
THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

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*The Vermont Geological Society's
Spring Meeting
April 23, 2005, 8:30 AM
at the University of Vermont*

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Directions to the Spring VGS Meeting
219 Delehanty Hall, University of Vermont
April 23, 2005
8:30 am

Delehanty Hall is located on the old Trinity College Campus adjacent to the University of Vermont. From I-89, take exit 14 (Main Street-Route 2 exit), and go west (towards the lake) to East Avenue. Turn right on East Avenue and go to the end of East Avenue and proceed straight across Colchester Avenue and into the driveway. Delehanty Hall has a slate exterior and large granite blocks in front of it. Once on the driveway, bear around to the left and the parking lot is in the rear.

SPRING MEETING PROGRAM

VERMONT GEOLOGICAL SOCIETY
Delehanty Hall, Room 219
University of Vermont, Burlington, Vermont

April 23, 2005

8:30 COFFEE & REFRESHMENTS

9:00 Derek Eaton: FAILED REMEDIATION – HISTORY OF A GULLY’S EXPANSION BY PIPING

9:15 Daniel King: STRAIN LOCALIZATION IN THE DEEP-CRUST: EVIDENCE FROM TWO SHEAR ZONES IN THE DOUBTFUL SOUND REGION OF FIORDLAND, NEW ZEALAND

9:30 Joel Cubley: GEOLOGICAL RELATIONSHIPS ALONG THE CONTACT BETWEEN THE LIBERTY-ORRINGTON AND CENTRAL MAINE LITHOTECTONIC BELTS, SOUTHWESTERN MAINE

9:45 Robert Zimmerman: TEXTURAL AND COMPOSITIONAL COMPARISON OF ICELANDIC RIFT ZONE VOLCANICS

10:00 Sean Leavitt: A COMPARISON OF THE GEOCHEMISTRY OF THERMAL WATERS FROM HOT SPRINGS IN ICELAND

10:15 BREAK

10:30 Bethany Zinni, Beverley Wemple, Andrea Lini, and James Shanley: USING IONIC AND ISOTOPIC CHEMISTRY IN THE ANALYSIS OF HYDROLOGIC FLOW PATHS IN A DEVELOPED AND UNDEVELOPED BASIN, MT. MANSFIELD, VERMONT

- 10:45 Gianina Farrugia: INVESTIGATING ALPINE PEDOGENESIS ON MT. MANSFIELD, VERMONT
- 11:00 Katharine North: AN EVALUATION OF STRUCTURAL AND BEDROCK CONTROLS ON NATURALLY-OCCURRING RADIOACTIVITY IN GROUND WATER, NW VERMONT
- 11:15 Levi Doria: BELVIDERE ASBESTOS MINE: SITE SUITABILITY FOR CO₂ SEQUESTRATION THROUGH MINERAL CARBONATION: A FIELD AND GEOCHEMICAL STUDY
- 11:30 Kristin Katoski and Greg Druschel: ASSESSING SO₂ LOSS DURING PYRITE OXIDATION: EXPERIMENTAL STUDIES TO BETTER UNDERSTAND ACID MINE DRAINAGE
- 11:45 – 12:15 JUDGING AND AWARDS**

ABSTRACTS

FAILED REMEDIATION – HISTORY OF A GULLY'S EXPANSION BY PIPING

Derek F. Eaton, Department of Geosciences, 815 N. Broadway, Skidmore College, Saratoga Springs, N.Y. 12866

Glacial sediments influence many surficial processes in the northeastern United States, particularly, landsliding and gullying. Such forms of mass wasting are particularly common in steeply sloped river valleys where glacial lake clays are common. At the Miller Brook gully, near Stowe, Vermont, the glacial sediments, from the bottom up, are 1) till with a clay matrix 2) sands and gravel from near glacial runoff 3) glaciolacustrine inter-bedded clays and fine sands and 4) capping sands and gravels. Such common stratigraphies, and the geomorphological processes associated with them, can have significant impacts on land use and land stability in glaciated landscapes.

Miller Brook Gully's exact date of initiation is unknown. The gully became active sometime in the late 1960s and early 1970s, indicated by aerial photographs. Extensive logging took place on the hillslope above the gully, with a hiatus between the late 1970s and 2000. The gully eroded due to a hydraulic conductivity difference between the sands and gravels (high) and the overlying glaciolacustrine clay and silt (low). Such a difference in hydraulic conductivity focused groundwater in the sands and gravels and formed a piping network that surfaced on the adjacent hillslope. The pipe roof collapsed in several locations, providing windows to the stratigraphy and to the pipe itself. By 1998 the gully expanded to 50 m x 8 m x 2.5 m. The landowner wanted the erosion to stop and in the summer of 2001 the north bank was intentionally collapsed to fill in the gully. Since the piping network was not affected, new roof collapses were observed in the fall of 2001.

