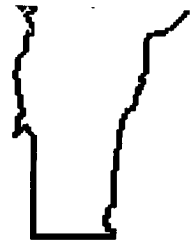
Vermont Geological Survey
103 South Main St., Laundry Building
Waterbury, VT 05671-0301 Phone (802) 241-3608
Laurence Becker, State Geologist

THE GREEN MOUNTAIN GEOLOGIST



NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

Winter 2002 VOLUME 29 No. 1

WINTER MEETING
February 16, 2002, 9:15 AM
Norwich University

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PRESIDENT'S LETTER

Dear Members:

I sit here looking out at a beautiful winter scene just a few days before Christmas and realize I have absolutely no idea how to start this "President's letter". So, let me introduce myself – since 1979, I've been at Middlebury College where I teach courses on bedrock geology of Vermont, earthquakes and volcanoes, mineralogy, petrology, intro geology, and others. My main research interests are in ancient volcanic rocks, particularly their geochemistry.

VGS has flourished for over 25 years on the basis of volunteerism (with a little arm twisting). I've been loosely associated with the society since my arrival but I'm ashamed to say that I have not been as involved as I should have been in keeping it going. I've always left that to others. If everyone had that attitude, the society would have long since disappeared. Fortunately, there have been dedicated members, those who started the society around 1975 and those who have kept it afloat since. VGS provides an important venue for undergraduate development in its spring meeting, keeps academics and professionals in touch via field trips and occasional winter meetings, and reaches out to secondary schools with well-received educational programs.

Since the last GMG appeared, the society hosted a very successful Fall field trip at the OMYA marble quarry in Middlebury. I would like to thank OMYA, especially Andy McIntosh for a very interesting tour. Also, thanks largely to the efforts of Marjorie Gale, Christine Massey, Shelley Snyder, and Alice Blount, Earth Science week was a great success throughout the state. At the meeting following the Fall trip, the society decided to reinstate the winter meeting, which will be held at Norwich University on February 16. I anticipate a stimulating line up of presentations.

I look forward to the coming year and will appreciate any help offered. Let me take this opportunity to thank Shelley Snyder for guiding the society successfully over the last two years. She put a lot of energy

into the society and I hope she'll be available for frequent consultations!

I end this letter on a sad note – Bob Cushman passed away unexpectedly on October 29, 2001. Bob was a USGS hydrogeologist, who retired to Middlebury over 20 years ago. He remained active in geology around Addison County right up to the time of his death. He was a strong supporter of the VGS – in fact, the last time I saw Bob was at the Fall field trip and meeting. I will remember him for his geological acuity, his kindness and his gentle manner.

Sincerely,
Ray Coish
coish@middlebury.edu

VGS CALENDAR FOR 2002

February 15:	Pre-registration Deadline for NE GSA Meeting
February 16:	Winter Meeting, Norwich Univ., Northfield, VT
March 25-27:	NE Geological Society of America, Springfield, MA
April 1:	Deadline for student abstracts for Spring VGS Mtg
April 1:	Deadline for submission of articles - Spring 2002 GMG
April 1:	Student Summer Research Grant Proposals Due
April 15:	Publish Spring GMG
April 20:	Spring VGS Meeting, Middlebury College, VT
April 20:	Student summer research grant money awarded
June 22:	Deadline for articles and news items for Summer GMG
July:	Spring/Summer Field Trip; details TBA
Sept. 4:	Deadline for articles and news items for Fall GMG
Sept. 18:	Publish Fall GMG
Sept. 27-29:	NEIGC, Lake George, New York

CALL FOR ABSTRACTS

Spring Meeting of the Vermont Geological Society
Spring 2002 Presentation of Student Papers
Saturday, April 20, 2002, 8:30 am

Hosted by:
Department of Geology, Middlebury College

The Vermont Geological Society will hold its Spring 2002 meeting at Middlebury College in Middlebury, Vermont. The meeting is dedicated to students conducting research in the geological sciences. Undergraduate and graduate students are encouraged to submit abstracts outlining the results of their research. Abstracts covering all aspects of the geological sciences are welcome and will be published in the Spring issue of the Green Mountain Geologist. The Charles Doll Award for outstanding undergraduate paper will be presented. A cash award for "Best Paper and/or 2nd place" will also be presented based on quality of the research, the abstract, and presentation of the paper.

Abstracts should be limited to one double spaced 8.5 x 11 inch sheet and can include figures. Font size should not be less than 10. Please submit both a paper and electronic copy (e-mail or disk; e-mail preferred) of abstracts, reviewed by the student's advisor, to the editor at the address given below. Disks should include both a formatted and "text only" version of the abstract (either Mac or IBM; IBM preferred). Abstracts submitted by e-mail should be sent to marjieg@dec.anr.state.vt.us .

Oral presentations will be limited to 15 minutes with 5 minutes for questions. Two slide projectors and an overhead projector will be available. Deadline for Abstracts: Monday, April 1, 2002.

Send abstracts to:
Marjorie Gale, Vermont Geological Survey
103 South Main St., The Laundry Building
Waterbury, VT 05671-0301
E-MAIL: marjieg@dec.anr.state.vt.us
For additional information contact Ray Coish at 443-5423; coish@middlebury.edu or Marjorie Gale at 241-3608 (o).

EARTH SCIENCE WEEK 2001

October 7-13 was the fourth annual Earth Science Week sponsored nationally by the American Geological Institute. Governor Dean issued the formal Earth Science Week proclamation on August 13, 2001. The organization and implementation of Vermont's celebration is spearheaded by the Vermont Geological Society, the Vermont Geological Survey, and Perkins Museum at the University of Vermont. This year we began planning in the spring and strengthened our connections with museums, nature centers, and the media in order to expand our reach and find additional groups and sites willing to host special events. The Dept. of Tourism and Marketing included publicity for the week in their fall press kit and on the web site, we maintained a list of events on the Survey web site, and both Shelburne Farms and the Dept. of Forest and Parks included the week's events in their mailings to educators.

Popular annual events were the Geologist-in-the-Parks program, the Perkins Museum Poster Contest, and Fleming Museum Tours. Vermont Geological Survey, the Dept. of Forest and Parks and the Vermont Geological Society sponsored the Geologist-in-the-Parks program on October 9-11. The program reached 400 students, parents and educators at 9 sites. Geologists led hikes during the three days at Owls Head, Little River, Button Bay, Ascutney, Townshend, Branbury, Mt Philo, Elmore and Lake Willoughby parks. We turned away about 200 students. Ginger Anderson and Bruce Amsden of FP&R helped coordinate this event. Geologists participating were Jon Kim, George Springston, Carey Hengstenburg, Rodney Pingree, Jeff Hoffer, Kristin Underwood, Rob Farley, Peter Thompson, Peter Gale, Marjorie Gale, Craig Heindel, and Kent Koptiuch. Laura Hollowell, a naturalist, assisted at Button Bay.

Perkins Geology Museum and the Vermont Geological Society sponsored a poster contest, "Vermont Geologic Resources: What we use in our everyday lives!" The poster contest drew 192 entries as compared to about 40 the previous year. The awards ceremony was held at the museum on October 23. Prizes were donated by the Society, Perkins Museum, the Survey, Barre Granite Museum, and Rock of

Ages Visitor Center. Winning posters were on display in the State House during December.

UVM's Fleming Museum hosted special tours to examine geologic materials used in objects and exhibits. Chris Fearon, Fleming Museum Education Specialist, organized this event and ran group tours for approximately 150 students and teachers.

It was a pleasure to have new events and the increased participation this year. OMYA hosted an open house Saturday the 13th at the marble quarry near Middlebury. Experts led hourly tours, helped visitors identify samples, and discussed local geology. Modern mining equipment was available for inspection. Alice Blount reports that they had a wonderful turnout and it was a successful outreach effort for OMYA. The annual FFA VT Land Judging Contest was held October 12 at Vermont Technical College in Randolph Center. The students viewed four different soil pits and made judgments on the soils' suitability for agriculture, forestry and housing. 170 high school students attended this year. The contest is co-sponsored by VT Ag Teachers Association, USDA-NRCS, and the White River Natural Resources Conservation District. Thomas Villars, a soil resource specialist with NRCS, oversees the contest.

This was the first year for hosting an event here in the Waterbury Complex. Larry Becker, Vermont State Geologist, presented his slide show on "Glaciers, Moraines and Meltwater: Alaska to Vermont." Also, VINS North Branch Nature Center offered "On the Rocks: Geology Mini-Course" for beginners taught by NBNC Educators Chip Darmstadt and Peter Watt and State Geologist, Laurence Becker. We anticipate continued enthusiasm for Earth Science Week and hope that more groups and businesses will join with us next year to meet the demand from the public and promote understanding of Vermont's natural systems. We are most thankful to all the Vermont Geological Society members who donate time and energy during this week and throughout the year to bring geology to the public.

Respectfully Submitted,
Christine Massey and Marjorie Gale

WINTER MEETING OF THE VERMONT GEOLOGICAL SOCIETY

Room 085, Cabot Science Bldg., Norwich University, Northfield, VT

Saturday, February 16, 2002, 9:15 AM

After a hiatus for several years, a Winter meeting of the VGS is scheduled for Saturday, February 16, 2001. The meeting will include six talks in the morning, followed by an afternoon lecture/workshop on varves presented by Dr. Jack Ridge of Tufts University.

PROGRAM

09:15 Coffee

09:30 Gregory J. Walsh, US Geological Survey: GEOLOGY OF THE TAGRAGRA DE TATA MASSIF, WESTERN ANTI-ATLAS, MOROCCO

09:50 Laurence R. Becker, Vermont State Geologist: GLACIERS, MORAINES, AND MELTWATER: ALASKA TO VERMONT

10:10 Fred D. Larsen, Norwich University: HOLOCENE SLUMPING OF LAKE WINOOSKI VARVES, BERLIN, VERMONT

10:30 Fred D. Larsen, Norwich University: HIGHLIGHTS OF THE LATE-GLACIAL AND POSTGLACIAL HISTORY OF THE RANDOLPH, VERMONT, 7.5-MINUTE QUADRANGLE

10:50 Stephen F. Wright, University of Vermont: SURFICIAL GEOLOGY OF THE JEFFERSONVILLE 7.5-MINUTE QUADRANGLE, NORTHERN VERMONT

11:10 Andrea Lini, University of Vermont: LAKE SEDIMENTS: MONITORS OF PAST AND RECENT ENVIRONMENTAL CHANGE

11:30 – 1:00 PM Break for Lunch (bring your own or venture into town)

1 – 3 PM Jack Ridge, Tufts University: VARVE CHRONOLOGY IN THE NORTHEASTERN U.S., A PRECISE CHRONOLOGY OF LATE PLEISTOCENE EVENTS

Presentations

GEOLOGY OF THE TAGRAGRA DE TATA MASSIF, WESTERN ANTI-ATLAS, MOROCCO

Gregory J. Walsh, US Geological Survey, Montpelier, VT

The talk will informally present recent results of a cooperative USGS - Morocco mapping project from two 1:50,000 sheets in the Anti-Atlas Mountains of Morocco. The talk will focus on the geologic evolution of the northern margin of the West African craton from the Paleoproterozoic Eburnean orogeny to the Carboniferous to Permian Hercynian orogeny.

GLACIERS, MORAINES AND MELTWATER: ALASKA TO VERMONT

Laurence R. Becker, Vermont State Geologist, Waterbury, VT

This talk will focus on how the glacial geology in Alaska helps us to understand Vermont's landforms and glacial history.

Abstracts

HOLOCENE SLUMPING OF LAKE WINOOSKI VARVES, BERLIN, VERMONT

Larsen, Frederick D., Dept. of Geology, Norwich University, Northfield, VT 05663 and Wright, Stephen F., Dept. of Geology, University of Vermont, Burlington, VT 05405

The Fecteau site is located in the town of Berlin on the Barre West, Vermont, 7.5-minute quadrangle 0.68 mi S20°W of the confluence of the Winooski River and its north-flowing tributary, the Stevens Branch. The site is a steep northeast-facing slope underlain by a thick sequence of varved silt and clay deposited in glacial Lake Winooski. Elevation at the site is about 560 ft above sea level; about 45 ft above and 550 ft from the Stevens Branch. Undercutting of the slope during expansion of a parking area for modular homes led to a typical slump with rotated block and exposed scarp in the month of October 1998. The scarp exposed a fault-like contact dipping 16° to the east in the lake-bottom sediments. The contact separated a layer of light gray clayey silt above a thin organic soil with wood fragments, which in turn overlies gray silt. Samples of the wood were collected and stored. The owners of the site quickly graded the slumped material and covered the scarp with rip-rap.

During the 1999 New England Intercollegiate Geological Conference, wood from a two-till site was collected at Culver Brook in the Montpelier quadrangle. In March 2000, the wood from Culver Brook was dated at 11,900 +/- 50 C-14 yrs BP, thus documenting the so-called Middlesex readvance. In October 2000, radiometric dating of wood collected at the Fecteau site was undertaken to determine whether or not the contact in question was possibly related to the Middlesex readvance. The radiometric date reported by Geochron Laboratories is 4090 +/- 60 C-14 yrs BP, which indicates that the contact is not a thrust fault related to glacial readvance, but is probably a low-angle normal fault related to slumping. The conclusion is that a block of Lake Winooski sediment slid down a slope and buried the organic soil with wood fragments during the mid-Holocene about 4090 C-14 years ago. This work was supported by the Vermont Geological Survey.

HIGHLIGHTS OF THE LATE-GLACIAL AND POSTGLACIAL HISTORY OF THE RANDOLPH, VERMONT, 7.5-MINUTE QUADRANGLE

Larsen, Frederick D., Dept. of Geology, Norwich University, Northfield, Vermont 05663

The Randolph quadrangle located in Central Vermont is underlain by belts of north-trending metamorphic rocks and a small area of igneous rocks. The terrain is rugged with relief of 1860 ft. Movement of Laurentide ice during the last glaciation was to the south-southeast based on an indicator fan of erratics derived from the Braintree pluton. Exposures of compact till are common, but have not been studied in detail. Ice-contact deposits are uncommon and only one small esker (?) has been mapped.

Thick varves of Lake Hitchcock, some greater than 3.0 ft in thickness, occur along the Third Branch of the White River and in Ayers Brook valley north of Randolph. The winter clay layer usually is less than 0.5-inch thick and the remaining summer portion consists of fine to very fine sand and silt. Laminations, A- and B-type ripple cross beds, and sinusoidal bedforms are common in the summer portion. Deltas of Lake Hitchcock have not been recognized, however, truncated foreset beds have been mapped at two locations.

The initial lowering of Lake Hitchcock resulted in sheets of pebbly sand and pebble gravel being washed out onto the former lake bottom where each tributary stream entered the main valley. With incision of the Third Branch and its tributaries these initial stream deposits have been left elevated above the streams and have been mapped as fan-terrace deposits.

Numerous stream terraces along the Third Branch and below the fan-terrace deposits are a significant component of the landscape. The terraces are capped by classic fining-upward sequences as formed by meandering streams. Coarse sediment at the base of the sequence is formed in the stream channel and fine sediment at the top is formed by overbank flooding. Lateral migration of the stream across a valley results in a fining-upward sequence of sediments under the flood

plain. On many terraces in the Randolph area there are curved stream channels that were abandoned when downcutting by the Third Branch took place. It appears that after relatively slow lateral migration of the Third Branch across the valley there was a short period of rapid downcutting during which the adjacent flood plain was left elevated as a terrace.

Interbedded fine sand and organic layers with wood fragments occur below a low stream terrace along Ayers Brook north of Randolph. These "ponded" sediments occur at an elevation (650 ft asl) and in an area where thick varves of Lake Hitchcock would be expected to occur. It appears that at this site Lake Hitchcock thick varves were removed by erosion by Ayers Brook and then the area was reflooded. The "ponded" sediments were deposited in a small, shallow basin and eventually covered by channel and overbank deposits of Ayers Brook. Subsequently, 25 ft of downcutting by Ayers Brook has exposed the "ponded" sediments. A sample of peat and wood from the organic layers has been dated at 8700 +/- 150 C-14 years BP (Geochron sample GX-28660).

A small U-shaped mound of fine sand resting directly on lake-bottom deposits at an elevation of 740 ft was mapped as a sand dune. The landform, 1.07 mi, S34°E of the confluence of Ayers Brook and the Third Branch, is evidence of eolian activity after Lake Hitchcock drained and before sand movement caused by the wind was halted by the growth of vegetation.

