

THE GREEN MOUNTAIN GEOLOGIST
 VERMONT GEOLOGICAL SOCIETY
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THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY
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*The Vermont Geological Society's
 Spring Meeting
 February 24, 2004, 8:30 AM
 At Middlebury College*

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Directions to the Spring VGS Meeting

Bicentennial Hall, Middlebury College

April 24, 2004

8:30 am

From the town green in Middlebury, take Rte. 125 west, past the Catholic Church, and up a hill through the College. Go over the crest, and at the bottom of the hill as it flattens to a valley; turn right (Bicentennial Drive) onto the winding driveway. Park in the large parking lot on the west side of Bicentennial Hall.

The meeting is in Room 220 of Bicentennial Hall.

SPRING MEETING PROGRAM

VERMONT GEOLOGICAL SOCIETY

Bicentennial Hall, Room 220

Middlebury College, Middlebury, Vermont

February 24, 2004

- 8:30 COFFEE & REFRESHMENTS
- 9:00 Kevin Mills: UNDERSTANDING THE SPATIAL VARIABILITY OF SNOW ACCUMULATION IN HIGH-ELEVATION WATERSHEDS: MT. MANSFIELD, VERMONT
- 9:15 Colin Rodgers: LATE HOLOCENE ENVIRONMENTAL CHANGE IN THE UINTA MOUNTAINS, UTAH, BASED ON ANALYSIS OF A SEDIMENT CORE FROM WATER LILY LAKE
- 9:30 Maria Hayes: NITRATE INPUTS TO FOUR VERMONT PONDS: A STABLE ISOTOPE STUDY
- 9:45 Susannah Cowden: LEAD IN GROUNDWATER DERIVED FROM A FRACTURED CARBONATE AQUIFER (CLARENDON SPRINGS FM.), NORTH-WESTERN VERMONT

- 10:00 Burch Fisher: A TROPICAL SOIL TERRACE PROGRESSION AND IMPLICATIONS FOR FORE-ARC DYNAMICS ON THE PACIFIC COAST, COSTA RICA
- 10:15 **BREAK**
- 10:30 Caroline Orsi: STRUCTURAL, TOPOGRAPHIC, AND HYDROGEOLOGIC ANALYSIS OF BEDROCK IN THE MONTPELIER QUADRANGLE, CENTRAL VERMONT
- 10:45 Deborah Joy Shulman: THE EFFECT OF INHERITED STRUCTURES ON THE FORMATION OF EXTENSION FRACTURES IN THE LAKE CHAMPLAIN BASIN
- 11:00 Emily Peterman: THE ORDOVICIAN TECTONIC HISTORY OF A PORTION OF THE LIBERTY-ORRINGTON BELT, SOUTH-CENTRAL MAINE
- 11:15 Evan Twelker: GREENSTONES IN THE MORETOWN AND CRAM HILL FORMATIONS, MONTPELIER QUADRANGLE: A FIELD AND GEOCHEMICAL STUDY
- 11:30 – 12:00 **AWARDS**

ABSTRACTS

UNDERSTANDING THE SPATIAL VARIABILITY OF SNOW ACCUMULATION IN HIGH-ELEVATION WATERSHEDS: MT MANSFIELD, STOWE, VERMONT.

Kevin W. D. Mills, Department of Geography, University of Vermont, Burlington, VT 05405

In mountainous terrain, precipitation is distributed in complex patterns that are related to topographic elements including elevation, aspect, and exposure. Precipitation influences various watershed processes, including

the rate and timing of runoff, erosion dynamics and the transport of chemicals and nutrients. Some aspects of the relationship between precipitation and topography are generally understood however very little research has been conducted in the eastern U.S. to *quantify* the topographic controls on precipitation distribution. This project examines controls on the distribution of snow in the mountainous landscape of Mount Mansfield in Stowe Vermont. The study area includes the West Branch (11.7 km²) and Ranch Brook (9.8 km²) watersheds on the eastern slope of the mountain. These watersheds are part of an on-going investigation of water quantity and quality dynamics as they relate to ski resort. This project is helping to quantify the amount of precipitation falling over these two watersheds and is providing local information for other researchers interested in predicting the patterns of precipitation over Vermont's complex terrain. The study includes field data collection and analysis using statistical methods and a geographic information system (GIS). Snow Water Equivalencies (SWE) were determined at 72 sites along 8 transects (12 elevations per transect) throughout the West Branch and Ranch Brook watersheds. The coring method for determining SWE involved plunging a snow coring device through the entire depth of snow cover. The resulting snow core was weighed to determine the SWE at each site. This analysis allows us to assess patterns of SWE associated with topography. This relationship is explored through the establishment of regression relationships for each transect to relate SWE to elevation and aspect. Using a GIS, a map of SWE was developed for the two watersheds by applying the regression equations to a digital elevation model to predict basin-wide SWE at it relates to topography.

