THE GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

SPRING 2000 VOLUME 27 NO. 2

The Vermont Geological Society's Spring Meeting

Presentation of Student Papers

Dedicated to Rolfe Stanley

Middlebury College
Saturday, April 15, 8:30 AM

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THE GREEN MOUNTAIN GEOLOGIST
VERMONT GEOLOGICAL SOCIETY
DEPARTMENT OF GEOLOGY
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President's Letter

Dear Members,

I sadly write this letter to you all. We have heard about Rolfe Stanley's passing. He has left a void in the geologic community that will not be easily filled. As I sat in the memorial service for him, I remembered as a new student in geology going to see him for the first time. In 1973, I was terrified. I remembered the poster that hung on the back of his door "Yeah though I walk through the valley..." said it all. It may hang there still. It did the last time I saw him. Dr. Stanley was a formidable man to a new and insecure geology student. Our relationship remained the same throughout my undergraduate career. It wasn't until years later that I began to get acquainted with and really got to know the caring individual underneath his hard rock exterior.

It was a long time before I could think of him as Rolfe rather than Dr. Stanley. On recent reflection over my acquaintance with Rolfe I worked hard for him in Structural Geology. At that time he was gracious, helping me to dismount rocks I had scrambled up (I was pregnant). Five years later I was beginning to think of him as Rolfe. I enrolled in Plate Tectonics and he was wonderful (I was pregnant, again). We joked in class about my "cravings" for hard rock geology. The last class I took with Rolfe was System Dynamics. I know he used and enjoyed the program, Stella, on many levels. Through his encouragement to take the class, I have a vehicle to pass on a piece of Rolfe's legacy to my students as do many other teachers.

I am looking forward to the student papers in April. The papers look like they will be interesting this year. I hope to see you all there. This meeting of the Vermont Geological Society will be dedicated to Rolfe Stanley as a tribute to his continued and long-standing dedication to the study of the earth and to education.

The summer field trip will be a site visit to the Cold Regions Research and Engineering Laboratories in Hanover, New Hampshire. It has been several years since the Society has visited this facility. It should be exciting. Thank you Larry Gatto for doing this for us.

Yours,

Shelley F. Snyder
Mt. Abraham Union High School
Bristol, VT 05443
802-453-2333

ssnyder@mtabe.k12.vt.us

Summer Field Trip to CRREL !!!

Vermont Geological Summer Meeting
Saturday, July 22, 2000, at 10:00 am

We will meet at CRREL, Hanover, NH at 10 am. For more information contact Shelley F. Snyder, VGS President, at 802-453-2333 or e-mail ssnyder@mtabe.k12.vt.us

Direction to CRREL: Take Exit 13 from I -91 north;
East across Connecticut River to Hanover;
Continue east thru light in Hanover;
Left on the road along the east side of the Dartmouth Green;
Continue north straight thru light on Rt. 10;
1.5 mile to CRREL on west side of Rt. 10.

Directions to CRREL are available on the web page @ www.crrel.usace.army.mil Click on: About CRREL Local travel information for maps and directions.

Directions to the Spring VGS Meeting
Middlebury College
April 15, 2000
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.

VGS Calendar

April 7:	Publish Spring GMG
April 15:	Spring VGS Meeting, Middlebury College
May 1:	Student Research Grant Proposals Due
June 1:	Research grant money awarded
June 16:	Deadline for articles/news items for Summer GMG
July 22:	Summer Field Trip, CRREL, Hanover, NH
Sept. 1:	Deadline for articles and news items for Fall GMG
Sept. 15:	Publish Fall GMG
Sept. 23:	Fall Field Trip led by Stephen Wright Business meeting, election of officers and dinner to follow field trip
Oct. 6 – 8	NEIGC, Orono, ME
Oct. 8-14:	Earth Science Week
Dec. 28:	Deadline for articles and news items for Winter GMG
Jan. 15:	Publish winter Green Mountain Geologist (GMG)
Mar. 12-14:	NE Geological Society of America, Burlington, Vermont
March 28:	Deadline for student abstracts, Deadline for submission of articles for Spring 2001 GMG

SPRING MEETING PROGRAM
Middlebury College, Bicentennial Hall
Room 220, April 15, 2000

8:30 **Coffee**

9:00 **Elizabeth Hunter**: THE MINERALOGY OF CHAMOSITIC OOLITHS IN THE RAASAY IRONSTONE, INNER HEBRIDES, SCOTLAND

9:15 **Caleb W. Holyoke, III**: MELTING AND DEFORMATION: EXPERIMENTAL RESULTS FROM TWO CONTRASTING CRUSTAL ROCK TYPES

9:30 **Erin K. Taylor**: GEOCHEMICAL AND REGIONAL CHARACTERISTICS OF THE AVERILL PLUTON, NORTHEAST KINGDOM, VERMONT

9:45 **Joshua Nathan Cole**: QUANTITATIVE STRAIN ANALYSIS OF THE AUREOLE OF THE VICTORY PLUTON, NORTHEASTERN VERMONT, USING THE FRY TECHNIQUE

