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The Vermont Geological Society
Spring Meeting
April 26, 2008, 8:30 AM
McCardell Bicentennial Hall, Room 220
Middlebury College, Middlebury, Vermont

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12:45PM EXECUTIVE COMMITTEE MEETING

ABSTRACTS

GEOCHEMISTRY OF LAMPROPHYRE DIKES OF WILLISTON, VERMONT

Melissa Whitehead, Geology Department, Middlebury College, Middlebury, VT 05753

Lamprophyres are relatively uncommon alkaline, silica-undersaturated, small volume ultrapotassic, igneous rocks often found as dikes or small intrusions. In New England, lamprophyres are most abundant in the New England–Quebec magma series found in parts of northern Vermont and southern Quebec. Here, they are relatively uncommon mafic to ultramafic magmas that are thought to have intruded sometime during the Mesozoic era. This study focuses on the lamprophyre dikes found in Williston, Vermont.

Thirty-seven samples were collected, seventeen were made into thin sections to understand mineralogical and petrographic characteristics, and twenty-nine samples were analyzed for major and trace element using ICAP. A subset of ten samples was analyzed for rare earth elements. Radiometric argon-argon ages were detemined on two samples.

Petrographically, lamprophyres are strongly porphyritic in mafic minerals and are dominant in biotite, amphiboles and pyroxene. Feldspar usually occurs in small amounts and is confined to the ground mass. From the petrographic and chemical analyses, the samples are characterized into one of four types based on the minerals present and the silica content of the lamprophyres. The lamprophyre rock types found in Williston include: diabasic, spessarite, camptonite, monchiquite. Argon-argon age-date for the whole rock was found to be 113 Ma with the total fusion age of the biotite flakes as 134 +/- 0.7 Ma.

Whole rock major, trace and rare earth chemistries of the rocks are used to classify and interpret the formation of the Williston lamprophyres. Harker plots and ternary diagrams have grouped the dikes as within plate basalts possibly forming as a result of partial melting of a peridotite source in the upper mantle. After their formation in the crust, the magmas moved along the weaknesses in the crust where they finally crystallized forming intrusive dikes. The formation of the dikes represents a period of rifting and continental extension between Newfoundland and the Iberian Peninsula.

GEOCHEMISTRY AND PETROGRAPHY OF GRANITIC BODIES IN WOODBURY AND HARDWICK, VERMONT

Ryder Musselman, Geology Department, Middlebury College, Middlebury, VT 05753

Konig's 1961 Bedrock map of the Plainfield Quadrangle in the Northeast Kingdom displays a number of small igneous intrusions collectively known as the Woodbury granites. The rocks are referred to in this study as the Woodbury granitic bodies, and intrude the Waits River and Cram Hill formations between Woodbury and Hardwick, Vermont. Despite intense quarrying in the area, no detailed petrography or geochemistry has been performed on these bodies. In the summer and fall of 2007, 35 samples were collected from quarries and natural outcrops. Petrography, whole rock chemistry, and individual mineral compositions were obtained for some of the samples, and these data were used to classify the Woodbury granitic bodies and to compare them with other post-kinematic granitoids in Vermont and New Hampshire.

The Woodbury granitic bodies are composed of medium- to coarse-grained two-feldspar, two-mica granitoids with 65%-75% SiO_2 contents. Modal classification ranges from granite to granodiorite. The rocks are subalkaline and weakly peraluminous, and are light rare earth enriched, with no Eu anomalies. Ta-Nb anomalies indicate a subduction zone signature, and negative P and Ti anomalies are also present. The Woodbury granitic bodies are likely a hybrid of I and S-type granites with a significant crustal component. This is supported by Yb-Ta and Yb+Ta-Rb ratios. The Woodbury granitic bodies are chemically similar to the Northeast Kingdom Batholith, particularly the Echo Pond and Derby granodiorites (Arth & Ayuso, 1991). They are also similar to the Concord granites of New Hampshire (Dorais & Paige, 2000). Intrusion of the post-collisional Woodbury granitic bodies occurred with crustal stacking and anatexis, lithospheric delamination, or subducting slab break-off as possible sources of magmatism.