LATE HOLOCENE ENVIRONMENTAL CHANGE IN THE UINTA MOUNTAINS, UTAH, BASED ON ANALYSIS OF A SEDIMENT CORE FROM WATER LILY LAKE

Colin Rodgers, Geology Department, Middlebury College, Middlebury, VT 05753

A 54.5-cm rhythmically laminated lake sediment core was extracted from Water Lily Lake in the southern Uinta Mountains of northeastern Utah. Water Lily Lake (surface area 8.1 ha, 2850 m asl) is a small alpine lake located in the Yellowstone River drainage. The core was retrieved from the surface sediment in order to compare recent sedimentation in the lake to that recorded by a longer sediment core, which was retrieved in the

spring of 2003. The watershed around the lake is underlain by Mississippian Madison limestone and Precambrian Red Pine shale. The core was retrieved from 10 m of water with a mini-Glew piston corer operated from an inflatable raft. The sediment was sampled at 1-cm intervals on site. Following return to the University of Utah the uppermost 10 cm was sampled for diatom analysis and ²¹⁰Pb dating, and the remaining sample was shipped to Middlebury, Vt. where % Loss on Ignition (LOI) and particle size distribution were analyzed, and major and trace element chemistry was determined by ICP-AES. A conifer needle, found at a depth of 40cm, returned a modern ¹⁴C age (within 50 calendar years), this suggests a sedimentation rate of ~10 mm/yr, which is unreasonably high, thus the sample may have been contaminated. The complete results of the ²¹⁰Pb dating are pending. LOI values range from 25 to 47% percent, with a gradual decreasing trend upward through the core. LOI values also become considerably more variable near the top of the core. Mean grain size increases upward through the core with all sediment being fine silt (7 to 19 μm). ICP-AES analysis illustrated a congruent upward decrease in Cr, Ti and Zr metallic elements. Cu was highly variable ranging from 38.3 to 81.8 ppm, but variability increases with depth. The upward decrease in LOI and increase in mean grain size may reflect increasing activation of an extensive landslide complex located upslope from the lake, which is underlain by the failure-prone Red Pine shale. This possibility is notable because no activity of this landslide is recorded in the longer sediment core from Water Lily Lake, which spans 7 to 1 ka BP with an average sedimentation rate of only 0.3 mm/yr.

NITRATE INPUTS TO FOUR VERMONT PONDS: A STABLE ISOTOPE STUDY

Maria Hayes, Chemistry Department, University of Vermont. Burlington, VT 05405

Nitrogen (N) is a limiting nutrient in the environment; an overabundance of N, however, can be catastrophic in most ecosystems. Significant anthropogenic contributions to the natural N cycle may be derived from the fertilizers that are incorporated into the hydrosphere from both surface runoff and water table penetration. The goal of this study is to determine, through the use of the stable isotope signature of nitrate-N found in surface waters, to what degree human-induced N inputs have impacted the N budgets of four Vermont ponds. Nitrogen isotopes afford

scientists to discriminate between different nitrate sources. Nitrogen has two stable isotopes: ^{14}N and ^{15}N (which comprise 99.63 and 0.37 % of all N, respectively). Natural waters typically have isotopic compositions depleted with respect to ^{15}N when compared to the atmosphere. However, fertilizers used for landscaping and farming generally display higher $^{15}\text{N}/^{14}\text{N}$ ratios.

The four sites chosen for this study are Little Pond in Richmond (control lake), Lake Winona near Bristol (pesticide/synthetic fertilizer active farm lake), Halfmoon Pond in Fletcher (lake receiving large inputs of manure from nearby farm) and Colchester Pond (recovered lake). During our fall 2003 sampling round nitrate concentrations in all four lakes were very low ($< 2 \mu\text{mol NO}_3 / \text{L}$), which considerably increased the complexity of the isotopic analyses. Nevertheless, the preliminary data (one more suite of samples will be collected after snowmelt) support our working hypothesis that the isotopic composition of nitrate-N reflects the varying anthropogenic inputs of N to these ponds.