Since 2001, the gully has continued to expand; however, the gully axis is at a different orientation and is eroding naturally deposited glacial sediments, not just the fill. The gully is mostly active during spring, when the water table is high and sapping occurs, as well as during summer thunderstorms. An August 2004 survey of the gully suggests an additional 830 m³ of

erosion, approximately equal to the original volume of the gully. The erosion rate since 2001 (~280 m³/y) is almost an order of magnitude higher than the estimated erosion rate from initiation until 2001 (~30 m³/y). Using the volume of an adjacent stable gully that bottoms on till and has eroded over 2500 m³ of sediment, we estimate that the active gully has at least several more decades before it stabilizes. This study suggests that in order to stabilize gullies in glacial sediments, one must correctly identify the erosion processes; otherwise the resulting erosion rates could be as much as an order of magnitude greater than the natural erosion rates.

STRAIN LOCALIZATION IN THE DEEP-CRUST: EVIDENCE FROM TWO SHEAR ZONES IN THE DOUBTFUL SOUND REGION OF FIORDLAND, NEW ZEALAND

Daniel King, Department of Geology, University of Vermont, Burlington, VT 05401.

The analysis of two major networks of shear zones in the Doubtful Sound region of Fiordland, New Zealand record evidence for strain localization along lithologic boundaries during both extension and contraction. The Western Fiordland Orthogneiss (WFO) is a large body of diorite which intruded into Paleozoic meta-sediments during the mid-Cretaceous. Mineral assemblages in the WFO indicate that it was deformed at granulite facies conditions shortly after its emplacement at depths ~40km. Recent U/Pb analyses of zircon in a sill-like body of hornblende-diorite at a margin of the exposure of the WFO provide evidence that the WFO was emplaced as sheets parallel to pre-existing foliation in the host-rock. The Doubtful Sound Shear Zone and associated structures create an anastomosing network of antithetic and synthetic extensional shear zones along the contacts of the WFO and the overlying host-rock. These structures formed in the mid- to late- Cretaceous during continental extension that pre-dates the opening of the Tasman Sea. Fabric measurements along transects across shear zone exposures show that the shear zone fabric diminishes significantly within several hundred meters into the lower plate where the original igneous fabric of the WFO is dominant. Folding in the meta-sediments of the upper plate accommodates strain over a broader zone, but strain is still localized within a mylonite zone along the contact. The Cascada Bay Shear Zone (new name, CBSZ) is a transpressional shear zone that cross-cuts older extensional structures. Structures associated with the CBSZ change with proximity to the center of the shear zone. This variation allows us to interpret the sequential stages of development of a deep-crustal transpressional shear zone. Exposures of the CBSZ along the contact between the WFO and its host-rock show greater localization of strain than exposures entirely within the meta-sediments. Strain localization along contacts in both of these shear zones suggests that rheologic contrast between different lithologies is an important mechanism of weakening rocks in the lower crust. Recent U/Pb analyses of zircons from several locations using ICPMS allow us to constrain the ages and sequential order of deformational events.

GEOLOGICAL RELATIONSHIPS ALONG THE CONTACT BETWEEN THE LIBERTY-ORRINGTON AND CENTRAL MAINE LITHOTECTONIC BELTS, SOUTHWESTERN MAINE.

Joel F. Cubley, Geology Department, Middlebury College, Middlebury, VT 05753

The Bowdoinham 7.5' Quadrangle, located just north of Casco Bay in southwestern Maine, holds regional significance because it is located along the boundary between two major lithotectonic terranes in the region: the Ordovician Liberty-Orrington belt and the Late Ordovician

to Early Devonian Central Maine belt. The purpose of this study is: 1) to compile a detailed bedrock geologic map of the northern half of the Bowdoinham quadrangle, 2) to gain an understanding of the Ordovician tectonic history of the Liberty-Orrington belt using field relationships and whole-rock amphibolite geochemistry and, 3) to characterize a previously unrecognized Devonian intrusive suite through structural, petrologic, and geochemical analyses. This intrusion is particularly important because it “stitches” the contact between the Liberty-Orrington and Central Maine belts.