10:00 **Patrick Keane**: ANALYSIS OF THE NATURAL DISTRIBUTION OF STABLE CARBON ISOTOPES IN VERMONT LAKE ECOSYSTEMS

10:15 **John Crockett**: HYDROLOGIC RESPONSE OF A SMALL URBAN WATERSHED TO A SUMMER STORM: CENTENNIAL BROOK, BURLINGTON, VT

10:30 **BREAK**

10:45 **Nathan P. Donahue:** CORRELATION OF AUGEN GNEISS ERRATICS FROM CENTRAL VERMONT WITH THEIR SOURCE AREAS IN QUEBEC

11:00 **Brooke Laundon**: MAJOR AND TRACE ELEMENT GEOCHEMISTRY OF WEATHERED ULTRAMAFIC ROCKS AND OVERLYING SOILS, LUDLOW AND DUXBURY, VERMONT

11:15 **Justin Klein**: METAMORPHISM IN THE CONTACT AUREOLE SURROUNDING THE MAIDSTONE PLUTON AND ITS RELATIONSHIP TO METAMORPHISM OF THE AUREOLE SURROUNDING THE VICTORY PLUTON AND THE MONROE FAULT, NORTHEASTERN VERMONT

11:30 **Nina Johnson**: THE PHYSICAL EFFECT OF LOGGING ON SOIL QUALITY NEAR ABBEY POND, GREEN MOUNTAIN NATIONAL FOREST, VERMONT

11:45 **Joshua J. Nothwang**: GEOCHEMICAL CHARACTERISTICS OF SOILS IN OLD-GROWTH AND HISTORICALLY LOGGED FORESTS, GREEN MOUNTAIN NATIONAL FOREST, VERMONT

12:00 **Daniel Eurich**: UNIVERSITY OF VERMONT BASELINE WATER QUALITY

12:15 **Break followed by announcement of awards**

Student Abstracts

THE MINERALOGY OF CHAMOSITIC OOLITHS IN THE RAASAY IRONSTONE, INNER HEBRIDES, SCOTLAND

Elizabeth Hunter, Middlebury College

The Raasay Ironstone is a Jurassic sedimentary rock located in the southeastern part of the Island of Raasay, Inner Hebrides, Scotland. Outcroppings are found on the southeastern coast of the island at the Raasay Iron Mine, where it is a typical ironstone, and also at Beinn Na Leac, where the laterally equivalent bed contains chamositic chlorite but is similar to a red limestone rather than an ironstone. The bed at Beinn Na Leac is dissected by a mafic dike, and samples from this site were collected along a transect from proximal to the dike to ~160 m away along a bedding plane perpendicular to the dike. Though previous studies have examined the microstructure and microchemistry of iron ooliths in the Raasay Ironstone, as well depositional environment of the ironstone, little is known about the clay mineralogy or specific crystal structures of the chlorite-group minerals. X-ray diffraction (XRD) analyses were conducted on both oriented and randomly-oriented < 5 micron sample mounts prepared from samples collected at various localities along the vertical and horizontal stratigraphy of the ironstone. Initial results indicate that the clay fraction of the ironstone is predominantly calcite, quartz, siderite, and chlorite group minerals, specifically interstratified chamositic 7Å/14Å phases. The iron ooliths present in the ironstone are chamositic chlorite and are the dominant mineral in samples taken from the former Raasay Iron Mine (55% to 67% of the rock). Within samples taken from Beinn Na Leac, chamosite content comprises < 5% of the rock. Preliminary analysis of the interstratification of 7Å and 14Å layers in the chamosite reveals that, with increasing proximity to the higher temperature dike intrusion, the proportion of 7Å layers increases. These data imply that 14Å layers transformed to 7Å layers with increasing temperature conditions. This is an interesting conclusion given that previous studies indicate 14Å layers predominate at higher temperatures. At the Raasay Iron Mine, the chamositic clay is essentially a pure 7Å phase. All chamosite is of the Ibb polytype. These data imply low-grade diagenetic conditions.