Previous studies have reported nitrate $\delta^{15}\text{N}$ values of approximately 2-4 ‰ for rain waters in the northeastern US, 0-1 ‰ for synthesized fertilizers, and around 12-14 ‰ for manure. The $\delta^{15}\text{N}$ values determined for the fall samples were as follows: Little Pond 2.0 ‰, Lake Winona 1.9 ‰, Colchester Pond 1.7 ‰, and Halfmoon Pond 3.8 ‰. The only lake that shows significantly different isotopic values is Halfmoon Pond. This clearly reflects the large input of N from cow manure to the lake. The data we will produce after spring snowmelt will provide additional information, especially in regards to seasonal fluctuations in both nitrate-N concentrations and isotopic composition.

LEAD IN GROUNDWATER DERIVED FROM A FRACTURED CARBONATE AQUIFER (CLARENDON SPRINGS FORMATION), NORTHWESTERN VERMONT

Susannah Cowden, Geology Department, Middlebury College, Middlebury, VT 05753

Elevated concentrations of Pb occur in groundwater associated with brecciated dolostone of the Cambrian-Ordovician Clarendon Springs Formation (CSF) in the Champlain Valley of northwestern VT. 34 wells that produce from the CSF were analyzed by inductively coupled plasma-atomic emission spectrometry (ICP-AES). Pb concentrations in acidified samples (pH ~ 1) range from < 15 ppb (detection limit) to 580 ppb, with a

mean value of 56 ppb. Spatial analysis of 35 CSF-derived ground water samples from 5 towns indicates elevated levels of Pb throughout the study area, with highest values and occurrence rates in the towns of Weybridge and Cornwall on the western limb of the Middlebury Synclinorium. ICP-AES analysis of dissolved orange particulate filtered out of well water suggests this is the dominant source of lead in the Clarendon Springs Formation. X-Ray Diffraction (XRD) analysis of particulate with 200-400 mg/kg Pb indicates the presence of amorphous Fe hydroxides and poorly crystalline lepidocrocite and goethite. Chemical analysis of bedrock through partial rock dissolution and bulk rock ICP-AES analysis show Pb is below the detection limit (< 5 mg/kg Pb) in carbonate minerals and slightly elevated (10 mg/kg Pb) in black breccia clasts. Scanning Electron Microscope (SEM) analysis indicates the presence of pyrite in black breccia from a Chittenden County CSF sample that contains 15 mg/kg Pb. The presence of Pb-bearing iron hydroxide combined with the presence of pyrite suggests that Pb is derived from sulfide oxidation. This suggestion is also consistent with (Pb concentrations in groundwater that increase by one to two orders of magnitude when water tables lower, implying dissolution of Pb-bearing minerals when oxygen penetrates the aquifer; and (2) lepidocrocite, goethite and amorphous Fe-hydroxides commonly form via sulfide oxidation and rapid formation of Fe-hydroxide. Particulate Pb in the study area is virtually insoluble in neutral to slightly alkaline carbonate aquifers, and most Pb is removed by filtration and ion exchange. Accordingly, Pb is rarely detected at concentrations > 15 ppb in drinking water, even in cases with > 100 ppb Pb in well water.

A TROPICAL TERRACE SOIL PROGRESSION AND IMPLICATIONS FOR FORE-ARC DYNAMICS ON THE PACIFIC COAST, COSTA RICA.

Burch G. Fisher III, Geology Department, Middlebury College, Middlebury, VT 05753

Soils developed on Quaternary fluvial and marine fill terraces on the Pacific coast of Costa Rica display progressive changes in mineral assemblage, chemical composition and particle size with age. Soils range from poorly-developed, dark yellowish brown (10YR 3/4) inceptisols to lateritic, dark red (10R 3/6) oxisols in the oldest terraces. Mean annual precipitation is seasonal averaging 3100 cm and mean annual temperature is 27 °C.