THE MAIDSTONE PLUTON: A COMPOSITE INTRUSION ON THE EASTERN MARGIN OF THE NORTHEAST KINGDOM BATHOLITH, VERMONT

Johnathon L. Miller, Department of Geology and Environmental Science, Norwich University, Northfield, VT 05663

The Maidstone pluton is located within the Lunenburg–Brunswick–Guildhall and Burke 7.5-minute quadrangles and is on the eastern margin of the Northeast Kingdom batholith that occurs primarily within the Siluro-Devonian-aged Connecticut Valley–Gaspé Trough. The Maidstone is elliptical to circular in shape at the surface and is approximately eight miles across from west to east. It intruded the Silurian-Devonian Gile Mountain Formation west of the Monroe Fault and the upper-middle Ordovician Albee Formation east of the fault.

Twenty-four rock samples were collected from bedrock outcrops. Petrographic analyses were conducted on twenty-two thin sections with discrimination staining for feldspars. Whole rock major and trace element analyses were performed on twenty-one samples using an inductively coupled argon plasma spectrometer. Initial field examination of the Maidstone suggested the presence of two units, diorite and granite. Detailed petrographic and geochemical analyses, however, revealed that the Maidstone consists of four separate compositional zones: 1. biotite-amphibole quartz diorite; 2. biotite tonalite; 3. biotite leuco-monzogranite; and 4. Ti-depleted,

biotite leuco-monzogranite. Whole-rock major element analyses show overlapping silica content with heterogeneity in other major element abundances.

Spatial isolation and geochemical characteristics of the four compositional zones indicate that their distinguishing characteristics developed prior to emplacement, rather than by *in situ* fractionation. A fractionation model of a single alkali-silica-poor, Fe-Mg-rich source at depth, to an alkali-quartz-enriched and Fe-Mg-Ti-depleted source, with sequential magma emplacement through multiple pulses, is explored.

PETROLOGY AND GEOCHEMISTRY OF A METAMORPHOSED ANORTHOSITE–DIORITE INTRUSIVE SUITE NEAR DRESDEN, NEW YORK

Ethan Lake, Geology Department, Middlebury College, Middlebury, VT 05753

Massive type anorthosite suites are complex large-scale igneous bodies consisting primarily of plagioclase-rich anorthosites and some residual mafic Fe-Ti bearing diorites. These bodies formed during the early- to mid-Proterozoic, some 2500 to 1000 million years ago and are relatively common throughout the Adirondacks. This study involves the mapping and sampling of a small deformed and metamorphosed anorthosite suite near Dresden, New York. The site was mapped during a week of field days and 30 samples were collected for petrographic analysis, whole rock geochemical analysis using an ICP-AES, and rare earth analysis using an ICP-MS. Much of the field area contains significant high-grade metamorphic overprinting from the late stages of the Grenville Orogeny (around 1080 Ma). Field mapping revealed the presence of a gradient of plagioclase-bearing rocks ranging from mafic ferro-diorites to more plagioclase-rich gabbroic anorthosites. Petrographic analyses confirmed the subdivision of the field area into three lithologies based on plagioclase modal compositions as well as identified younger mafic intrusions into the anorthosite suite. Rare earth element analysis indicated that the suite likely differentiated from a single plagioclase-rich magma source. Both the rare earth analysis and whole rock geochemistry linked the anorthosite suite at Dresden to the broader Adirondack Proterozoic anorthosite event and indicated that the Dresden suite likely comprised a small, mafic off-shoot of that regional event.

BEDROCK GEOLOGY OF THE NORTHERN HALF OF THE PURGATORY 7.5' QUADRANGLE, SOUTHWESTERN MAINE

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

The Purgatory 7.5' quadrangle in southwestern Maine is underlain by the stratified rocks of the Central Maine sequence. Detailed 1:24,000 scale bedrock mapping of 70 km^2 in the northern half of the quadrangle reveals the geology is dominated by a sequence of deformed Silurian metasedimentary rocks that have been intruded by several different types of igneous rocks. The metasedimentary rocks include mappable units of pelitic schist, rusty weathering sulfidic schist, marble, and various types of granofels.

The stratified rocks have been deformed into a series of upright isoclinal folds whose axes trend northeast. In addition to this folding, three northeast-trending faults are interpreted to be present based on offsets in rock units. Petrographic analysis of mineral assemblages in a variety of bulk compositions indicates the rocks were metamorphosed under amphibolite facies conditions. Both the deformation and metamorphism are interpreted to have occurred in the Devonian in association with the Acadian Orogeny.