MELTING AND DEFORMATION: EXPERIMENTAL RESULTS FROM TWO CONTRASTING CRUSTAL ROCK TYPES

Caleb W. Holyoke, III, University of Vermont

Differentiation of the crust is accomplished through partial melting of the mid to lower crust. Partial melting will produce felsic products which migrate to the upper crust leaving a chemically depleted residue in the lower crust. In order for melt migration to occur, however, there must be a network of flow paths. The permeability of the lower crust is too low (~10-21 m^2) for melt to flow. Melting can generate an abnormal fluid pressure causing rocks to deform in a brittle rather than ductile manner. However, the rate of pore pressure development will also be a factor in the development of flow paths. Static experimental studies of dehydration melting of pelites have determined that dilational strain produced during melting can form a crack network. However, this only occurs when muscovite is present in the source rock. When biotite-only bearing parent rock is partially melted under static conditions, cracks do not form. This is due to the negligible dilational strain associated with melting and also suggests that a low melt pore pressure accompanies some biotite dehydration melting reactions. The stoichiometry, solid-solution effects in biotite, and melt productivity of the melting reaction all control this behavior. The hypothesis tested here is the rate of build-up of melt pore pressure will be significantly different between biotite and muscovite-bearing assemblages. In contrast to muscovite-bearing rocks, melt pore pressure development in the biotite assemblage may be very slow or non-existent.

GEOCHEMICAL AND REGIONAL CHARACTERISTICS OF THE AVERILL PLUTON, NORTHEAST KINGDOM, VERMONT

Erin K. Taylor, University of Vermont

The Averill Pluton is a medium- to coarse-grained biotite granite, which intrudes Early to Middle Devonian metasedimentary rocks of the Gile Mountain and Ironbound Mountain Formations. It is one of up to twenty Late Devonian granitoid plutons exposed in eastern Vermont. These plutons were originally described as part of the New Hampshire Plutonic Series emplaced during or after the Acadian Orogeny in New England. As part of a larger study on the origin and emplacement of the Averill Pluton, the bulk geochemistry of the pluton is being used to investigate its magmatic history.

Several samples from the Averill Pluton were analyzed. The major element data include SiO_2, Al_2O_3, CaO, MgO, Na_2O, K_2O, Fe_2O_3, and MnO, and the minor and trace element data include TiO_2, P_2O_5, Cr_2O_3, Rb, Sr, Y, Nb, and Ba. The majority of the samples, 15 of 19, were tested for REE, including Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Th, and U. Geochemical data were plotted on variation and spider diagrams. Bulk chemistry (SiO_2 content, An content, Peraluminosity Index, and Mg number) were contoured on the outcrop map pattern. In addition, differences in geochemistry were used to determine if the Averill Pluton is composite pluton or if it formed from a single intrusive event. The amount of trace and rare earth elements in the southeastern samples are very uniform, and overall indicate a calc-alkaline affinity. Geochemical contours drawn mimic this behavior. They show that the center and the northwest portions of the pluton have lower SiO_2 content and Peraluminosity Index, and a higher An component than the outer edges. The highest $MgO/MgO+Fe_2O_3$ ratios are also towards the center of the pluton and in the northwest corner. This indicates a more mafic component in the middle and western portions of the pluton.

The Averill fault, located in the northeast part of the pluton is oriented N30E, parallel to the regional deformation trends. Several roof pendants (?), magmatic foliations defined by biotite and other solid-state deformational fabrics throughout the pluton are consistent with this trend. The outcrop pattern indicates that an anisotropy, oriented N30E and possibly an extension of the Averill Fault, continues through the entire pluton. The nature of the geochemical contours may be explained by: (1) Uplift and preferential erosion of the pluton west of the Averill Fault, and/or (2) fractional crystallization, differentiation and assimilation processes. The similarity in bulk rock and trace element geochemical characteristics suggests the Averill Pluton was emplaced as a single intrusive event.

QUANTITATIVE STRAIN ANALYSIS OF THE AUREOLE OF THE VICTORY PLUTION, NORTHEASTERN VERMONT, USING THE FRY TECHNIQUE

Joshua Nathan Cole, Middlebury College

Strain analysis of plutonic rocks and their contact aureoles is a critical means of interpreting emplacement kinematics, but is limited by the weaknesses inherent in the quantitative analysis techniques. The Fry technique is a center-to-center strain analysis developed by Norman Fry in 1979. It analyzes the relative distances from the center of one object, such as an ooid, to another. Because the objects will grow closer in the direction of the minimum principle finite strain, and further apart in the direction of the maximum principle finite strain, the distance can be used to determine strain.

I used contact metamorphic porphyroblasts in rocks from the contact aureole of the Victory Pluton to complete a Fry analysis of strain within the aureole. The Victory Pluton is located in the Northeast Kingdom of Vermont, and is part of the Devonian New Hampshire Plutonic series associated with the Acadian orogeny (Doll et al., 1961). The Monroe Fault roughly bisects the pluton, and it has been shown that pluton intrusion occurred during fault movement (Hannula et al., 1999).

The orientations of the strain ellipsoid for each of the samples collected are similar in orientation. The long axes of the str ain ellipsoids plunge predominantly towards the east, while the short axes of the ellipsoids plunge subhorizontally towards the south. There does not appear to be any significant pattern of subvertical elongation or concentric flattening around the pluton, such as are associated with diapirism or balloon style emplacement. These results indicate that the majority of syn-intrusion strain in the contact aureole of the Victory Pluton was caused by regional deformation, and that the emplacement mechanism for the pluton is most likely fault-related. This hypothesis is supported by foliation data from the contact aureole (Hannula, et al., 1999).