In June 1998, the Third Branch experienced a greater than 100-year flood. This resulted in rapid lateral cutting and subsequent slumping of loose lake-bottom deposits. The town of Randolph alone experienced damage greater than $1.4 million to roads and infrastructure. Mapping of surficial deposits in the Randolph quadrangle by the author, Professor Richard Dunn, Nathan Donahue and assistance from Fiona Johnstone, all of Norwich University, was supported by the Vermont Geological Survey.

SURFICIAL GEOLOGY OF THE JEFFERSONVILLE 7.5-MINUTE QUADRANGLE, NORTHERN VERMONT

Wright, Stephen F., Bosley, Andrew C., McGee, Megan A., Guerino, Matthew J., Department of Geology, University of Vermont, Burlington, VT, 05405, swright@zoo.uvm.edu

We present a detailed map and cross-sections depicting the surficial geology of the Jeffersonville 7.5-minute quadrangle based on 4 months of field work conducted during the summers of 2000 and 2001. Research was supported by the Vermont Geological Survey and the U.S. Geological Survey, National Cooperative Mapping Program, under Assistance Award No. 98HQAG2068. Students were also supported through the Research Experience for Undergraduate funds administered by the American Association of State Geologists.

The Jeffersonville Quadrangle lies within the Green Mountains and is traversed by the Lamoille River valley. The surficial geology of the quadrangle is dominated by both till and lacustrine sediments deposited by the late Wisconsinan advance of the Laurentide ice sheet and a series of glacial lakes that occupied the river valleys during retreat.

Striation measurements at high elevations all record the NW to SE flow of the ice sheet, a direction that cuts across the N-S alignment of most ranges in the Green Mountains. At lower elevations, striae are aligned parallel to the Lamoille River valley, indicating the topographic control exerted on the thinning tongue of the ice sheet. The most common till at the lower elevations is relatively loose, has a fine sand or silt matrix, and contains only sparse erratics that are cobble size and larger. This till overlies deformed lacustrine sediments and was deposited during a readvance episode that may correspond to the well-documented Littleton readvance in the Connecticut River valley to the east and the Middlesex readvance to the south dated at 11,900 C-14 ybp (Larsen, 2000) or ~13,950 calibrated ybp.

The bedrock valley of the Lamoille River and smaller tributaries are deeply buried beneath ice-contact, lacustrine, and modern alluvial sediments between the bedrock dam in Fairfax and Ithiel Falls in Johnson. An esker system (esker ridge and associated subaqueous fan

deposits) exposed in the village of Johnson continues west along the Lamoille valley, but is deeply buried. Water well logs have allowed us to partially trace this esker and to document its utility as a high-yield, although hard-water-bearing, confined aquifer. Thick sequences of undeformed, varved lacustrine silt and clay fill much of the valley bottoms. Deltas indicate glacial lake levels in the valley at 1130 ft (345 m, Glacial Lake Winooski), ~800 ft (244 m, Glacial Lake Mansfield), ~720-660 ft (220-200 m, Glacial Lake Vermont).

Except in the vicinity of the Brewster River delta, near Jeffersonville, Holocene river terraces are rare and occur at elevations less than 50 ft (15 m) above the modern flood plain of the Lamoille river. In most areas alluvium beneath the modern floodplain is less than 5 m thick. The implication is that the Lamoille River has only eroded ~20 m of lacustrine sediments since the last glacial lake drained from the valley, i.e. an almost complete section of glaciofluvial, glaciolacustrine, and glaciotectonic (readvance) sediments lies buried beneath the valley.

LAKE SEDIMENTS: MONITORS OF PAST AND RECENT ENVIRONMENTAL CHANGE

Lini, Andrea, Dept. of Geology, University of Vermont, Burlington, VT, 05405, alini@zoo.uvm.edu

New England has numerous lakes that provide a temporal record of surface and lacustrine processes that have been influenced by both natural environmental change and human activities. Often these changes affect biological communities in and around lakes, thus much of the paleoenvironmental information stored in the sedimentary record can be inferred from the analysis of sedimentary organic matter. In addition, the abundance as well as the temporal distribution of layers consisting mostly of inorganic matter (e.g., sand, silt, and clay) can provide very valuable information about processes active in a lake's watershed. For example, such layers can be used to infer frequency and magnitude of paleostorms.

We have investigated numerous lake records in Northern New England focusing on two distinct time intervals: a) the last glacial-postglacial transition and, b) the more recent post-settlement period. Analyses of these two time intervals provide significant insight into the

response of lake ecosystems to environmental change at different resolutions (yearly vs. centennial and millennial). The last glacial-postglacial climatic transition allows us to investigate how, and at what rates, watershed and lake ecosystems were established on once glaciated, carbon and nutrient-poor landscapes. Detailed records of isotopic (delta-13C and delta-15N) and elemental composition (%C, %N, C/N ratios) produced for ten post-glacial lakes in northern New England have documented the individualistic response of lacustrine ecosystems to deglaciation. The sedimentological and isotopic data show that in the studied lakes aquatic communities were not fully established until about 500 to 3000 years after the glaciers left, thus giving indications about the time necessary for lacustrine biota to recover from extreme climatic events.

Many Vermont lakes contain excellent records of human-induced events that have altered the ecological balance of the watershed and the productivity of the lake, such as: settlement, clear-cutting, farming, grazing, and industry. In collaboration with the VT Dept. of Environmental Conservation, we are investigating the use of stable isotopes and elemental composition of sedimentary organic matter as tracers for land-use change and cultural eutrophication in a number of VT lakes. The data obtained so far suggests that fluctuations detected in the geochemical records of lake sediments can be linked to specific human disturbances. In particular, the signals of logging and farming are easily identifiable and were found in several of the studied lakes. Nevertheless, further study is required to explain some of the patterns common to all of the study lakes, and for which catchment-scale human disturbances can only partially account for the observed fluctuations.

VARVE PRESENTATION & WORKSHOP

VARVE CHRONOLOGY IN THE NORTHEASTERN U.S., A PRECISE CHRONOLOGY OF LATE PLEISTOCENE EVENTS

Jack Ridge, Dept. of Geology, Tufts University, jack.ridge@tufts.edu

Topics to be covered include:

1. The existing varve chronologies in the northeastern United States and the history of their development,
2. The construction of outcrop varve sequences and how they are matched to a master chronology,
3. The use of varve chronology as a means of constructing time scales for deglaciation and late glacial climate change,
4. Calibration of the varve chronologies with radiocarbon ages and plaeomagnetism, and
5. Important events (climatic and non-climatic) recorded by the varves themselves.

The talk will also touch on depositional mechanisms for glacial varves. About 20 varve cores from northern New England will be available so people can see what they look like and their variety.

(The presentation by Dr. Jack Ridge is supported by the Larsen Fund, an endowed gift from alumni and friends to support science lectures at Norwich University.)

DIRECTIONS TO NORWICH

Norwich University is located on VT Route 12, a mile south of the center of Northfield. It can be reached from I-89 by taking Exit 5 and following Route 64 west to Route 12, and then north to the university. Coming from the north, it's a toss up which is easier/quicker, using the interstate or taking Route 12 south from Montpelier. The Geology Department is located in Cabot Science, the southeastern most brick building on campus, just west of Route 12. The entrance is near the northeast corner of the very large white Kreitzburg Library which can't be missed. The easiest parking for the meeting will be in the commuter lot opposite the Science/ Engineering complex on the east side of Route 12.

STATE GEOLOGIST'S REPORT

Drought and aquifers: The State Geologist attended a meeting co-sponsored by Senator Jefford's office and VT Emergency Management to air concerns about the drought. Senator Leahy's and Representative Sander's Offices were also in attendance. The State Climatologist, Leslie-Ann Dupigny-Giroux (UVM) and the Water Supply Division summarized the existing monitoring data that indicate drought conditions. The State Geologist discussed the drying up of shallow sources such as dug wells and of springs that are often served by the declining water table aquifer. Even the artesian wells drilled into fractured rock are dropping in yield. Much discussion focused on loan programs to help with drilling bedrock wells and getting truckloads of water to homeowners. In the closing discussion on long-term solutions, the State Geologist noted how the drought shows the importance of ground water to individuals and the economy of Vermont. We need to better understand the aquifer resources of the State to supply groupings of houses, farms, and municipalities to provide sustainable yields during extended dry periods. Staff to Senator Jefford's Committee on Environmental and Public Works were very interested in following up on research into the identification of aquifer resources.

Radionuclides: Jon Kim gave a talk entitled "Geologic Context of Elevated Radionuclide Occurrences in Northwestern Vermont" at Johnson State College on Dec. 12 as part of a weekly environmental lecture series. The Division will work with the Environmental Program at Johnson State to involve students in some aspects of future radionuclide research. The Division is already co-sponsoring a senior thesis at Middlebury College that will focus on the geologic basis of an airborne uranium anomaly in the Starksboro/Monkton area. This study will utilize field mapping, gamma ray spectrometer surveys, radon measurements, and water well radionuclide testing. The geologic information gathered in this investigation will be a valuable addition to the Geology Division's radioactive hazard mapping program.

Science education: The Division of Geology and Mineral Resources was an exhibitor at the third annual Pathways to Standards-Based

Science Conference in Rutland. The conference provides an opportunity for us to learn about science curriculum and the needs of Vermont educators, showcase classroom resources available through the Division, and to meet and brainstorm with others about our educational outreach programs. This year the Division shared a booth with the Perkins Museum, one of our Earth Science Week partners, and focused on that program.

State bedrock map progress: As many of you are aware, the Vermont Geological Survey and the US Geological Survey, in conjunction with geologists from the University of Vermont and elsewhere, are in the process of producing a new bedrock geologic map of Vermont at a scale of 1:100,000. The project was delayed with the passing of Rolfe Stanley, one of the Chief Editors. Nick Ratcliffe, Chief Editor from the USGS, is now working with Marjorie Gale and Peter Thompson who have adapted to their new roles as Associate Editors. We are continuing to make progress on the bedrock map and spent field time this summer reviewing geology in various areas throughout Vermont and fine-tuning linework so that the northern and southern maps could be joined. This fall maps were edited based on additional field data, review of previous works, and new age data which impact stratigraphic and structural interpretations. As the New Year begins, the northern Vermont one-degree sheets have been compiled and preliminary edits are complete. Linework on the master mylar (which will be submitted for peer review) is finished and the northern map has been forwarded to USGS so that linework for the southern portion of the map can be added at the join. The plan is for the map to be produced as five sheets: three contain the linework and two contain descriptions, references, geochronological data, metamorphic data, a tectonic map and cross-sections. Additional edits will be completed next summer/fall based on resolving questions from the scientific review process. Following peer review, the map will go through technical editing and a final version will be prepared. That version will enter production where it will be scribed, digitized, and published. We greatly appreciate the contributions and commitment to the project from the geologic community.

Respectfully Submitted,
Laurence R. Becker, State Geologist

VGS ANNUAL MEETING & ELECTIONS

Saturday, October 20, 2001

Following an excellent field trip to OMYA's Middlebury quarry (many thanks! to OMYA geologist Andy McIntosh), a general membership VGS meeting and election of officers was held at Middlebury College.

Election results and committee chairs for 2002 are as follows:

President: Ray Coish
Vice President: Helen Mango
Secretary: Jeff Hoffer
Treasurer: Kristen Underwood

Board of Directors: Shelley Snyder, Kristen Underwood,
and Stephen Wright
Geological Education Committee Chair: Christine Massey
Public Issue Committee Chair: Larry Becker
Publications/Editorial Committee Chair: Marjorie Gale
Advancement of Science Committee Chair: Stephen Howe

Following the elections, several general membership items and ideas were discussed. Stephen Howe announced the award of a $425 research grant to Middlebury student Parham Gardner. VGS is now reviewing grant proposals on an annual basis. Stephen mentioned the possibility of publishing a Vermont Geology publication, with the possible inclusion of detailed field trip guides. Stephen also indicated an interest in reviving a winter meeting, and a discussion of possible formats were discussed.

Respectfully submitted,
Jeff Hoffer
VGS Secretary

ADVANCEMENT OF SCIENCE COMMITTEE

The Advancement of Science Committee has been busy initiating several projects proposed at the Fall Annual Meeting. The Committee felt strongly that it was important to resume the Winter Meeting on an annual basis to provide our professional members with a forum to present results of their current research. To this end, our Winter Meeting will be held at Norwich University on Saturday, February 16, 2002, to include a workshop on varves coordinated by Fred Larsen and featuring Jack Ridge. We have recently received approval to establish a website for the Vermont Geological Society on the University of Vermont's main server. We are currently in the process of developing content for the site during its construction phase. Finally, plans are being drawn up for two new issues of Vermont Geology that the Committee hopes will be published in the next year or two.

Stephen S. Howe
Chair, Advancement of Science Committee

NEW HAMPSHIRE LICENSING GEOLOGISTS

Administrative rules for the licensing of geologists in New Hampshire were adopted effective July 2, 2001. Applications are being accepted for licensure without examination until June 30, 2002. Applications can be obtained by submitting name and address via e-mail to dlobdell@nhsa.state.nh.us, fax (603-271-6990), phone (603-271-2219), or downloading the forms from www.state.nh.us/jtboard/geo.htm

For additional and background information, visit the New Hampshire Council of Professional Geologists website: www.nhcpg.org

NEW YORK STATE

The New York State Council of Professional Geologists (NYSCPG) is continuing with its efforts to promote the profession and the licensing of geologists. NYSCPG and its lobbyists are optimistic that the proposed licensure bill will pass into law in 2002. For additional information and to become a supporting member, please visit NYSCPG's website: www.nyscpg.org

YOU MIGHT BE A GEOLOGIST IF. . .

You can pronounce the word "molybdenite" correctly on the first try.
You think the primary function of road cuts is tourist attractions.
You own more pieces of quartz than underwear.
You associate the word "hard" with a value on the Mohs scale instead of "work".
Your rock collection weighs more than you do.
You don't think of "cleavage" the same way everyone else does.
You follow when you see the local university's geology class going on a field trip.
You associate the name "Franklin" with New Jersey instead of "Ben".
Your spelling checker has a vocabulary that includes the words "polymorph" and "pseudomorph".
Your children are named Rocky, Jewel, Crystal, and Beryl.
You think there's nothing wrong with looking at the stone facades of buildings with your hand lens.
You've ever spent more than ten dollars for a book about rocks.
You shouted "Obsidian!" to a theater full of movie-goers while watching "The Shawshank Redemption".
You find yourself compelled to examine individual rocks in driveway gravel.
You're planning on using a pick and shovel while you're on vacation.
You think Herkimer, New York might be a cool place to go on a vacation.
You've taken a copy of Dana's Manual of Mineralogy to the bathroom.
You still think pet rocks are a pretty neat idea.
You never throw away anything.
You get excited when you discover a hardware store that stocks 16 pound sledge hammers and 5 foot long pry bars.
Your employer has asked you not to bring any more rocks to the office.
You file stratigraphically yet can find important files faster than your secretary.
You decide not to get married because you'd rather keep your rock collection.

excerpted from http://geology.csusb.edu/geoclub/ymbgeo.html

VGS TREASURER'S REPORT

The financial condition of the Society remains strong. Please see the Income Statement for the period January 1, 2001 through December 31, 2001. Expenses exceeded income for the calendar year, largely due to the Society's renewed focus on awarding student research grants. Two student grants were paid out this year, one of which was applied for and awarded in calendar year 2000. The checking account balance is $2,570.60 as of December 31, 2001. All bills received by me have been paid and are reflected in the above balance. I welcome feedback and suggestions from the Board and membership.

Kristen L. Underwood
December 31, 2001

Income and Expenses
1/1/01 through 12/31/01

INCOME		
Total Dues		$833.00
Dues-Family	$120.00	
Dues-Institution	$0.00	
Dues-Member	$705.00	
Dues-Student	$8.00	
Interest		$11.78**
Publications		$22.00
Student Research Grant Contributions		$305.00
TOTAL INCOME		$1,171.78
EXPENSES		
US Post Office (stamps, GMG Distribution)		$163.40
Minuteman Press (GMG Publishing)		$369.64
Earth Science Week Poster Awards		$90.00
Research Grant Awards		$772.60
Student Awards (VGS Spring Mtg)		$155.00
TOTAL EXPENSES		$1,550.64
TOTAL INCOME – EXPENSES		($378.86)

** *Does not reflect interest from October, November, December.*

VERMONT GEOLOGICAL SOCIETY - DUES STATEMENT 2002

Membership dues for 2002 are $15.00 for Members and Associate Members, $20.00 for a Family Membership with one newsletter subscription, and $8.00 for Student Members. Membership dues are used to publish the *Green Mountain Geologist*, to finance our Student Research Grants, and to cover the costs associated with meetings and field trips. If your address, phone, or e-mail address has changed since last year, please fill in this information below, if not, just give your name. A new membership directory will be published with the Summer *GMG*. Return this form with your check for the appropriate amount made payable to the Vermont Geological Society by March 30, 2002. Thank you.