Rocks within the quadrangle can be split into four main units, from east to west these include: 1) migmatitic biotite gneisses and subordinate lithologies including amphibolites and rusty weathering biotite schist/gneiss, 2) a thin band of mixed lithologies including rusty weathering biotite-sillmanite schist, garnet-bearing amphibolite, calc-silicate gneiss, and biotite-garnet gneiss, 3) a previously unrecognized, deformed and recrystallized intrusive suite (Hornbeam Hill), and 4) interlayered biotite granofels and calc-silicate gneisses of the Vassalboro Formation (Central Maine sequence). The first two units are correlated with the Falmouth-Brunswick sequence of the Liberty-Orrington belt.

All stratified rocks within the quadrangle have been penetratively deformed, folded, and metamorphosed to upper amphibolite facies conditions during the Silurian-Devonian Acadian Orogeny. A penetrative east-dipping foliation (generally $< 45^\circ$) can be found in rocks of both lithotectonic belts as well as the Hornbeam Hill Intrusive Suite. This foliation is axial planar to reclined isoclinal folds.

Geochemistry on amphibolites from the Falmouth-Brunswick sequence shows tholeiitic basalt compositions with slight LREE enrichment. Tectonic discrimination diagrams suggest formation in an evolved back-arc environment, similar to patterns found in metamorphosed mafic rocks in other parts of the Liberty-Orrington belt. The Hornbeam Hill Intrusive Suite is characterized by significant petrologic and geochemical variability, ranging from coarse-grained granitic gneisses to syeno-dioritic gneisses (SiO_2 ranges from 54 to 72%). New U-Pb zircon (SHRIMP) dates from the intrusion indicate a Devonian age for both igneous crystallization and subsequent metamorphic recrystallization.

TEXTURAL AND COMPOSITIONAL COMPARISON OF ICELANDIC RIFT ZONE VOLCANICS

Robert Zimmermann, Department of Geology, University of Vermont, Burlington VT 05405

Iceland is located on a divergent plate boundary and experiences active volcanism in three major rift zones. This region represents the only place where mid-ocean ridge volcanism may be observed directly on land. Textural and compositional differences observed in rock samples collected from the Eastern and Western Rift Zones (ERZ and WRZ, respectively) suggest that the two zones record different volcanic mechanisms and magma sources. This study reinforces previous hypotheses that suggest the tectono-volcanic processes that produced Iceland are highly variable and are linked to both a mantle plume and a mid-ocean spreading center.

The WRZ is represented in this study by two basalts (PV-1 and PV-2), and a banded rhyolite (HN-1). PV-1 and PV-2 are coarser-textured with a more diverse mineralogy than HN-1. This suggests that the basalts not only began to crystallize at depth but cooled more slowly upon

extrusion than the rhyolite. The ERZ is represented by three vesicular basalts (HK-1, HK-2, and HK-3), and a banded rhyolite (LA-1). A similar textural-compositional relationship among the basalts and the rhyolite in the ERZ suggests a differentiation process similar to the WRZ. In addition, the three basalts exemplify the variable composition of the stratovolcano Hekla.

The ERZ and WRZ in Iceland appear to be manifestations of at least two different volcanic settings. Samples from both zones appear to have undergone magmatic differentiation. However, the WRZ samples reflect highly evolved magmas that erupted primarily in fissures. These samples are more mineralogically diverse, as shown by a wide variety of mineral assemblages that include plagioclase, olivine, pyroxene, and magnetite. In contrast the ERZ samples appear to reflect more primitive magmas that erupted in stratovolcanoes, such as Hekla. These latter samples are mineralogically more uniform, displaying mainly plagioclase and a small amount of olivine. Textural differences among the samples in the ERZ also can be explained by their proximity to the volcanic source. The mineralogical differences between the ERZ and WRZ are interpreted to reflect different styles of emplacement and possibly also different magma sources. Geochemical analysis is currently underway to determine the trace element compositions of these rocks and further test these conclusions.