Clay minerals from active floodplains are predominately smectite with lesser 7Å halloysite and traces of 10Å halloysite. Soils on 5 – 10 Ka terraces at elevations < 30 m above mean sea level (MSL) exhibit similar clay mineral assemblages, with smectite decreasing at the expense of halloysite with age. Soils on 37 – 240 Ka (Sak et al. 2004) terraces 60 to 210 m above MSL consist of 7Å halloysite with only traces of 10Å halloysite and smectite. A 7m soil profile sampled at 140 m above MSL is dominated by halloysite with traces of smectite only present at depths of > 5 m. Bulk mineral assemblage varies from a smectite-plagioclase-pyroxene-quartz assemblage in young terrace soils < 30 m above MSL to a halloysite-goethite-hematite-quartz-magnetite assemblage in terrace soils > 60 m above MSL. Leaching results in rapid loss of soluble base cations, and residual concentration of Ti and Zr indicates mass losses of ~50% by chemical denudation.

Plots of terrace age vs. various measures of clay mineralogy and chemical composition produce parabolic curves consistent with rapid chemical weathering pre-37 Ka and slower rates of change from 37 – 240 Ka. These findings are significant because they (1) indicate that terraces 5-20 m above sea level are Holocene (5 – 10 Ka), (2) have potential to be applied to correlating terraces and uplift rates across tectonic blocks on the Pacific coast of Central America, and (3) appear to confirm age estimates of Sak et al. (2004) that are consistent with uplift rates that vary from 1 – 4 m/Ka over the time interval studied. This further suggests that the subduction of anomalous bathymetric features at the Middle America Trench is having a significant impact on fore-arc dynamics over a relatively small geologic time period.

Sak, PB; Fisher, DM; Gardner, TW; Murphy, K; Brantley SL. 2004. Rates of weathering rind formation on Costa Rican basalt. *Geochimica et Cosmochimica Acta*, Vol. 68, pp. 1453-1472.

STRUCTURAL, TOPOGRAPHIC, AND HYDROGEOLOGIC ANALYSIS OF BEDROCK IN THE MONTPELIER QUADRANGLE, CENTRAL VERMONT

Caroline M. Orsi, Geology Department, Middlebury College, Middlebury, VT 05753

Detailed bedrock geologic mapping was conducted in the Montpelier Quadrangle during the summers of 2002-03 by the Vermont Geological Survey and students from Middlebury College and the University of

Vermont. The metasedimentary and metaigneous rocks of the Montpelier Quadrangle are Pre-Silurian to the northwest (Moretown and Cram Hill fms) and Silurian and Devonian to the southeast (Shaw Mt, Northfield, and Waits River fms). Comprehensive ductile and brittle structure data sets were collected during the mapping and are currently being integrated with photolinear data derived from airphotos and yield information from domestic bedrock wells.

Photolinears were identified through the stereoscopic analysis of aerial photographs. First, a photolinear overlay for each airphoto was made and, second, a composite georectified overlay for all airphotos was assembled using ERDAS Orthobase software. Several photolinear sets were recognized during the initial stereoscopic analysis that correlate strongly with the orientations of lithologic contacts and specific ductile and brittle structural features.

NNE-trending photolinears are parallel to major lithologic contacts such as the Richardson Memorial Contact (RMC)- a major unconformity separating Pre-Silurian from Silurian-Devonian rocks. These photolinears appear as a series of distinct ridges and valleys/wetlands near the RMC that become progressively less abundant as one moves away from the RMC.

A series of east-west trending stream valleys and ridges on the western slope of Long Meadow Hill comprise a set of prominent photolinears that are parallel to a dominant fracture set in the area. Similarly, NW-SE trending ridges and valleys are found throughout the quadrangle and are likely related to a strong NW-SE trending fracture set. Some linear segments of the Winooski River are also thought to be fracture-controlled.

A comprehensive database of GPS-located domestic bedrock well locations for the Montpelier Quadrangle was added to the photolinear and structural data layers to see if bedrock well yields correlate with macro and mesoscale structures. The well data revealed distinct relationships between lithology and yield, however the data were inadequate for determining structural relationships. Further statistical analysis is recommended.