Date: Check No.:
Name:
Affiliation:
Street or Box:
City, State, ZIP:
Work Phone:
Home Phone:
Fax No.:
e-mail address:
Circle Type of Membership:

Member ($15) Student Member ($8) Family ($20)

Amount Due: _____

Add't Contribution to VGS Research Grants: _____

Total Enclosed: _____

Send to:
Kristin Underwood, Treasurer
2852 South 116 Road
Bristol, VT 05443

VGS
STUDENT RESEARCH GRANTS

are designed to aid our future geologists investigate Vermont's geo-history. Please consider helping the VGS promote a deeper insight into Vermont Geology. Students receiving assistance through the program will present their research results at the VGS Spring Meetings. Your generosity will help cover a lot of terrane!

To contribute to the VGS Student Research Grant Program, please include your contribution with your dues statement, or clip or copy this form and send it, along with your check or money order made payable to the Vermont Geological Society, to:

Kristen Underwood, VGS Treasurer
2852 South 116 Road
Bristol, VT 05443

I've enclosed my tax-deductible contribution to be dedicated to the VGS Student Research Grant Program.

TOTAL GIFT $_____

NAME:_____

ORGANIZATION:_____

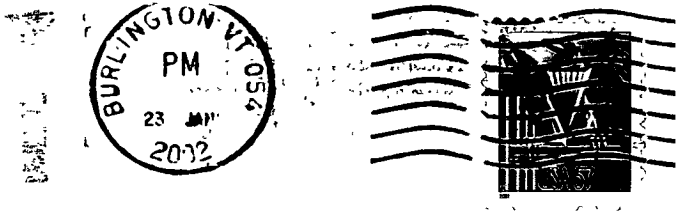
ADDRESS:_____

CITY:_____ STATE:_____ZIP:_____

THE GREEN MOUNTAIN GEOLOGIST
VERMONT GEOLOGICAL SOCIETY
DEPARTMENT OF GEOLOGY
UNIVERSITY OF VERMONT
BURLINGTON, VERMONT 05405-0122

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

ADDRESS CHANGE?
Please send it to the Treasurer at the above address.
–Printed on Recycled Paper–



Marjorie Gale
379 Poker Hill Rd.
Underhill, VT 05489

Summary of
VGS Summer Field Trip – Saturday, July 21, 2001
Great Brook, Plainfield, VT

This sunny, humid day concluded with a discussion of sediment transport mechanisms while cooling our Teva™- and sneaker-clad feet in the Great Brook, south of Plainfield, Vermont. VGS sponsored the Summer Field Trip to this 14.2 square mile basin, hosted by Lori Barg of Step By Step and George Springston of the Vermont Geological Survey. In recent years, the Great Brook channel has responded to floodplain encroachment, channelization, and other human disturbances by incision, bank failure and widening, resulting in substantial infrastructure and agricultural losses [1]. Recently conducted mapping of the watershed's fluvial geomorphology (Lori) and surficial geology (George) has been funded in part by the Vermont Geological Survey, Dept. of Environmental Conservation and the US Geological Survey, National Cooperative Mapping Program. Results of the study are being utilized to prepare a slope instability and erosion hazard map for the watershed to support future planning and zoning and reduce flood damage and infrastructure losses.

The Great Brook watershed spans the Plainfield, Barre East, and Knox Mountain topographic quadrangles in Washington, Orange, and Caledonia Counties. The main channel is approximately 9 miles in length, draining lands from an elevation of 3352 feet to 712 feet above sea level at the Great Brook confluence with the Winooski River in Plainfield, Vermont.

The lower portions of the watershed (below an elevation of 960 feet) are predominantly occupied by lacustrine sands, silts and silty clays associated with Glacial Lake Winooski. Surficial deposits of the upper watershed include lodgment till with localized deposits of ablation till, ice-contact sands, and several occurrences of high-level glacial lake deposits up to 1300 feet and higher. Field trip **Stops #3 and 6** highlighted mass failure slopes providing exposures of lodgment till overlain by compact, varved lacustrine silt and silty clay, overlain by more lodgment till. These sequences, and others in the basin, appear to indicate at least a minor late Wisconsinan ice readvance [1]. Varves in these lacustrine deposits were measured at up to 1 meter in thickness!

George and Lori's study focused in part on the nature of the surficial deposits and their susceptibility to erosion under the hydraulic stresses imparted by anthropogenic disturbances in the basin. Weathered lodgment till and lacustrine sands were found to be highly erodible and subject to mass failure, while fine-grained lacustrine silt and silty clay are relatively resistant. Some slope failures seem to be associated with contacts between deposits with markedly different permeabilities. **Stop #2** (Fowler Pit) provided an example of highly-erodible soils: an ephemeral stream canyon developed in ice-contact silty fine sands **(see Photo).** Local farming operations have diverted concentrated flow off adjacent till slopes to the ice-contact sand deposits. In addition, active mining of sands from the Fowler pit at the base of the slope has served to reduce the base level. Severe headcutting and incision have resulted in the development of a canyon in the sand deposits, which is hundreds of feet in length, up to 200 feet across and nearly 80 feet deep.

The lower 5 miles of the Great Brook are dominated by active incision and over-widening, resulting in substantial geomorphic instabilities with more than 25 mass failures recorded in this study. "Floodplain encroachment and in-stream management practices in the lower part of the Great Brook shares a confined stream valley with the Brook Road, and thirteen narrow bridges cross the brook along this 5 mile length. According to Lori, the bridges are often narrower than the channel width at bankfull flow and generally cause the channel to be constricted. Following a large flood in 1973, the Brook was channelized using a bulldozer for an approximate distance of four miles upstream from Plainfield village. Results of this channelization were evident at **Stop 6** where the stream channel had been significantly modified to reverse natural meander patterns, and large boulders, possibly capable of grade control, had been selectively removed from the channel for use as rip-rap.

References:

1. Barg, Lori and George Springston, March 13, 2001, *The Influence of Land Use Change and In-stream Management Practices on Channel Evolution in the Great Brook Watershed, Central Vermont.* Poster Session presented at Northeast Section Meeting of the Geological Society of America, Burlington, VT.

Submitted by:
Kristen Underwood
VGS Treasurer
Oct. 3, 2001

The Vermont Geological Society extends its thanks to Lori Barg and George Springston for contributing their time on a Saturday to enlighten and educate us on this Summer Field Trip.

Suggested Further Reading:

Center for Watershed Protection, Aquafor Beech Limited, and Step by Step, September 1999, *Impact Assessment of Instream Management Practices on Channel Morphology*, prepared for Vermont Geological Survey.

Center for Watershed Protection, Aquafor Beech Limited, Lori Barg, and Robert Kort, September 1999, *Watershed Hydrology Protection and Flood Mitigation Project Phase II – Technical Analysis Stream Geomorphic Assessment*, prepared for Vermont Geological Survey.

Montgomery, David R. and John M. Buffington, 1997, *Channel-Reach morphology in mountain drainage basins.* GSA Bulletin, v. 109, no. 5, pp. 596-611.

Schumm, S., 1984. The Fluvial System. John Wiley and Sons, New York, NY.

Rosgen, D., 1996. *Applied Fluvial Morphology.* Wildland Hydrology Books, Pagosa Springs, Co.

Leopold, L., Wolman, M. and Miller, J. 1964 *Fluvial Processes in Geomorphology*, W. H. Freeman and Co.

VGS SUMMER FIELD TRIP 2002

Stop #1: George Springston and Stephen Wright ponder a possible sediment-draped, ice-rafted boulder at the base of a mass failure developed in a sequence of interbedded lodgement till and fine-grained lacustrine sediments on the outside of a meander bend in the Great Brook. *(Photo: Jeff Hoffer)*

Stop #2: Up to 200 ft wide by 80 ft deep canyon eroded into ice-contact silty fine sands by an ephemeral tributary to the Great Brook. Erosion of this gully was initiated in the 1970s resulting from concentrated watershed, including channelization and removal of armor, contribute to the instability" which is associated with the absence of channel-spanning bedrock control [1]. This lower portion of the flow from agricultural runoff and lowering of the base level through active sand extraction. Fowler Pit, Plainfield, VT. *(Photo: Jeff Hoffer)*

VERMONT GEOLOGICAL SOCIETY - DUES STATEMENT 2002

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Affiliation:

Street or Box:

City, State, ZIP:

Work Phone:

Home Phone:

Fax No.:

e-mail address:

Circle Type of Membership:

Member ($15) Student Member ($8) Family ($20)

Amount Due: _____

Add't Contribution to VGS Research Grants: _____

Total Enclosed: _____

Send to:
Kristin Underwood, VGS Treasurer
2852 South 116 Road
Bristol, VT 05443

VERMONT GEOLOGICAL SOCIETY
RESEARCH GRANT PROGRAM
Policy and Procedures

The primary goal of the Vermont Geological Society (VGS) Research Grant Program is to promote and support original research on Vermont geology by undergraduate and graduate students and secondary school teachers (grades 7-12). The grant program does not seek to cover all of the researcher's expenses but instead should be viewed as a professional endorsement of the research endeavor. Requests for grants are judged on how well the proposed research will advance the science of geology and its related branches within the State of Vermont. Since the grant program budget is not anticipated to be large enough to fund every research proposal, the grants will be awarded on a competitive basis. The policy for applying for and awarding grants is outlined below.

Eligibility

Undergraduate and graduate students and secondary school teachers (grades 7-12) who are undertaking original research projects on Vermont geology and related disciplines are eligible for VGS research grants. VGS research grant applicants need not be members of the Vermont Geological Society. Graduate and undergraduate students must be currently enrolled in degree-granting institutions and their research must be part of a degree requirement. Secondary school teachers will ordinarily be teaching within Vermont. Post-graduate students, college or university faculty, primary school teachers, and institutions are not eligible. Institutions may not request that overhead costs be added to budgets. **The Vermont Geological Society strongly encourages women, minorities, and people with disabilities to participate fully in this research grant program.** The research proposals will be evaluated on the basis of the feasibility and scientific merit of the project, the abilities of the researcher, and the reasonableness of the budget. Students are eligible for only one VGS Research Grant per degree pursued.

Research Grant Guidelines

Individual grants will not ordinarily exceed $500, although a higher sum may be awarded based on merit and number of grant applications received. One or two (see below) confidential letters of recommendation are required for each grant applicant. These letters should be either sent directly to the Vermont Geological Society or included with the grant application in sealed envelopes to preserve confidentiality.

Graduate students:

Priority will be given to graduate students who are ready to begin their research. Graduate students need to submit a completed application form and ***two*** letters of recommendation. These letters will ordinarily come from the student's academic or thesis advisor and from one additional faculty member.

Undergraduate students:

Due to different schedules at different institutions for senior work, research should be scheduled to begin within 9 months the grant award. Undergraduate grant applicants need ***one*** letter of recommendation which will ordinarily come for the student's academic or thesis advisor.

Secondary school teachers:

Research should be scheduled for sometime during the summer or the school year. Secondary school teachers will need ***two*** letters of recommendation from people able to evaluate the applicant and the proposed research.

Rules for the Use of VGS Research Grant Funds

Grants are to be used for expenses directly associated with the research proposed. For example research funds may be used for field expenses (travel, meals, lodging), materials and supplies (sample bags, base maps, air photos, film and developing costs, etc.). Travel to professional meetings will not be funded. Funds requested for equipment, computer time and software, thin-sections, chemical and isotopic analyses, and the purchase of services must be fully justified. Research grants may not be used for salaries or tuition but may be used to pay a field assistant or technician. Upon completion of the research, equipment and materials purchased with a VGS research grant become the property of the department in which the student is enrolled or the school where the teacher is employed and are expected to be available to help additional students/teachers with their research.

Responsibilities of Recipients

Grant recipients are encouraged to present their results at professional meetings as well as to publish them. In both cases support by the Vermont Geological Society should be acknowledged. Recipients who cannot undertake or complete their project must return any unused funds along with a written explanation of expenses incurred. Grants may be subject to tax by the IRS and the grant recipient is responsible for determining this.

Within 1 year of receiving their grant, all VGS research grant recipients are expected to 1) submit a written abstract of the results of their research to be published in the Green Mountain Geologist, and 2) present their research at the Spring Meeting of the Vermont Geological Society.

Applications

Use the application format on the reverse side of this sheet. For additional information, please write to the Vermont Geological Society Research Grant Program, c/o Stephen Howe, Dept. of Earth & Atmos. Sciences, Earth Science 351, University at Albany, 1400 Washington Avenue, Albany, NY, 12222, e-mail: showe@csc.albany.edu, or by calling (518-442-5053. The application should be typed, signed, and submitted together with the letters of recommendation. Each application will be reviewed by the Research Grant Committee of the Vermont Geological Society. The decisions of this committee are final.

Vermont Geological Society Research Grant Program

Application for 2002

Please follow the **format** below and submit a **signed** application to arrive by April 1, 2002.

1. Name of Applicant:
   Address:
   e-mail:
   Telephone numbers and hours that are best to reach you:

2a. If you are a student, to which degree will this research lead?
   At which college/university?
   Expected degree completion date:
   Project supervisor and address/phone/e-mail (students only):

2b. If you are a secondary school teacher, how does this project fit into your professional development?

3. Project title:

4. Statement of problem. Please include in your statement how this work will further our understanding of Vermont Geology.

5. Concisely state how you plan to accomplish your investigation.

6. Give a brief bibliography of the most important papers related to your proposed research.

7. Duration of investigation (dates):

8. Budget: (If you are only asking the Vermont Geological Society to support part of your budget, specify those parts. Calculate mileage at a rate of $0.25 per mile.)

9. Budget justification:

10. Other support for this project, both applied for and received. For support applied for, include dates you expect to know outcome:

11. Have you received a previous VGS research grant? If yes, give year and title of project.

12: Sign & Date the Submittal

Please send an application to: **Vermont Geological Society Research Grant Program, c/o Stephen Howe, Dept. of Earth & Atmos. Sciences, Earth Science 351, University at Albany, 1400 Washington Avenue, Albany, NY, 12222**

THE
GREEN MOUNTAIN GEOLOGIST

NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

Spring 2002 VOLUME 29 No. 2

VERMONT GEOLOGICAL SOCIETY SPRING MEETING
Presentation of Student Papers

April 20, 2002, 8:30 AM
Middlebury College

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SPRING MEETING PROGRAM

VERMONT GEOLOGICAL SOCIETY

Annual Presentation of Student Papers
Bicentennial Hall, Room 220
Middlebury College, Middlebury, Vermont

April 20, 2002
8:30 AM

8:30 Coffee

9:00 Susan Ludwick, Middlebury College: THE MERTZ DRIFT: A PALEOENVIRONMENTAL ARCHIVE IN EAST ANTARCTICA

9:15 Holly Carlson, Middlebury College: QUANTITATIVE XRD ANALYSIS AS A MEANS OF DETERMINING LAST GLACIAL MAXIMUM ICE FLOW DIRECTION IN VERMONT

9:30 Bradley Corr, Middlebury College: SOURCE IDENTIFICATION OF THE STARKSBORO RADIONUCLIDE ANOMALY: A FIELD, GEOCHEMICAL AND PETROGRAPHIC STUDY OF ANOMALOUSLY HIGH RADON LEVELS

9:45 Dayna Adelman, University of Vermont: AN ANALYSIS OF AN EIGHTEEN YEAR RECORD OF CARBON AND OXYGEN ISOTOPE RATIOS IN MONTASTREA ANNULARIS, ROATAN, BAY ISLANDS, HONDURAS

10:00 Alysa Snyder, University of Vermont: TRACE ELEMENT ANALYSIS OF STREAM SEDIMENTS AND THEIR RELATIONSHIP TO BEDROCK GEOLOGY, ROATAN, BAY ISLANDS, HONDURAS

10:15 Dana Drummond, Middlebury College: CHEMICAL WEATHERING OF THE EAST DOVER ULTRAMAFIC BODY, EAST DOVER, VERMONT

10:30 Parham P. Gardner, Middlebury College: GEOCHEMISTRY AND PETROLOGY OF A SERPENTINIZED ULTRAMAFIC UNIT IN EAST DOVER, VERMONT

10:45 BREAK

11:00 Jeff Polubinski, Middlebury College: A GEOCHEMICAL ANALYSIS OF GREENSTONES IN THE PINNACLE, UNDERHILL AND HAZENS NOTCH FORMATIONS NEAR BOLTON, VERMONT

