scheduled for Thursday, September 6, 7 PM at Norwich University to discuss the fall field trip and meeting, the Vermont Geoscience Directory, and the winter program. The fall field trip is tentatively scheduled for October 20.

The 1993 or 1994 meeting of the Northeast section of the Geological Society of America will likely be in Burlington pending approval of the conference facilities available. Rolfe Stanley and Barry Doolan have tentatively agreed to organize this conference and have requested that the Vermont Geological Society help sponser the event. There will be ample opportunities for members to help out.

Editor's Notes

Vermont Geology: Volume 6
The Québec–Vermont Appalachian Workshop
Editors: Maurice Colpron and Barry Doolan

The collection of expanded abstracts that accompanied the Québec–Vermont Appalachian Workshop in April 1989 has been reissued as Vermont Geology: Volume 6. Unlike many abstract volumes, the 26 short papers and accompanying figures presented here are sufficiently detailed to serve as valuable references for those interested in the Québec–Vermont section of the Appalachians. The volume is organized into five sections. The first two sections focus on the rift history and depositional setting of the northern Appalachian orogen prior to the Taconic orogeny (I Evolution of the Ancient North American Margin in the Québec Reentrant, II Terranes outboard of the ancient North American Margin). The third and fourth sections address the style and sequence of deformation associated with formation of the orogen (III Destruction of a passive margin I: Evolution of the Québec/Northern Vermont Orogen, IV Destruction of a Passive Margin II: New developments in the Vermont Appalachians). The fifth section presents results and discusses problems encountered using geochemical and geochronological techniques to study the orogen (V Geochemistry and Geochronology in the Vermont-Québec orogen).

Vermont Geology: Volume 6 and other publications of the Society can be ordered by contacting the treasurer, Brad Jordan, at our Montpelier address.

Recycled Paper

With this issue of the Green Mountain Geologist and Volume 7 of Vermont Geology all publications of the Society will be printed on recycled paper (defined here as having at least 50% recycled fibre) whenever possible. Although our use of paper is relatively small, we feel that our use of recycled paper will encourage

our printers to regularly stock and use recycled as opposed to virgin paper. Currently the price of recycled paper is 10–20% more than paper made of virgin fibre. We do not anticipate the need to increase memberships fees to cover this cost.

Stephen Wright, Editor
Cambridge, VT

STATE GEOLOGIST'S REPORT

Charles A. Ratté
Vermont State Geologist

New Legislation

On June 16, 1990 Governor Kunin signed S. 339 into law creating the Division of Geology and Mineral Resources within the Agency of Natural Resources. This is the first enabling legislation that officially establishes a geological organization in Vermont State Government. A State Geologist was first appointed by Public Act #12 in 1844 with the specific duty to conduct a geological and mineralogical survey of the State. Over the years that "duty" grew into an "organization" — the Vermont Geological Survey. However, the Survey had never been sanctioned by the legislature. Various duties and responsibilities were assigned to the State Geologist in legislation that harkens back to those early years including the duty and title of Curator of the Cabinet. The "Cabinet" of geological and natural history specimens was destroyed in the 1927 flood, but the title lingered on. The new legislation has modernized the duties and responsibilities of the State Geologist and the new Division of Geology and Mineral Resources. The title of State Geologist is retained and the State Geologist will also be Director of the new Division. This official recognition of geology and mineral resources as an integral and important part of Vermont's natural resource heritage is a significant step forward in strengthening the progress of geological work in the state.

No. 245: AN ACT RELATING TO A DIVISION OF GEOLOGY AND MINERAL RESOURCES (S. 339)

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

3 V.S.A. Sec. 2802 (a) (7) is added to read:
(7) the division of geology and mineral resources

3 V.S.A. Sec. 2879 is added to read:
Sec. 2879: DIVISION OF GEOLOGY AND MINERAL RESOURCES

The division of geology and mineral resources is created. It shall be administered by a director who shall be the state geologist.

10 V.S.A. Sec. 101 is amended to read:

Sec. 101. *DIVISION OF GEOLOGY AND MINERAL RESOURCES: DUTIES*

The division of geology and mineral resources shall:

(1) Conduct surveys and research related to the geology, mineral resources and topography of the state.

(2) Give aid and advice as may be possible relating to the development and working of rock or mineral deposits suitable for building, road making, and economic or other purposes.

(3) Provide information and education to government, industry, other institutions and organizations, and to citizens regarding the geology, mineral resources and topography of the state.

(4) Provide technical information and advice regarding the management of mineral resources on state-owned lands, and cooperate where possible by providing geologic expertise and advice to persons conducting regulatory programs for the state.

(5) Provide geological services for the natural gas and oil resources board.

(6) Maintain records of old and new information relating to the geology, mineral resources and topography of the state and make public new information resulting from research and field studies conducted by or for the division. Certain information provided by the mineral industries of the state may be held in confidential status at the industries' request and used only for purposes and in a manner permitted by the industry.

(7) Prepare and publish reports on the geology, mineral resources, and topography of the state.

10 V.S.A. Sec. 103 is amended to read:

Sec. 103 *CONTRACTS*; MAPS

(a) For the purpose of *maintaining* the *geologic, mineral resource and* topographic *surveys* of this state, the *division of geology and mineral resources may contract with agencies or departments* of the United States *government,* for such work *as may be required, including* the methods of its execution and the order in which the *mapping, research* and *other* surveys of the different parts of the state shall be completed; provided that *the agencies or departments with whom the division enters into a contract under this section* shall agree to expend annually, on the part of the United

States, upon such work a sum equal to *or greater than* that made annually available by this state for *these purposes.*

(b) *All maps and other products shall conform to the highest quality and standards established by this state and the participating federal agency. All maps shall be made adaptable to the most modern techniques of production, reproduction, and display.*

10 V.S.A. Sec. 104 is amended to read:

Sec. 104. EXPENDITURE OF MONEYS

The moneys annually available for the purposes of section 103 of this title shall be expended by the state in accordance with the provisions of that section and *relevant federal* regulations

REPEALS

3 V.S.A. Sec. 2877 (c) (state geologist), 10 V.S.A. Sec. 102 (records), and No. 228 of the Acts of 1963 (limit on expenditures) are repealed.

TRANSITIONS PROVISION

Notwithstanding the repeal of 3 V.S.A. Sec. 2877 (c), the position of state geologist shall continue to be an exempt position as long as the person in that office on the effective date of this act remains in office. Thereafter, the position of state geologist shall be a classified position.

Approved: 16 June 1990

Division of Radioactive Waste Management

The State Geologist has recently accepted the responsibility of supervisor of the new Division of Radioactive Waste Management in the Agency of Natural Resources. This new duty extends the State Geologist's responsibilities into the regulatory arena and provides eight new permanent positions to conduct the program.

State Bedrock and Surficial Geology Mapping Programs

The U.S. Geological Survey has approved continued support for the Vermont state-wide bedrock and surficial mapping program in 1990. This jointly funded program is part of the nationwide geologic mapping effort sponsored by U.S.G.S. called COGEOMAP, Cooperative Geologic Mapping Project. Vermont has participated in COGEOMAP since its inception in 1985.

A summary of geologic mapping completed during 1989 and 1990 will appear in the Fall *Green Mountain Geologist.*

Topographic Mapping

The National Mapping Division of the U.S. Geological Survey indicated in its progress map published in April 1990 that all of the 7.5' mapping has been

published for the State of Vermont. The Vermont--U.S.G.S. cooperative topographic mapping program will now concentrate on:

1) Conversion of the 7.5 x 15 minute, 1:25,000 scale metric maps to the 7.5 x 7.5 minute, 1:24,000 scale with standard contours in feet.
2) Developing the computerized mapping process so that up-dates and scale conversions of topographic maps will be relatively easy in an automated system.

New Publications of the Vermont Geological Survey

Mock, Timothy D., 1989, Bedrock Geology of the East Fletcher-Bakersfield area, Northern Vermont; *Vermont Geological Survey Special Bulletin* No. 10, 28 pp., 3 plates.

Mehrtens, Charlotte J. and Borre, Mary A., 1989, Stratigraphy and bedrock geology of parts of the Colchester and Georgia Plains Quadrangles, Northwestern Vermont; *Vermont Geological Survey Special Bulletin* No. 11, 29 pp., 2 plates.

These publications can be ordered from:

Office of the State Geologist
103 South Main St. – Center Building
Waterbury, Vermont 05676

MINERAL OF THE QUARTER
SMOKY QUARTZ

Ethel Schuele

Characteristics:

Formula	SiO_2
Color	Light grey to brownish grey and black
Hardness	7
Specific Gravity	2.65
Crystal Form	Hexagonal, usually tips are not prisms
Fracture	Conchoidal
Cleavage	None
Luster	Glassy

The Vermont location featured this month is in Bolton Valley near the ski village. Take Route 2 to the Bolton Ski Village road. About 3/4 of the way up to the ski area a steep bank on the east side of the road slopes down to Joiner Brook. Groups of smoky quartz crystals can be found in the Brook. The stream sediments also contain gold flakes which can be found by panning.

This type of quartz is colored by exposure to radioactive materials in the vicinity. The unevenness of the dark coloration is a function of the distribution of certain impurities in the quartz crystal lattice. In the case of smoky quartz these impurities would not cause any color effect in the unirradiated crystal at all, but after the crystal has been subjected to radiation the areas holding the impurities will show dark color. the irradiation produces structural defects in the crystal lattice (called color Centers) which will absorb light.

The color centers in many smoky quartz crystals are produced by aluminum ions and lithium ions which have substituted for silicon ions. These cause a change in the electrical balance of the crystal lattice forming the color centers. It turns out that the greater the amount of aluminum ions in the lattice the greater will be the darkening effect in the quartz crystal upon irradiation.

New England Intercollegiate Geological Conference

September 21–22, 1990
La Gaspésie, Québec

The 1990 NEIGC is being held on the Gaspésie Peninsula, Québec and is hosted by the Département de géologie, Univérsité de Montréal. Five field trips are scheduled on both Friday and Saturday. To obtain a description of the field trips and registration materials contact:

NEIGC–90
W.E. Trzcienski, Jr.
Département de géologie
Univérsité de Montréal
C.P. 6128, Succursale A
Montréal, Québec H3C 3J7
Canada

Telephone:
514-343-5977
514-343-6111-2662

Fax:
514-343-5782

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VERMONT GEOLOGICAL SOCIETY
P.O. BOX 304
MONTPELIER, VERMONT 05601

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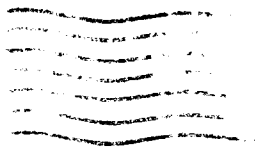

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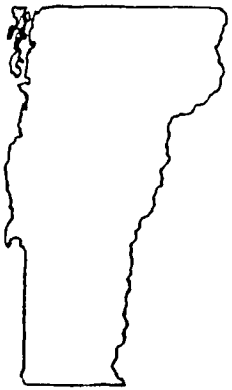

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

FALL 1990 VOLUME 17 NUMBER 3

Vermont Geological Society's Annual Fall Field Trip and Banquet

TACONIC GEOLOGY NEAR FAIR HAVEN, VERMONT

Brewster Baldwin and Andy Raiford

GRANITES OF THE TUSCAN ARCHIPELAGO AS GUIDES TO VERMONT'S DEVONIAN HISTORY

Keynote Address: Dave Westerman

SATURDAY, OCTOBER 20, 1990

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PRESIDENT'S NOTE

I would like to thank everyone for their help and support during the last year. I recommend that everyone take the opportunity to serve as an administrator of the society because you learn about what everyone else is doing and you enjoy working with great people.