A COMPARISON OF THE GEOCHEMISTRY OF THERMAL WATERS FROM HOT SPRINGS IN ICELAND

Sean Leavitt, Department of Geology, University of Vermont, Burlington, VT 05405

The goal of this project is to compare the composition and temperatures of hot spring waters from five geographically diverse areas of Iceland. In August 2004, I collected water samples from hot springs that are hypothesized to record different temperatures and different types of interactions among host rocks, glacial and meteoric waters. The study areas include Landmannalaugar, Hveravellir, Geysir, Krísuvík and Nesjavellir. Landmannalaugar is located in central southern Iceland west of the Vatanajökull glacier. Samples were collected at the base of a basalt flow within the mostly rhyolitic Mt. Brennisteinsalda. Hveravellir is located in central Iceland between the Lanjökull and Hofsjökull glaciers. Geysir site is located within the volcanic rift axis south of the Lanjökull glacier in west-central Iceland. Krísuvík, located in arid southwestern Iceland, is in a fissure that is distal to any glaciers. Nesjavellir is located in western Iceland in basalt flows that also are distal to any glaciers.

At each hot spring, 60mL of water was collected and distilled through a Nylon 0.2 μ filter to remove organic particles. The water samples then were separated into 30 mL metal and anion containers. Representative host rock samples were also collected at each of the sites. Thin section analyses of these rock samples showed variable degrees of hydrothermal alteration at each locality. The anion water samples were analyzed for Si, Ca, Mg, Na and K using an inductively coupled plasma spectrometer (ICP). Preliminary SiO₂ results show that temperatures range between 35°C and 655°C. Geothermometers calculated using SiO₂ record lower temperatures on average than those based on the ions Na and K. This difference is due to ion exchange reactions with clay minerals and the presence of calcic minerals such as plagioclase. Geysir records the highest temperatures; Nesjavellir records the coolest temperatures. In general, the temperatures become cooler with distance from the volcanic rift axes. This suggests that the dominant control on hot spring temperature is the proximity to magma bodies beneath the rift zones. Metallic water samples are being analyzed for 21 additional elements. Comparisons of Mn anions and

metals will be used to model the possible interactions between hot springs and meteoric and glacial waters in each of the sites.

USING IONIC AND ISOTOPIC CHEMISTRY IN THE ANALYSIS OF HYDROLOGIC FLOW PATHS IN A DEVELOPED AND AN UNDEVELOPED BASIN, MT. MANSFIELD, VERMONT

Bethany Zinni, Beverley Wemple, Andrea Lini, Department of Geology, University of Vermont, Burlington, VT 05405; and James Shanley, USGS

The purpose of this work is to determine the timing and relative contributions of various source waters to stream water generation through rainfall and snowmelt events, in two meso-scale watersheds located on the eastern slopes of Mt. Mansfield, Vermont. The watersheds are situated adjacent to one another and are quite similar with the exception of the amount of development within each. The Ranch Brook watershed (9.6 km²) consists of mainly state forest land, while the West Branch watershed (11.7 km²) encompasses a large-scale ski resort. The second major goal of this project is to utilize these sites for a paired watershed study to identify any effects of ski resort development on hydrologic flow paths within the West Branch (developed) basin. Ionic and isotopic chemistry data from potential source waters, sampled within the watersheds, are being used in an end-member mixing analysis to determine their significance in contributing to stream flow through events. Oxygen isotope analysis has been conducted to both characterize event-level trends in the streams and to perform hydrograph separations. The results of using this set of methods will provide two separate lines of evidence for the dynamics of stream water generation in the two watersheds.

INVESTIGATING ALPINE PEDOGENESIS ON MT. MANSFIELD, VERMONT

Gianina Farrugia, Geology Department, Middlebury College, Middlebury, VT 05753

Alpine soils were investigated on Mount Mansfield (~1300 m asl) to determine their physical and chemical properties and to elucidate the role of bedrock weathering in their formation. Samples of soil horizons and underlying bedrock were taken at 21 locations. Most profiles (12 of 21) consist of A horizons over bedrock, while 9 profiles contained AC or C horizons. Soil thickness ranges from 0 to 55 cm with a mean of 18cm. pH values range from 3.1 to 4.8 and are generally lowest in surface horizons. Bulk density ranges from 0.06 to 1.04 g cm⁻³. Percent loss-on-ignition ranges from 1 to 82% with a mean of 47% in A horizons and 23% in deeper layers. ICAPS analysis revealed that concentrations of Fe and or Mg decrease within all profiles from the bedrock to the surface, while less soluble elements such as SiO₂, TiO₂ and Na₂O increase. XRD patterns also demonstrate a universal decrease in the amount of chlorite within each soil profile from bedrock to A horizon. Corresponding < 2 μm XRD patterns show an increase in the amount of clay minerals such as gibbsite (3.58Å), kaolinite (4.83Å), and hydrobiotite (some variation of 24 and 12Å) (mixed layer illite-vermiculite clays) as well as the disappearance of chlorite along the same gradient. Comparison of the bulk mineralogy and chemistry of paired soil and bedrock samples indicates that the alpine soils of Mt. Mansfield are more than a simple accumulation of non-mineral organic material and further demonstrates that bedrock weathering is a component of pedogenesis in this environment.