THE EFFECT OF INHERITED STRUCTURES ON THE FORMATION OF EXTENSION FRACTURES IN THE LAKE CHAMPLIAN BASIN

Deborah Joy Shulman, Geology Department, University of Vermont, Burlington, VT 05405

Rocks of the Lake Champlain Basin contain fracture sets that control many surface features and influence the transport of groundwater. In this study I

examined some of these exposures to determine how two types of structural anisotropies may have influenced the formation of these fractures. The first type includes Paleozoic compressional structures such as folds, thrust faults and cleavage planes. Outcrops of calcareous shale located in South Hero were chosen to investigate the effects of inherited structures on fracture style and geometry. The second type is variation in rock lithology. Outcrops of dolostone and quartzite located in Shelburne were chosen to investigate the effects of lithologic variation on fracture geometry. In South Hero cleavage planes strike to the N and NE and dip from 73° to 90°. Most thrusts parallel bedding and folds of bedding are upright, open and display axes that trend to the NE. In these outcrops cleavage planes control fracture geometry. Steep cleavage planes are reactivated by extension fractures that crosscut most thrusts and folds. Many of these cleavage-parallel fractures are faults that record normal motion that is consistent with Mesozoic extension. Some fault planes display two or more sets of superposed slickenlines, providing direct evidence that the reactivation of pre-existing fault planes also was an important process during extension. In contrast, outcrops composed of quartzite and dolostone in Shelburne lack steep penetrative cleavage planes and display different styles of fractures. Outcrops of dolostone contain dipping normal faults that strike to the NE, similar to those observed in calcareous shale near South Hero. However, few normal faults were observed in adjacent quartzite units. Instead, these outcrops preferentially preserve compressional structures. In one outcrop my analysis suggests that steep fractures and faults reflect a Paleozoic compressional regime rather than extension. On the basis of these observations, extensional fractures preferentially were partitioned into weak rock units. The results of this study indicate that inherited cleavage planes, fault reactivation and strength contrasts created by different lithologies are primary factors that controlled the geometry of extensional fractures and the formation of the Lake Champlain Basin.

THE ORDOVICIAN TECTONIC HISTORY OF A PORTION OF THE LIBERTY-ORRINGTON BELT, SOUTH-CENTRAL MAINE

Emily M. Peterman, Geology Department, Middlebury College, Middlebury, VT 05753

Ordovician rocks of the Liberty-Orrington belt in south-central Maine have been repeatedly deformed, metamorphosed and intruded by igneous bodies during the Silurian-Devonian Acadian Orogeny. While much

attention has been focused on Acadian tectonism in the region, little is known about the Ordovician history of these rocks. This work focuses on unraveling the Ordovician history of a portion of the Liberty-Orrington belt (Razorville 7.5' quad) through a combination of bedrock mapping, metamorphic stratigraphy, and geochemical analysis of selected metaigneous rocks.

Rocks in the study area were previously assigned to the Casco Bay Group (Cushing and Cape Elizabeth Fms) and more recent studies in adjacent areas subdivided the Cushing Fm into several different units. Original relative age relationships have been obscured by the effects of multiple phases of ductile deformation and amphibolite facies metamorphism. In addition, evidence for dextral transpression is widespread and thus the contact relationships between major units in the quadrangle may be tectonic rather than depositional. Because of these factors, the following stratigraphic descriptions proceed from southeast to northwest across the strike of the belt.

The metasedimentary Cape Elizabeth Fm, the most extensive unit in the area, is composed primarily of interlayered feldspathic mica schists and granofels. Immediately northwest of the Cape Elizabeth Fm is a thin but distinctive rusty weathering garnet-grunerite gneiss (Wilson Cove Mbr of the Cushing Fm), which is interpreted to represent a metamorphosed iron rich horizon (rock contains ~ 40 wt % FeO). The next major unit within what had previously been mapped as the Cushing Fm is the Sheepscot Pond Gneiss. This unit is characterized by felsic gneisses with thin interlayers of amphibolite. Geochemical data and lithologic variations suggest that the unit may represent, in part, an assemblage of metamorphosed volcanic rocks rather than a deformed intrusive rock body as was suggested in an adjacent quadrangle. Northwest of the Sheepscot Pond Gneiss is a thick heterogeneous assemblage of lithologies that correlates with the Nehumkeag Pond Fm of the Falmouth-Brunswick sequence. This unit is dominated by quartz-plagioclase-biotite gneiss with subordinate amounts of amphibolite, rusty schist/gneiss and calc-silicate/marble. Whole rock geochemistry from metaigneous rocks of the Cushing Fm, Sheepscot Pond Gneiss, and Nehumkeag Pond Fm shows significant variability suggesting subtle differences in tectonic environment. While more detailed geochemical work is needed, the data thus far is consistent with magma generation proximal to a volcanic arc setting.