I would also like to personally thank Marian Warren for leading a splendid field trip through her thesis area in Ripton in August. Some 20 participants were led from the rift-clastic cover sequence on the west flank of the Lincoln massif, through the massif, and into the highly deformed eastern cover sequence. Spectacular conglomeratic cigars were had by all. We all wish Marian well in the pursuit of her Ph.D. with Ray Price in Kingston, Ontario.

The annual meeting and field trip is scheduled for October 20. The field trip and banquet details are found elsewhere in this bulletin. The agenda for the banquet will be: 1) Dinner, 2) Presentation of awards and the election of a new slate of officers, and 3) Introduction of Dave Westerman and his talk on Italian geology. I am, in behalf of the entire membership, especially pleased to recognize the contributions of both Jeanne Detenbeck and Dave Westerman to the Vermont Geological Society. As editor of the Society Jeanne has produced the first 10 years of *The Green Mountain Geologist* and the first 5 volumes of *Vermont Geology*. The newsletter is what keeps this organization together and Jeanne has almost single-handedly carried out this task. Dave Westerman too has only recently resigned his post as Treasurer of the Society after many years of managing the Society's books, membership, and publication sales. We offer him our sincere thanks for a job well done and greatly look forward to his keynote address during this fall's banquet. I hope as many of you as possible can help us celebrate the work of these two very special members of the Society at the fall banquet.

Sincerely,

Andrew V. Raiford
Castleton State College

FALL FIELD TRIP

Taconic Geology near Fair Haven, Vermont
Saturday October 20, 1990

Brewster Baldwin, Middlebury College, Middlebury , VT
Andy Raiford, Castleton State College, Castleton, VT

Meeting Place

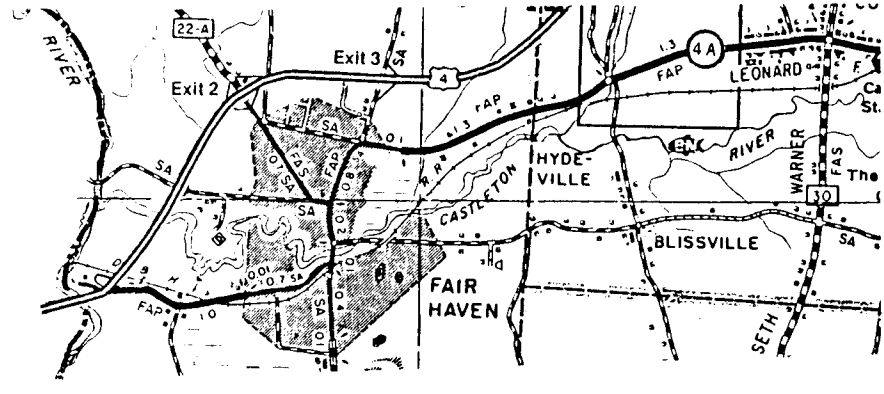
We will meet along the Fair Haven village green at 9:30 AM. Members are encouraged to bring lunches, although food can be purchased in Fair Haven. The last field stop is in the OMYA quarry in Middlebury and will be followed by a tour of the Middlebury College geology department.

Purpose of the Fair Haven Trip

Fair Haven is set in the westernmost and least metamorphosed Taconic slice. An active slate quarry exposes a key to the stratigraphy. A 10-minute walk and a scramble down a 50-foot bank leads to a glacially smoothed outcrop — 330 feet of vertical turbidites and submarine channel conglomerates from the continental shelf. Roadside stops exhibit disruption of limestone beds into "conglomerates", and emplacement-related conglomerates ("wildflysch"), cleavage, folding, and duplex faulting that date to when the deep-water sediments moved onto the platform sequence, dragging along some platform slices.

Field Trip Guides

Brewster Baldwin and Andy Raiford have published a field guide to many of the stops on this trip in Volume 5 of *Vermont Geology*. Reprints of this paper will be available for sale to members on the trip, both as separates and as part of Volume 5.



FALL BANQUET, ANNUAL MEETING, & KEYNOTE ADDRESS

Sugar House Restaurant
Middlebury, Vermont

Place: Sugar House Restaurant, Route 7, Middlebury

The Sugar House Restaurant is located on Route 7, approximately 2 miles north of center Middlebury.

Reservations:

Please drop Brad Jordan a card to the below address or give him a call at Norwich University (485-2310) to give us and the restaurant an idea of how many people will be attending the banquet.

Department of Earth Science
Norwich University
Northfield, VT 05663

5:30–6 PM: Social Hour/Cash Bar

6–7:30 PM: Dinner

A buffet dinner including roast beef, ham, lasagne, fettuccini, potatoes, rolls, salad, and vegetables has been arranged for a cost of $15 per person which includes tax and tip. Payment will be collected at the restaurant.

7:30–8 PM: Business Meeting: Election of new officers

Members not attending the field trip or dinner are welcome to come late to hear Dave Westerman's talk and to participate in the business meeting.

8–9 PM: Dr. David Westerman, Norwich University

Granites of the Tuscan Archipelago as Guides to Vermont's Devonian History

Recent mapping of the Giglio monzogranite off the west coast of north-central Italy indicates that the magma was derived by partial melting of continental crust. The pluton was emplaced by a "ballooning" mechanism which resulted in the formation of an outer layered facies. Following crystallization of the main mass, a younger granite (less than 5 Ma) intruded the core. This activity resulted from extensional tectonics following the collision of the Corsica-Sardinia microplate against the Italian Peninsula during the Oligocene. Understanding this recent tectonic setting may provide insight into the processes of formation of Devonian granites in Vermont.

VERMONT GEOLOGICAL SOCIETY BUSINESS AND NEWS

New Members

We would like to welcome the following people who have joined the society since the last issue of the *GMG:*

Stephen C. Bechtel	Winooski, VT
Elizabeth F Gilbert	Dorset, VT
Howard and Elizabeth Jaffe	Underhill, VT
Nancy Keller	St. Albans, VT
Michele Wendel	Bristol, VT

Geoscience Directory of Vermont

Wouldn't it be nice if: a home or business owner knew where they could turn for an answer to a geology-related problem; a teacher could find someone to tell them the best place to take their class to collect fossils; a legislator could easily find a person to act as a resource to help resolve an issue; or if someone knew where they could go to cut a rock that they collected on their vacation?

That's the purpose of the Geoscience Directory; to be a resource for anyone looking for earth-science-related information, personnel, colleagues, or businesses in Vermont. A request for information was mailed in early September and if you feel that it would be appropriate to include yourself or your place of business in the directory, please respond as soon as possible. Building a comprehensive directory will be a growing process as there will be little chance of including every person or business in the first issue, but as more people find out about the directory, it will become an increasingly important resource for both professionals and the private citizens alike. We will be preparing the first issue of the directory in January, so if you would like to be included, please respond soon!

Brad Jordan
Treasurer

Future Meetings

The annual membership meeting and election of officers will occur during the fall banquet on October 20, 1990. This and all other meetings are open to all members.

Executive Committee Minutes

September 6, 1990
Norwich University

Present: Chris Stone, Susan Williford, Brad Jordan, Eric Lapp, and Stephen Wright

Meeting called to order at 7 PM.

Treasurer's Report: Brad reported that we currently have about $2,500.00 in the bank. A new publications list is being prepared to include all Society publications. A price of $12.00 was set for Volume 6 of *Vermont Geology*. A special thanks to Stephen for his efforts in publishing Volume 6 and as editor of the *GMG*. Brad has purchased a software package which can be used for address labels and for compiling and publishing the Geoscience Directory.

Old Business: The "Call for Information" forms for the *Geoscience Directory of Vermont* were mailed out 9/5/90. Tentative plans were made to publish the first edition of the directory in January 1991.

Fall Field Trip and Annual Meeting ideas were discussed. October 20, 1990 was confirmed as the date for the field trip and meeting. Several proposed awards and honorary memberships were discussed.

New Business: Nominations were put forth to fill positions for VGS officers and Board of Directors for 1990–91.

It was suggested that a separate "Call for Abstracts" for the winter meeting be mailed in late fall, perhaps with the dues notice. No specific theme was set for the winter meeting.

Meeting adjourned at 9 PM.

Respectfully submitted,
Susan L. Williford

Public Issues Update

Strict Water Quality Standards Proposed... Questions Remain on their Need, Implementation, and Cost

At press time (9/18/90) the State Water Resources Board (a small but very powerful "citizens board," not to be confused with the Water Quality Division of the Department of Natural Resources) is in the final stages of considering their

proposed amendments to the Vermont Water Quality Standards. The changes include adoption of very strict numeric criteria (limits) for so-called "toxic pollutants," nitrates, and phosphorous. The toxics include many naturally occurring trace metals which are common in soil, rock, and water. The proposed standards are far stricter than current groundwater and drinking water standards and would attempt to regulate some of these metals to the parts-per-trillion level. Some of the proposed limits are beyond current treatment technologies and laboratory detection limits. The numbers are based on "one-in-a-million" cancer risks and require that almost all of Vermont's surface waters be drinkable.

The Board could not quantify the economic impact of the new standards, but preliminary compliance-cost estimates by state government for municipal sewage treatment plants were described as "enormous." A task group of "The Associated Industries of Vermont," which includes representatives of mineral, stone, and consulting companies, also projects a severe economic impact and continues to study this for the Board.

Protection of health and the environment are undeniably important, but the geologic sources and controls on the background levels of metals in natural waters also need to be determined. The economic impacts (taxpayers, jobs, etc.) must be quantified and alternatives to the proposed numbers should be proposed. The Board held an afternoon and evening public hearing on Sept. 6 in Norwich and Waterbury, respectively, at which citizens, environmental groups, industry, and government all commented. However, the final public comment deadline has been extended to Oct. 22 on the issues of toxic pollutants and the economic impact of the proposed regulations. Interested persons can get more information from: William Bartlett, Executive Officer, Water Resources Board, State Office Building, Montpelier, VT 05602; tel. 802-828-2871.

I would appreciate information from anyone on new bills for the upcoming legislative session as I prepare a summary update for the winter GMG.

During my year-long sabbatical from the public issues/professionalism committee, Chuck Ratté has referred to us a model geologist registration bill which answers many of the previous questions on this issue. Our group will be studying this shortly.

Finally, as always your concerns, comments, questions, and CONTRIBUTIONS are welcome, in fact, REQUESTED.

Eric Lapp
39 1/2 Beaver Pond Rd.
Proctor, VT 05765
Evening Phone: 459-2945

STATE GEOLOGIST'S REPORT

Charles A. Ratté
Vermont State Geologist

Geologic Mapping Progress Reports for 1988 and 1989

The maps on the following pages delineate new geologic mapping that is either in-progress or completed. Many of these mapping projects have been funded by the Vermont Geological Survey as part of the COGEOMAP project which is supported by the U.S. Geological Survey. Individual mapping projects are keyed, by number, to the list below.