11:15 Heather Beal, Middlebury College: A PETROLOGIC AND MICROSTRUCTURAL STUDY OF THE SCARBORO FORMATION, CASCO BAY SEQUENCE, SOUTH-CENTRAL MAINE

11:30 Nathan Toke, University of Vermont: TECTONICS AND TOPOGRAPHY: SOME NEW RELATIONSHIPS IDENTIFIED ALONG THE ALPINE FAULT IN NEW ZEALAND

11:45 Ben Cichanowski, University of Vermont: ISOTOPIC AND ELEMENTAL COMPOSITION OF LAKE BIOTA AND RECENT SEDIMENTS: A REGIONAL COMPARISON

12:00 Fred Coriell, Middlebury College: RECONSTRUCTION OF A PALEOFLOOD CHRONOLOGY FOR THE MIDDLEBURY RIVER GORGE USING TREE SCARS AS FLOOD STAGE INDICATORS

12:15 LUNCH BREAK

1:00 Anna Cotton, Middlebury College: STRATIGRAPHY AND SEDIMENTOLOGY OF A PARAGLACIAL FAN NEAR HANCOCK, VERMONT

1:15 Angela Rogers, University of Vermont: THE IMPORTANCE OF HAZARD MAPS IN THE THIRD BRANCH OF THE WHITE RIVER VALLEY, CENTRAL VERMONT

1:30 Jamie Laidlaw, Middlebury College: A MID TO LATE HOLOCENE RECORD OF FIRE FREQUENCY FOR THE NORTHWESTERN UINTA MOUNTAINS INTERPRETED FROM CHARRED PLANT REMAINS IN LACUSTRINE SEDIMENTS

1:45 Christopher Q. Kautz, Middlebury College: THE MINERALOGICAL RECORD OF EOCENE/OLIGOCENE CLIMATE CHANGE IN THE JOHN DAY FORMATION, CENTRAL OREGON

2:00 Robyn C. Cook, Middlebury College: DIFFERENTIATION OF TWO QUATERNARY MT. HOOD LAHARS BY CLAY MINERALOGICAL, QUANTITATIVE X-RAY DIFFRACTION AND PARTICLE SIZE ANALYSES

STUDENT ABSTRACTS

THE MERTZ DRIFT: A PALEOENVIRONMENTAL ARCHIVE IN EAST ANTARCTICA

Susan Ludwick, Geology Department, Middlebury College, Middlebury, VT 05753

The Mertz Drift, located in the Mertz-Ninnis Trough of East Antarctica, is an area of high sedimentation and contains a high-resolution sedimentary record of paleoclimactic variability (Harris et al., 2001). This record was expanded during East Antarctic Cruise NBP0101, February 2001, when two Jumbo Piston Cores (JPC10, JPC11—21.24m and 23.98m respectively) were obtained from the drift. Physical property data was collected, along with p-wave velocity, electrical resistivity, and magnetic susceptibility data at 5cm intervals for each core. P-wave velocity and bulk density were used to generate synthetic seismograms to compare between sediment cores and PDR records. Grain size analysis, using the Malvern MastersizerE®, was conducted on 397 samples from JPC10, containing an expanded sediment record, and on 224 samples from JPC-11, containing a more condensed record with 1.06m of diamicton at the base.

These sites, verified by radiocarbon dating, contain a record of Holocene climate change. At approximately 5000 yrs BP (between 1500-1750cm core depth), there is a change in sedimentation rate for both cores. This corresponds to a lithology change from laminated and water saturated oozes to silty/muddy diatom oozes, according to electrical resistivity classifications created by Burgdorff (2002). This

change in deposition is reflected in the physical properties of electrical resistivity, porosity, and voids ratio.

JPC11 (sampled in a condensed stratigraphic section) recovered diamicton. The diamicton is the transition facies from ice-covered to open-marine conditions. Open marine conditions were sampled throughout JPC10. Spectral analyses of grain size, magnetic susceptibility, electrical resistivity and density all show variability indicating paleoproductivity trends. Paleoclimactic shifts are documented and a climate model is proposed to explain the variations in data, along with a proposed forcing mechanism for climate shifts.

QUANTITATIVE XRD ANALYSIS AS A MEANS OF DETERMINING LAST GLACIAL MAXIMUM ICE FLOW DIRECTION IN VERMONT
Holly Carlson, Geology Department, Middlebury College, Middlebury VT

Quantitative X-ray diffraction (QXRD) was used to examine directions of glacial ice flow for the late Wisconsinan advance, and to test Stewart and MacClintock's (1970) model suggesting a glacial advance derived from the northeast. Data from QXRD analysis from localities across Vermont universally indicate NW to SE ice flow and provide no evidence for a northeasterly advance. Till SE of the k-feldspar-rich Barre Granite contains 14.8% k-feldspar whereas till to the SW averaged just 2.5% and contained no k-feldspar at 1 m depth, clearly indicating glacial advance from NW to SE. A similar trend was observed near serpentine-rich ultramafic rocks in East Dover (southern Vermont), where serpentine was detected in elevated concentrations (5 - 10%) S SE of the serpentine-bearing outcrop, while only in trace amounts (<2%) were detected to the SW. In west-central Vermont, kaolinite is clearly detectable in the clay fraction of tills to the SE of the kaolinite-rich Brandon Residual Formation, but in the same area only traces magnetite are detected SW of the magnetite-rich Pinney Hollow Formation. Lastly, no k-feldspar was detected in pits SW of the k-feldspar-rich granitic plutons in the Northeast-Kingdom, suggesting no advance from NE to SW.

Three two-till sequences were also analyzed. These tills consist of oxidized sandy till over unweathered gray-green clay-rich till, and have been previously interpreted as indicative of ice advance from

both NE and NW. However, QXRD analysis reveals nearly identical mineralogical compositions between upper and lower tills in each case, suggesting both were derived from the same location. Oxidized till over unweathered till suggests that the two-till sequences may be lodgement overlain by ablation till.

QXRD analyses strongly suggest late Wisconsinan glacial ice advanced over Vermont from NW-SE. These results provide no evidence to support Stewart and MacClintock's (1969) claim of a NE-derived glacial advance and are supported by boulder train and indicator fan data as well as the predominant orientation of striations. The pattern of sediment redistribution by glacial action has implications for acid-buffering capacities of soils, potential identification of metals that could become environmentally available through weathering, and varying aquifer potential between various glacial till deposits.

SOURCE IDENTIFICATION OF THE STARKSBORO RADIONUCLIDE ANOMALY: A FIELD, GEOCHEMICAL, AND PETROGRAPHIC STUDY OF ANOMALOUSLY HIGH RADON LEVELS

Bradley Corr, Geology Department, Middlebury College, Middlebury, VT, 05753

Radon is a naturally occurring radioactive gas that forms through the decay of uranium and thorium isotopes. Airborne radionuclide studies focused on locating uranium deposits were conducted in the northeastern United States in the 1970's and early 1980's. These studies revealed an approximately 10 square kilometer anomaly near Starksboro, Vermont, but no field work or sampling has ever been conducted in the area to more precisely locate the source of the anomaly. A combination of field, petrologic, and geochemical studies were employed in this study to identify the source and impact of the radionuclide anomaly on the local community.

Gamma ray spectroscopic measurements conducted along a series of perpendicular to strike traverses within the anomalous zone revealed elevated radionuclide values associated with a highly foliated, phyllitic member of the Cheshire Quartzite. Uranium counts ranging from 15 to 27 ppm characterize this unit, while surrounding rocks have values that range from 1 to 12 ppm. Petrographic analysis of samples

collected from the phyllite unit reveal: (1) the presence of small amounts (< 1%) of uranium-bearing detrital minerals such as zircon and apatite, and (2) textures indicative of high ductile shear strain. Whole rock geochemical analysis of the highly strained phyllite unit is forthcoming, as are results of groundwater sampling in the field area. It is hypothesized that uranium-bearing minerals were concentrated in the phyllite unit during high-strain ductile deformation. The weak properties of the fine-grained foliation planes in this unit make them more susceptible to weathering and results in greater permeability. Radon, being an inert gas, is then easily transported along these foliation planes. It is believed the combination of small amounts of detrital uranium-bearing minerals, high degrees of ductile deformation, and greater permeability in this phyllitic member of the Cheshire Quartzite explain the observed radionuclide anomaly.

AN ANALYSIS OF AN EIGHTEEN YEAR RECORD OF CARBON AND OXYGEN ISOTOPE RATIOS IN MONTASTREA ANNULARIS, ROATAN, BAY ISLANDS, HONDURAS

Dayna Adelman, Department of Geology, University of Vermont, Burlington, VT 05405

A sample of the reef-building scleractinian coral Montastrea annularis from Roatan, Bay Islands, Honduras, was analyzed for variation in the carbon and oxygen isotopes. Variation in these stable isotopes can be used to identify changes in temperature and salinity. The sample site, Gibson Bight, is located in a partially enclosed bay on a portion of the island which is experiencing rapid land use change. Ocean water exchange is limited, and much of the water affecting the reef is susceptible to anthropogenic influences. Rosenheim (1999) examined a shorter record of oxygen isotope values for coral collected around Roatan. He suggested that these data reflected freshwater dilution and attributed it to land use change.

The coral head in this study was slabbed, X-rayed and eighteen annual growth bands identified. From each growth band we collected multiple samples of CaCO3 and analyzed this material in the mass spectrophotometer. After statistical analysis of the data I found no correlation between carbon and oxygen isotopic composition. There does not appear to be a trend in oxygen isotope fractionation; carbon

isotope values vary widely due to the complexity of carbon fixing mechanisms in coral.

TRACE ELEMENT ANALYSIS OF STREAM SEDIMENTS AND THEIR RELATIONSHIP TO BEDROCK GEOLOGY, ROATAN, BAY ISLANDS, HONDURAS

Alysa Snyder, Department of Geology, University of Vermont, Burlington,VT 05405

The distribution of trace elements within fluvial sediment has been shown to be an effective way of identifying source area in a watershed. The small island of Roatan (Bay Islands, Honduras) is experiencing increased terrigenous runoff as a result of changing land use patterns. The approximately 160km2 island has over 80 small watersheds. Analysis of the sediment currently being deposited on the reef around Roatan indicates that some terrigenous sediment is making its way across the lagoon to the reef. I analyzed the trace element composition of bedload sediment from stream channels around the island in order to determine if it differed and was related to the gross bedrock composition. If the trace elements do reflect difference in the bedrock geology, then this technique might be an effective way to correlate the sediment composition to a specific watershed. Eleven samples were collected and sieved for grain size and the fine silt and clay fraction was subsequently analyzed for 14 trace elements on an ICP. Statistical analysis was then used to see if significant differences exist between samples.

CHEMICAL WEATHERING OF THE EAST DOVER ULTRAMAFIC BODY, EAST DOVER, VERMONT

Dana Drummond, Geology Department, Middlebury College, Middlebury, VT 05753

The East Dover Ultramafic Body is an ophiolite sequence that is believed to have been emplaced during the Taconic Orogeny and later metamorphosed during the Acadian orogeny (Hoffman and Walker, 1978). The soils and hydrosphere surrounding ophiolites are at a high risk of becoming enriched in trace metals such as Ni, Cr and Co due to the chemical weathering of the rock and subsequent release of these metals (Ryan, 2000). Ten rock samples with both fresh and weathered components were collected along a roadside outcrop in East Dover, VT

for analysis. Stream water and sediment was collected from 10 sites on several nearby streams that begin above and crosscut through the body.

A combination of ICAP, XRD and optical microscopic analysis has been done on highly weathered rinds, fresh ultramafics, stream sediment and surface water to determine trace metal concentrations in this area. Both Ni and Cr concentrations remain at a constant 1:1 ratio for both fresh rock and weathered rock in 3 of the rock samples. A ratio of 1:3 between the fresh rock and the weathered rock occurs in the other 2 rock samples analyzed. The fresh rock samples (at each location) are nearly identical in chemical but not in mineralogical composition, which has resulted in different weathering patterns.

Analysis of the sediment shows a Ni:Cr ratio of 1:3. This may be the result of the different resistances to weathering that the minerals in which these metals are found. Cr is limited to the stable chrome spinel mineral, while Ni is found in the unstable olivine mineral. Solubility of each of these metal ions differs as well. The pH of the surface water sampled was 7.1-7.3, a level that allows Ni to enter solution but is too high for Cr to enter solution (Faure, 1998). For these reasons it is likely that Cr will be found at a constant concentration and not be mobile, while Ni will be found in decreasing concentrations along the weathering process and will be fairly mobile.

GEOCHEMISTRY AND PETROLOGY OF A SERPENTINIZED ULTRAMAFIC UNIT IN EAST DOVER VERMONT

Parham P. Gardner, Geology Department,
Middlebury College, Middlebury, VT 05753

The texture and geochemistry of ultramafic rocks exposed at the Earth's surface can be used to distinguish their origin as either magmatic or tectonic. Tectonite ultramafics can be indisputably linked to ophiolite sequences and are interpreted as uplifted sections of the upper mantle, while cumulate ultramafics are interpreted as either part of an ophiolite sequence or as the lower "strata" of a layered intrusion.

Preliminary investigation of the petrology and geochemistry of the East Dover ultramafic unit in south central Vermont indicates that the serpentinized dunitic body formed as residual mantle emplaced

tectonically, rather than ultramafic cumulate formed by a magmatic intrusion. The East Dover ultramafic body consists of serpentine surrounding islands of olivine, with accessory chrome spinel, and minor pyroxene and secondary calcite. Plots of Al2O3 vs. TiO2 for the East Dover ultramafic body classify it within the dunite field. Because chrome spinels from throughout the unit contain Cr# [(Cr/(Cr+Al)] >0.60, the rock can be classified according to Dick and Bullen (1984), as a Type III Alpine-Type peridotite. A mantle origin is widely accepted for Type III Alpine-Type peridotites (Dick and Bullen, 1984). Additional support for the interpretation of the East Dover ultramafic unit as a fragment of uplifted residual mantle is provided by compositional data from olivine and chrome spinel, using Ni (~2200-2700 ppm) vs. %Fo (~88-96%) in olivine grains (Leblanc, 1984), and Cr-Al-Fe+3 in chrome spinels (Barnes, 2001).

The interpretation of the East Dover ultramafic unit as the mantle tectonite section of an ophiolite sequence suggests that it can be correlated with the ophiolites and fragments thereof in northern Vermont, Quebec and Newfoundland.

A GEOCHEMICAL ANALYSIS OF GREENSTONES IN THE PINNACLE, UNDERHILL AND HAZENS NOTCH FORMATIONS NEAR BOLTON, VERMONT

Jeff Polubinski, Geology Department, Middlebury College, Middlebury, VT 05753

In spite of low-grade metamorphism during the Taconic Orogeny, metavolcanic units in the Pinnacle, Underhill and Hazens Notch formations of Vermont can be sorted by their chemistry. Furthermore, major and trace element geochemistry can be used to fingerprint their tectonic environment of formation. The metavolcanics occur as greenstone bodies interlayered with metasedimentary rocks formed in the Proterozoic to the Cambrian. The sedimentary units are generally schists, graywackes and phyllites while the metavolcanic units appear as epidote or albite-rich greenstones. In thin section, the epidote-rich greenstones typically consist of 60% epidote, 10% quartz, 10% plagioclase feldspar and 10% chlorite with minor inclusions of sphene, calcite, muscovite, biotite and magnetite. The albite-rich greenstones typically comprised of 30% chlorite, 30% plagioclase feldspar, 15%

quartz, and 10% sphene, with minor inclusions of calcite, muscovite, magnetite, epidote, and biotite.

Geochemically, the greenstones are characterized as transitional (alkaline to tholeiitic) basalts as shown by Al/Si versus Fe+Ca+Mg and Zr versus P2O5 discrimanant diagrams. Tectonic discriminant diagrams such as the Ti-Zr-Y diagram designate these greenstones as within plate basalts. These results fit in most regularly with other greenstones from the Underhill and Hazens Notch formations (Geochemical Zones 2 and 3 (Coish et al., 1991)), which have been characterized as basalts formed during the early and intermediate stages of continental rifting. At one site, the geochemical data of an apparent greenstone is highly variable and inconsistent with other greenstones in the area. This unit is interpreted as either a highly metasomatised volcanic rock or a volcaniclastic unit. The results from most greenstones in this study support the hypothesis that they were basalts formed in a rift valley during the break-up of the Laurentian continent and the subsequent formation of the Iapetus Ocean in the Late Proterozoic and Early Cambrian.