In addition to these deformed and metamorphosed stratified rocks, several mappable igneous intrusions are present in the field area. These can be divided into two general types: (1) Devonian granitic rocks, and (2) a poorly exposed alkaline syenite pluton. Relatively small granitic rock intrusions can be found at many localities, but are geochemically similar, and are likely part of the same intrusive event. Whole rock geochemical analyses of the alkaline syenite reveal a composition unique to the field area and the region. Specifically, the rocks are characterized by intermediate SiO_2 contents (58-65 wt. %) and extremely high alkali concentrations ($K_2O + Na_2O$ = 12-14 wt. %) A new $^{40}Ar/^{39}Ar$ biotite total gas age of 239 ± 1.1 Ma has been obtained from this syenite, providing a minimum age for the intrusion of this unusual magma. Collectively, the rocks in the study area represent a period of Silurian sediment deposition followed by Devonian ductile deformation, high-grade metamorphism and igneous intrusion.

ANALYSIS OF SPATIAL AND TEMPORAL VARIATIONS IN LONGITUDINAL STRAIN RATES NEAR SWISS CAMP, GREENLAND

Julie A. Rumrill[1], Thomas A. Neumann[1], and Ginny A. Catania[2]; (1) Geology Department, University of Vermont, Burlington, VT 05405; (2) Institute for Geophysics, University of Texas at Austin, Austin, TX 78712

We investigate the evolution of the longitudinal strain regime over the melt season by using data collected at 15 second resolution from ten GPS receivers installed along a flowline through Swiss Camp, Greenland. Network baseline solutions are used to calculate strain rates throughout the 2006 and 2007 melt seasons. Analyses of 2006 data show that the strain rate over a 36-km longitudinal baseline has a background rate of ~ $-1.1 \times 10^{-3}\ a^{-1}$ but becomes variable shortly after the onset of melt around day 200, changing by as much as $1.5 \times 10^{-3}\ a^{-1}$ within a span of 24 hours. Longitudinal strain rate reversals occur intermittently over short-lived intervals of one to three days, with rates returning to background magnitudes around day 240, coinciding with the decline of seasonal melt, suggesting a hydrologic link. The phasing of strain rates along the flow line are analyzed and used to determine the locus of initiation and the spatial extent of strain related to each event. During the 2006 season, we focus on two time periods of interest. The first event was initiated in the ablation zone, and the second was initiated in the accumulation zone, suggesting that short-term altered stress conditions are not confined to the ablation zone. Associated longitudinal strain rate changes spanned more than 35 km. The geometry of the GPS array was rearranged for the 2007 season to improve our ability to resolve phasing of strain and location of strain initiation. Preliminary results show a background strain rate of $-0.7 \times 10^{-3}\ a^{-1}$ for a 37-km longitudinal baseline which becomes variable as the melt season progresses. Strain rate analysis is focused on one time period of interest around decimal day 190. This event is initiated in the equilibrium zone, and phasing of strain is evident ~15 km up flow and ~18 km down flow from the initiation site. Strain changes are most consistent with short-term changes in basal stress conditions likely due to increased basal water pressure at the ice-bedrock interface.

Results from this study may be useful in making broader inferences regarding the response of grounded portions of the ice sheet to seasonal changes in stress.

ANALYSIS OF BIOGENIC SILICA FROM MARINE SEDIMENT IN MAXWELL BAY, ANTARCTICA: A LOOK AT HOLOCENE CLIMATE HISTORY

Allison Klein, Geology Department, Middlebury College, Middlebury, VT 05753

The Shallow Water Drilling project (SHALDRIL) retrieved a 108-meter core in 2005 from Maxwell Bay, a fjord in the South Shetland Islands of the Antarctic Peninsula. Electric resistivity (ER), magnetic susceptibility (MS), mean grain size, weight percent biogenic content using XRD analysis and other physical properties of the core were determined (Michalchuk, 2006). The goal of this study is to perform a Holocene climate reconstruction using biogenic silica (BSi) and analyze it with respect to other climate proxies.

This study determined BSi content at 50-cm intervals downcore using a NaOH leaching analysis procedure (DeMaster, 1981). Duplicates were done at random intervals having accuracy predominantly within 1.1% with a few having a slightly higher difference than the original values.