ANALYSIS OF THE NATURAL DISTRIBUTION OF STABLE CARBON ISOTOPES IN VERMONT LAKE ECOSYSTEMS

Patrick Keane, University of Vermont

Isotopic and elemental signatures of organic matter preserved in lake sediments provide significant insights into the individualistic response of lacustrine ecosystems to anthropogenic disturbances and to extreme climatic events. However, to better interpret this kind of data a better understanding of the physical, chemical, and biological parameters controlling the isotopic and elemental composition of lacustrine primary producers, the most significant source of sedimentary organic matter, is required.

Carbon isotopic analyses of land plants (for comparison), dissolved inorganic carbon (DIC), aquatic macrophytes, and algae indicate significant variability within and among the studied lakes. The data suggest a general relationship between lake trophic status and isotopic composition of DIC and lake biota, but other factors, such as bedrock lithology, are also important. Less negative delta-13C values are found in eutrophic to hypertrophic lakes and lakes located in carbonate-rich bedrock. More negative delta-13C values are typical for oligotrophic lakes. A similar relationship between lake productivity level and carbon isotopic signature is also found in surface sediments collected from the studied lakes. However, the interpretation of the sediment isotope data is complicated by the fact that lacustrine sedimentary organic matter has multiple sources, namely phytoplankton, macrophytes, and organic detritus entering the lake from the watershed. We have used elemental ratios (C/N) in combination with stable isotopes to determine which of these sources is the dominant one in each lake.

The inferred correlation between isotopic composition and productivity levels provides a powerful tool that we are now applying to studies of sediment cores to monitor the response of lake ecosystems to known increases or decreases in nutrient loads.

HYDROLOGIC RESPONSE OF A SMALL URBAN WATERSHED TO A SUMMER STORM: CENTENNIAL BROOK, BURLINGTON, VT

John Crockett, University of Vermont

A rain event causes significant change to stream hydrology. A storm occurring from 12 to 1 PM on June 29, 1999 produced 0.91 cm of rain, and its effects were observed in the Centennial Brook watershed in Burlington, VT. Water samples and channel cross section measurements were taken at one site at Centennial Brook, a second site at Wool Pullery Brook a tributary to Centennial Brook, and a third site downstream from the confluence of the two brooks. The storm hydrograph constructed from the data showed peak discharge at Site 1 occurring 60 minutes after sampling began at 0.18 m^3/s. Sites 2 and 3 peaked at 110 minutes with values of 0.32 m^3/s and 0.51 m^3/s, respectively. Total suspended solids (TSS) reflected the storm hydrograph with peak values at Site 2 of 1.2 g/L. Conductivity and pH were inversely related to discharge with minimum values of 380 mmhos at Site 1 and 7.49 at Site 2 occurring at peak discharge. Chemical parameters generally decreased in concentration values and increased in flux values with increasing discharge. Chemical species that deviated from this general trend were K^+ which increased with discharge at Sites 2 and 3 and NO_3 which increased with discharge at Site 1. Most cation and anion concentrations such as Mg^{+2}, Na^+, Cl^-, and K^+ were highest at Site 2 and lowest at Site 1 for all sampling intervals. Exceptions to this trend include SO_4^{-2} which was greatest at Site 1 and lowest at Site 2. For all anions and cations, Site 3 exhibits the highest flux levels which peak at approximately 100 minutes and decline with decreasing discharge. With the exception of NO_3, fluxes for all species at Site 1 decrease with time over the entire sampling period regardless of discharge. In contrast, fluxes at Sites 2 and 3 were found to be highly correlative with discharge. TSS levels at all sites reflect the stream bed composition and may not be an accurate indicator of storm runoff quality. Conductivity levels reflect the dilution effect of increased discharge. The pH data exhibit the acidifying effect of the precipitation on the naturally basic streamwater. The sharp increase of all flux levels shows the first flush effect of the precipitation. These chemicals are representative of the salts that form on drying soil and then are easily dissolved and flushed out during the initial stages of a storm. The rise in K^+ concentration is possibly due to leaching from biological material or exchange sites on clay material within the soil. Anthropogenic impact can be most clearly observed in Cl^- flux levels which are likely to reflect road salt residue from the previous winter as well as other pollution sources. Differences between fluxes at Site 1 compared with Sites 2 and 3 could be due to a detention pond located at the headwaters of Centennial Brook.