A PETROLOGIC AND MICROSTRUCTURAL STUDY OF THE SCARBORO FORMATION, CASCO BAY SEQUENCE, SOUTH-CENTRAL MAINE

Heather M. Beal, Department of Geology, Middlebury College, Middlebury, Vermont 05753

Ordovician rocks of the Liberty-Orrington belt in south-central Maine are flanked by younger rocks to the southeast (Fredericton belt) and northwest (central Maine belt) and thus occupy an important structural position in the region. This study focuses on detailed petrologic and microstructural analyses of Middle Ordovician (?) metapelitic rocks of the Scarboro Formation (upper part of the Casco Bay sequence) exposed within the Liberty-Orrington Belt. At least two phases of deformation are observed in these rocks: (1) An early phase of upright isoclinal folding with an associated axial planar foliation that trends N10-25 degrees E and dips steeply (> 60 degrees) to the southeast. (2) A later phase (based on cross-cutting relationships) of dextral shear deformational features.

Metamorphic mineral assemblages in these rocks indicate low-pressure metamorphism (< Al2SiO5 triple point conditions) at lower sillimanite grade conditions. Typical AFM mineral assemblages in these rocks include garnet, biotite, andalusite and sillimanite. Local variations in bulk composition result in the presence of staurolite (Fe-rich) and cordierite (Mg-rich) porphyroblasts in some samples. Compositional data from garnets indicate high manganese concentrations (up to 30 mole % in cores) and patterns typical of growth zoning. Previously published Ar-Ar hornblende ages provide a Middle Devonian age for the timing of this metamorphism.

Microstructural analysis of porphyroblast-matrix relationships in these rocks provide information on the timing of metamorphic mineral growth relative to the deformational fabrics in the rocks. Complex, locally spiraled inclusion trails in garnet porphyroblasts are generally discordant to the matrix foliation. Caution should be taken in interpreting such relationships, but it is suggestive of growth during a deformational episode that preceded the development of the matrix foliation. Andalusite and staurolite porphryoblasts are often syntectonic with respect to the external foliation, although examples of post-tectonic growth can be found. This external foliation is parallel to the axial surfaces of upright isoclinal folds and thus peak metamorphic mineral growth appears to have been synchronous with this deformational episode. Localized, late dextral shear deformation of all porphyroblasts often accompanied by chlorite growth indicates this phase of deformation occurred after peak metamorphism (Middle Devonian).

TECTONICS AND TOPOGRAPHY: SOME NEW RELATIONSHIPS IDENTIFIED ALONG THE ALPINE FAULT IN NEW ZEALAND

Nathan Toke, Dept. of Geology, University of Vermont, Burlington, VT 05405

Digital Elevation Map (DEM) imaging of the Fiordland Belt in Southwestern New Zealand shows unusual, asymmetric topographic features characterized by extremely high slopes (up to 87°) and deeply incised river networks. This mountain range is bounded on all sides by strike-slip and oblique-slip faults that form restraining bends east (outboard) of the present-day trace of the Australian-Pacifc transform plate boundary. The western edge the range is characterized by

average and maximum elevations of 468 meters and 1467 meters, respectively. In contrast, the eastern side of the range is over 300 meters higher in both average and maximum elevations than the western side. This asymmetry contrasts with that exhibited by the rest of the Southern Alps in New Zealand where there is typically a steep, erosion-controlled, western edge with a gently eastward sloping outboard plateau.

Even more unusual, Fiordland contains a large, 2000 km2 diamond-shaped topographic uplift in the northernmost part of the mountain range. The uplift mostly has slopes of 45° to 65°, with some reaching up to 87°. This uplift rises 300 to 1100 meters above the surrounding topography of Fiordland and ranges in elevation from 1877 to 2699 meters. The average elevation of the uplift is approximately 900 meters with the greatest elevations on the eastern side adjacent to curved traces of the Darran and Hollyford faults. These two oblique-slip faults from splays of the modern transform plate boundary. The eastern side of this uplift has an average elevation of nearly 1200 meters and contains the highest peaks in the region at 2699 meters. I have determined that the highest slopes and greatest elevations of this region coincide with the maximum curvature of the faults where they merge into the transform plate boundary. Our DEM and fault data indicate that a transpressional style of deformation in the region between the strike-slip faults is responsible for 300-1100 meters of uplift above the rest of the Fiordland range. These features illustrate the important role of strike-slip and oblique-slip tectonics in creating and modifying mountain topography.

ISOTOPIC AND ELEMENTAL COMPOSITION OF LAKE BIOTA AND RECENT SEDIMENTS: A REGIONAL COMPARISON

Ben Cichanowski, Geology Department, University Of Vermont

Since first settlement in the northern New England region, both cultural and natural impacts have greatly influenced the trophic and chemical status of many lake ecosystems. Entire lake ecosystems are no longer nutrient balanced, many have become eutrophic, while some have become hypertrophic. Being able to quantify the level of deterioration using relatively simple chemical indicators such as stable isotopes of carbon and elemental ratios (e.g., C/N ratios) would be invaluable in determining type and scale of remediation measures. The

correlation between isotopic composition and productivity levels can also be used in studies of recent sediments to monitor the response of these lake ecosystems to documented increases and/or decreases in nutrient loads.

Lake sediments provide natural archives that record the response of the Earth's biota to environmental perturbations from the local to the global scale. Organic remains preserved in lacustrine sediments allow us to reconstruct the environmental histories of lakes and their watersheds because they reflect the biological communities found in and around lakes.

In summer 2001 samples of land and aquatic plants, and short (25-50 cm) sediment cores were collected from three NH lakes: South Pond, Crystal Lake, and Stinson Lake. These samples have been analyzed for C isotopic composition using the Department's stable isotope mass spectrometer. In addition, %C, %N, and C/N for each sample were determined using an Elemental Analyzer. The data collected so far has offered trends suggesting an up-core increase in algal remains in the sediments, possibly suggesting moderate eutrophication. The results of this study will be compared to similar data collected for numerous VT lakes as part of two previous undergraduate theses and one graduate thesis. A compilation of records from numerous lakes will give insight into the broader scale response of ecosystems to environmental change.

RECONSTRUCTION OF A PALEOFLOOD CHRONOLGY FOR THE MIDDLEBURY RIVER GORGE USING TREE SCARS AS FLOOD STAGE INDICATORS

Fred Coriell, Geology Department, Middlebury College, Middlebury, Vermont

Botanical evidence is commonly used in order to determine the stage past flood events. Most of these studies have been concerned with tree ring intervals, which depict years of high and low water. However, there has been little work done correlating flood frequency with flood magnitude on streams not gauged by the United States Geologic Survey. One must be a bit creative when trying to make this correlation on such streams. One feature that can both date and help determine discharge of a flood is the tree scar. This is direct evidence of the flood recording its year, its stage, and thus its magnitude.

The study site was the Middlebury River in East Middlebury, VT. Dates of scars were determined by using an increment borer. Seventeen scarred trees were sampled. Channel cross-sections were measured at seven different scars randomly selected throughout the study area in order to calculate discharge. Due to the nature of the river it would have been impossible to get cross sections at all scar locations. Manning's equation for stream discharge was used to make these calculations. The slope coefficient for the equation was determined as the average slope over the study area. The n coefficient was determined from USGS examples posted on their website. Data showed several instances in flooding over the last half century with past discharges ranging from 107 m3/sec to 366 m3/sec. These values show similarities with high water years over the last half-century on the Otter Creek, a USGS gauged stream in the same drainage basin. Actual flood years for the Middlebury River are still pending upon completion of tree ring analysis.

STRATIGRAPHY AND SEDIMENTOLOGY OF A PARAGLACIAL FAN NEAR HANCOCK, VERMONT

Anna Cotton, Geology Department, Middlebury College, Middlebury, VT 05753

The Bowen Fan is an anomalously large alluvial fan in the Third Branch of the White River Valley. This project involved investigation of the sedimentology, size, and physical characteristics of the Bowen Fan in an attempt to determine the processes responsible for its formation, and its anomalous size.

The internal stratigraphy of the Bowen Fan was studied in a large borrow pit excavated in the fan by the Bowen family. Interbedded coarse debris flow and finer fluvial deposits indicate that the fan formed through a combination of sedimentary mechanisms. Particle size distributions were determined for each major horizon through dry sieving (>0.063 mm). A Coulter counter was used to determine the particle size distribution for finer fractions. Age control for fan formation was provided by a core from the oldest living tree on the fan, and AMS radiocarbon dates on organic fragments recovered from 240 cm, 288 cm and 540 cm depths in the borrow pit. Based on historical reports, the presence of trees on the fan surface, and the

extent of incision of the modern stream, there has been no activity on the fan for at least 60 years

The working hypothesis is that the Bowen Fan is a paraglacial fan that formed soon after retreat of the Laurentide Ice Sheet from Vermont. At this time, large volumes of unconsolidated glacial sediment would have been available for transport from the unvegetated slopes in the fan catchment. This scenario explains the discordant size and volume of the fan relative to other fans in the White River Valley. To further evaluate this theory, a GIS analysis of fan volume and drainage basin area was completed for nineteen alluvial fans along the White River Valley, north and south of the Bowen Fan. This analysis revealed that within the total population of fans in the valley, there is a subset of paraglacial fans (including the Bowen Fan) that have extremely large volumes relative to their drainage basin area. These fans contrast strongly with the subset of smaller fans, many of which have been active during the post-settlement period.

THE IMPORTANCE OF HAZARD MAPS IN THE THIRD BRANCH OF THE WHITE RIVER VALLEY, CENTRAL VERMONT

Angela Rogers, University of Vermont, Burlington, VT

The Third Branch of the White River, which flows southerly from Roxbury to Bethel, Vermont, was assessed during the summer of 2001. The assessment involved examining the geomorphology and habitat of the mainstream and the tributaries. One component of the assessment involved determining areas of the stream that are undergoing degradation, aggradation, overwidening, or changing its planform. Mass failures, alluvial fans, channel avulsions, and cut off chutes were also identified. The data collected could be used to create hazard maps, which can be used as a planning tool to reduce costly flood damage to house, roads, and bridges. The mass failures identified in the Third Branch valley can be caused by the surficial geology, where lacustrine sands or gravel overlie glacial lake silts and clay. This stratigraphy can lead to failure from hydraulic loading, especially after a heavy storm or long periods of precipitation, which can create saturated conditions. Mass failures are also caused by the river actively cutting away the bank.

Channel avulsions and cut off chutes are indicators of potential hazards, since they denote a change in the channel's planform. Channel avulsions and cut off chutes are concerns where the channel is overwidening, because the river will change its planform to achieve adequate sediment and water flow.

Alluvial fans also present potential hazards due to their stratigraphy and general nature of deposition. The sudden change in topography causes energy to be transported to lower elevations. In these areas the river forms multiple channels and potentially changes its planform. Developers and planning commissions should be aware of these hazards before they build infrastructures. Mapping mass failures, channel avulsions, cut off chutes, and alluvial fans could assist in decreasing flood damage as well as maintaining the ecosystems viability.

A MID TO LATE HOLOCENE RECORD OF FIRE FREQUENCY FOR THE NORTHWESTERN UINTA MOUNTAINS INTERPRETED FROM CHARRED PLANT REMAINS IN LACUSTRINE SEDIMENTS

Jamie Laidlaw, Department of Geology, Middlebury College, Middlebury VT. 05753

Charred plant remains isolated from lake sediments were quantified in an attempt to construct a middle to late Holocene fire history of the northwestern Uinta Mountains. Lily Lake (surface area 57 ha, 2710 m asl) was targeted for this study because of its location within continuous Pinus contorta (Lodgepole pine) forest, and its small drainage basin (615 ha), which simplifies interpretation of the charcoal record. A 171-cm long core was retrieved from the lake during February 2000 with a modified Livingston corer. Charcoal and wood found in samples 66, 149, and 171 returned AMS dates of 1970 ± 40, 4040 ± 50, and 4760 ± 50 14C BP. Calibrated into years BP, these dates yield a near linear sedimentation rate in which 1 cm represents from 20 to 50 sidereal years (mean of 32). Samples were taken every centimeter (1.3 cm3 volume), disaggregated in a 5% solution of sodium hexamataphosphate for three days, and wet-sieved to 125 microns. Charcoal fragments were identified, counted, and measured under a stereoscope. Results show CHAR (charcoal accumulation rate) background levels post 3250 years BP ranging from 0.002-0.03 fragments/cm2/yr with peaks (0.04-0.39 fragments/cm2/yr)

interpreted as fire events within the basin occurring with an average frequency of 320 years. Prior to 3250 BP CHAR values were much higher with background levels ranging from 0.1-0.9 fragments/cm2/yr and peaks ranging from 28.8-223.3 fragments/cm2/yr. The average fire frequency during this period was 236 years. Our preliminary interpretation is that this period prior to 3250 BP represents a period of water downdraw in excess of 5 m. Peaks indicate fires that burned both the surrounding forest and the surface of the wet meadow, which occupied the exposed lake floor.

THE MINERALOGICAL RECORD OF EOCENE/OLIGOCENE CLIMATE CHANGE IN THE JOHN DAY FORMATION, CENTRAL OREGON

Christopher Q. Kautz, Geology Department, Middlebury College, Middlebury, VT 05753

John Day Formation paleosols formed in volcaniclastic sediment under climatic conditions that changed from humid-subtropical to sub humid-temperate across the Eocene-Oligocene boundary. In this study, we seek to take advantage of the well-constrained paleoclimatic (Retallack et al., 2000) and zeolite (Hay, 1963) records of the John Day paleosols to examine (1) the mineralogical record of climate change and (2) the effects of burial diagenesis on pedogenic minerals. XRD analyses of 85 paleosols indicate clear distinction in clay mineral content between late Eocene (39 – 34 Ma) and early Oligocene (34 – 29 Ma) paleosols. Late Eocene paleosols contain abundant kaolinite (K) and lesser kaolinite/smectite (K/S). Early Oligocene paleosols are virtually devoid of kaolin minerals and are dominated by smectite. The kaolin in the lower John Day Formation reflects intense subtropical weathering of the late Eocene. Abrupt shift to smectitic soils across the Eocene-Oligocene boundary is attributed to step-like change to cooler, more arid climates of the early Oligocene as described by Bestland et al (1997). The presence of clinoptilolite in the Turtle Cove Member (30-29 Ma) constrains pre-uplift burial depth to approximately 1000 – 2000 m, an estimate that is consistent with the folded and faulted character of the John Day Formation.

DIFFERENTIATION OF TWO QUATERNARY MT. HOOD LAHARS BY CLAY MINERALOGICAL, QUANTITATIVE X-RAY DIFFRACTION AND PARTICLE SIZE ANALYSES

Robyn C. Cook, Geology Department, Middlebury College, Middlebury, Vermont 05653

Multiple analytical methods have successfully differentiated three similar Quaternary lahar deposits on the northern flank of Mount Hood and in downstream valleys. These methods include X-ray diffraction (XRD) of clay mineral content, quantitative XRD of bulk mineral content, and laser diffraction particle size analysis (LDPSA). The best differentiators are clay and bulk mineralogy. QXRD results of bulk samples indicate that the older lahar (older than 425 Ka) contains 16-24% plagioclase feldspar and 35-65% total dioctahedral clay (predominantly halloysite), whereas the younger lahar (40 to 80 Ka) contains 36-63% plagioclase feldspar and 25-36% total dioctahedral clay (predominantly expandable smectitic-vermiculitic clay). The intermediate unit (~130Ka) consists of 33-38% clay (more weathered than smectite) and 40-43% plagioclase. At most sites, the older lahar is relatively enriched in clay and sand-sized grains as compared to the more silt-rich younger lahar. These preliminary results will prove valuable in determining the spatial variability of lahars and may be used in remote sensing mapping by providing differentiating characteristics.

Previous work by the USGS Cascade Volcano Observatory (CVO), as part of their hazard assessment program, has identified at least two distinct Quaternary lahars based on field mapping and limiting K-Ar dates. The field area encompasses roughly 200km2 from the northern flanks of Mt. Hood through the Hood River valley to across the Columbia River. This work provides the impetus for our current study because of speculation raised during mapping the lahars. Since it is apparent that field identifiers are not the most reliable indication of specific units, this study was undertaken to produce quantitative data that can then be applied to more accurate mapping and hazard analysis.

PRESIDENT'S LETTER

April 5, 2002

Dear Members:

Since the last GMG, we had a very successful winter meeting at Norwich University. On behalf of the society, I'd like to thank all the participants for very interesting presentations. I want to especially thank Dave Westerman and Norwich University for doing a fine job of hosting. There was general agreement among the executive committee that we should re-instate the winter meeting as an annual event.