Salient results are: 1) The difference between BSi values in the lower and upper sections of the core is consistent around 2.3%, distinguishing between the Mid-Holocene Climatic Optimum and the colder period before. Climate stages previously outlined by Domack et al. (2003) and confirmed by Michalchuk (2006) suggest the delineation between these two stages to occur approximately 9000 years BP while the significant change in BSi spans a later time period from approximately 8,100–7,100 years BP. 2) There is an extreme difference between the biogenic content determined from XRD and BSi from the NaOH leach in not only magnitude, but also overall trend. The most likely reason for this is that the volcaniclastic material that makes up the Antarctic Peninsula Group, which dominates this region, is not picked up by the XRD as one of the key minerals due to its lack of crystalline structure and is therefore attributed to biogenic content. Using XRD as a proxy to determine biogenic content, although possible in other environments, has to be approached with caution as it clearly is not appropriate to use in an environment with volcanic and volcaniclastic rocks.

USE OF AUTONOMOUS UNDERWATER VEHICLES (AUV) AND THEIR EFFECTIVENESS IN MAPPING HYDRODYNAMIC VARIABILITY IN LAKE CHAMPLAIN

Kristen Poehling, Geology Department, Middlebury College, Middlebury, VT 05753

The evolving technology of autonomous underwater vehicles (AUVs) is an exciting new advancement in the field of marine science. Old methods to study the water column can be labor, equipment and time intensive in order to gain accurate data. Old methods included the use of ROVs (unmanned underwater vehicles controlled from the surface), manned underwater vehicles and shipboard hydrographic surveys typically taken with CTDs (conductivity/temperature/depth) sensors. AUVs, on the other hand, can provide massive amounts of data with a minimum of user intervention while at the same time surveying spatial and temporal domains that would be dangerous or impossible. For example, dynamic changes in the water column occur during extreme wind events. Fortunately, the size and cost of these instruments are continually being reduced. Additionally, the software that controls the AUVs, as well as the sensors installed on them, are presently being tested and improved to better map ocean and lacustrine environments. As part of a pilot program with the U.S. Navy, Tom Manley (Geology Department) will be using two new AUVs (model Iver2 from OceanServer Technology, Inc.) to test the accuracy of these devices in Lake Champlain. As a basis to compare the AUV results to, a two-ship (UVM's *Melosira* and Middlebury College's *R/V Baldwin*), 106-station CTD survey will be taken each day for 4 days (starting July 29th) in the Thompsons Point–Split Rock Gap region (~4 km^2). Concurrently, the AUVs will be deployed while each CTD survey is underway. AUV and CTD daily data sets will be three-dimensionally modeled and characterized using earthVisons4® (Dynamic Graphics, Inc) software. Statistical comparison of the AUV and CTD final 3-D grids of the various parameters (temperature, fluorescence, and turbidity) will provide information as to the reliability and accuracy of the AUV data in a complex hydrodynamic regime. Additionally, representatives from the U.S. Navy, YSI (providing the sensors), DGI (earthVisons4®), and OceanServor will be on site for validation purposes as well as looking at the ability to acquire, model, characterize, and display information in a real-time environment.

BROAD CLIMATE VARIABILITY BASED ON SEISMIC STRATIGRAPHY AND SEDIMENT CORES FROM WILLSBORO BAY, LAKE CHAMPLAIN

Emily Dawson, Geology Department, Middlebury College, Middlebury, VT 05753

Seismic profiles and sediment cores provide researchers with abundant information about climate history. Seismic profiling generates subsurface images of stratigraphy that reveals large-scale changes in sediment type as well as events in depositional history. Sediment cores can be analyzed with various proxies in order to determine the sedimentological record of a particular region. This study focuses on integrating 14 seismic profiles and 4 piston cores collected in Willsboro Bay, a finger-like bay on the western edge of Lake Champlain.

Seismic profiles were collected using a swept frequency CHIRP sonar. The profiles were analyzed and digitized using SonarWizMap technology. A sedimentological record of Willsboro Bay was constructed using magnetic susceptibility, electric resistivity, grain size, spectral analysis, physical properties (saturated bulk density, porosity, and water content), ^{210}Pb-dating, and microfossil analysis of the sediment cores. Correlation of seismic stratigraphy and sediment cores confirm the presence of Lake Champlain's three main sediment units (Lake Champlain Sediments, Champlain Sea Sediments, and Lake Vermont Sediments) in Willsboro Bay. Specific shifts in physical properties indicate local climate swings that may be correlated with broad climate events.