1) St. Albans/Highgate Center, Mehrtens, C.J. and Dorsey, R.J., 1987, Vermont Geological Survey Special Bulletin #9.

2) Northern and Eastern Lincoln Massif, DelloRusso, V. and Stanley, R.S., 1986, Vermont Geological Survey Special Bulletin #8.

3) Mt. Grant/South Lincoln, Lapp, E.T. and Stanley, R.S., 1986, Vermont Geological Survey Special Bulletin #7.

4) Mt. Abraham/Lincoln Gap, O'Loughlin, S.B. and Stanley, R.S., 1986, Vermont Geological Survey Special Bulletin #6.

5) Lincoln Area, Tauvers, P., 1982, Vermont Geological Survey Special Bulletin #2.

6) Starksboro Area, DiPietro, J.A., 1983, Vermont Geological Survey Special Bulletin #4.

7) Milton Quadrangle, Dorsey, R.J. and others, 1983, Vermont Geological Survey Special Bulletin #3.

8) Gilson Mountain Area, Doolan, B.L., principal investigator, in progress.

9) East Fletcher–Bakersfield Area, Mock, T.D., 1989, Vermont Geological Survey Special Bulletin #10.

10) Waitsfield to Rochester Area, Stanley, R.S., principal investigator; 10 separate mapping projects undertaken by: Armstrong, T., Cua, A., Haydock, S., Kimball, C., Kraus, J., Prewitt, J., Taylor, S., Walsh, G., Warren, M., and Wright, S.

11) The Winooski River Transect Project, Thompson, P.J., principal investigator.

12) Northfield Quadrangle, Westerman, D.S., principal investigator.

13) Colchester Quadrangle, Lively, G.A., brittle fracture, groundwater project.

14) Starksboro/Hinesburg Area, Franzi, D.A., surficial geology mapping project.

15) Bennington/Pownal and Vicinity, DeSimone, D. and DeThier, D.P., surficial geology and mapping project.

16) Mt. Ellen/Waitsfield Quadrangles, surficial geology, slope stability mapping project, special U.S.G.S./Vermont cooperative project

17) Bennington (east half)/Wilmington (west half), U.S.G.S. mapping, completed 1986 & 1987.

18) Sunderland/Londonderry (south half), U.S.G.S. mapping, completed 1988.

19) Manchester, Londonderry (north half), Wilmington (NE quadrant, U.S.G.S. mapping, completed 1989.

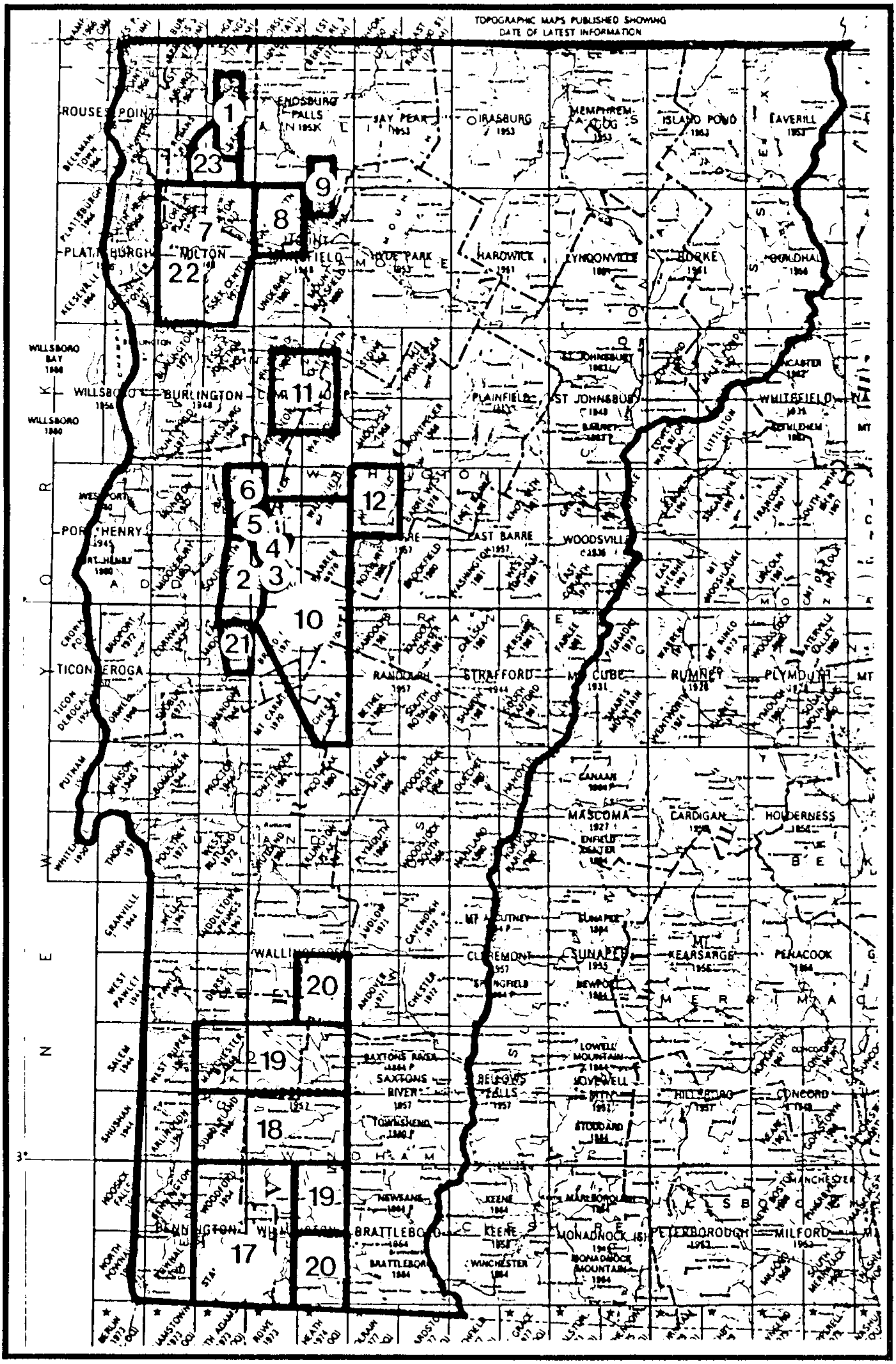
20) Wallingford (SE quadrant)/Wilmington (SE quadrant), U.S.G.S. mapping, planned 1990.

21) East Middlebury, Warren, M., bedrock mapping, in progress.

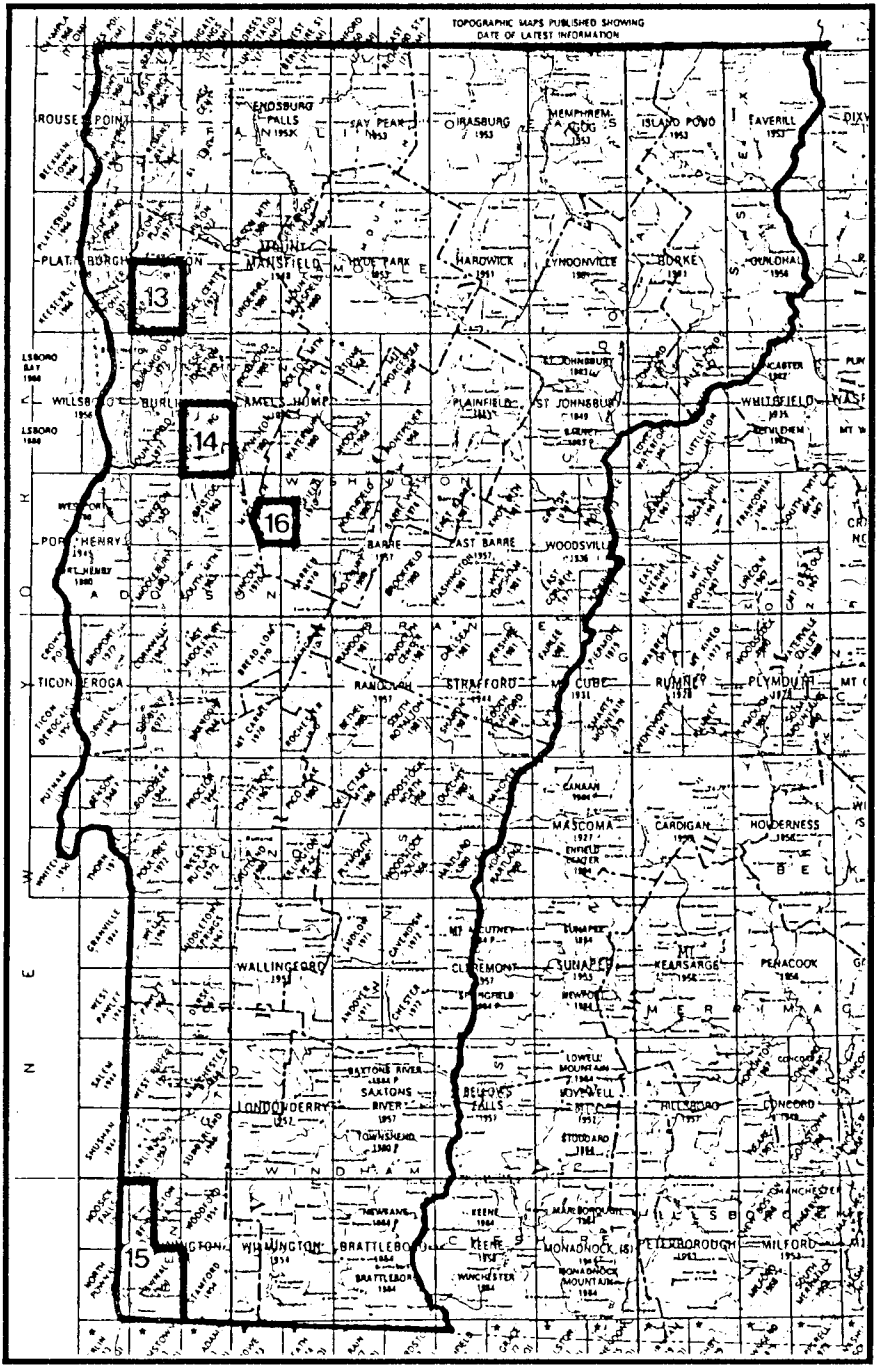
22) Colchester/Georgia Plains, Mehrtens, C.J. and Borre, M.A., 1989, Vermont Geological Survey Special Bulletin #11.

23) St. Albans, Mehrtens, C.J., bedrock mapping in progress.

Recently Completed or In-Progress Bedrock Geologic Mapping



Recently Completed or In-Progress Surficial Geologic Mapping



CHANGES TO WATER WELL DRILLER LICENSING

On July 1, 1990, amendments to Vermont's well and driller licensing law became effective. Actual implementation of licensing provisions, however, will not be fully accomplished until licensing renewal in 1991. Some provisions, such as those related to abandoned wells, will be implemented as soon as the rule-making process is complete, estimated to be March 1991.