Following up on a discussion at the executive meeting in Norwich, Jeff Hoffer and I composed a letter in support of the Vermont Geological Survey for this spring's round of budget negotiations in Montpelier. I sent copies to key members of finance committees in both branches of the state legislature. The executive committee felt it was important to show state legislators that the Survey is well respected and supported by the geological community in Vermont.

What's in a name? After some heated debate, the executive committee decided to look into changing the name of our society to the Geological Society of Vermont. There are two main reasons: (1) the name Vermont Geological Society (VGS) is often confused with the Vermont Geological Survey and (2) the change would bring us in line with most other state societies such as Maine and New Hampshire. Steve Howe, Christine Massey and Jeff Hoffer are looking into the logistics of such a name change. In the meantime, if you have opinions on this proposal, please contact Steve, Christine, Jeff or me.

I look forward to seeing many of you at the spring meeting in Middlebury on April 20th.

Sincerely,
Ray Coish
coish@middlebury.edu

EXECUTIVE COMMITTEE MEETING MINUTES

Saturday, Feb. 16, 2002: Meeting opened by President Ray Coish at 12:15 PM. Based on the success of the Winter meeting, it was decided to reinstate the Winter meeting on an annual basis, to be hosted by Norwich University. Treas. Kristen Underwood reported the financial status of the Society remains strong. A discussion followed regarding dues. Existing members receive dues statements in the GMG with no separate mailing. It was decided to send institutional members a separate statement. The publications committee discussed the frequency of publishing the GMG, particularly the summer issue, when there is not always enough material to justify publication. It was decided to let the publications committee determine publishing frequency. Steve Howe reported that the society website will be up and running shortly. A discussion followed as to what will be posted on the web site and whether or not to include the GMG as an electronic version. A decision was made not to include the entire GMG on the website, but only certain portions, to be decided by the web site and GMG editors.

State Geologist Larry Becker spoke of upcoming budget battles over the Vermont general fund, which funds the Survey. A discussion followed regarding a potential mailing (by e-mail) to Society members to elicit support letters to legislators regarding the funding of the Survey. The committee also decided to submit letters from the Society in support of the Survey.

The possibility of changing the Society's name to the Geological Society of Vermont was discussed. Committee members considered the name change to have merit, but that the ramifications of doing so needed to be evaluated and put to a general vote of the Society if desired. Christine Massey, Steve Howe, and Jeff Hoffer were requested to evaluate the ramifications and report back to the committee and board at the Spring meeting. The New Hampshire version of the Society recently went through a name change and will be contacted for information.

Potential field trips for the summer and fall of 2002 were discussed. Possibilities mentioned included a summer field trip led by Helen Mango and a fall field trip led by Peter Thomas. Meeting was adjourned at 1:15 PM.

Respectfully submitted,
Jeff Hoffer

DIRECTIONS TO SPRING MEETING

Middlebury College, April 20, 2002, 8:30 am

Take Rte 125 west, past the Catholic Church, up hill through the college. Go over the crest to bottom of the hill as it flattens to a valley; turn right onto the winding driveway (may have road sign saying Bicentennial Way by April). Continue up the driveway and park in the large parking lot on the west side of Bicentennial Hall. Don't worry about the sign saying faculty and staff only. Meeting is in Bicentennial Hall, Room 220. Come in the west door from the parking lot, go up the first stairs you see to the Great Hall; room 220 is first lecture room in the south wing off the Great Hall. Coffee and donuts at 8:30; meeting begins at 9:00 am.

STATE GEOLOGIST'S REPORT

Thanks to Letter Writers

I want to thank the Society and others who have written letters in support of the Vermont Geological Survey during these times of budget uncertainty. Your letters show that the geological community has a direct interest in a vibrant state survey that provides framework information to address a variety of geoscience problems. Whether you work in the field or just have a curiosity about the earth, state surveys are intended to meet your needs. Those outside the community are not always aware of the usefulness of the information and how it influences their lives and your letter writing brings the importance of geology to light. It matters in Vermont when a community of 150 plus members speaks with one voice about the need for our science. Thanks again for your efforts.

Sincerely,

Laurence R. Becker, State Geologist
Vermont Geological Survey, DEC
103 South Main Street
Waterbury, Vermont 05671-0301
Phone - 802-241-3496
Fax - 802-241-3273
e-mail larryb@dec.anr.state.vt.us
http://www.anr.state.vt.us/geology/vgshmpg.htm

VGS TREASURER'S REPORT

The financial condition of the Society remains strong. The checking account balance is $3,685.92 as of March 31, 2002. Please see the attached Income Statement. All bills received by me have been paid and are reflected in the above balance. Within the next month, letters will be sent to individuals whose memberships have lapsed for one or more years. The status of lapsed memberships has been based on the Society's most current membership and treasurer records. Please call or email if it is felt that such letters have arrived in error.
Kristen L. Underwood, March 31, 2002

Income and Expenses, 1/1/02 through 3/31/02

INCOME		
Total Dues		$893.00
Dues-Family	$80.00	
Dues-Institution	$70.00	
Dues-Member	$735.00	
Dues-Student	$8.00	
Interest		$0.57 **
Publications (UVM Geology)		$30.00
Credit for Lost Student Check		$30.00
Student Research Grant Contributions		$270.00
TOTAL INCOME		**$1,223.57**
EXPENSES		
US Post Office (stamps, GMG Distribution)		$0.00
GMG Publishing		$96.39
Earth Science Week Poster Awards (reissue lost check)		$30.00
Expense Reimbursement (UVM Geology)		$30.00
Research Grant Awards		$0.00
Student Awards (VGS Spring Mtg)		$0.00
TOTAL EXPENSES		**$156.39**
TOTAL INCOME – EXPENSES		**$1,067.18**

** *Does not reflect interest from February or March.*

The Society gratefully acknowledges the generous contributions to the Student Research Grant funds received from the following members during the first quarter of 2002: Alexis P. Nason, John Cotton, Arthur W. Gilbert, Jr., Lawrence W. Gatto, Christine Massey, Paul Bierman, Jeff Hoffer, Cassie Major, Peter and Thelma Thompson, Sue Hadden, Barbara L. Hennig, Sharon Strassner, and Bill Norland.

THE GREEN MOUNTAIN GEOLOGIST
VERMONT GEOLOGICAL SOCIETY
DEPARTMENT OF GEOLOGY
UNIVERSITY OF VERMONT
BURLINGTON, VERMONT 05405-0122

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

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THE
GREEN MOUNTAIN GEOLOGIST

NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

Summer 2002 VOLUME 29 No. 3

VERMONT GEOLOGICAL SOCIETY SUMMER FIELD TRIP

Mt. Independence State Historic Site Orwell, Vermont July 20, 10 AM

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PRESIDENT'S LETTER

June 24, 2002

Dear Members:

I hope you are all having a productive and relaxing summer. This is a short note to accompany our short summer GMG.

I want to thank all the presenters and their advisors for such interesting and professionally-presented papers at our spring student meeting on April 20. All participants deserve to be congratulated for their excellent contributions to geology in Vermont and elsewhere – Maine, Utah, Oregon, New Zealand, Honduras and Antarctica. And also thanks to the geology gods for scheduling the Ausable Forks earthquake that morning!

I also want to encourage members to participate in our two planned field trips: the first in July and the second in September. Details are included in this edition of the GMG.

Finally, I invite nominations to fill three executive committee positions in the society. Helen Mango, our current VP, will move into the president's slot next year. Thus, we need a person to be VP next year with the understanding that in the following year, they will become president. Also, after years of exceptional service, Treasurer Kristen Underwood and Secretary Jeff Hoffer have decided to step down next year. So, please send me names of people who might be interested in filling the VP, Treasurer, and Secretary positions next year.

Sincerely,
Ray Coish
coish@middlebury.edu

VGS SUMMER FIELD TRIP

Mount Independence, Orwell, VT led by Dr. Helen Mango, Castleton State College

July 20 at 10 am - 1 pm

Directions to Mount Independence. Make your way to Rt. 22A in western Vermont. Rt. 22A runs from Fair Haven to Vergennes. Take Rt. 22A to the intersection with Rt. 73 in Orwell. Go west on Rt. 73 (towards Lake Champlain). In 0.3 miles, Rt. 73 bends right and the road to Mount Independence goes straight (there's a sign). Continue 5 miles to the end of the road. (Just after the road turns to dirt, there's a fork, and Mount Independence is up the left route, around a small hairpin turn.) Park in the parking lot on the left, across from the museum (which looks like a boat).

Alternately, one could take Rt. 100 to the intersection with Rt. 73, then follow Rt. 73 west through Brandon, Sudbury and Orwell, and then follow the directions above to get to Mount Independence.

We will also have a brief business meeting and Earth Science Week planning discussion following the hike. Bring your own lunch and snacks.

ADVANCEMENT OF SCIENCE COMMITTEE

The Committee is pleased to announce the launch of the Vermont Geological Society's website at:

http://www.uvm.org/vtgeologicalsociety

The site presently includes the Society's Constitution and Bylaws, a calendar of events, a list of contacts for the Executive Committee and the Chairs of the Special Committees, a list of VGS publications, instructions for submitting a VGS Research Grant proposal, and several interesting geological links. Coming soon will be a downloadable annual dues form. The Committee will be adding content to the website continually, and is especially interested in

digital photos or scannable print photos of interesting geological sites in Vermont. Please send any photos, and any other information pertinent to Vermont geology and the Society, to me at showe@csc.albany.edu for inclusion in the website.

No applications to the Research Grant Program were received by the April 1st deadline. The Committee is considering adding a second round of reviews with an October 1st deadline. This will be discussed further at the next Executive Committee meeting following the Mt. Independence field trip.

The Committee intends to begin soliciting field trip manuscripts for a new issue of Vermont Geology. It hopes to include descriptions and road logs from several past and upcoming VGS field trips, and possibly from a field trip being offered during the Vermont National Education Association Meeting in October.

Respectfully submitted,

Stephen S. Howe
Chair, Advancement of Science Committee

VGS CALENDAR 2002

July 20:	VGS Summer Field Trip, Mt Independence State Historic Site, Trip Leader- Helen Mango
July 27-28:	23rd Annual Champlain Valley Gem, Mineral and Fossil Show, Tuttle Middle School, Dorset St., South Burlington, VT
August 17:	Champlain Thrust Canoe Trip, Green Mtn Club, 802-860- 0724, Trip Leader- Jon Kim
Sept. 14:	VGS Fall Field Trip, details TBA
Sept. 27-29:	New England Intercollegiate Geologic Conference, Lake George, New York
October 12:	OMYA, Inc. Quarry Open House for Earth Science Week 2002
October 13-19:	Earth Science Week 2002
October 24:	Vermont NEA Convention Field Trip, Trip Leaders- Christine Massey and Shelley Snyder

EXECUTIVE COMMITTEE MEETING MINUTES

Middlebury College, Middlebury, VT
April 20, 2002

3:00 pm - Meeting called to order by Ray Coish
Present: Ray Coish, Helen Mango, Steve Howe, Tim Grover, Christine Massey, Kristen Underwood

Student Paper Awards presented earlier today:

Charles G. Doll Award ($100): Christopher Kautz
2nd Place Award ($75): Parham Gardner
3rd Place Award ($50): Anna Cotton

Stephen Howe announced the release of a new webpage for the Vermont Geological Society. The site presently includes the organization's By Laws and a schedule of upcoming events. There was discussion of placing a general invitation to new members including an announcement of annual dues and address of the VGS treasurer as a downloadable pdf file on the web site. Stephen will do this. All who have VT geology pictures, articles, papers and /or information to share are invited to submit them to Stephen for the Society to consider posting on the website.

Reports from Officers: President Ray Coish, reported that a letter of support for the Vermont Geological Survey, drafted by Jeff Hoffer and Ray, was forwarded from the Vermont Geological Society to State Senators and Representatives in March. VGS did not receive responses from the legislators.

Treasurer, Kristen Underwood, reported that the financial position of the Society remains strong. A slew of dues payments were received in the last week following the general notice sent via email and mail to those individuals whose membership had lapsed. Stephen and others raised the question of merging the duties of Treasurer and Membership Coordinator, for efficiency's sake.

Reports from Committees: Education - Christine Massey and Shelley Snyder are working together on a Field Trip entitled Geologic Sites in Northwestern Vermont to be offered in October, 2002, during the VT National Education Association Meeting for teachers, in Essex. This is a shorter version of their 1999 NEIGC trip. Earth Science Week preparations are slowly underway with Geologists in the Parks (Marjie

Gale) and the Poster Contest (Perkins Museum). OMYA may be planning another event as well. Larry Becker, State Geologist, is working to help create a Vermont State-Based Alliance to foster earth science education-stay tuned for further developments. The Perkins Geology Museum is moving forward in its project to digitize the collections of the Perkins Museum, including the Vermont State Collection. An on-line learning environment is in the development stages. Digital archive users will also be able to access the new database from new educational exhibits in the renovated Perkins Museum.

Advancement of Science - Steve Howe. Another issue of Vermont Geology is being considered. Possible inclusions are: a road log from Helen Mango's upcoming Summer VGS Field Trip (July 20), a writeup or road log from the upcoming Fall VGS Field Trip (Sept 14).

No applications for Student Research Grants were received by the April 1st deadline. There was discussion of adding a Fall deadline, which may be more suitable for the undergraduate students.

While past meetings recognized that publication of the Summer GMG could be optional, the group discussed that there appears to be enough material to warrant publication. Deadline for submissions for the Summer GMG is June 22. More information is pending regarding the issue of whether to change the name of the Society to "Geological Society of Vermont". This topic will be placed on the agenda for the Summer meeting.

3:40 pm - Meeting adjourned.

CALL FOR NOMINATIONS

VGS EXECUTIVE COMMITTEE

The election of the VGS Executive Committee officers for 2003 will take place at the VGS meeting following the Fall field trip. We need nominations for Vice-President, Secretary, and Treasurer. Please forward nominations to Jeff Hoffer, 167 Boynton Street, Barre, VT 05076 (geohoff@AOL.com) or to Ray Coish at coish@middlebury.edu

VGS TREASURER'S REPORT

The financial condition of the Society remains strong. The checking account balance is $3,889.24 as of June 24, 2002. All bills received by me have been paid and are reflected in the above balance. The Society appreciates the response from Members as we went through a process to update lapsed memberships this Spring. It is evident that geologists across Vermont and New England value the Society and its ongoing sponsorship of educational outings, professional meetings, and student research. Thank you for your renewed support. Finally, I would like to notify the Society that I will leave my position of Treasurer effective this Fall at the Society's Annual Meeting. It has been a pleasure to serve the Society over the past 3 years. Any member who wishes to serve as Treasurer beginning in October 2002, please feel free to notify myself or Ray Coish.