A MULTIPLE PROXY STUDY OF LAKE SEDIMENT FROM MARSHALL LAKE, UTAH: INFERENCES ON PERIODS OF ENHANCED SEDIMENT TRANSPORTATION

Andrew Peters, Geology Department, Middlebury College, Middlebury, VT 05753

In the arid climate of the western United States, understanding paleoclimate is crucial for managing freshwater resources. Lake sediment, once dated, can provide a complete climatic timeline that reveals the magnitude of past paleoclimate variations, including drought. This study investigated the paleoclimate history of the southwestern Uinta Mountains from the sedimentary record in Marshall Lake, Utah.

X-ray diffraction (XRD), inductively coupled argon plasma mass spectrometry (ICP), grain size analysis (GS), and rare earth element analysis (REE) and loss on ignition (LOI) analyzed at 1- or 2-cm intervals were combined in a multi-proxy study of past sedimentation in this lake. AMS dating of organic matter indicates that the sediment matter in the core starts at roughly 13,000 yrs BP and provides a continuous record through 1000 yrs BP. Particular attention was given to intervals of the sediment that were apparently influenced by sources beyond the watershed. The presence of exotic materials in the lake could indicate enhanced transport of clay-sized particles as dust from the low elevation basin floors up to the lake.

Results suggest a correlation between the LOI, XRD, ICP and GS in particular intervals. XRD analysis, which measures relative amounts of minerals throughout the core, indicates variance in the ratio between clay and the locally derived feldspars. ICP elemental analysis also suggests that the geochemistry of the sediment changed through time. GSA shows an increase in clay size particles (<2 μm) in section of the core that also contains high levels of clay and low organic matter. The balance of results indicates that conditions have varied over time in the lake. In particular, an event between 5000 to 4000 yrs BP appears to have returned the lake to conditions that prevailed during the latest Pleistocene, ca. 11,000 BP.

AN ANALYSIS OF ARSENIC, URANIUM AND MANGANESE CONCENTRATIONS IN WESTERN BANGLADESH'S DRINKING WATER

Lawrence J. Mastera, Department of Geology and Environmental Science, Norwich University, Northfield, VT 05663

Contour maps of contaminant concentration and graphs of depth vs. concentration have been prepared for groundwater (drinking water) samples from four neighborhoods in western Bangladesh (Bualda, Fulbaria, Jamjami, and Komlapur) collected over the past decade by the Bangladesh Association for Needy Peoples Improvement. To the extent possible, the sampled tubewells in each neighborhood were distributed at 500-meter intervals along perpendicular axes that radiated in 4 equal lengths from the center. Each neighborhood had 17 sampling locations: 4 north, 4 east, 4 south, 4 west, and 1 in the center. Each sample was analyzed for arsenic (As), uranium (U), manganese (Mn), nickel (Ni), antimony (Sb), lead (Pb), chromium (Cr), iron (Fe), pH, boron (B), barium (Ba), molybdenum (Mo), selenium (Se), and zinc (Zn). In this study, As, U, Mn, Ni, Sb, Pb, and Cr were found above WHO health-based drinking water guidelines in 33%, 48%, 75%, 3%, 3%, 1%, and 1% of these tubewells, respectively. Conversely, B, Ba, and Mo were not found above these guidelines.

Analyses of the 3-D spatial distribution of As and U identified relationships between these toxins, with U content increasing and As content decreasing with depth at two of the four sites. In these villages medium- to coarse-grained sandy channel deposits at depth may be under oxidizing conditions where the sediment is withholding As and the U is being mobilized in groundwater. In wells high in As, whether shallow or deep, organic-rich peat and clay of floodplain origin may occur near the level of tubewell completion where reducing conditions associated with organic-rich sediments may be withholding U while As is mobilized in the groundwater. This work allows speculation on what types of toxins would be found if new tubewells are drilled.