Under the new measure, Act 201, four classes of license are established: 1) water well driller, 2) monitoring well driller, 3) well servicer, and 4) pump installer. The water well driller class consists of individuals installing ground-coupled heat pumps or wells to locate, extract, or recharge groundwater. A special license class is established for individuals constructing, servicing, or closing monitoring wells for ground water quality or quantity. The well servicer class includes individuals performing work on existing wells, such as lining, grouting, cleaning, hydrofracing, or closing. Licensed water well drillers may also do well servicing work. Individuals who install or maintain well pump systems are in the pump installer class. Persons holding water well driller or well servicer licenses may also install and maintain well pump systems.

The amendments add a definition of "abandoned well" to clarify the scope of regulation. An abandoned well is defined as a "well or hole whose original purpose and use has been permanently discontinued or which is in such a state of disrepair that the well or hole has the potential for transmitting contaminants into an aquifer or otherwise threatens the public health or safety." The commissioner of the Department of Environmental Conservation is also given explicit authority to order a person to close an abandoned well. Notification and an opportunity for an informal conference must precede issuance of the order.

Several changes were made to the well records requirements. In addition to the Department of Environmental Conservation, well reports must now be provided to the well owner. For monitoring well completion or closure reports, an extension to the normal 60-day filing deadline may be requested. The request must be signed by both the licensee and well owner. The delay may be granted for one or more six-month periods. Additional amendments include a change to the license renewal period from a three-year to a one-year renewal cycle and strengthening of penalty provisions.

Jim Ashley
Vermont Department of
Environmental Conservation

NEW PUBLICATIONS

The Maine Geological Survey has recently published an impressive series of review papers on many facets of Maine geology. *Studies in Maine Geology,* edited by R.D. Tucker and R.G. Marvinney, is a six-volume, 1,000 page series of bulletins commemorating 150 years of state geologic studies in Maine. The six paperback volumes cost $10 per volume and can be ordered from the Maine Geological Survey, State House Station 22, Augusta, ME 04333. Make checks payable to: Treasurer, State of Maine. Interested members can request a more complete description of the contents of each volume from the Maine Geological Survey.

Volumes 1 & 2: Structure and Stratigraphy
Volumes 3 & 4: Metamorphic and Igneous Geology
Volumes 5 & 6: Quaternary Geology

SEMINARS

University of Vermont

All seminars start at 4 PM in Room 200 of the Perkins Geology Building.

September 17: Dr. Sheila Seaman, Colgate University
"Magma mixing in Volcanic Environments"

October 8: Dr. George Davis, University of Vermont
"The Discovery of Thrust Faulting in the Bryce Canyon Region, Utah"

October 15: Dr. Hans Hofmann, University of Montréal
"The Old and the New in the Precambrian Zoo"

November 9–10: Dr. Frank Spear, Rensselaer Polytechnic Institute
Short Course, 9 AM – 4 PM, *"Metamorphic Pressure-Temperature-Time Paths"*

November 12: Dr. Naomi Oreskes, Dartmouth College
"The Olympic Dam Cu-U-Au REE Deposit: Ore Genesis and Implications for Proterozoic Crustal Evolution"

December 3: Dr. Julie Brigham-Grette, University of Massachusetts
"Glacially tectonized moraine sequences of Kotzebue, western Alaska"

ANECDOTES

Sunset Lake in Brookfield, Vermont is the focus of a "hands-on" experience for the Oceanography class at Norwich University. For three weeks in February, the ice on the lake is used as a "platform" for taking lake-bottom core samples, water temperature, and soundings to analyze this freshwater system. Two years ago, as several students and I were walking back to shore after finishing a lab on the ice, we passed by several of the fluorescent orange flags used to mark locations for drilling through the ice. One of the students glanced back at the flags and said, "Sir, should we pick up those up or just leave them for next year's class?"

One of the "teams" for the Sunset Lake project is the Drill Team. It usually consists of two students using a power auger to drill through the ice at locations determined by a survey team. The drilling technique typically involves two students on opposite sides of the auger, facing each other, struggling to maintain control of the auger as they drill through two to three feet of ice. Last year, as Jim Reynolds was directing a group of students on the lake, he became concerned when the two students who were operating the power auger suddenly yelped in pain as they broke through the bottom of the ice. As he rushed near, one student was rubbing his head and saying to the other,"That's the third time that's happened. Next time we are about to break through the ice, you move your head left and I'll move mine left too!"

-contributed by Brad Jordan

Your Photograph Here

The *Green Mountain Geologist* is now accepting photographs for publication on this last page. Members are encouraged to submit interesting black and white photographs of geologic features with a short written explanation. Please submit your photographs "camera-ready" (enlarged, reduced, and/or trimmed to a size amenable for publication on one page of the GMG. Submit your photographs directly to the editor (Stephen Wright, P.O. Box 433, Cambridge, VT 05444).

ABSENTEE BALLOT: 1990
Vermont Geological Society

Officers:

President	Chris Stone	___
	_____	___
Vice-President	Bruce Wilson	___
	_____	___
Secretary	Ron Parker	___
	_____	___
Treasurer	Brad Jordan	___
	_____	___

Board of Directors (2-year term):

Larry Gatto	___
_____	___

If you will not be attending the VGS Annual Meeting in Middlebury, please complete this ballot and return it in an envelope marked with the work "BALLOT" in the lower left hand corner and your name and address in the upper left hand corner to:

Susan Williford, Secretary
Vermont Geological Society
P.O. Box 304
Montpelier, VT 05602

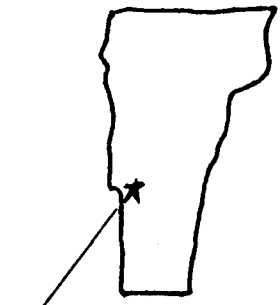
To be counted, this ballot must be received by October 19, 1990.

GREEN MOUNTAIN GEOLOGIST
VERMONT GEOLOGICAL SOCIETY
P.O. BOX 304
MONTPELIER, VERMONT 05601

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

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

THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

WINTER 1990 VOLUME 16 NUMBER 4

The thirteenth annual winter meeting can't be unlucky. Prove it by attending this VGS meeting held at Castleton College for the first time. The theme is:

ENTERING A NEW DECADE IN THE ENVIRONMENT AND GEOLOGY IN VERMONT

SATURDAY, FEBRUARY 24, 1990 9:00 AM

CASTLETON STATE COLLEGE
CASTLETON, VERMONT

Directions: Approaching Castleton, VT, on Route 4A going west, turn left on South Street to the Florence Black Science Center at Castleton State College.. Enter the north wing and follow signs to the auditorium.

CONTENTS

PRESIDENT'S NOTE

The theme for the winter meeting is "Entering A New Decade In The Environment And Geology In Vermont". The Executive Committee felt that this was not only a timely theme but one which offered the occasion to determine the status quo of Vermont geology and examine goals and opportunities for the nineties. This seems to be particularly important considering the progress and growth experienced during the last ten years.

Speakers at the winter meeting will provide us with food for thought and prognostication. Representatives of government, academia, business, elementary and secondary education will help us to construct a picture of the present and a vision of the future. The society can plan and implement programs which are relevant today and support the vision of the next decade.

My hope for the society, this year, is a threefold plan to provide additional individual access to educational, professional, and service oriented activities by:

1. Being a clearinghouse for all that is going on in the earth sciences in and around Vermont
2. Keeping the lines of communication open with news and information flowing out, and input from the membership regarding needs, opportunities, and comments returning.
3. Planning workshops or conferences that are needed and not otherwise scheduled, in the near future.

As you receive this GMG, I invite you to send in your suggestions and/or requests to me at either the Society address or my office address listed at the end of this note. The new Executive Committee is largely inexperienced in running the society, but we are committed to serving the membership by getting your input and offering additional programs.

Andrew V. Raiford
Castleton State College
Castleton, VT 05735

CALL FOR SPRING PAPERS

The 17th annual VGS spring meeting for the presentation of student research papers will be held April 28, 1990 at UVM. 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 6, 1990 to: Barry Doolan, Department of Geology, University of Vermont, Burlington, VT 05405. Abstracts should be limited to 300 words. Fifteen minutes will be allotted to each talk, followed by a 5 minute question period. The Society awards a cash prize to the best undergraduate and graduate student papers.

FOUND

At the end of the fall banquet, a denim jacket with an automatic pencil in the pocket was found in the dining room. If it belongs to a member, please contact the Society.

WINTER PROGRAM

ENTERING A NEW DECADE IN THE ENVIRONMENT AND GEOLOGY IN VERMONT

February 24, 1990
Black Science Center North
Castleton State College, Castleton, VT

8:30 COFFEE AND DONUTS Room 04, Auditorium

MORNING SESSION

ANDY RAIFORD, Moderator

9:00 CHARLES RATTE'
Vermont State Geologist
"Entering a New Decade in the Environment and Geology in Vermont

9:30 RODNEY PINGREE
Technical Services Coordinator, Vermont Association of Conservation Districts, On-Site Sewage Program
"Surficial Geology and its Role in Waste Water Disposal"

10:00 ALAN LIPTAK
Hydrogeologist, Solid Waste Division, Department of Environmental Conservation
"Landfills and Geology in the 90s"

10:30 COFFEE BREAK

11:00 MARGARET OTTUM and LESLIE KANAT
Department of Environmental and Health Science, Johnson State College
"Developing Awareness, A Cooperative Effort Between Johnson State College and Elementary Teachers of Northern Vermont"

12:00 LUNCH Bring a brown bag lunch or "order in" when you arrive. Join in the conversation or investigate more carefully the "hands-on" materials which Margaret Ottum will bring from project GEO for 6th graders.

AFTERNOON SESSION

1:30 ROLFE STANLEY
Department of Geology, University of Vermont
"A Look Ahead at Bedrock Geology Research in Vermont"

2:00 MICHAEL WURTH
Manager of Environmental Services, TWM Northeast, Williston, VT
"The Role of Consulting Geologists in Vermont"

2:30 JIM ASHLEY
Hydrogeologist, Water Quality Division, Vermont Department of Environmental Conservation
"Vermont Well Driller Program: Past, Present and Future"

Talk times allow for questions and discussion.

3:00 EXECUTIVE COMMITTEE MEETS

VGS BUSINESS & NEWS

VACANCIES - HELP WANTED!!!

VGS always encourages participation from its membership, and we have a special request to fill two offices in the very near future. As you will read in the State Geologist's Report, Sharon O'Loughlin has moved to Massachusetts and has resigned as Chair of the Geological Education Committee. She has turned the files over to the Society and they contain an exciting project that needs to be completed urgently. VGS is assembling a field trip guide for non-professional geologists, specifically to help earth science teachers in Vermont. There are several completed trip guides and leads to persons with trips that would be appropriate. They and any others that can be identified need to be encouraged to compete guides suitable for publication. The Committee also is serving as an intermediary to link earth science teachers with geologists to help locate and interpret field trip locations. Such education is an important goal of VGS.