Sincerely,
Kristen L. Underwood

Income and Expenses - 1/1/02 through 6/24/02

INCOME		
Total Dues		$1,453.00
Dues-Family	$100.00	
Dues-Institution	$70.00	
Dues-Member	$1,275.00	
Dues-Student	$8.00	
Interest Through January		$0.57
Publications (UVM Geology)		$30.00
Credit for Lost Student Check		$30.00
Dues Overpayment		$10.00
Student Research Grant Contributions		$270.00
TOTAL INCOME		$1,793.57
EXPENSES		
US Post Office (stamps, GMG Distribution)		$8.50
GMG Publishing		$229.57
Earth Science Week Poster Awards		$30.00
Expense Reimbursement (UVM Geology)		$30.00
Student Awards (VGS Spring Mtg)		$225.00
TOTAL EXPENSES		$523.07
TOTAL INCOME – EXPENSES		$1,270.50

THE GREEN MOUNTAIN GEOLOGIST
VERMONT GEOLOGICAL SOCIETY
DEPARTMENT OF GEOLOGY
UNIVERSITY OF VERMONT
BURLINGTON, VERMONT 05405-0122

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

ADDRESS CHANGE?
Please send it to the Treasurer at the above address.
–Printed on Recycled Paper–

ABSENTEE BALLOT

Vermont Geological Society

Officers

President	Ray Coish	_____
	_____	_____
Vice-President	Helen Mango	_____
	_____	_____
Secretary	Jeff Hoffer	_____
	_____	_____
Treasurer	Kristen Underwood	_____
	_____	_____

Board of Directors (2-year term):

	Shelley Snyder	_____
	_____	_____

If you will not be attending the VGS Annual Meeting in Middlebury on October 20, please complete this ballot and return it in an envelope marked with the "Ballot" in the lower left hand corner and your name and address in the upper left hand corner to:

Jeff Hoffer, VGS Secretary
Hoffer Consulting Inc.
167 Boynton Street
Barre, VT 05641

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

GEOLOGY OF THE MOUNT INDEPENDENCE STATE HISTORIC SITE, ORWELL, VERMONT

Helen N. Mango, Department of Natural Sciences, Castleton State College, Castleton, VT 05735

Geologic Setting

The rock formations found at Mount Independence are typical of Cambrian and Ordovician sedimentary deposition on the passive margin that developed on the east coast of ancient North America (Laurentia). Beginning in the Late Proterozoic, rifting of a supercontinent began, leading to the formation of the Iapetus Ocean (forerunner of the present-day Atlantic Ocean) with Laurentia as the landmass to the west. Approximately 600 m.y. ago, sediment, at first of continental origin, began to accumulate on the eastern margin of Laurentia. As rifting continued, sedimentation on the developing passive margin became of shoreline and shallow marine affinity. The earliest of these sedimentary units occurring in western Vermont (Dalton, Cheshire, Dunham, Monkton, and Winooski Formations) are not found at Mount Independence; here, the oldest unit is the medial Late Cambrian Potsdam Formation, a quartz sandstone which unconformably overlies the Proterozoic metamorphic rocks of the Adirondack massif just to the west. Overlying the Potsdam Formation is the Late Cambrian Ticonderoga Formation, a sandy dolomite which marks the transition from a shoreline to more of a shallow marine environment. Overlying the Ticonderoga Formation is the Late Cambrian/Early Ordovician Whitehall Formation, which is mostly a massive dolomite, and then the cross-bedded sandstone at the base of the Early Ordovician Great Meadows Formation. The Whitehall and Great Meadows Formations belong to the Beekmantown Group. All formations dip gently to the north, at angles of between 4 and 10°, averaging 6 or 7°. The formation names used are from the New York stratigraphy because of lithologic similarities and geographic proximity; the equivalent "Vermont" stratigraphic names are given below:

New York – Champlain Valley	Vermont – Middlebury Synclinorium
Great Meadows	Cutting
Whitehall	Shelburne
Ticonderoga	Clarendon Springs
Potsdam	Danby

Road Log

Mount Independence is located in Orwell, Vermont, five miles west of the intersection of Vermont Routes 22A and 73. From that intersection, go west on Rt. 73 (toward Lake Champlain and away from the village of Orwell). In about 0.3 miles, Rt. 73 curves to the right (north); bear left on the road to Mount Independence (there's a sign). Continue to the end of this road. Just after the road turns to dirt, there is a fork in the road. Bear left, up a steep little hairpin turn. The parking lot for the Mount Independence State Historic Site is on the south side of the road (on your left) and the museum is on the north side (it's the building that looks like a boat). Park in the parking lot.

Note: 1.8 miles after the intersection of Rts. 22A and 73, as you head toward Mount Independence, you will go down a short, fairly steep descent. This marks the Champlain Thrust, one of the largest structural features of western Vermont.

Note: Bring a lunch and something to drink. There is nowhere to purchase supplies closer than the village of Orwell, which is six miles away.

This tour is done entirely on foot, and follows the colored and numbered trails of the State Historic Site (make sure you get a trail guide brochure). Therefore, instead of mileage notations, trail numbers and stop location descriptions will be given in this guide. Approximate compass directions will be given for orientation purposes. The trip will take three or four hours, and includes a fairly leisurely 3.5 mile walk and a little scrambling up talus slopes and through the trees.

Warning: Mount Independence is well endowed with poison ivy! Be vigilant!

Warning: Mount Independence is a State Historic Site. To the untrained eye, many of the historically important building remains bear a striking resemblance to scattered outcrops. Please make sure you know what rocks you're looking at before you start examining them too closely!

On the southern side of the parking lot is a signpost. From there, follow the Southern Defense Trail to the east (left), down the stairs, then along the path and downhill to first a set of three steps, then a set of six steps.

STOP 1. POTSDAM FORMATION. This "stop" begins here and continues down to the water. Typical upper Potsdam sandstone is displayed in the numerous outcrops along this trail. It is in general a pinkish, tan, and gray quartz-cemented quartz sandstone. As the trail descends to the Carillon dock at the water's edge, various features of the Potsdam Formation are visible both in outcrop and in the steps, including grain size differences, shaly layers, worm burrows and cross-bedding.

After completing Stop 1, return to the trip starting point, walk down to the road, and then follow the road to the east (in the direction of Orwell) to the hairpin curve. The outcrop in the inside of the curve is the next stop.

STOP 2. TICONDEROGA FORMATION. The outcrop displays most of the main features of this formation. It is a light- to medium-gray siliceous dolostone, weathering various shades of gray. It contains rounded quartz grains and scattered knots of white calcite and quartz. Some terminated quartz crystals are also present. Cross-bedding is also found elsewhere in the Ticonderoga Formation.

Cross road to north and go into the woods at the end of the split rail fence. Be careful of old strands of rusty wire. Go straight uphill and slightly left (west). The outcrop here is of Potsdam Formation with some excellent cross-bedding, structurally higher than the outcrop of Ticonderoga Formation just seen at Stop 2. Therefore, there is a fault between the two outcrops. This fault continues to the west, just south of the road leading to the marina.

Walk back up the road to the entrance to the State Historic Site. Go left (west) of the museum and walk up the gravel path, past a low exposure of Potsdam Formation (on strike with what we just saw in the woods). Continue up the grassy slope, following the sign to "Trails." The outcrop to the left (west) is also Potsdam Formation. After about 100 m, the trail flattens out briefly. To the right is a small marshy area containing an outcrop.

STOP 3. TICONDEROGA FORMATION. Somewhere in the last 50 m or so just traversed is the contact between the Potsdam and Ticonderoga Formations. This outcrop is therefore near the bottom of the Ticonderoga Formation. The flat surface of the outcrop is approximately equal to bedding, and contains a raised ridge of quartz sandstone. This is likely a clastic dike.

Continue up the path toward the Trail Information Outpost. Approximately halfway between Stop 3 and the Information Outpost, a mown trail heads around a boulder on the right (east) and goes in a southerly direction, at a 30° angle to the trail you just walked up. This is the White Trail, but because we are walking it backwards, the trail markers are only visible if you turn around and look back.

Follow the path downhill through the woods, looking back every now and again to see the White Trail markers. The trail goes around a large curve, heading east, and large slabs of rock lie next to and across the trail. About 5 m into this rocky section, a grassy glade is visible downhill and ahead, containing White Trail Stop 3 (Southern Battery). A large, squarish slab of Potsdam formation is on the upslope side of the Trail, and contains some good cross-bedding. Straight ahead along the contour is an outcrop.

STOP 4. POTSDAM/TICONDEROGA CONTACT. This outcrop contains the contact between the Potsdam and Ticonderoga Formations. The contact is taken to be the undulating surface where gray quartz-cemented quartz sandstone (containing truncated cross-bedding) is overlain by pinkish-tan coarse-grained sandy dolostone.

Continue along the White Trail, past White Trail Stop 2 (Foundation) and uphill over ledges of Ticonderoga Formation. Follow the White Trail to the Information Outpost, and continue west along the Red and Blue Trails. Where these trails diverge, follow the Red Trail (left) all the way to the end (Red Trail Stop 3). The outcrop just below the overlook is of dolostone containing chert, sandy layers/lenses and laminations. This outcrop is considered to be Whitehall Formation on the basis of the laminations and slightly fetid odor on a freshly broken surface, although the many similarities with the Ticonderoga Formation (dolomitic matrix, sand layers, chert) illustrate the difficulty in placing the contact between the two formations, especially in relatively flat areas where outcrop is discontinuous.

Take the Red Trail back to the junction with the Blue Trail. Go left (north) on the Blue Trail to the first outcrop on the left (west) side in the woods.

STOP 5. WHITEHALL FORMATION – WARNER HILL LIMESTONE MEMBER. This rock is a thick-bedded, light- to medium-gray limestone or calcic dolostone containing large, rounded, frosted quartz sand grains and having an almost conglomeratic appearance. Weathered surfaces are almost white, and contain wavy raised lines that resemble the stromatolites seen in the Warner Hill Limestone Member of the Whitehall Formation in Whitehall, New York. There are patches and pebbles of dark blue/gray chert, and occurrences of coarse calcite crystals stained yellow-orange by iron oxide.

Continue north and downhill along the Blue Trail. Where the trail gets closest to the water (Catfish Bay), there is a Blue Trail marker on the left (west) side of the trail. (This is about 40 m south of Blue Trail Stop 7.) Walk directly east through the trees along a vague trail that climbs up the talus slope to the base of a steep cliff.

STOP 6. WHITEHALL FORMATION – SKENE DOLOSTONE MEMBER. The outcrop is of massive dolostone with layers of chert containing nodules of dolostone, iron oxide staining on groundwater seeps, and a dark shaly layer. The dolostone is mostly medium- to dark-gray and finely crystalline, with a slightly fetid odor on a freshly broken surface. The massive bedding is characteristic of this part of the Whitehall Formation.

Continue north along the Blue Trail to its end, at a junction with the Orange Trail. Go left on the Orange Trail, toward the northernmost point of Mount Independence.

STOP 7. LUNCH. The "beach" here is a large outcrop of the fairly featureless, massive gray dolostone that typifies a large part of the Whitehall Formation. Coarse calcite is visible in some cracks.

Continue along the Orange Trail (east and south) to Orange Trail Stop 4 (Horseshoe Battery).

STOP 8. GREAT MEADOWS FORMATION – WINCHELL CREEK MEMBER. The basal unit of the Great Meadows Formation, the Winchell Creek Member, occurs all around the Horseshoe Battery in scattered outcrops on the slopes. To the north, along a now-abandoned section of the Orange Trail, are a few small outcrops of the distinct cross-bedding that exemplifies this unit. Other outcrops contain a sedimentary breccia that is also characteristic of the lowermost Great Meadows Formation. The fragments in the breccia are laminated and cross-laminated.

Continue south along the Orange Trail to where is bends to the east (an unused portion of the trail continues straight). Scattered about the trail are numerous moss-covered boulders and discontinuous outcrops of Winchell Creek breccia.

The Orange Trail continues all the way back to the Trail Information Outpost (about 15 minutes). Continue walking south to get back to the museum and parking lot.

THE
GREEN MOUNTAIN GEOLOGIST

NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

Fall 2002 VOLUME 29 No. 4

VERMONT GEOLOGICAL SOCIETY FALL FIELD TRIP & ANNUAL MEETING

Waterbury, Vermont
September 14, 9:30 AM

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PRESIDENT'S LETTER

August 27, 2002

Dear Members:

I hope you've all had a great summer.

We did have a summer field trip to Fort Mount Independence led by Helen Mango. It was a beautiful day with great geology – thanks Helen. For those of you who missed it, Helen will be running the field trip again for the NEIGC conference in late September – you can get details at www.neigc.org.

Our Fall field trip and meeting will be on September 14 – see details in this issue of the GMG. I hope that many of you can make it to the field excursion and to the meeting that will follow. At that meeting, we will elect a new slate of officers for the coming year. The list is in this GMG - please send in your vote if you cannot make it to the meeting in September. Thanks to all nominees for agreeing to serve the society.

Earth Science Week is the week of Oct. 13 – 19. Many activities are planned around the state, including Geologist-in-the-Park, a poster competition for students and tours of OMYA quarry in Middlebury. Marjie Gale has compiled a list of activities on the Vermont Geological Survey website.

At our executive committee meeting in the summer, we decided to table the issue of a name change for the society until at least the Fall meeting. I hope that we can discuss it then and come to a decision.

Finally, I want to thank all who have helped during my tenure as president, especially Marjie Gale who has given so much of her time to keep the society functioning smoothly. Thanks to Helen Mango for agreeing to take on the job of president next year.

Sincerely,
Ray Coish
coish@middlebury.edu

VGS ANNUAL MEETING & ELECTIONS

Saturday, September 14, 2002

The Fall Field Trip and Annual Meeting will be held on Saturday, September 14, 2002. Archeologist Dr. Peter Thomas will be leading the field trip, which will depart from the Vermont Geological Survey (103 South Main St., The Laundry Building) in Waterbury at 9:30 am. To get to the Survey, take Rte 89 to Exit 10. From Exit 10 go south on Rte 100 to Rte 100 and Rte 2 South. Take Rte. 100 (also Rte. 2) about 1 mile south through Waterbury village. Turn right at the light onto Park Row and drive around to the back parking lots. The Laundry Building is behind the ANR main office complex (in front of a gigantic smokestack visible from the highway). Following the field trip, the Annual Meeting will be held.

The Annual Meeting and Elections will be held at ARVADS, Main St., Waterbury, VT at 4 pm on Saturday, September 14, 2002. Here are nominees for VGS positions next year:

President - Helen Mango
Vice President - Tim Grover
Secretary - Dave West
Treasurer - Steve Howe

Board - Shelley Snyder, Ray Coish, Kristen Underwood
Advancement of Science - Steve Howe
Education - Christine Massey
Public Issues - Larry Becker
Publications - Marjorie Gale, Peter Gale, Dave West
Membership - disband

If you are not planning to attend, please send the enclosed absentee ballot by mail* to the VGS Secretary c/o Marjie Gale by September 13, 2002.

* Marjie Gale, Vermont Geological Survey, 103 South Main St., Laundry Bldg., Waterbury, VT 05671

STATE GEOLOGIST'S REPORT

Isle LaMotte Ordovician Reef B Goodsell Ridge

At a Burlington Boat House kick-off meeting to raise funds to preserve the Goodsell Ridge (a section of the Chazy reefs on Isle LaMotte), the State Geologist introduced Dr. Charlotte Mehrtens, Vermont expert on the Ordovician reef. Her talk highlighted the geology, paleontology, and the educational value of preserving this world-class example of reefs in which coral first appears. The gathering was sponsored by the Lake Champlain Land Trust and the Isle LaMotte Reef Preservation Trust. Please consider this worthy cause to preserve a geologic treasure.

State Based Earth Science Education Alliance

The State Geologist has started to organize a State Based Alliance to advance Earth Science education in Vermont in cooperation with TERC, a Cambridge, Mass. non-profit that publishes science curricula. The Vermont Geological Survey is cooperating with TERC on a grant application to the National Science Foundation. The State Geologist invited the Director of TERC's Center for Earth and Space Science Education to the Association of American State Geologists (AASG) annual meeting in New Harmony, Indiana. He explained the alliance concept and a new national initiative to advance Earth Science education. As chair of the AASG Education Committee, the Vermont State Geologist submitted a resolution for AASG consideration. AASG agreed that State Surveys should consider joining or leading State Based Alliances for Earth Science Education in their own states as changes to meet the new science standards take place on the state and local levels.

Education

Marjorie Gale led a full day geology workshop at Shelburne Farms. The workshop was designed to deliver content in geology to elementary school teachers who had limited science/earth science background. The workshop included lecture, discussion, hands-on rock, mineral, and map activities, and field time. The workshop was

followed by a field day in South Hero in August. Marjorie also spent an afternoon at the middle school in Essex Junction during the annual Career Day.

Jon Kim taught geology at one of the seven field stations at the Tunbridge Central School Environmental Field Day. Over 140 students (in groups of 20) spent 30 minutes at each field station. Jon also led a field trip for an Environmental Geology class from Alfred University (N.Y.). The trip visited the Belvidere Mountain Asbestos Quarry, Lake Willoughby, and the Jeffersonville landslide area.

Earthquake

Emergency Management contacted the State Geologist within 10 minutes of the event on the morning of April 20, 2002. The State Geologist contacted Weston Observatory of Boston College immediately to get the size and location of the quake. Weston manages a seismograph here in the Waterbury complex in cooperation with the VGS. The information was relayed by approximately 8:45 am.

Since we re-set the counter in October 1999, we have an average of 589 hits per month on our web site. On Saturday, April 20 we logged about 400 hits. We probably owe some of the increased traffic to Alice Blount (OMYA) and Vermont Public Radio who posted a link to ANR with the location of our earthquake information (*A Report on the Seismic Vulnerability of the State of Vermont*, by John E. Ebel, Richard Bedell and Alfredo Urzua).

The VGS in cooperation with Vermont Emergency Management employs a FEMA computer program known as HAZUS, a tool for estimating potential losses from earthquakes. On Monday morning, the VGS worked quickly to get HAZUS information into an Emergency Management press release.

HAZUS modeling of the 5.1 Richter magnitude, April 20, 2002 earthquake predicts ground shaking slightly below the damage threshold, consistent with the early reports from the actual event. A simulation of a 5.5 magnitude event at the same location predicts potentially damaging ground shaking in northwestern VT. In general,

northwestern Vermont has a 10% chance of experiencing damaging ground shaking in a 50-year period.