AN EVALUATION OF STRUCTURAL AND BEDROCK CONTROLS ON NATURALLY-OCCURRING RADIOACTIVITY IN GROUND WATER, NW VERMONT

Katharine North, Geology Department, Middlebury College, Middlebury, VT 05753

Elevated levels of naturally-occurring radioactivity (i.e. gross alpha values of 24.2 - 243 pCi/L) have recently been discovered in bedrock ground water wells in the towns of Hinesburg and St. George. This area straddles the east-dipping Ordovician-age Hinesburg Thrust (HT), which separates Proterozoic-Cambrian metamorphic rocks (Cheshire, Fairfield Pond, and Pinnacle Fms.) to the east from Cambrian-Ordovician sedimentary rocks (Bascom Fm.) to the west. Given that elevated radioactivity in water poses a health concern, the goal of this study is to identify the geologic factors contributing to the problem. This study concentrates on bulk rock geochemistry and ground water geochemistry (including radioactivity testing) of wells penetrating the four formations and the HT.

Eight wells tested for gross alpha (GA) activity and trace metal geochemistry were selected because they had previously been found to have elevated GA levels (of these, four were completed in metamorphic rocks and four penetrated the HT into the Bascom Fm. limestone). Given that wells producing from the metamorphic rocks were found to have GA values 4-35 times those of wells producing from the Bascom Fm., an additional five wells that produce from the metamorphic rocks were sampled.

Bulk rock geochemical analyses indicate elevated Ba, Zr, Th, and U in the metamorphic rocks, whereas the Bascom Fm. contains background concentrations of these elements. Elevated levels of Ba are associated with elevated levels of Ra; elevated Zr in Cheshire and Fairfield Pond rocks indicates that dissolution of radiogenic minerals (e.g. zircon) are a likely primary source of radioactivity in bedrock ground water. Elevated concentrations of both Th and U do not implicate either as the primary source. GA results indicate that radioactivity is concentrated in the Pinnacle Fm and to a lesser extent, the Fairfield Pond Fm. This implies that ground water derived from the HT fault zone and Bascom Fm. has been diluted. Ongoing analyses will clarify the elemental and mineralogical content of the Pinnacle Fm.

BELVIDERE ASBESTOS MINE: SITE SUITABILITY FOR CO₂ SEQUESTRATION THROUGH MINERAL CARBONATION: A FIELD AND GEOCHEMICAL STUDY

Levi Doria, Geology Department, Middlebury College, Middlebury, VT 05753

Carbon Dioxide (CO₂), when released into the atmosphere can have dramatic consequences on world climate. Annual emissions of CO₂ have increased greatly since the industrial revolution. Today it is estimated that 6 gigatons of carbon (GtC) is emitted annually into the atmosphere due to fossil fuel use. Reliance on fossil fuels is undoubtedly the number one catalyst in current global warming worldwide. Therefore, while known reserves of fossil fuels are adequate for centuries of future use, there needs to be significant change in the infrastructure of their use to better address greenhouse gas emissions.

Carbon sequestration referring to the capture of CO₂ from the atmosphere and its storage in permanent reservoirs is an attractive option in remediation of the harmful effects of CO₂ emissions. Mineral carbonation is one of six possible routes of sequestration. Mineral carbonation is a naturally occurring process, seen whereby CO₂ in the atmosphere reacts with

minerals to form carbonates. Magnesium (Mg) rich silicates such as serpentines are widespread throughout the world and are readily available source for carbonation efforts.

Research focused on basic geochemical analysis of serpentine mine tailings in the Belvidere Asbestos mine in Eden Mills, Vt. An estimated 75,000,000 tons of tailings make up the mine's waste product. ICP and X-Ray Diffraction were used to characterize tailings. MgO comprises 46.99 % (wt) of the tailings, and SiO₂ comprises 42.15 % (wt). Fe₂O₃ and Al₂O₃ comprise 8.6 % (wt) and 1.37 % (wt) respectively. XRD analyses indicate that the tailings are dominated by serpentine with associated magnetite and traces of calcite and quartz. No amphibole was detected.