The second position to be filled is that of Editor/Chair of the Publications/Editorial Committee. I have been editor since the beginning of 1980. It has been a very rewarding job and I write this request reluctantly, but am finding that a new job and responsibilities of guardianship for my Mother in a local residence for the memory impaired, leaves less time than I would like - and need- to continue as Editor. To those who are interested (and it could be more than one person), it is an opportunity to be in contact with people around the state and in the Society to gather information for publication 4 times a year in the GMG. I do have some very loyal contributors and you will find that members are very accomodating when you have a timely request. The job requires access to a computer with a letter quality printer (I can't believe that I used to do it on a typewriter!) and possibly a reducing photocopier. It takes me a good share of a week to get each newsletter out. I also work closely with the Executive Committee. The newsletter is the most important consideration, but I have also edited and seen through to publication the five volumes of Vermont Geology.

I have promised our President, Andy Raiford, that I won't leave him without an Editor, so if you are interested or would like more information, please contact me --- soon.

Jeanne Detenbeck
29 Collamer Circle
Shelburne, VT 05482
(802)+985-2390

ABOUT THE ADDRESS LIST

In 2 1/2 years our address list has changed considerably and is republished in this issue of the GMG. If you discover omissions or needed corrections please contact the treasurer (Brad Jordan). We try hard to keep our list correct but we do goof at times and, from past experience, addresses will change even before this goes to press! Only our individual members are listed here. We have 14 corporate members, also.

PUBLIC ISSUES - PROPOSED LEGISLATION

Three bills, which may be of interest to the Vermont Geological Society Membership, are on the legislative docket this year. Two of these bills respectively encompass such divergent topics as licensing of septic system designers, to reserving disposal space in Nevada for low level radioactive wastes generated in Vermont. The third bill, S.339, probably has the most immediate and far reaching impact on the geologic community. This bill, introduced by Senator Gannett of Windham County, Senator Little of Chittenden County, Senator Doyle of Washington County and Senator Racine of Chittenden County, proposes to create a division of geology and mineral resources in the Agency of Natural Resources. This division will be administered by a director who will be the State Geologist. Duties and responsibilities of the Division of Geology and Mineral Resources will be:

1) Conduct surveys and research related to the geology, mineral resources and topography of the state.

2) Give aid and advice as may be possible relating to the development and working of rock or mineral deposits suitable for building, road making and economic or other purposes.

3) Provide information and education to government, industry, other institutions and organzations and to citizens regarding the geology, mineral resources and topography of the state.

4) Provide technical information and advice regarding the management of mineral resources on state-owned lands, and cooperate where possible by providing geologic expertise and advice to persons conducting regulatory programs for the state.

5) Provide geological services for the natural gas and oil resources board.

6) Maintain records of old and new information relating to the geology, mineral resources and topography of the state and make public new information resulting from research and field studies conducted by or for the division. Certain information provided by the mineral industries of the state may be held in confidential status at the industries' request and used only for purposes and in a manner permitted by the industry.

7) Prepare and publish reports on the geology, mineral resources and topography of the state.

The Division will also be responsible for coordinating and eliciting funds from the Federal Government to perform additional topographic and geologic surveys.

Right now, many of these functions and duties are being performed by Chuck Ratté, the State Geologist. But his position is an appointed position which makes it clearly vunerable to changes in government which may occur every two years. In addition, Chuck has been working at this for over 15 years and expects that he would retire sometime in the not too distant future. Since the position of the State Geologist is not a so-called classified position, it would be quite easy under current tight budgets to postpone filling the position and thereby leaving a fairly large gap in this important role. Additionally, by classifying the position of State Geologist, any future candidate for that job could be provided with a promise of at least some job security.

I think the benefits of recognizing and maintaining a Division of Geology and Mineral Resources in the State of Vermont should be clear to our members and others that have an interest in geologic issues. We as a Society will be in support of this bill and let George Little, Chairman of the Natural Resources Committee know of our posotion in this matter. We encourage individual members to write to George Little indicating their support for this bill.

H.579, which proposes to require licensing of septic system installers, is a far cry from earlier legislation requiring registration of hydrogeologists. This bill appears to be aimed at individuals such as heavy equipment operators or earth moving contractors that may be involved in septic system installation.

S.294 proposes to authorize the Governor to sign a short-term contract for the disposal of Vermont low level radioactive waste with the Rocky Mountain low level radioactive waste, raise the funds necessary to satisfy that contract, restrict the use of the disposal capacity provided by that contract to the Beatty, Nevada, disposal site and ensure that temporary storage capacity that is now available at that site is reserved for when it is most needed by the State of Vermont. The cost of the contract is relatively high and amounts to approximately one million dollars to be paid over a three-year period. Most of these funds will be supplied by Vermont Yankee, which is the prime generator of low level radioactive waste in the state. If you wish more information on this bill, we suggest you contact one of the following: Senator Skinner of Washington County, Senator Page of Bennington County or Senator Ready of Addison County.

Submitted by
Chris Stone

EXECUTIVE COMMITTEE MINUTES - January 10, 1990

Meeting called to order at 7 PM. In attendance: Andy Raiford, Chris Stone, Brad Jordan, Susan Williford, Randy Spydell, Jeanne Detenbeck. Andy outlined purpose of the meeting:
1. Organization of winter meeting - Time: February 24, 1990; Place: Castleton State College; Theme: Entering a New Decade of the Environment and Geology in Vermont.
The Executive Committee members were to search for speakers from government, industry, and education to present to 30 minutes at the winter meeting.
2. Discussion of dues announcement: It will include request for name, address and phone number. Extra membership form will be included in an effort to increase membership.
3. Discussion of VGS goals for 1990: increase membership, duties of public issues committee support for state geologist and associated proposed legislation, spring program of student papers at UVM.
Meeting adjourned at 9 PM.

Respectfully submitted,
Susan Williford, Secretary

[Minutes continued on page 22.]

Vermont Geological Society - Treasurer's Report

January 1,1990

Balance as of 1/1/89		$1932.32
Income		
Interest	119.45	
Dues	1287.00	
Publication Sales	424.10	
		+1830.55
		$3762.87
Expenses		
Postage	435.96	
Printing/Copying	460.69	
Office Supplies	15.00	
Meeting Expenses	344.12	
Doll Student Prizes	50.00	
P.O. Box Rent	28.00	
Engraving	6.75	
Money Orders	1.00	
Binding	22.40	
Telephone	21.35	
		-1385.27
Balance as of 12/31/89		$2377.60

Respectfully submitted,
Brad Jordan
Brad Jordan
Treasurer

NEW MEMBERS

We want to welcome seven new members who have joined VGS since publication of the last GMG.

Sandra Giesler	Shelburne, VT
Arthur W. Gilbert, Jr.	Dorset, VT
Dean Grover	Burlington, VT
Alexander Latzer	Morris Township, NJ
Paul D.G. Miller	Hoosick, NY
Dr. Russell M. Potter	Castleton, VT
Jonathan Wells	Boston, MA

FOR THE TEACHER

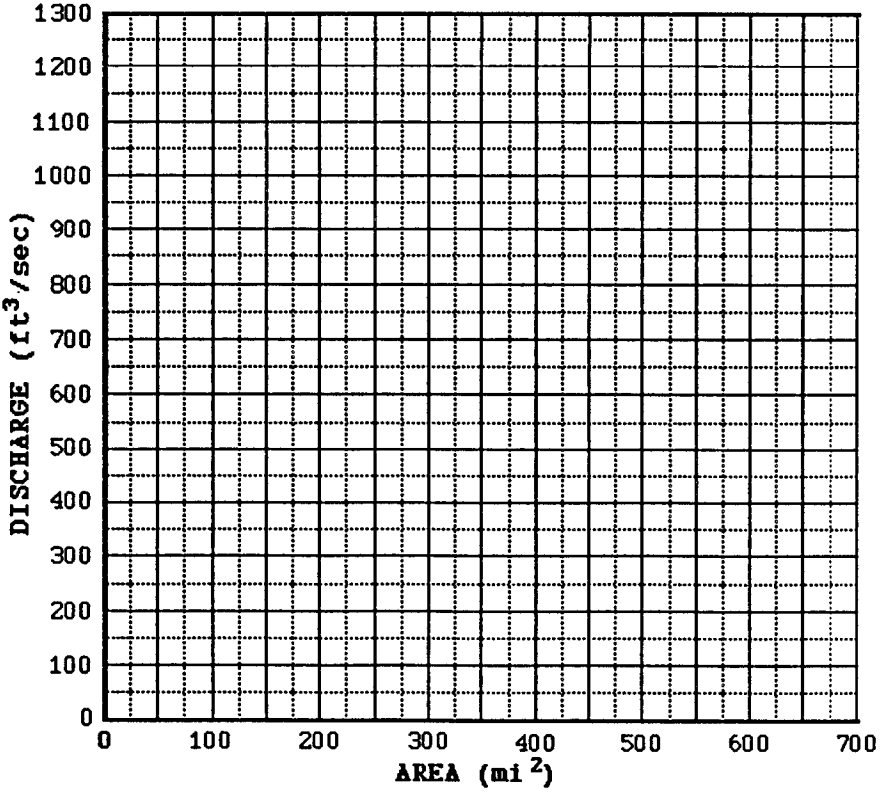
WATER YIELD FOR VERMONT

Brewster Baldwin
Middlebury, Vermont

Stream-gaging records, published by the U.S. Geological Survey, can be used to estimate water yields for any given drainage area. The records here are from U.S. Geological Survey Water-Supply Paper 1727. This volume is for Part 4, St. Lawrence Basin, for 1950-1960. (The "water year" used in their records goes from October through the next September.)

These stations are selected from the full list of Vermont stations, by eliminating those stations whose flow is strongly affected by reservoirs or mill ponds or similar storage areas upstream. Plot the data on the graph below, and draw a best-fit line.

Station	2870	2880	2920	2925	2930	2935	2960	2965
Area (mi^2)	76	139	310	686	131	479	122	142
Discharge (ft^3/sec)	121	250	525	1214	269	911	197	250



STREAM-GAGING, A SIMPLE WAY

Brewster Baldwin
Middlebury, Vermont

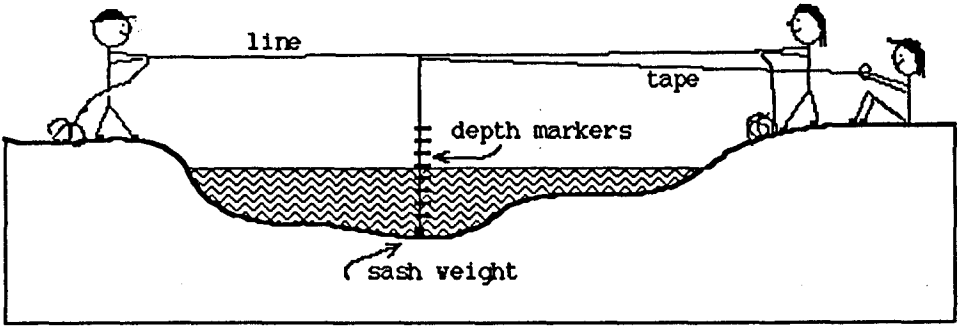
For gaging a stream using Pooh-sticks, pick a stream that drains at least 10 square miles but less than 100, and pick a place where there is a bridge nearby and not much turbulence. The best time of year to get a discharge that is approximately the mean annual discharge is in a dry week in October. This avoids snow melt of springtime, and evapotranspiration of the summer. Or do this several times a year.