CORRELATION OF AUGEN GNEISS ERRATICS FROM CENTRAL VERMONT WITH THEIR SOURCE AREAS IN QUEBEC

Nathan P. Donahue, Norwich University

Distinctive augen gneiss erratics found in the central Vermont have been tentatively traced to their source area in the Grenville Province of Quebec, Canada, near St. Gabriel de Brandon. The cobble and bedrock samples are correlated in hand specimen by their porphyritic texture with phenocrysts dominantly of 1 to 5 cm potassium feldspar and minor plagioclase phenocrysts of similar size, in a coarse-grained matrix of biotite, hornblende, quartz, and varying percentages of orthoclase and oligoclase. Significant amounts of magnetite occur in all samples as an accessory mineral. All samples are foliated, some mylonitic in character while others display variable degrees of deformation. In thin section, the cobble and bedrock samples are the same petrographically and texturally. Orthoclase phenocrysts are somewhat recrystallized with internal patches of mosaic quartz, and feldspars. Hornblende is hydrothermally altered on cleavage surfaces, and some biotites contain chloritized zones. Magnetite is accompanied by minor sphene, and is locally altered to hematite. Other minor accessory constituents are apatite and zircon.

The Hunterstown Batholith is the major source area suggested for this augen gneiss indicator fan and is located 110 km northeast of Montreal, Quebec, and is mapped as part of the Morin Complex. Another smaller source is 36 km west of the batholith near the town of Lac Lasalle. The general ice movement during the last glaciation could also verify these source areas. Compiled striations for ice movement in northwest New England suggest that material from south-central Quebec could be carried southeast to central Vermont. Other evidence consists of isopleths for indicator fans mapped by Norwich University students down glacier from the Knox Mountain, Barre, Braintree and Glover plutons indicate a south-southeast direction for movement of the last ice sheet.

Overall, geochemical analysis shows that the trace elements in the cobble and bedrock samples correlate very well to each other. The four bedrock samples which show the greatest similarities are located in the central part of the massif which is also greater in elevation than the surrounding area suggesting it as a primary source. Cd, Nb, Zr, and Ce all show strong correlations with narrow field groupings for both the cobble and primary bedrock source. The cobbles are, however, depleted in Rb as a result of the weathering of potassium feldspars. A secondary source of the same magma formed isolated intrusions in the Lac Lasalle massif to the west where severe glacial plucking greatly sculptured the topography.

MAJOR AND TRACE ELEMENT GEOCHEMISTRY OF WEATHERED ULTRAMAFIC ROCKS AND OVERLYING SOILS, LUDLOW AND DUXBURY, VERMONT

Brooke Laundon, Middlebury College

The discontinuous ultramafic belt that runs the length of Vermont is the product of two orogenies, the Taconian and Acadian. These ultramafic rocks typically contain about 0.5% of both Ni and Cr, which are both known to have adverse impacts on plant communities and other aspects of ecological systems. Furthermore, the high ratio of Mg:Ca (> 30:1) in many ultramafic rocks significantly limits plant growth.

ICP-AES major and trace element analyses of rock, rock weathering rinds and overlying soil horizons were determined for two localities in the ultramafic belt, one at Ludlow VT and the other at Duxbury VT. Average pH values of the A, E, B and C horizons at Ludlow were 4.8, 4.6, 5.3 and 5.6, respectively. At Duxbury, average pH values of the A, E, B and C horizons were 4.4, 4.1, 4.2 and 3.9, respectively. Given that these soils are relatively high in Eh, it can be predicted that both Cr and Ni would be mobile in the soils at these pH conditions.

Mg:Ca values of ultramafic rocks analyzed in this study range from 160:1 at Ludlow to 70:1 at Duxbury. Weathering rind Mg:Ca ratios are 160:1 at Ludlow and 80:1 at Duxbury, suggesting that Mg and Ca are leached at equal rates from the rock. High Mg:Ca ratios in soils formed directly from chemical weathering of Vermont ultramafic rock would imply plant stress. However, Mg:Ca ratios of the soils analyzed in this study are 1:1 to 1:2. These values reflect a significant detrital component in the soils, which produces Mg:Ca ratios far more suitable for plant growth than purely ultramafic-derived soil.

Analyses of trace metal content in rock, weathering rinds and overlying soils will help to determine Ni and Cr mobility in this environment.

METAMORPHISM IN THE CONTACT AUREOLE SURROUNDING THE MAIDSTONE PLUTON AND ITS RELATIONSHIP TO METAMORPHISM OF THE AUREOLE SURROUNDING THE VICTORY PLUTON AND THE MONROE FAULT; NORTHEASTERN VERMONT

Justin D. Klein, Middlebury College

The Acadian Maidstone Pluton intrudes along the Monroe Fault, which forms the boundary between the metasediments of the Connecticut Valley trough and the Bronson Hill belt. The metamorphic grade for its aureole ranges from sillimanite grade near the contact to garnet grade further away. Comparison with the aureole of the Victory Pluton, located to the southwest, suggests the two aureoles are similar in many ways. Both plutons are bisected by the Monroe Fault and contain a well defined sillimanite zone near the contact of the pluton. In the aureoles of both plutons, andalusite is only found west of the Monroe Fault, and has been partially to completely replaced by muscovite and staurolite. Staurolite is also only found west of the Monroe Fault, and is partly replaced by muscovite and chlorite. East of the fault, deformed clots of decussate muscovite and tourmaline may represent staurolite pseudomorphs. Garnet from both aureoles within close proximity to the fault contains inclusion trails at high angles to the dominant foliation. This suggests that deformation was syn or post contact metamorphism. East of the Victory Pluton, sillimanite + k-feldspar and cordierite-bearing assemblages have been found, but these assemblages have not been seen east of the Maidstone Pluton. Microstructures and mineral assemblages in the aureole of the Maidstone Pluton, which are similar to those in the aureole of the Victory Pluton, indicate that contact metamorphism likely occurred during movement along the Monroe Fault.