Current research consists of calculating the tailings' suitability for sequestering CO₂ by means of mineral carbonation.

ASSESSING SO₂ LOSS DURING PYRITE OXIDATION: EXPERIMENTAL STUDIES TO BETTER UNDERSTAND ACID MINE DRAINAGE

K. Katoski, K. and G.K. Druschel, Department of Geology, University of Vermont. Burlington, VT 05405

The potential for sulfur dioxide gas (SO₂) loss during pyrite (FeS₂) oxidation in acidic aqueous solutions was studied by setting up batch experiments. A better understanding of the reaction pathway of pyrite oxidation aids in understanding the overall reaction kinetics of this process. Pyrite oxidation is environmentally important in the context of understanding acid mine drainage that occurs downstream from sulfide ore mines because exposure of sulfide minerals to atmospheric oxygen releases significant amounts of metals and acidity to watersheds. To investigate the question of SO₂ formation as an intermediate step in the overall oxidation pathway for pyrite, HCl was added to two septum bottles containing carefully cleaned, crushed and sieved pyrite. One of these bottles was kept open while one was kept closed, and samples were taken at intervals for five hours using a syringe and 0.22-micron filter. The amount Fe²⁺ and SO₄²⁻ in the solutions were measured using a ferrozine colorimetric method (analyzed with a UV/VIS Spectrophotometer) and an Ion Chromatograph, respectively. A SO₄²⁻: Fe²⁺ ratio of 2:1 indicates stoichiometric pyrite oxidation, while a SO₄²⁻: Fe²⁺ ratio less than 2:1 indicates that sulfur is being lost due to either elemental sulfur formation at the surface or to SO₂ degassing. This comparison of open vs. closed systems will indicate if SO₂ is being lost via degassing due to the solubility of SO₂. In an open system the SO₂ loss would be continuous, and in a closed system a small amount of SO₂ would build up in the headspace. We will present the results of these experiments and discuss their importance on proposed pyrite oxidation pathways (Descostes et al., 2004) in addition to the potential importance of this work on active sulfide oxidation at sites such as the Ely and Elizabeth mines in central Vermont.

PRESIDENT'S LETTER

Dear VGS Members:

Although as an avid skier I am somewhat saddened to see the snow melt, as the days grow longer and warmer I am excited about the prospect of getting out in the field and doing some geology, as I'm sure are many of you. Speaking of which, although we have a summer field trip lined up, we are looking for volunteers to lead a fall trip. If you have any suggestions please contact any members of the Board.

Thanks to everyone who participated in the winter meeting and thanks to the folks at Norwich for hosting us once again. A special thanks goes to Dave Westerman for sharing his experiences with his forensic geology course and leading us through a lab. Hopefully now that Dave's course is over the crime rate at Norwich has dropped. I would also like to thank George Springston and Thelma Thompson for reporting on the shift to electronic documents in the Government Printing Office and bringing the issues associated with this change to the attention of the Society.

Lastly, in the latest membership renewal letter we were presented with the option of receiving the GMG electronically as a pdf file rather than a paper copy. Very few members took advantage of this option. I would like to strongly urge everyone to consider receiving the GMG as a pdf because it would save some paper, cut down on the postage costs, and reduce the labor required to send out the issues.

I hope to see everyone at the spring meeting in Burlington. Have a great spring!

Happy Trails,

Tim

WINTER MEETING MINUTES

Saturday, February 19, 2005, Northfield, Vermont

The meeting of the Executive Committee followed five professional presentations during the Winter Meeting held at Norwich University and a hands-on forensic geology laboratory exercise led by Dave Westerman of Norwich University for approximately 15 participants. President Tim Grover called the board meeting to order and a total of 11 people were in attendance. Treasurer Steve Howe indicated that the financial condition of the Society is sound with contributions to the Research Grant Program equaling or exceeding that of last year. Steve also indicated only one student research grant proposal was submitted by the last submission deadline (Oct. 1, 2004) and that this proposal was fully funded (\$331).

The Committee discussed potential venues and leaders for upcoming VGS field trips. Marjie Gale and Jon Kim of the Vermont Geological Survey have agreed to lead the summer field trip to the Worcester Mountains in central Vermont (the details of which appear elsewhere in this issue). Plans have yet to be developed for the fall meeting field trip. Dave Westerman and Rick Dunn of Norwich University discussed the possibility of leading an overnight canoeing field trip

through the upper Connecticut River valley in 2006. The Committee then discussed the pros and cons of having student poster presentations (in addition to oral presentations) at the spring meeting. No decisions were made on this matter and for now the presentations at the spring meetings will remain in oral format.