GREENSTONES IN THE MORETOWN AND CRAM HILL FORMATIONS, MONTPELIER QUADRANGLE: A FIELD AND GEOCHEMICAL STUDY

Evan Twelker, Geology Department, Middlebury College, Middlebury, VT 05753

Greenstones and other metavolcanic rocks are abundant within parts of the metasedimentary Moretown and Cram Hill Formations—Ordovician-age rocks that are part of a north-south trending Taconian thrust slice running the length of Vermont and into adjacent parts of New England. This research focuses on greenstone samples taken throughout the Montpelier Quadrangle in Central Vermont, and in particular on two strip maps through Cram Hill and Moretown rocks just east of the Richardson Memorial Contact (RMC), a boundary separating pre-Silurian from Silurian rocks.

Metasedimentary rocks in the area of the RMC dip steeply to the northwest. Lithology varies considerably across the 200-350m across-strike mapped area, variably alternating beds of rusty black phyllite, gray granofels, and interbanded green phyllite and coticule. Distinctly quartzose and granular units generally concentrate towards the RMC, grading into coticule banded green phyllite followed by rusty gray granofels and pinstriped granofels associated with the main body of the Moretown Formation. Greenstones are concentrated within the coticule-rich unit and to the west within the gray granofels dominated units. Greenstones are found as beds or sills along foliation, ranging from 10cm to 7m thick and averaging about 1m in thickness. They are sometimes discontinuous, and may pinch and swell. None in the immediate mapping area appear to cut the foliation of the host rocks, though elsewhere in the quad they sometimes do. Tectonic fabric varies widely, from strongly foliated and lineated to unfoliated. Mineralogy is generally consistent with greenschist grade metamorphism; some igneous textures remain.

Geochemistry indicates the greenstones were tholeiitic basalts. Major and trace element plots suggest that the greenstones are related by fractional crystallization, particularly of olivine. Two geochemical groups are distinguished by Rare Earth Element (REE) data. The depleted group has mid-ocean ridge basalt affinities and is associated with the Cram Hill Formation, whereas samples from the Moretown Formation have REE enriched characteristics. Findings from this group are consistent with previous work by Kim et al. (2003) concluding that a back-arc basin is the most probable tectonic environment for the emplacement of these rocks.

PRESIDENT'S LETTER

Dear Members:

Thanks to all the participants who helped make our winter meeting a success. Everyone who attended the meeting was impressed by the high quality of the presentations. At the business meeting that followed the presentations the Executive Board discussed and approved several important agenda items. The Society will initiate two new speaker programs. Funds were established to provide a small honorarium for a keynote speaker to make a presentation during our winter meetings. If anyone has any suggestions for such a keynote speaker please pass them along to any member of the Executive Board. We also voted to establish a Vermont Geological Society speaker program in which one of our own members volunteers their time to visit several schools, either college or high school level, throughout the academic year. The Society will post an announcement about next year's speaker on its website in the near future along with information regarding how to arrange to have the speaker come visit your group.

Earth science week and other forms of public outreach were also discussed at the winter meeting. The board voted to provide some form of support for Earth Science week and we will discuss this further at our spring meeting. We also hope to make available a web page with field trips or geological sites of interest for educators in our area. If you have any field trip guides or information you think would be appropriate please pass them along to me. Look for the site to come online sometime over the summer.

Speaking of this summer, Jonathan Kim and Greg Walsh have agreed to run a summer field trip. They will show us some of the results of their recent mapping in the Montpelier and Barre West quads. The trip will be sometime in late July or early August and the details will be published in the summer edition of the GMG.

Thanks and I hope to see everyone at the spring meeting.

Happy Trails,
Tim Grover
grovert@castleton.edu

ANNUAL MEETING MINUTES

Saturday, February 7, 2004, Northfield, Vermont

The meeting of the Executive Committee followed nine professional presentations associated with the Winter Meeting held at Norwich University. President Tim Grover called the meeting to order and a total of 9 people were in attendance. Treasurer Steve Howe indicated that the financial condition of the Society is sound. As of this date, approximately 25% of the currently active members had not yet paid their annual dues. On a more positive note, contributions to the Research Grant Program are up significantly this year. Steve also indicated that a total of 6 research grants totaling \$1,563 were recently awarded to students from 4 different colleges and universities. Related to VGS budget issues, the Committee voted to raise the mileage rate to \$0.35/mile from the current \$0.25/mile.