As a result of the press release, both WCAX Channel 3 and WVNY, Channel 22 visited the VGS for interviews on the science of seismic events and the need to prepare for future events that could cause damage in northwestern Vermont.

In an interesting follow up, a consulting firm performing a slope stability analysis for a site in Colchester requested technical data on the level of shaking that occurred in Colchester on April 20, 2002. The Division used HAZUS, which predicts horizontal shaking as a percent of the acceleration of gravity. The consulting firm wanted to know the vertical component. As a general rule, vertical shaking is about 2/3rds of the horizontal push that occurs during earthquake events. The consulting firm will use this information in the slope stability analysis.

Radioactivity in Rocks, Soil, and Water

The VGS met with the towns of Milton and Colchester to explain the results of geologic mapping to define the potential for encountering radioactivity in rocks and drinking water. The VGS discussed the creation of a derivative map distilled for public audiences that will help the towns manage the radioactivity problem.

Geology and Town Plans

A strategic plan goal is to increase the number of town plans that include geological information and address geological issues such as hazards, ground water, and resource needs. In the last several weeks, requests for town plan information have come from Belvidere and Waitsfield. The Waitsfield request is for general geological information to apply to the town plan. The Belvidere gravel pit capacity is finite and the town will be looking for new sources. Also, Belvidere wants to know about extraction potential as mineral rights are owned by third parties on some properties and surrounding towns such as Johnson, Eden and Lowell - all have had active extraction sites. Addison County Regional Planning Commission is putting together a hazard mitigation plan that will include the earthquake, landslide and river erosion issue

Shoreline Erosion - Lake Champlain

The State Geologist attended a steering committee meeting to discuss a Lake Champlain Shoreline Stabilization Handbook. The Northwest Regional Planning Commission is using Project Impact funds to create a handbook. In 1977, as a student, Laurence Becker conducted a survey of Lake Champlain shoreline erosion for Professor Allen Hunt at UVM under contract to the New England River Basins Commission. Because of present day assessment issues and the Survey's physical hazard mapping initiative which applies to lakeshore erosion/slope instability, the State Geologist will track the handbook development. The Director of the Sea Grant program in Vermont was in attendance, but as of now the sea grant monies would not apply to Lake Champlain shoreline erosion issues. There may be an attempt to go back to Congress to get the ability to spend sea grant money on shoreline erosion and other issues.

Personnel

On January 28th, Dr. Jonathan Kim began work in the Vermont Survey as an Environmental Scientist III with an emphasis on geologic hazard mapping. He has broad experience in many aspects of geology and has conducted geologic mapping for radionuclides in the Milton/Colchester area and St. George. His major focus will be work on the radioactivity in rocks and ground water problem but he will also be involved in the identification of physical hazards such as landslides and erosion.

In cooperation with Norwich University, the Survey is supporting a Research Associate position at the Department of Geology. The Research Associate's work will focus on physical hazard mapping that combines the identification of the landslide, slope instability, and riverine erosion hazard. The Research Associate will help develop the physical hazard mapping methodology and map presentation. Completion of mapping in the Third Branch of the White River and future mapping projects will be conducted by the research associate. George Springston, a principal investigator on the Statemap grant that supports the position, has been named as the Research Associate.

Christe Wedlund is volunteering as an intern with the VGS. She is using ArcView GIS to combine the water well database, digital orthophotos, E-911 location data, digital parcel maps, boring logs from AOT and other sources, and information from Town Clerks in order to check locations of water wells and boring logs in Randolph and Bethel. The final product will be a set of accurate well and boring locations that will help the Survey evaluate the three-dimensional distribution of the surficial deposits in the area as part of the Survey's study of surficial geology and fluvial geomorphology. Christe recently graduated from Appalachian State University with a B.A. in Geology.

Laurence Becker, Vermont State Geologist
Vermont Geological Survey
103 South Main St., Laundry Bldg., Waterbury, VT 05671

EARTH SCIENCE WEEK 2002, Oct. 13 - 19

Scheduled Events

Saturday, Oct. 12:	OMYA Open House
Tuesday, Oct. 15:	Geologists-in-the-Parks at Button Bay, Elmore, Groton, and Mt Philo
	Fleming Museum Geologic Resource Tours
	Mercury in the Environment Guest Speakers
Wednesday, Oct. 16:	Geologists-in-the-Parks at Elmore and Mt. Philo
	Fleming Museum Geologic Resource Tours
	Mercury in the Environment Guest Speakers
Thursday, Oct. 17:	Fleming Museum Geologic resource Tours
	Mercury in the Environment Guest Speakers

Friday, Oct 18:	Posters due at Perkins Museum: Awesome Forces that Shape the Earth! Fleming Museum Geologic Resource Tours Mercury in the Environment Guest Speakers National Water Monitoring Day
Saturday, Oct. 19:	VINS North Branch Nature Center Mineral ID Day

OMYA's Marble Quarry Open House: As part of the National Earth Science Week celebration, a special open house will take place on October 12th from 10:00 a.m. to 3:00 p.m. at OMYA's marble quarry near Middlebury, Vermont. Experts will be on hand to lead tours into the quarry, to help visitors identify samples that they have collected and to talk about Vermont geology. Modern mining equipment will be available for inspection. For further information: 802-770-7267 or alice.blount@OMYA.com

Geologist-in-the-Parks sponsored by VT Geological Survey, VT Geological Society and Dept. of Forest and Parks: Park sites include Groton, Button Bay, Mt Philo, & Elmore. Spaces are limited and reservations are required. Contact: Marjorie Gale at 802-241-3608 or e-mail marjieg@dec.anr.state.vt.us

Awesome Forces that Shape the Earth! Poster Contest: Perkins Geology Museum at UVM and the Vermont Geological Society are sponsoring a poster contest for Vermont students in grades K-2, 3-5, 6-8, & 9-12. There will be a $30 cash prize for each grade group. This year's theme is: Awesome Forces that Shape the Earth! (e.g. plate tectonics, earthquakes, volcanoes, tsunamis, glaciers, or even the stream in your backyard). Contact: Christine Massey at 656-1344; cmassey@zoo.uvm.edu

Geologic Resource Tours at the Fleming Museum: Special tours with a geologist to examine geologic materials used in objects and exhibits at UVM's Fleming Museum. Tuesday-Friday, October 15-18, 2002. Contact: Chris Fearon, Fleming Museum Education Specialist, 656-0750.

Mercury in the Environment Guest Speakers: Karen Busshart, Mercury Project Coordinator, and Tom Benoit, Hazardous Materials Specialist, from the VT Dept. of Environmental Conservation will visit your school or group to talk about mercury in the environment. Contact Karen Busshart at 802-241-3455; e-mail karenbu@dec.anr.state.vt.us

VINS North Branch Nature Center Mineral Identification Day: Spend the morning with geologists and mineral collectors to identify your own rocks and minerals, plus learn about common minerals in Vermont. Contact Peter Watt or Chip Darmstadt at VINS, 713 Elm St., Montpelier, VT; 802-229-6206

National Water Monitoring Day: Citizen monitors including families, classrooms, civic organizations and service clubs can participate and sample for a core set of water quality parameters (Temperature, pH, Water Clarity, Dissolved Oxygen). Participants will need to register their monitoring location before October 18th by clicking on http://www.yearofcleanwater.org

Vermont Geological Society Booklist: A copy of the booklist may also be obtained from VT Geological Survey, 103 S. Main St., Laundry Bldg., Waterbury, VT 05671.

Earth Science Week is a joint project of the Vermont Geological Society, the Vermont Geological Survey at the Department of Environmental Conservation, the Perkins Museum at the University of Vermont and the American Geological Institute. Other individuals, organizations and businesses also sponsor activities during the week. Please join us for Vermont's Fifth Annual Earth Science Week. Events are posted at: http://www.anr.state.vt.us/geology/vgshmpg.htm

For more information about Earth Science Week contact the following.

Christine Massey at 656-1344; cmassey@zoo.uvm.edu
Marjorie Gale at 241-3608; marjieg@dec.anr.state.vt.us

VERMONT GEOLOGICAL SOCIETY BOOK LIST

Many thanks to all of you who contributed to the booklist. This list also has some annotations from various contributors.

Atlantic Geoscience Society, 2001, *The Last Billion Years: A Geological History of the Maritime Provinces of Canada*, Nimbus Publishing, Halifax, NS. "Although the last one is set in Canada, much of the information in it also applies to the NE USA, and it is a wonderful and colorful explanation co-written by a team of real experts. Very impressive." from Greg McHone

Dann, Kevin, 1989 , *Traces on the Appalachians: A Natural History of Serpentine in Eastern North America*, Rutgers University Press

Decker, Robert and Decker, Barbara, 1997, *Volcanoes*, W.H. Freeman and Company

Fortey, Richard, 2000, *Trilobite: Eyewitness to Evolution*, Knopf "...a good read." from Jim Dawson

Keay, John, 2001, *The Great Arc: The Dramatic Tale of How India was Mapped and Everest Was Named*, Harper Perennial. "...a good read." from Jim Dawson

Kohnke, Helmut and Franzmeier, D.P., 1995, *Soil Science Simplified*, Waveland Press

Little, Richard, 1986, *Dinosaurs, Dunes, and Drifting Continents: The Geohistory of the Connecticut Valley*, Earth View (MA)

About Mcphee-

"...various works by John McPhee, of course." from Thelma Thompson.

"I would recommend *Rising from the Plains* by John McPhee; Also *Assembling California* and *Basin and Range* by McPhee." from Bob Badger

"Of course for adults, you can't go wrong with anything by John McPhee;" from Kent Koptiuch

Greg Walsh, Paul Bierman and Stephen Wright recommended McPhee, too.

McPhee, John, 1983, *In Suspect Terrain*, Farrar Straus and Giroux (re-issue 1998 in paperback by Econo-Clad Books)

McPhee, John, 1990 , *In Control of Nature*, Noonday Press

McPhee, John, 1990, *Encounters with the Archdruid*, Noonday Press

McPhee, John, 1991, *Rising from the Plains*, Noonday Press

McPhee, John, 1994, *Assembling California*, Noonday Press

McSween, Harry J., 1999, *Meteorites and their Parent Planets*, Cambridge University Press

Morrison, Taylor, 2001, *The Great Unknown*, Houghton Mifflin Co. "Describes the efforts of Charles Wilson Peale to excavate and display the bones of a mastodon unearthed in New York--a great blend of science and history." from Cheryl Cox

Officer, Charles and Page, Jake, 1993, *Tales of the Earth: Paroxsysms and Perturbations of the Blue Planet*, Oxford University Press "...good for the lay person and addresses favorite topics like ice ages, extinctions and man's impact." from Tracy Rushmer

Powell, John Wesley, 2002, *The Exploration of the Colorado River and its Canyons*, National Geographic Society

Raymo, Chet and Raymo, Maureen E., 2001: *Written in Stone: A Geological History of the Northeastern United States (2nd Edition)*, The Globe Pequot Press, Old Saybrook, CT.

Rolando, Victor, 1992, *200 Years of Soot and Sweat: the Geology and Archeology of Vermont's Iron, Charcoal, and Lime Industries*, Vermont Archaeological Society, Burlington, VT
"...a great compendium of Vermont's industrial archeology/geology, but is probably interesting to a narrower audience." from Stephen Wright

Stevens, C.J., 1997, *The Next Bend in the River*, John Wade Publishing
"...a fascinating account of several mini-gold rushes in western Maine in the late 1800s through mid 1900s." from Kent Koptiuch

Strahler, Arthur N., 1988, *A Geologist's View of Cape Cod*, Parnassas Imprints
"...an excellent short book on coastal morphology for the layperson." from Kent Koptiuch

Van Andel, Tjeerd, 1994, *New Views of an Old Planet: A History of Global Change*, Cambridge University Press
"...good for the introductory geology student-a bit more meaty." from Tracy Rushmer

Van Diver, Brad, 1987, *Roadside Geology of Vermont and New Hampshire*, Mountain Press Publishing
"...an obvious choice." from Thom Villars and from Jim Malter

Wieshampel, David B. and Young, Luther, 1996, *Dinosaurs of the East Coast*, Johns Hopkins University Press, Baltimore, MD

Winchester, Simon, 2001, *The Map the Changed the World*, Harper Collins
"...interesting, but personally I think it is overrated." from a shared sentiment

Children/Young Readers Books

Blobaum, Cindy, Illustrated by Michael P. Kline, 1999, *Geology Rocks--50 Hands-on Activities to Explore the Earth*, Williamson Publishing

Christian, Peggy, Illustrated by Barbara Hirsch Lember, 2000, *If You Find a Rock*, Harcourt

Cole, Joanna, Illustrated by Bruce Degen, 1989, *The Magic School Bus Inside the Earth*, Scholastic Trade

Gibbons, Gail, 1998, *The Planet Earth: Inside Out*, Mulberry Books

Hiscock, Brian, 1999, *The Big Rock*, Aladdin Paperback

Hooper, Meredith, Illustrated by Christopher Caody and Chris Coady, 1996, *The Pebble in My Pocket: A History of Our Earth*, Viking Childrens Books

Hurst, Carol Otis, 2001, *Rocks in his Head*, Greenwillow

Kerley, Barbara, Illustrated by Brian Selznick, 2001, *The Dinosaurs of Waterhouse Hawkins*, Scholastic Trade. "a brilliantly illustrated tale of how Hawkins excited the world about dinosaurs" from Cheryl Cox

Martin, Jacqueline, Illustrated by Mary Azarian, 1998, *Snowflake Bentley*, Houghton Mifflin Co.
"...an obvious choice." from Thelma Thompson

Prager, Ellen, J., Illustrated by Nancy Woodman, 2002, *Sand*, National Geographic Society

Thorson, Kristine and Thorson, Robert, Illustrated by Gustav Moore, 1998, *Stone Wall Secrets*, Tilbury House, Gardiner, ME

Vancleave, Janice, 1991, *Janice Vancleave's Earth Science for Every Kid: 101 Easy Experiments that Really Work*, John Wiley

Oldies but Goodies

"I suggest adding these "oldies but goodies":
John S. Shelton: *Geology Illustrated* (Freeman);
Cornelius S. Hurlbut. Jr.: *Minerals and Man* (Random House); and
Ian McHarg: *Design with Nature* (Natural History Press)."
from Jutta Hager

VERMONT GEOLOGICAL SOCIETY
TREASURER'S REPORT

August 30, 2002

Dear President and Board:

The financial condition of the Society remains strong. The checking account balance is $3,762.36 as of August 30, 2002. Please see the attached Income Statement. All bills received by me have been paid and are reflected in the above balance.

Sincerely,
Kristen L. Underwood

Income and Expenses
1/1/02 through 8/30/02

INCOME		
Total Dues		$1,488.00
Dues-Family	$120.00	
Dues-Institution	$70.00	
Dues-Member	$1,290.00	
Dues-Student	$8.00	
Interest	$0.57	
Publications (UVM Geology)	$30.00	
Credit for Lost Student Check	$30.00	
Dues Overpayment	$10.00	
Student Research Grant Contributions	$270.00	
TOTAL INCOME		$1,828.57
EXPENSES		
US Post Office (stamps, GMG Dist.)	$8.50	
GMG Publishing	$229.57	
Earth Science Week Poster Awards	$30.00	
Expense Reim. (UVM Geo.)	$30.00	
Expense Reim. (Postage for GMG)	$82.30	
Research Grant Awards	$0.00	
Student Awards (VGS Spring Mtg)	$225.00	
TOTAL EXPENSES		$605.37
TOTAL INCOME – EXPENSES		$1,223.20

THE GREEN MOUNTAIN GEOLOGIST
VERMONT GEOLOGICAL SOCIETY
DEPARTMENT OF GEOLOGY
UNIVERSITY OF VERMONT
BURLINGTON, VERMONT 05405-0122

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

ADDRESS CHANGE?
Please send it to the Treasurer at the above address.
–Printed on Recycled Paper–

ABSENTEE BALLOT

Vermont Geological Society

Officers

President:	Helen Mango	_____
	(*write in*)_____	_____
Vice-President	Tim Grover	_____
	(*write in*)_____	_____
Secretary:	Dave West	_____
	(*write in*)_____	_____
Treasurer	Steve Howe	_____
	(*write in*)_____	_____

If you will not be attending the VGS Annual Meeting in Waterbury on September 14, please complete this ballot and return it in an envelope marked with "Ballot" in the lower left hand corner and your name and address in the upper left hand corner to:

VGS Secretary
c/o Marjie Gale
Vermont Geological Survey
103 South Main St./Laundry Bldg.
Waterbury, VT 05671

To be counted, this ballot must be received by September 13.