Thelma Thompson (Government Documents and Maps Librarian at the University of New Hampshire) expressed concern on the matter of proposed changes in the availability of government documents supplied to libraries of the Federal Depository System, a matter first brought to the Society's attention by George Springston. In short, the proposed changes call for the elimination of print forms of many government documents (including maps) in favor of electronic formats. Issues associated with this proposed change include the authenticity of electronic information and the long-term availability of these government documents. This switch from print to electronic formatting is obviously relevant to earth scientists and Thelma asked that the VGS consider taking an official position on the proposed changes.

Steve Howe forwarded a request by VGS member and former State Geologist Charles Ratte. The request asks that the VGS consider making a donation to the Isle LaMotte Fossil Reef Preservation Trust. The Committee discussed the request and conditionally agreed to contribute \$500 to the Trust. Steve Howe was authorized to investigate the merits of such a contribution and will report back to the Committee before final authorization. The meeting was adjourned.

Respectfully Submitted,
Dave West, Secretary

STATE GEOLOGIST'S REPORT

Agency of Natural Resources Reorganization

During the summer and fall of 2005, it is expected that the VT Legislature will establish committees to recommend reorganization of the Agency of Natural Resources (ANR). The Vermont Geological Survey is a Division within ANR. It is hoped that there is a **constituency for geology**, the earth sciences, and science in general that can make its interest known. It looks like this may be a sweeping reorganization and those who understand the importance of geology and the sciences to natural resource planning can help these committees reach a sensible structure for a next generation Vermont Natural Resource Agency. Without such input, science will lose out to concerns dominated by regulatory and political considerations.

State Geologist Testifies on Groundwater Resources and Protection

A draft of the reorganization bill voiced a concern that the Agency of Natural Resources has not mapped aquifers as indicated by statute. The State Geologist testified before the Senate Natural Resources Committee on a prototype aquifer and aquifer recharge area effort that the Vermont Survey is undertaking. The approach uses, as a base, located water wells and new surficial mapping through STATEMAP grants. The effort can only reach about two towns a year even though the legislature calls for statewide mapping. Resources needed to conduct statewide mapping were discussed

Northeast GSA

At the March Northeast GSA meeting in Saratoga Springs, the Vermont Survey was involved in four technical presentations, all of which were also joint projects with geologists from universities, the USGS, the Geological Survey of Canada, and students.

During the summer of 2004, the Vermont Geological Survey (VGS) and students from UVM and Middlebury College conducted geologic mapping in the Worcester Mountains. For his senior thesis, Paul Montane (UVM student) worked with Jon Kim (VGS), Keith Klepeis (UVM), and Caroline Orsi (Middlebury student) to compare the orientation of photolineaments identified on air photos with ductile and brittle structures in the field area. Paul, Jon, Keith and Caroline presented this research in a poster “Ductile and Brittle Structural Control on Topographic Photolineaments in the Southern Worcester Mountains, Central Vermont”.

Jon Kim, Greg Walsh (USGS), and Sarah King (summer intern) presented a poster “Lithologic Control on Naturally Occurring Radioactivity and Ground Water Chemistry Across the Richardson Memorial Contact, Central Vermont”. The study integrated bedrock geology, gamma ray surveys, and ground water chemistry from domestic bedrock wells in the Montpelier area. The results indicate distinct water quality differences by rock type.

Between 1999 and 2003, elevated levels of naturally-occurring radioactivity were discovered in bedrock wells in St. George and Hinesburg. Mapping in the area was completed by Barry Doolan (UVM) and Peter and Thelma Thompson (UNH) during the summer of 2004. Katherine North (Middlebury College student), Jon Kim, and Pete Ryan (Middlebury College) integrated geologic maps with well driller logs, conducted geochemical analyses and investigated the ground water geochemistry (including radioactivity testing) of wells penetrating each formation. They presented the results of their research in a poster titled “Evaluation of Geologic Controls on Elevated Naturally-Occurring Radioactivity in Bedrock Ground Water Wells, NW Vermont”.