The Committee clarified the length of student presentations associated with the Spring Meeting. Each presenter will have a 15 minute block of time – with 12 minutes allocated for the presentation and 3 additional minutes for questions following the talk (note this is a change from the announcement printed in the Winter, 2004 GMG). The Committee approved the allocation of \$100 annually to provide honorariums for Keynote Speakers at future VGS meetings, beginning in 2005. The Committee also approved the establishment of a “VGS Visiting Speakers Program” beginning in the fall of this year. Each year a speaker(s) will be selected to travel to smaller colleges, secondary schools, community groups, etc. to give presentations on their research (typically topics of broad interest). The speaker(s) will be selected at the Spring Meeting and mileage reimbursements will be made available to the speaker(s) if necessary.

The Committee voted to make an electronic version (PDF file) of the Green Mountain Geologist available to members beginning next year. Beginning with next year’s dues statement, members will have an opportunity to choose between receiving a paper copy of the GMG through the mail (as they do now) or receiving an electronic copy of the GMG as a PDF file attachment to an e-mail message. It is hoped this will not only add convenience, but it will also reduce photocopy and mailing costs. In a somewhat related matter, the Committee voted to establish an official VGS mailing address (a P.O. Box) at the St. Albans Post Office. Currently VGS mail goes to the Geology Department at UVM.

Christine Massey initiated a discussion of the role of VGS in Earth Sciences Week. There are currently more requests than volunteers for the

“Geologist-in-the-Park” program associated with Earth Sciences Week. The Committee agreed to put an announcement in the Spring GMG in an effort to recruit more volunteers for this important program. It was also indicated that UVM would no longer be able to host the Poster Contest associated with Earth Science Week - - but there are currently a couple of options being explored that would allow for the continuation of this program. The Committee voted to continue to support (about \$100/year in awards) this program. The Committee also discussed the development of web-based field-trip resources (downloadable PDF files that provide brief descriptions of easily accessible geologic field sites). The Committee agreed this was a good idea and some examples may be made available on the VGS website soon.

Finally, the Committee discussed potential leaders for the upcoming summer and fall field trips – and the President agreed to follow up on this. The meeting was adjourned.

Respectively submitted,
Dave West, Secretary

STATE GEOLOGISTS REPORT

For the past two years, the Vermont Geological Survey (VGS) has participated in the American Association of State Geologists (AASG) Field-Mentoring Program for undergraduate geology majors. The program provided a salary and travel expenses for 2 students (each summer) to work on bedrock mapping projects with VGS Geologists for six weeks. The participating students have all gone on to write senior theses on some aspect of the mapping and contribute to a poster presentation at Geological Society of America-Northeastern Section meetings. One of the Mentor students is currently working as a term employee for the VGS whereas another will be a Field Assistant this summer.

Two posters were recently presented by the VGS and associates at the Geological Society of America-Northeastern/Southeastern Section Meeting in Tyson’s Corner, Virginia on March 25-27, 2004. The first poster was presented by AASG students Lelia Pascale (UVM) and Caroline Orsi (Middlebury College) with Jon Kim (VGS) and Keith Klepeis (UVM) titled “Structural, Topographic, and Hydrogeologic Analysis of Bedrock in the Montpelier Quadrangle: Central Vermont. This poster focused on the relationship between photolinears that were

stereoscopically determined from airphotos and the underlying lithologies and ductile and brittle structures measured in the field. The dominant photolinear trends were north-northeast in the Silurian and Devonian rocks and northwest and east-west in the Pre-Silurian rocks. In addition, this research attempted to relate the photolinears and underlying structure to domestic bedrock well yields.

The second poster by Jon Kim and Marjorie Gale of the VGS was titled: "Superposition of Ductile Structures in the Montpelier Quadrangle: Central Vermont". This poster established three structural domains in the Montpelier Quadrangle, which were a Taconian Orogeny-dominated (Ordovician) structural domain, an overlap domain of Taconian and Acadian (Devonian) orogeny structures, and an Acadian-only structural domain. Fold generations, foliations, and lineations were tracked across these domains. The data from these two posters is being integrated to further understand the distribution and flow of groundwater in crystalline bedrock.