THE PHYSICAL EFFECT OF LOGGING ON SOIL QUALITY NEAR ABBEY POND, GREEN MOUNTAIN NATIONAL FOREST, VERMONT

Nina Johnson, Middlebury College

This study investigates the effects of logging on soil quality, specifically the physical properties of soil in the Green Mountains of Vermont. The study location is centered near 44° 02' 08" N Latitude, 73° 03' 23" W Longitude in the Abbey Pond area of the Green Mountain National Forest. Here, historically logged National Forest land shares a boundary with an old growth forest (the Battell Biological Preserve) to the south. Four soil pits were excavated, two in the logged area and two in the old growth area. All four pits have similar elevations, parent material (till) and attitudes. The only difference between them is the vegetation. Each pit was described by horizon and samples were taken from each horizon.

In the lab, analyses for particle size distribution, bulk density and total organic matter were carried out. Particle size distribution was facilitated with the Coulter LS230A Laser Diffraction Particle Size Analyzer. Preliminary analyses show that there is no significant difference between the various A horizons. However, the E and B horizons differ. There is more clay in the E horizon of the old growth soils and comparatively less in the logged forest soils, but greater amounts of clay in the B horizons of logged soils than in the old growth soils. This may be due to greater infiltration and translocation in the logged forest as a result of decreased canopy and less transpiration. Bulk density is greater in the old growth forest soils than in the historically logged soils. This may be due to the recent accumulation of tree litter and organic matter on the soil surface as a result of logging practices. Total organic matter content was investigated by heating the samples and calculating the amount of organic matter lost after ignition at 360° C. It was concluded that the soils in the logged areas have more organic matter than the old growth areas. The O and A horizons of the historically logged soils are thicker than the old growth soils and have greater weight percentages of organic matter than old growth soils.

Low bulk density in the logged soils may explain why clay particles have mobilized to lower horizons in the logged soils to a greater extent than in the old growth soils. The high organic matter content in the upper horizons may contribute to excessive infiltration and translocation of clays. These organics are not absorbing the increased water supply due to 1) the decreased forest canopy from logging, and 2) decreased absorption of water and nutrients via transpiration due to logging and tree removal.

GEOCHEMICAL CHARACTERISTICS OF SOILS IN OLD GROWTH AND HISTORICALLY LOGGED FORESTS, GREEN MTN NATIONAL FOREST, VERMONT

Joshua J. Nothwang, Middlebury College

Research investigating the possible impacts on soils of forest harvesting practices has been documented for the last several decades. Previous studies in the United States and Canada have indicated that harvesting, primarily in clearcut form, leads to a significant decrease in available and total soil nutrients (Mroz et al. 1985, Pennock and van Kessel 1997, Tew et al. 1986). These decreases are caused by direct removal of organic matter and pH-induced leaching from precipitation.

This study attempts to examine the impacts on soils of selective harvesting in the northern forest of central Vermont. Four soil pits were sampled and described in deep, loamy, well-drained spodosols of Middlebury, Vermont (Soil Survey of Addison County 1971). Two soil pits were located in old-growth hemlock forest of the Battell Biological Preserve, while the remaining two were located in historically logged northern hardwood forest of the Green Mountain National Forest. Each horizon of the four soil pits was subjected to several analyses. Horizon thickness and pH were initially determined. Concentrations of total K, Ca, Mg, Na, Si, Al, and Fe were analyzed using ICP-AES. Concentrations of available forms of these nutrients will also be analyzed using ICP-AES, as well as nitrate and phosphate, which will be analyzed using spectrophotometry.

The O and E horizons in the old-growth soil pits are considerably thicker than comparable horizons in the historically logged soil pits, indicating some loss of soil material. Samples in the historically logged soil pits exhibit a lower average pH, indicating 1) decreased solubility of P, an essential nutrient for vegetation, and 2) increased solubility of toxic Al. A positive correlation between the total concentrations of relatively insoluble Si, Al, and Fe suggests these concentrations are controlled by the presence of silicate minerals in the soil. An inverse relationship between total concentrations of K and Si, Al, and Fe indicates that K is not controlled by the presence of silicate minerals, but by active soil processes. Total K concentration in the old growth soil pits is low in the A and E horizons and high in the Bt and B2 horizons, indicating ongoing illuvial/elluvial processes in these pits. This is in contrast to the historically logged soils, which are characterized by relative depletion of K in the B horizons. These preliminary results indicate that soils of the northern forest are negatively impacted by selective harvesting practices. Further analysis using the spectrophotometer and ICP-AES will likely confirm this conclusion.