Sebastian Castonguay (Canadian GS), Barry Doolan (UVM), Marjorie Gale (VGS), Jon Kim (VGS), Gilles Ruffet (France), Peter Thompson (UNH), Alain Tremblay (U. of Quebec) and Mike Villeneuve (Canadian GS) presented “ $^{40}\text{Ar}/^{39}\text{Ar}$ Geochronological Data from the Sutton/Green Mountains Anticlinorium, Southern Quebec-Northern Vermont Appalachians: Episodic and Diachronous Tectonism from Middle Ordovician to Middle Devonian”. The talk presented the results of four new age dates for rocks in the Green Mountains and compared the data with that in the Sutton Mountains.

Lastly, both Jon and Marjorie participated as mentors in the Roy J. Shlemon Mentor Program in Applied Geoscience sponsored by GSA Foundation. The program, for undergraduate and graduate students, led by professional geoscientists, covers real life issues including professional opportunities and challenges that await students after graduation.

Respectfully submitted,
Laurence R. Becker, State Geologist

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

The Society's Winter Meeting, with its "forensic geology" theme, was informative and fun-filled. Five presenters from three local colleges and universities and the Vermont Geological Survey discussed topics ranging from acid mine drainage in California and Vermont, erosion hazard mapping along the Mad River, and geoarchaeology of a Roman cemetery in Greece, to geology in detective novels and a new forensic geology course. Attendees, guided by Dave Westerman, then puzzled over a forensic geology laboratory exercise entitled "The Case of the Middle Disney Murder." As always, members are encouraged to contact me with suggestions they may have for topics or presenters for next year's meeting.

The Committee received two applications to the Society's Research Grant Program by the deadline of April 1, 2005. Applications for the 2nd round are due October 1, 2005. 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
Jeanne C. Detenbeck
Lawrence W. Gatto
Albert W. Gilbert, Jr.
Timothy W. Grover
Craig Heindel
Barbara L. Hennig
Jefferson P. Hoffer
Jon Kim
Carl Koteff**

**Frederick D. Larsen
Cassandra Major
John A. Malter
Gregory and Nancy McHone
Alexis P. Nason
George Springston
Sharon Strassner
Peter and Thelma Thompson
David West**

Respectfully submitted,
Stephen S. Howe, Chair

TREASURER'S REPORT

The financial condition of the Society continues to be very strong. As of April 3, 2005, the Society's checking account balance was \$6,426.15. To my knowledge, there are no outstanding bills.

Respectfully submitted,
Stephen S. Howe, Treasurer

ANNOUNCEMENTS/CALENDAR**June 11-15, 2005**

42nd Annual Meeting of the Clay Minerals Society

Location: Burlington, Vermont

Details: See their Website (<http://www.clays.org/>) or contact Peter Ryan in the Geology Department at Middlebury College

Late July-Early August (specific date to be announced soon)

Vermont Geological Society Summer Field Trip

Location: Worcester Mountains

Leaders: Marjie Gale and Jon Kim

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 23-25, 2005

New York State Geological Association 77th Annual Meeting

Host: SUNY Oswego

Location: Oswego, New York and surrounding area

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

September 30 – October 2, 2005

New England Intercollegiate Geological Conference

Host: Yale University

Location: Southwestern Connecticut

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

October 16-19, 2005

GSA Annual Meeting - Geoscience in a Changing World

Host: Geological Society of America

Location: Salt Lake City, Utah

Details: See the GSA website

(<http://www.geosociety.org/meetings/2005/>) or call (800) 472-1988

SOME USEFUL GEOLOGICAL WEBSITES**Vermont Geological Society**

<http://www.uvm.org/vtgeologicalsociety/>

Geological Society of America

<http://www.geosociety.org/>

American Geophysical Union

<http://www.agu.org/>

Vermont Geological Survey

<http://www.anr.state.vt.us/dec/geo/vgs.htm>

United States Geological Survey<http://www.usgs.gov/>**Geological Survey of Canada**<http://gsc.nrcan.gc.ca/>**Lamont-Doherty Cooperative Seismographic Network**<http://www.ldeo.columbia.edu/LCSN/>**University of Vermont Geology Department**<http://www.uvm.edu/geology/>**Middlebury College Geology Department**<http://web.middlebury.edu/depts/geol/default.htm>**Norwich University Geology Department**<http://www.norwich.edu/academics/mathematics/geology.html>**Castleton State College Natural Science Department**<http://www.csc.vsc.edu/NaturalSciences/index.htm>***THE GREEN MOUNTAIN GEOLOGIST***

VERMONT GEOLOGICAL SOCIETY

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Please send it to the Treasurer at the above address.

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