The Vermont Survey provided research funds as part of our cooperation with Norwich University for the following posters at the Tyson's Corner meeting: Surficial Mapping of the Mad River Watershed, Central Vermont, And Preliminary Results Concerning Its Deglaciation History, (Rick Dunn, Nathan Donahue and George Springston) and Surficial Geology of the Third Branch of the White River, Central Vermont (Fred Larsen, George Springston, and Nathan Donahue)

Respectfully submitted,
Laurence R. Becker, State Geologist, Vermont Geological Survey, 103 South Maine Street, Waterbury, VT 05671

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

The Society's Winter Meeting was a well-attended success, as a predicted ice storm never materialized. Nine presenters from four local colleges and universities and the Vermont Geological Survey discussed a particularly varied array of research topics. Members are encouraged to contact me with any suggestions they may have for topics or presenters for next year's meeting.

The Committee did not receive any applications to the Society's Research Grant Program by the deadline of April 1, 2004, following an

especially active round last Fall. Applications for the second round are due October 1, 2004. Please see the Society's website for details.

The Committee gratefully acknowledges the contributions to the Society's Research Grant Program by the following members:

Laurence R. Becker
David Butterfield
E. Stanley Corneille, Jr.
Jeanne C. Detenbeck
Lawrence W. Gatto
Arthur W. Gilbert, Jr.
Timothy W. Grover
Barbara L. Hennig
Jefferson P. Hoffer
Jon Kim
Carl Koteff

Frederick D. Larsen
John A. Malter
J. Gregory & Nancy W. McHone
Alexis P. Nason
Adam Schoonmaker
Sharon Strassner
Peter J. & Thelma B. Thompson
Roger & Terry Thompson
David West
Richard & Susy Ziegler

Respectfully submitted,
Stephen S. Howe, Chair

TREASURER'S REPORT

The financial condition of the Society continues to be very solid. As of March 27, 2004, the Society's checking account balance was \$5,224.74. To my knowledge, there are no outstanding bills.

I would like to thank the large majority of members who promptly renewed their membership by the deadline of January 31, 2004. However, about 10 members still have not paid their dues. Please send your check and orange membership directory form to me at the Society's new mailing address, P. O. Box 1224, St. Albans, VT 05478-1224. We will be publishing a new membership directory in the Summer GMG and I would like it to be as current as possible.

The following members have been approved for membership in the Society since the last report: Veronica M. Alberico, Florence, VT, and Ronald B. Krauth, Middlesex, VT. In addition, John S. Warren, East Dummerston, VT, rejoins the Society.

Respectfully submitted,
Stephen S. Howe, Treasurer

ANNOUNCEMENTS/CALENDAR**Late July-Early August (specific date to be announced soon)**

Vermont Geological Society Summer Field Trip

Location: Montpelier and Barre West Quadrangles

Leaders: Jon Kim and Greg Walsh

Details: Please keep an eye on the VGS website

(<http://www.uvm.org/vtgeologicalsociety/>) as the date along with meeting details will be provided as soon as they become available.

September 17-10, 2004

New York State Geological Association 76th Annual Meeting

Host: SUNY Postdam

Location: Postdam, New York and surrounding area

Details: See their website (<http://www.nysgaonline.org/>)

For more information contact: Robert Badger, badger1@potdam.edu

October 8-10, 2004

New England Intercollegiate Geological Conference

Host: Salem State University

Location: Salem, Massachusetts

Details: See the NEIGC Website (<http://nhgs.org/NEIGC>)

For more information contact Lindley Hanson, lhanson@salemstate.edu

October 10-16, 2004

Earth Science Week - Living on a Restless Earth

Host: The seventh annual Earth Science Week is a national project

jointly sponsored by the Vermont Geological Society, Vermont Geological Survey at the Agency of Natural Resources, Perkins Museum at the University of Vermont, and the American Geological Institute.

Location and Details: TBA

For more information contact:

Marjorie Gale, marjorie.gale@anr.state.vt.us, (802) 241-3608

or Christine Massey, Christine.Massey@uvm.edu, (802) 656-1344

November 7-10, 2004

GSA Annual Meeting - Geoscience in a Changing World

Host: Geological Society of America

Location: Colorado Convention Center, Denver, Colorado

Details: See the GSA website

(<http://www.geosociety.org/meetings/2004/>) or call (800) 472-1988