MATERIALS

- a line 3 times as long as the stream is wide
- a sash weight or similar heavy weight
- a vertical line (insulated wire?) to tie to the weight and to the long line
- a 100-foot tape measure (or 50 for a small stream)
- people, graph paper, calculator

PROCEDURE

1) Profile the stream by having a meek and fairly tall kid wade across, holding a measuring rod and one end of the tape measure. Or throw a line across to a couple of people on the other bank. See the sketch for who does what. Record the distance from your side of the creek to each depth-measured point. On graph paper, plot the profile points. Count squares to get the cross-sectional area.



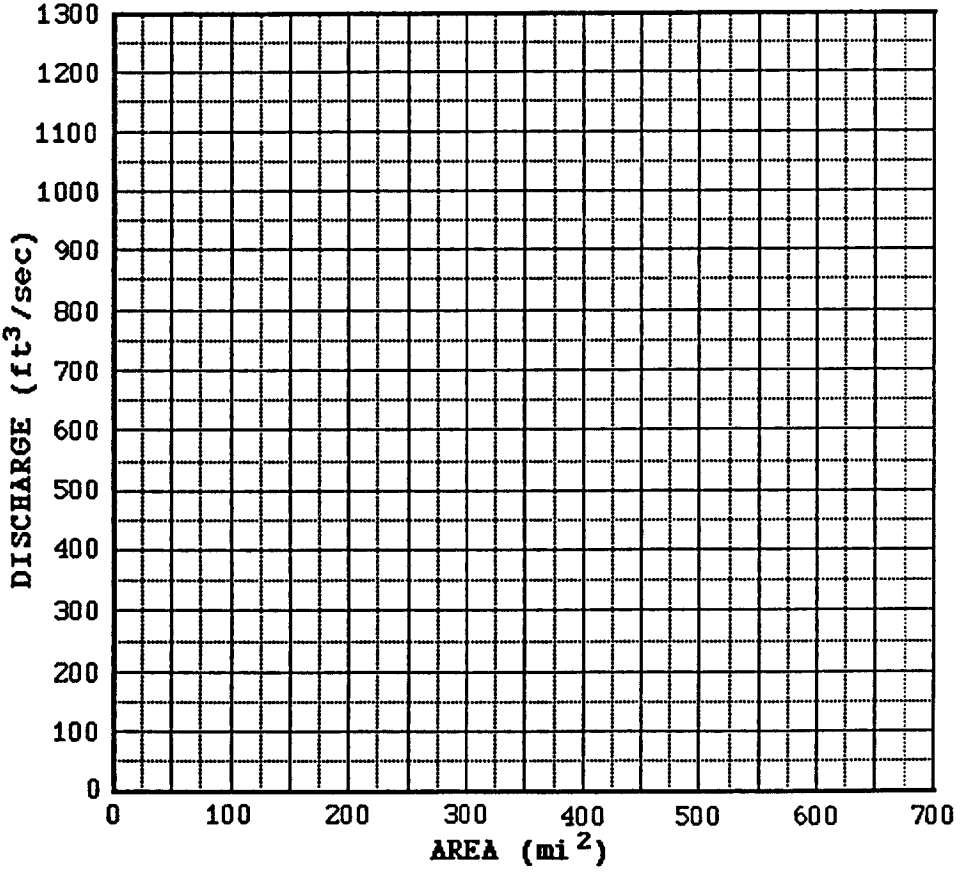
2) For the mean velocity, other people measure a 100-foot stretch along either bank. Then one throws in a stick to mid-stream and someone starts a stop-watch. When the stick gets to the other end of the 100 feet, that person stops the watch. Several measurements will get the maximum surface velocity. Multiply this maximum surface velocity by 0.7 to get the mean velocity in feet per second.

3) Get the discharge by multiplying the mean velocity times the cross-sectional area in square feet. This gives the discharge in cubic feet per second.

4) To measure the drainage area, put a sheet of translucent paper over a topographic map of the area and draw the drainage divide upstream from the gaging station. Cut out this shape

and weigh it. Also cut a square sheet of that paper to find its weight per square furlong or square mile. Divide one number into the other to find the drainage area.

On the water yield graph, plot the data and the best-fit line. Determine the average annual discharge per 100 square miles, and compare that with the gaging data.



VGS MEMBERSHIP LIST - FEBRUARY 1990

Spafford ACKERLY	Department of Geology, Snee Hall, Cornell University, Ithaca, NY 14853
Chris ALLEN	9 Davis Road, Apt. B2, Acton, MA 01720
Thomas ARMSTRONG	Dept. of Geological Sciences, VPI, Blackburg, VA 24061
James ASHLEY	RR 1 Box 133, Danville, VT 05873
Robert L. BADGER	Department of Geology, SUNY, Potsdam, NY 13676
Brewster BALDWIN	Science Center-Geology, Middlebury College, Middlebury, VT 05753
Donald K. BALMER	Shannon & Wilson, Inc., P.O. Box C-30313, Seattle, WA 98115
Peter BEBLOWSKI	1600 Candia Road, Apt. 9, Manchester, NH 03103
Larry BECKER	RD #3 Box 57, Montpelier, VT 05602
Marland P. BILLINGS	Department of Geological Sciences, 24 Oxford St., Cambridge, MA 02138
Arlen BLOODWORTH	RR 2 Box 2068, Pittsford, VT 05763
Mimi BOXWELL	c/o Roy F. Weston, Inc., 7 Eagle Square, Concord, NH 03301
Dwight C. BRADLEY	USGS Branch of Alaskan Geology, 4200 University Avenue, Anchorage, AK 99508
James Robert BUTLER	Dept. of Geology, CB#3315, Univ. of No. Carolina, Chapel Hill, NC 27599-3315
David BUTTERFIELD	38 George Street, Montpelier, VT 05602
David K. BUTTLE	P.O. Box 672, Quechee, VT 05059-0672
Gwen BUTTLES	RR 1 Box 3110, Hinesburg, VT 05461
Wallace CADY	8585 W. Dakota Ave., Lakewood, CO 80226
Stewart CLARK, Jr.	25 Marvin Street, Montpelier, VT 05602
Ray COISH	Science Center-Geology, Middlebury College, Middlebury, VT 05753
Barry CONOLLY	RR 1 Box 355, Westford, VT 05494
E. Stanley CORNEILLE, Jr.	4 Terrace Street, Randolph, VT 05060
John COTTON	P.O. Box 31, East Andover, NH 03231
Bret W. COX	985 North Avenue, Apt. E2, Burlington, VT 05401
Bruce COX	Dufresne-Henry, Inc., Precision Park, No. Springfield, VT 05150
Mary CRANDALL	17 North Street, Rutland, VT 05701
Fred CROWLEY	RR 2 Box 172, Springfield, VT 05156
Robert V. CUSHMAN	20 Court Street, Middlebury, VT 05753
James DAWSON	Center for Earth and Environmental Science, SUNY, Plattsburgh, NY 12901
Vincent DELLORUSSO	114A North Street, Belchertown, MA 01007
Jeanne C. DETENBECK	29 Collamer Circle, Shelburne, VT 05482
Robert J. DINEEN	c/o NYS Geol. Soc., RM3160 Cul. Ed. Center, ESP, Albany, NY 12230
Charles G. DOLL	1 Mansfield Avenue, Essex Jct., VT 05452
Barry DOOLAN	Department of Geology, University of Vermont, Burlington, VT 05405
John DRAKE	Department of Geology, University of Vermont, Burlington, VT 05405
Ballard EBBETT	RFD 1, Lyndonville, VT 05851

Sandria EBBETT	RFD 1, Lyndonville, VT 05851
David ELBERT	Geology-Science Center, Middlebury College, Middlebury, VT 05753
Peter J. FISK	c/O Conoco Inc., Box 2197, PR 3120, Houston, TX 77252
Brian FOWLER	RFD 7 Box 159, Gilford, NH 03246
Charles FOX	705 West Market, Silver City, NM 88061
David A. FRANZI	Center for Earth and Environmental Science, SUNY, Plattsburgh, NY 12901
Lawrence GATTO	RR 1 Box 371, Fairlee, VT 05045
Sandra GIESLER	107 Falls Road, Shelburne, VT 05482
Arthur W. GILBERT, JR.	c/o A.W. Gilbert, Rt. 1 Box 923, Dorset, VT 05251
Richard P. GILLESPIE	15 Spencer Drive, Nashua, NH 03060
Peter GOREAU	Science Center-Geology, Middlebury College, Middlebury, VT 05753
Dean GROVER	Wagner, Heindel & Noyes, Inc., P.O. Box 1629, Burlington, VT 05402-1629
Julie HACKBARTH	RD Box 2250, Plainfield, VT 05667
Eric R. HANSON	RR #1 Box 193, Huntington Center, VT 05462
Lindley HANSON	Dept. of Geological Sciences, Salem State College, Salem, MA 01920
Lucy HARDING	Science Center-Geology, Middlebury College, Middlebury, VT 05753
Glen HARRINGTON	130 Ipswich Road, Topsfield, MA 01983
Norman L. HATCH, Jr.	MS 926, U.S. Geological Survey, Reston, VA 22092
Herbert E. HAWKES	RFD 2 Box 162-5, Orleans, VT 05860
Joseph J. HAYES	RD 3, 89 Terrace Street, Montpelier, VT 05602
Brian HECKENBERGER	48 Locust Hill Drive, Shelburne, VT 05482
Craig HEINDEL	Wagner, Heindel & Noyes, Inc., P.O. Box 1629, Burlington, VT 05402-1629
J. Christopher HEPBURN	Geology and Geophysics, Boston College, Chestnut Hill, MA 02167
Malcolm HEYBURN	201 Walnut Tree Hill Road, Sandy Hook, CT 06482
Robert HIBBERT	10C Spring Street, Montpelier, VT 05602
Arthur L. HODGES, Jr.	P.O. Box 26, Camden, DE 19934
John T. HUMPHREY	P.O. Box 108, Cambridge, MA 02142
Allen S. HUNT	Department of Geology, University of Vermont, Burlington, VT 05405
Brad JORDAN	Earth Science, Norwich University, Northfield, VT 05663
Robert JORDAN	Delaware Geological Survey, University of Delaware, Newark, DE 19716
Leslie KANAT	Dept. of Envir. and Health Sci., Johnson State College, Johnson, VT 05656
Paul KARABINOS	Department of Geology, Williams College, Williamstown, MA 01267
H. Douglas KLEMME	R.R. 1 Box 179B, Bondville, VT 05340
John KLIMENOK	South Road, Portland, CT 06482
Shirley KNOWLTON	Box C, South Londonderry, VT 05155
Robert G. LaFLEUR	Department of Geology, RPI, Troy, NY 12181
Michael LANDSMAN	Box 337, Burlington, VT 05402