UNIVERSITY OF VERMONT BASELINE WATER QUALITY DATA

Daniel Eurich, University of Vermont

Baseline water quality data was collected for the University of Vermont's main campus starting on July 16, 1999 and ending on November 16, 1999. Top of casing water levels, temperature, and conductivity were measured on a weekly basis using the Fleming, Wills, and Williams well nests. Water samples were collected monthly and analyzed for inorganic compounds at the Plant and Soil Science laboratory, Burlington, VT. This study was performed to see how the main campus ground water system responds to precipitation events as well as how salt applications affect ground water quality.

Water levels at the Fleming, Wills, and Williams well nests declined throughout the dry summer of 1999. Then, approximately 4 inches precipitation fell on September 16 and 17, 1999 increasing water levels as much as 4.94 feet in two weeks (well #8). For the September 16 and 17 event, well #2 had a recharge lag time of about 2 weeks. Water levels continued to increase until mid-November where they then decreased. Well screens for all wells are located in comparable material consisting of sand and varying amounts of silt and gravel.

Water temperatures generally decreased as the air/water interface depth increased. Well #2 was the most thermally dynamic well with a total temperature variation of 4.5 degrees. Well #2 also had the lowest temperatures, which I believe are a result of its location on a lawn, in contrast to wells at Williams and Wills, which are surrounded by asphalt and concrete.

The highest initial conductivity values were measured at well #7 (2.85 milliseimens/cm), #8 (2.74 milliseimens/cm), and #5 (2.54 milliseimens/cm) located in the Wills and Williams well nests. The highest water conductivity is found in wells near walkways and roadways where the University of Vermont applies salt to melt winter snow. The lowest conductivity was measured in Fleming well nest, well #2 (0.602 milliseimens/cm) where no salt is applied. The September 16 and 17 precipitation event increased conductivity in all wells; wells #8 (2.43 milliseimens/cm) and #5 (1.29 milliseimens/cm) increased most significantly, 87% and 41%, respectively.

Chloride, sodium, sulfate, calcium, potassium, magnesium, and sulfur are found in significant quantities dissolved in the ground water. After the September 16 and 17 precipitation event, concentrations of these constituents increased significantly in wells #8 and #5, the same wells in which conductivity rose significantly. Well #8 had the highest level of chloride (1620 mg/L) which exceeds the secondary maximum contaminate level set by the EPA by 6.5 times. Chloride and sodium were the best correlated of all elements, r^2=0.93.

Vermont Geological Society Student Research Grants

are designed to aid our future geologists investigate Vermont's geo-history.
Help the VGS to 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**, clip or copy this form and send it, along with your check or money order made payable to VGS, to:

Kristen Underwood, Treasurer, Vermont Geological Society
Department of Geology, University of Vermont
Burlington, Vermont 05405-0122

- *I'VE ENCLOSED MY TAX-DEDUCTIBLE CONTRIBUTION TO BE DEDICATED TO THE* ***VGS STUDENT RESEARCH GRANT PROGRAM.***

  TOTAL GIFT: **$**__________

*NAME:*______________________________

*ORGANIZATION:*______________________________

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1997 NEIGC Guidebooks Still Available!

The cost of the 1997 NEIGC guidebook has risen to $22.00 plus $3.00 shipping. Please make checks payable to
"Castleton State College - 1997 NEIGC"
Department of Natural Sciences
Castleton State College
Castleton, VT 05735

STATE GEOLOGIST'S REPORT
APRIL 2000

Laurence R. Becker, State Geologist
Vermont Geological Survey
103 South Main Street
Waterbury, Vermont 05671-0301

Over three days, a group of State Geologists visited with federal partners to discuss areas of mutual interest. The highlight of the trip was the "Pick and Gavel" award given by the Association of American State Geologists(AASG). The award is "to recognize individuals who have made significant contributions to advancing the role of geoscience in public policy and have supported AASG's mission in government affairs". Representative Jim Gibbons, a geologist representing a Nevada district and Dr. Rita Colwell, Director of the National Science Foundation (NSF), were honored at the Cosmos Club. Dr. Colwell is a microbiologist who is supporting Earth Science initiatives at NSF. The NSF is providing funds for the State Geologists to mentor undergraduate students in geologic field mapping. Vermont received funds in1999 and worked with Dr. Steven Wright at UVM who mentored two students. The Vermont State Geologist attended a meeting the following day at NSF where other avenues of educational cooperation were discussed.

An interesting note is that two of the five or so geological associations that are sponsoring fellows in Congress are in Vermont congressional offices. Melody Brown Burkins from the Geological Society of America is in Senator Leahy's Office and Dave Hunter from the American Geophysical Union is with Senator Jeffords. We discussed the Statemap program and a coming landslide initiative from USGS. Apparently, fellows are helping to organize a Congressional Natural Hazards Caucus. An invitation has gone out from Senators Ted Stevens and John Edwards for colleagues to become charter members.

Other visits for Vermont were Federal Emergency Management Agency (FEMA), United States Geological Survey (USGS), Environmental Protection Agency (EPA), the National Resource Conservation Service (NRCS), and the National Research Council. FEMA presented information on its map modernization program that includes a component called "riverine erosion". FEMA is considering adding this component to their flood plain hazard maps. At USGS a new National Landslide Initiative is

in its early stages of development. Vermont suggested that USGS coordinate with FEMA to combine the landslide and the riverine erosion hazard into a slope instability initiative much as we plan to do here in Vermont. When Congress is approached, the states that do not have landslide potential will be interested in supporting a hazard mapping program because of the flood erosion component.

At both the EPA Office of Water and at EPA Research, the State Geologist discussed Vermont Geological Survey's experience with radionuclides in ground water and the need to better understand geology to find new water sources that are devoid of radium and gross alpha emitters. Much research is ahead of us. At NRCS there are ways to coordinate in regards to "deep soil" investigations, agricultural waste pond liner design, stream geomorphology, and the geologic component of NRCS dam safety rehabilitations.

At the National Research Council, we met with the Directors of the Board of Earth Sciences and Resources; the Commission on Geosciences, Environment, and Resources; the Water Science and Technology Board; the Radioactive Waste Management Board; Ocean Sciences; and Meteorology.

Summer Field Trip to CRREL !!!

Vermont Geological Summer Meeting
Saturday, July 22, 2000, at 10:00 am

We will meet at CRREL, Hanover, NH at 10 am. For more information contact Shelley F. Snyder, VGS President, at 802-453-2333 or e-mail ssnyder@mtabe.k12.vt.us

Direction to CRREL: Take Exit 13 from I –91 north;
East across Connecticut River to Hanover;
Continue east thru light in Hanover;
Left on the road along the east side of the Dartmouth Green;
Continue north straight thru light on Rt. 10;
1.5 mile to CRREL on west side of Rt. 10.

Directions to CRREL are available on the web page @ www.crrel.usace.army.mil Click on: About CRREL Local travel information for maps and directions.

Editors' Favorite Web Sites

Thanks to Greg McHone for sending some addresses and suggestions for geology sites:

You might be interested in a research web site that I have been building on the largest volcanic province, called CAMP (Central Atlantic Magmatic Province). The address is:

www.wesleyan.edu/~jmchone/CAMP.html

I am also heading a group to develop a web site (still in construction) on Connecticut geology, aimed especially at teachers and their students. Perhaps someone in Vermont can start something like it:

www.wesleyan.edu/ctgeology

The editors' favorite is reached through Greg's CT geology page and is a virtual field trip site

http://www.wesleyan.edu/ctgeology/geotrips.html

Please e-mail your favorite sites to us: marjieg@dec.anr.state.vt.us

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UVM Geology Seminar Series

April 17, 2000, 4:15 PM, Room 200, Perkins Hall, UVM

Christian Teyssier, University of Minnesota, will present a talk entitled "Partial Melting of Crust and Evolution of Orogens"

VGS Treasurer's Report

April 5, 2000

Dear President and Board:

The financial condition of the Society remains strong. Below is the Income Statement for the period January 1, 2000 through March 31, 2000.

The checking account balance is $2,432.84 as of March 31, 2000. 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.

Sincerely,

Kristen L. Underwood

Income and Expenses
1/1/00 through 3/31/00

INCOME		
Total Dues	$598.00	
Dues-Family	$120.00	
Dues-Institution	$15.00	
Dues-Member	$455.00	
Dues-Student	$8.00	
Interest	$4.88	
Student Research Grant Contributions*	$267.00	
TOTAL INCOME		$869.88
EXPENSES		
Postage (12/99 GMG)	$52.80	
Minuteman Press (12/99 GMG)	$102.25	
TOTAL EXPENSES		($155.05)
TOTAL INCOME - EXPENSES		$714.83

*The Society gratefully acknowledges the generous contributions to the student Research Grant funds received from the following members during the first quarter of 2000: Peter and Thelma Thompson, Jeff Hoffer, Jeanne C. Detenbeck, Sharon Strassner, G. Scot Applegate, Arthur W. Gilbert, Jr., A. P. Nason, Barbara L. Hennig, Lawrence W. Gatto, J. Gregory & Nancy W. McHone, Shannon Foster, Roger & Terry Thompson, Craig Heindel, and Jack Jemsek. THANKS!!