Eric LAPP	c/o OMYA Inc., 61 Main Street, Proctor, VT 05765
Fred LARSEN	9 Slate Avenue, Northfield, VT 05663
Alexander LATZER	Lake Road at Baker Street, Morris Twp, NJ 07960
Crea LINTILHAC	Box 6080, Barnes Hill, Waterbury Center, VT 05677
Alan LIPTAK	RD 2 Box 3110, Northfield, VT 05663
John MALTER	P.O. Box 176, Waterbury, VT 05676
Winona MANNING	Route 1 Box 164, Williamstown, VT 05679
Ronald MARCOTTE	Box 71, Bakersfield, VT 05441
Linda G. MAREK	Extension Service, School of Nat. Res., Univ. of Vt., Burlington, VT 05405
Donald MAYNARD	The Johnson C., Inc., 5 State Street, Montpelier, VT 05602
Cameron McCORMACK	P.O. Box 402, Montpelier, VT 05602
Jake McDERMOTT	P.O. Box 126, Newfane, VT 05345
Gregory McHONE	208 High Street, Middletown, CT 06457
Nancy McHONE	208 High Street, Middletown, CT 06457
Lance MEADE	P.O. Box 133, Pittsford, VT 05763
Mary Ann MENTO	RD #1, Arlington, VT 05250
Carolyn MERRY	P.O. Box 85, Enfield Center, NH 03749
Paul D.G. MILLER	P.O. Box 121, Hoosick, NY 12089
Thomas S. MOON	Montana Tech, Dept. of Eng. Science and Physics, Butte, MT 59701
Alexis P. NASON	8 Timber Lane, Brattleboro, VT 05301
Duncan OGDEN	Landgrove, Londonderry, VT 05148
Sharon O'LOUGHLIN	180 Oakland Street, Apt.#8, Springfield, MA 01108
Margaret G. OTTUM	RFD 2 Box 617, Johnson, VT 05656
Ronald PARKER	RR #1 Box 862, Cambridge, VT 05444
Sanborn PARTRIDGE	62 Ormsbee Avenue, Proctor, VT 05765
Jeffrey L. PELTON	409 Highland Road, Springfield, VT 05156
Rod PINGREE	P.O. Box 267, Jonesville, VT 05466
Seth PITKIN	The Johnson Co. Inc., 5 State Street, Montpelier, VT 05602
Dr. Russell M. POTTER	Dept. of Natural Science, Castleton State College, Castleton, VT 05735
Michael POTTINGER	40 Wright Street, Burlington, VT 05401
Jeffrey PREWITT	33 Harbor View Road #1204, So. Burlington, VT 05403
Andy RAIFORD	Geology Department, Castleton State College, Castleton, VT 05735
Nicholas RATCLIFFE	National Center MS 925, U.S. Geological Survey, Reston, VA 22092
Charles A. RATTE'	4 Chestnut Hill, Montpelier, VT 05602
Thomas C. RAY	19 Pinehurst Drive, Shelburne, VT 05482
Stephen REVELL	RD #1 Box 128-B, Bristol, VT 05443
Jim REYNOLDS	Dept. of Earth Science, Norwich University, Northfield, VT 05663

Dorothy A. RICHTER	180 N. Policy Street, Salem, NH 03079
Robert J. ROSS	R 1 Box 7289, Stowe, VT 05672
Edward H. SALVAS	P.O. Box 396, Johnson, VT 05656
Ethel SCHUELE	33 Clover Street, So. Burlington, VT 05403
William SIOK	RD 1, Sherman Ave., Exeter, NH 03833
Rev. James SKEHAN	Weston Observatory, Boston College, Weston, MA 02193
Michael B. SMITH	163 State Street, Apt. 3A, Montpelier, VT 05602
Shelley SNYDER	72 Blacklantern Lane, So. Burlington, VT 05403
Bill SPITZEL	Little Eagle Bay, Apt. F-8, Burlington, VT 05401
D. Randall SPYDELL	P.O. Box 325, Hartford, VT 05047
Rolfe STANLEY	Department of Geology, University of Vermont, Burlington, VT 05405
Nate STEARNS	P.O. Box 3152, Brown University, Providence, RI 02912
James B. STEWART II	Terrace Heights, RD #1, Middlebury, VT 05753
William E. STOCKWELL	8 Country Hill, Brattleboro, VT 05301
Steven J. STOKOWSKI, Jr.	Consulting Geologist, 10 Clark Street, Ashland, Ma 01721
Chris STONE	Calais Stage Box 910, Montpelier, VT 05602
Sharon STRASSNER	Meadow Way, Middlebury, VT 05753
John STRUNK	340 NW 83rd Street, Seattle, WA 98117
Gordon STURGEON	6 Lee Road, Lynnfield, MA 01940
Peter J. THOMPSON	519 First Street West, Mt. Vernon, IA 52314
Roger B. THOMPSON, Jr.	RFD #2 Box 745, Woodstock, VT 05091
Terry F. THOMPSON	RFD #2 Box 745, Woodstock, VT 05091
Thelma THOMPSON	519 First Street West, Mt. Vernon, IA 52314
Preston TURNER	12 Walnut Street, Berlin, MA 01503
Christine WARD	148 Home Road, Burlington, VT 05401
John S. WARREN	81 Green St., Brattleboro, VT 05301
Paul A. WASHINGTON	2927 Japonica Drive, RR 5 Box 80, Laurinburg, NC 28352
Bruce G. WATSON	RR# 1 Box 787, So. Hero, VT 05486
Jonathan WELLS	45 Grove Street, Apt. 1, Boston, MA 02114
David WESTERMAN	Earth Science, Norwich University, Northfield, VT 05663
Christopher WHITE	799 Prospect Ave., Apt. A1, West Hartford, CT 06107
John M. WHITE	HCR-75 Box 18, Platt Road, Cornish, NH 03745
Susan WILLIFORD	TWM Northeast, P.O. Box 784, Williston, VT 05495
Bruce D. WILSON	RD 2 Box 406, W. Brattleboro, VT 05301
Philip WINNER	584 So. Race Street, Denver, CO 80209
Steven F. WRIGHT	P.O. Box 433, Cambridge, VT 05444
Michael WURTH	The Johnson Co., Inc., 5 State Street, Montpelier, VT 05602

COMMENT & DISCUSSION

The following article is published with the intent of stimulating a dialog, and does not reflect the opinion of the Vermont Geological Society. An Editor's comment follows.

SHOULD THE TERM "MIDDLEBURY SYNCLINORIUM" BE RETAINED?

Paul Washington
Pembroke State University
North Carolina

During the recent Quebec-Appalachian Workshop held at UVM, I suggested publicly that the term "Middlebury Synclinorium" should be disregarded and replaced with a "more appropriate" term such as "Western Vermont thrust belt". This suggestion met with quite vocal opposition from several people because "Middle Synclinorium" is entrenched in the literature. I would like to take this opportunity to review the historical development of the term and underlying ideas and to discuss the implications of both retention and replacement of the term.

The term "Middlebury Synclinorium" was introduced to the literature less that 50 years ago by Wallace Cady, first in abstracts of papers presented at GSA meetings (the first was Cady, 1937) and more fully in his dissertation (Cady, 1945). The term was picked up quickly by Marshall Kay (Cady's Ph.D. advisor) and incorporated in his compilations of geosynclines (Kay, 1947, 1951) and in his publications on the stratigraphy of the Champlain Valley (Kay, 1958, 1959; Kay and Cady, 1947). Cady's continued presence in western Vermont (Cady, 1956, 1960, 1968a,1968b, 1969; Cady and Zen, 1960; Doll and others, 1961; Cady and Murphy, 1962; Cady and others, 1963) and Kay's influence in the field were major factors leading to the quick adoption of the term.

A number of other historical factors also contributed to the acceptance of the term, however. The most important of these were: 1 - his map was the first comprehensive map of the Champlain Valley since the original state map (Hitchcock and others, 1861); and 2- he published it just after the prior workers in the area (Arthur Keith - 1944, and T. Nelson Dale - 1937) died. In addition, although these other geologists had come to the conclusion that thrusting dominated the structure in the central Champlain Valley, only brief summaries (Keith, 1932, 1933) or details in small areas (Dale, 1912, 1913, 1929) had ever been published for much of the central Champlain Valley, so there was no readily available data contradicting Cady's conclusions.

DEVELOPMENT OF THE SYNCLINORIAL HYPOTHESIS

The historical development of thought on the structure of western Vermont contributed to the rapid incorporation of the term into current terminology. The synclinorial concept that Cady cemented in place had been around since the mid-1800s, originating with the work of Augustus Wing. Through exhaustive field work over approximately 20 years, Wing (1858-1875) worked out the basic stratigraphy of the central Champlain Valley. In the process he recognized that the rocks east of

the central slate belt, although nearly barren of fossils, were correlatives of the fossiliferous strata seen to the west. Only after discovering (during May 1867) Trenton fossils in the carbonate strata of the Sudbury nappe, which he interpreted as crossing beneath the Hortonville slate belt did he finally conclude that the structure of the area was a large syncline (Wing, 1867). He never was comfortable with connecting the strata around the north end of the slate belt in Weybridge without this evidence from Sudbury.

The postmortem report of Wing's findings by James Dana (1877a, b) reported the conclusions about the structure without expounding on the attendant doubts. By incorporating these conclusions into his textbooks (e.g. Dana, 1880, p. 212), Dana added credibility to the synclinal theory. In addition, Wing had introduced Brainerd and Seely (the subsequent workers in the area) to the geology of the the area, and knowing the extent of his work they did not see the need to question his structural or stratigraphic synthesis. They did come to recognize thrust faults in eastern Shoreham (Brainerd and Seely, 1890) and along Otter Creek (Seely, 1910), but this did not shake their faith in the synclinal concept.

Because Cady, for the most part, simply updated Wing's work while accepting the ultimate conclusions, the basis for Wing's conclusions need to be examined. Two aspects of general geologic thought of the mid-1880s had a significant effect on Wing's thinking. First, thrust faults were not recognized as common phenomena until the late 1880s, over ten years after Wing's death. Although the first published description of a thrust fault was Emmon's (1842, p. 279-282) cursory description of the Champlain thrust at the north end of Snake Mountain and at Charlotte, the controversy surrounding this interpretation (e.g. Adams, 1847; Gray and Adams, 1852) and its incorporation into the larger Taconic question delayed its acceptance until Logan (1860) correlated it with similar thrusts in Quebec. This meant that Emmon's (1855, p. 85-90) recognition of other thrusts in the area went unnoticed. Although thrusts were subsequently reported from several other areas (Rogers and Rogers, 1843; Murchison, 1849; Safford, 1856), most geologists at the time still considered thrusts to be merely local phenomena developed on the flanks of major folds (see Heim, 1878; Daubree, 1879; and Reade, 1886). Thus, there was no precedent for considering a thrust belt model for the eastern repetition of the strata seen to the west of the slate belt. Second, both Adams (1846, unpubl.) and Hitchcock and others (1861) (Wing was a contemporary of the Hitchcock survey and both communicated and spent time in the field with the members of the survey) hinted at the possibility that the structure might be a large syncline, but they had not worked out the stratigraphy in sufficient detail to be able to draw firm conclusions. Despite his predisposition toward a synclinal interpretation, however, it is to Wing's credit that he did not jump to the conclusion. He finally accepted the model after finding the Trenton fossils in Sudbury in 1867; the sketch map from his 1858 field notes reproduced by Cady (1945), must have been a simple preliminary sketch detailing the hypothesis he was examining.

Cady was also predisposed toward accepting the synclinorial model. It should be remembered that he had grown up

around and attended Middlebury College, and he had rediscovered Wing's notebooks in the college library (the original notebooks disappeared from the library in the early 1940s [Cady, written communication 1977] and the existing typescript was made some time before that by Cady's father who was an English professor at Middlebury). The real key, however, was Cady's continual attempts (during his time in Vermont) to explain everything by folding rather that faulting (John Rodgers, oral communication, 1985) unless he saw an irrefutible fault. With that mindset, there was little chance he would disagree with Wing.

Development of Thrust Belt Hypotheses

Although the central Champlain Valley can claim precedence on the description of thrust faults, it was not until the early 1900s that thrust faulting was recognized to be a dominant deformation mechanism other than along "Logan's Line". The key event occurred when Arthur Keith was placed in charge of Structural and Stratigraphic Geology for the USGS in 1907. In this position, he had to review and approve Geologic Folios prior to publication. One of the first folios to cross his desk was Dale's Fort Ticonderoga folio (Dale, unpubl.) incorporating the Ticondeeroga, Brandon, Castleton, and Whitehall 15' quadrangles. Dale had interpreted the Taconic thrust as an angular unconformity, which struck Keith as improbable. As a result, Keith began studying the structure around the north end of the Taconics. Additional impetus for this work was provided by the provisional completion of the Hoosic Folio (Vermont, Massachusetts, New York). Over the next 30 years, Keith spent considerable time in western Vermont, mapping the structure and redefining the stratigraphy. Unfortunately, he never published a full account of his findings (see Washington, 1988) except north of Burlington (Keith, 1923), despite having everything prepared for publication a few years before his death in 1944.

During this same time period, Dale (now under close supervision of Keith) worked on the detailed structure around Hyde Manor (Dale, 1912a, 1913, 1929). He also spent considerable time on the marble belt (Dale, 1912b). During this time, he came to accept (at least in print) Keith's structural synthesis. Other geologists (eg. Gordon, 1923) doing reconnaissance mapping in the region also reached the conclusion that the structure is dominated by thrusting rather that large-scale folding. All of these geologists, however, were no longer active by the time Cady's (1945) synthesis was published. The objections of Rodgers and Bain, being limited to marginal areas, had no effect.

Other than a plethora of detailed mapping projects, primarily by students at Columbia and at Middlebury, which resulted in local modifications of Cady's mapping, there was no challenge to Cady's model until the mid-1970s. The basic reason for the lack of challenge was that the synclinorium structure had been so thoroughly accepted that these subsequent mapping projects were not designed to test the theory, but rather were designed to study aspects of the structure within the context of the theory.

When I began mapping in the area in 1973, I also began with attempting to understand and refine the structure within Cady's framework. By the summer of 1975, however, I was

beginning to question major aspects of the structure, and my field work of the summer of 1975 led me to believe that the synclinorium model was fatally flawed. I therefore designed a test of the synclinal theory which included detailed mapping of the north end of the "synclinorial axis" in Weybridge. Based on the results of this work (Washington, 1981a, 1981b), I have disregarded the synclinorial theory as untenable, and have developed a thrust belt model for the area (see Washington 1987, 1989; Washington and Chisick, 1986). During the course of my mapping, I have found evidence for many thrusts; most of Cady's stratigraphic contacts on the "east limb of the synclinorium" can be shown to be thrusts. It is interesting to note that the model that I have arrived at independently of Keith and his contemporaries (I found copies of his unpublished maps only after my model was thoroughly developed) contains most of the same elements. In fact, my model differs from Keith's only in details, not in any of the essentials.

Implications of Terminology

Continued use of the term "Middlebury Synclinorium" can be justified either by refering to its standing in historical literature or by discounting the thrust belt models developed by me and earlier workers. Obviously, if the synclinorial concept is retained, the use of the term is appropriate. However, the use of an inaccurate term, despite entrenchment in the literature, can be quite confusing and misleading.

In invoking entrenchment, it should be noted that the term has only been in common use approximately 40 years. Although it is true that this area has become known to the rest of the world with this reported structure imbedded in the terminology, the continued use of the term will only serve to promulgate the misconception about the structure of western Vermont in the minds of the rest of the world. Substitution of a most accurate descriptive term, such as "Western Vermont Thrust Belt" (Washington, 1987, 1989; Washington and Chisick, 1986), will tend to correct the outside world's perception of the structure. It will also make the present structural synthesis more easily understood by newly arrived geologists at the various educational institutions in the region. In other words, disregarding "Middlebury Synclinorium" from current usage will reduce misunderstanding.

As Nicholas Ratcliffe pointed out at the workshop, there are other implications to be taken into account. The Taconic allochthons sit in a broad, roughly synclinal trough atop the carbonates. The basal Taconic thrust served as a roof thrust for much of the imbrication of the underlying carbonates. For the last few decades (not having worked extensively with the Taconic literature, I cannot pinpoint precisely how long), Taconic geologists have been using the term "Middlebury Synclinorium" to refer to this synclinal feature in the belief that it was related to the underlying synclinorial feature in the carbonates. Although it is indeed related to the underlying structure of the carbonates, the relation is that of a roof thrust sheet above a thrust system in which the displacements diminish forelandward. It should be noted that the Taconic thrust surface is breached by several thrusts rising out of the carbonates, giving the carbonate slivers (which are simply the leading tips of the penetrating thrust sheets)

found throughout the Taconics. To retain the use of "Middlebury Synclinorium" just to keep from confusing Taconic geologists, however, seems somewhat unreasonable, especially considering that they are the group whose misunderstanding of the structure of the carbonates will have the greatest impact on the development of geologic thought. Also, considering that Taconic geology is still in a state of flux, conversion to a more appropriate term such as "Taconic Synclinorium" should not have a significant negative impact.

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Editor's Comment: After much consideration, I am publishing this article, but not just for the controversy that it may generate. A dialogue in these pages is welcome, and we will publish as many responses as possible. However, I think the import of this article goes beyond a change of nomenclature of a Vermont geologic feature. First, it outlines the history of bedrock mapping and subsquent publication (or lack thereof) in the Middlebury area. It is unimaginable in this age of burgeoning publication to think that so much key research went unpublished. But are we sure that what is published today represents the complete story? "A little data spoils a good story" applies to all ages. Second, the article raises the question in my mind of what influences scientists to promote one theory or another. We have a unique opportunity in this century to record the thought processes of a generation of geologists, now middle-aged, who had to accept, and then incorporate into their research, the revolutionary theory of plate tectonics. Will geologists in the 21st century wonder why their 20th century predecessors chose this particular theory over some other that cannot now be imagined?

Jeanne Detenbeck, Editor

ANNUAL MEETING MINUTES - October 7, 1989

I. Treasurer's Report
$2394 approximate balance, six new members to be approved, 37 current members have not paid dues.

II. A. Voting for New Officers
All officers elected by unanimous vote.
B. Discussion of 2 Ballot Quesstions, see Fall 89 GMG for descriptions.
Preliminary vote taken; several people wanted to continue discussions of ballot questions 1 and 2.

III. Old Business
Sharon O'Loughlin - Geological Education Committee - request for information for a field trip guide for non-geologists. The field trips should be as self-explanatory as possible.

IV. No New Business

Meeting adjourned at 9:30 PM.

Respectfully submitted,
Susan Oppenlander Williford, Secretary

STATE GEOLOGIST'S REPORT

The State Geologist's Office lost a valued employee and a hard won position in January. Sharon O'Loughlin, our information specialist has taken a position with the consulting firm of Con-Test Environmental Consultants Inc., East Longmeadow, MA (see address below). Sharon did a magnificent job of organizing and conducting the information services for this office. We thank her sincerely, and will miss her very much. However, Sharon is a hard working, intelligent, self-motivated professional. She needed a greater challenge and an opportunity for professional growth that could not be provided in state government. We wish her the success and satisfaction she deserves. I am sure Sharon would enjoy hearing from her friends and colleagues in the Vermont Geological Society. Her address follows:

Business c/o Con-Test Environmental Consultants
P.O. Box 591
East Longmeadow, MA 01028
Home 180 Oakland Street Apt#8
Springfield, MA 01108

The State Geologist has introduced a bill in this (1990) legislative session. S.339 creates for the first time in the history of state government, an official geological organization. The division of geology and mineral resources will have a director (the State Geologist) who serves directly under the Secretary of the Agency of Natural Resources. The bill also modernizes the duties and responsibilities of the division. The bill contains a transitory provision, that will place the director in the classified service at the time a new state geologist is hired. The current state geologist is an administration appointee.

The bill is presently being discussed in the Senate Natural Resources and Energy Committee.

A first assessment of the progress of the new state bedrock mapping project being conducted in cooperation with the U.S. Geological Survey (COGEOMAP) will take place at a special meeting to be held in conjunction with the Northeastern GSA sectional meeting in Syracuse, NY, on 5-7 March 1990. Regional compilers will be presenting 1:100,000 scale compilations of the mapping completed to date.

Charles Ratté, State Geologist
103 South Main Street, Waterbury, VT 05676

MEETINGS

FEB 24 **VGS WINTER MEETING**
See Page 3 for details

APR 28 **VGS SPRING MEETING**
Presentation of student papers at UVM.

MAR 4-7 GSA Northeastern Section
in Syracuse, NY. For information contact Henry Mullins, Dept. of Geology, Syracuse University, Syracuse, NY 13244, (315) 443-4706.

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

FEB 26 Dr. Pat Manley, Middlebury College:
Gas hydrates, sediment waves and fan channels: Deep-Sea sedimentary regimes of the Amazon Fan and Argentine Basin.

APR 2 Dr. Laurie Brown, University of Massachusetts:
Magnetostratigraphy of the Treasure Mountain Tuff, San Juan Mountains, Colorado.

APR 20 Dr. Jay Namson, Davis and Namson Consulting Geologists:
Active fold and thrust belt of the California coast ranges and western transverse ranges: implications for earthquake hazards, oil exploration, and lithospheric kinematics.

APR 6-7 MacIntosh - Computers in the University Cirruculum
For information call Rolfe Stanley or Barry Doolan at the Geology Department. Preregistration $20.00.

The Lecture Series presented by the Department of Geology at Middlebury College this Spring follows. Lectures will be held in Room 420, Science Center at 12:15 PM. You are encouraged to bring a lunch. Call (802)+388-3711 x5429 for more information.

FEB 15 Dr. J. Murray Journeay, Geological Survey of Canada:
Tectonic Framework of the Southern Coast Belt, British Columbia

FEB 16 Hawaiian Geology Class, Middlebury College Winter-Term '90:
A Case Study of Hawaiian Volcanic Rocks and Landforms - an informal lecture and video presentation

MAR 23 Dr. Thomas Gold, Cornell University:
Petroleum on Earth: from Biology or from the Stars?

APR 13 Dr. Edwin Roedder, Mineralogical Society of America, Distinguished Lecturer; USGS, Reston; Harvard University
Nuclear Waste Disposal - Where Do We Put It?

APR 20 Dr. Christopher Chalokwu, Auburn University
Magma Dynamics in the Duluth Complex.

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VERMONT GEOLOGICAL SOCIETY
BOX 304
MONTPELIER, VERMONT 05601

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

DUES ARE DUE

FIRST CLASS

Charles A. Rattè
4 Chestnut Hill
Montpelier, VT 05602