IDENTIFYING UNKNOWN MINERAL AND INVESTIGATING POSSIBLE CAUSES FOR ITS FORMATION AT THE PIKE HILL MINE IN CENTRAL VERMONT

Tyler George-Minetti and Gregory K. Druschel, Geology Department, University of Vermont, Burlington, VT 05405

The Pike Hill Mine is an abandoned copper mine located within massive Besshi-type sulfide deposits (Piatak et al, 2006). These deposits contain massive ores of Silurian-Devonian age and a carbonate-rich host rock that is unlike the siliciclastic host rock of the nearby Ely and Elizabeth mines (Piatak et al, 2006). Located in Corinth, VT, the first copper mining took place in 1847 and continued off and on until 1919 (www.scorecard.com, 2005). Talus slopes consisting of a brownish-orange sediment rich in metals and large rock piles fill the mine shafts. At the base of these slopes lay small basins rich with an unidentified blue-green mineral that appears immediately under the surface of the water. Rocks and surrounding sediment just upslope from the basin are also stained with this blue mineral and are presumed to have once been in direct contact with the water. Because Cu is an important element of interest for acid mine drainage remediation, mineral changes which affect Cu mobility are important to investigate in these settings. Mineral and water samples collected at the Pike Hill Mine were analyzed using a number of different techniques including XRD analysis, electron microscopy/energy-dispersive X-ray analysis, ICP-OES analysis, and reflectance microscopy. Results indicate that the mineral is an alumino-silicate, with the principal chemical constituents being Al, Si, Au, Cu, and Fe. Under reflective light microscopy, the mineral appears almost the exact same color as it does to the naked eye, with little change to this color under crossed nicols and with no pleochroism. Results from a series of experiments to precipitate the mineral in the laboratory in the hopes of achieving a better understanding of how the mine environment influences the equilibrium conditions that control mineral stability and how this environment can possibly control Cu concentrations in water will be presented.

ANOMALOUS GRAPHITE AT THE BELVIDERE MOUNTAIN SERPENTINITE, VERMONT

Danielle Kerper and Mark R. Van Baalen, Department of Earth and Planetary Sciences, Harvard University, Cambridge, MA 02138

The Belvidere Mountain serpentinite is part of a chain of Taconic-age ophiolites that stretches from the southern Appalachians to Newfoundland. Asbestos-bearing rocks in the serpentinite

have been quarried here for over a century. On the north wall of the C-area quarry there is a fault zone containing anomalous graphite-bearing rocks (Van Baalen et al., 1999). This zone is about 15 feet wide and extends to the top of the quarry wall, about 90 feet, and has a strike of 5° and a dip of 85°W. Graphitic rocks within the fault zone are bounded on the east side by the asbestos-bearing serpentinite and on the west side by massive, gray-weathering antigorite. As far as we know, this occurrence is unique in the quarry. However, extensive quarrying activity has not only wiped out evidence of its original extent, but may have destroyed evidence of similar occurrences within the quarry. The foliated rock from the graphitic zone is dark gray and has a greasy luster. In thin section, we estimated 20% opaques finely disseminated, but also concentrated in submillimeter veins.

Geochemical studies will help to determine the origin of this graphite. We first separated the graphite from the serpentinite host rock using a combination of dilute HNO_3 and concentrated HF. The graphite remained as an insoluble residue. X-ray powder diffraction revealed a broad, weak X-ray peak near the known graphite peak at 26.38° 2θ. This could be explained by poorly crystallized graphite that does not diffract strongly. An exploratory study using mass spectrometry was then undertaken. The mean $\delta^{13}C$ value attained from this study was –16.77 +/- 0.1 per mil, implying that there is a significant organic carbon component in the graphite.

The graphite may have been precipitated from C-O-H fluids moving along a fault zone from a carbonaceous source in the underlying Hazen's Notch or overlying Ottauquechee Formations (Gale, 1980). For example, the Cambrian Ottauquechee Formation is characterized by black graphitic quartz-sericite phyllite and schist and by massive beds of dark-gray quartzite (Albee, 1957). This mechanism could possibly be similar to that for New Hampshire graphite veins described by Rumble and Hoering (1986). Further work to test this theory is currently in progress.

PRESIDENT'S LETTER

[not available at press time]

WINTER MEETING MINUTES

The Executive Committee of the Vermont Geological Society met following the Winter Meeting held at Norwich University on March 1, 2008. Neither Dave West nor Steve Howe was able to make the Winter Meeting. Although minutes were taken by George Springston, they were not available at press time. I have summarized a report I sent to George immediately prior to the Winter Meeting, and I have also included some information concerning the Executive Committee's meeting provided to me by Jon Kim during his recent trip to Albany in his capacity as VGS Lecturer for 2008.

Steve Howe, as Treasurer, reported that the financial condition of the Society is extremely strong. As of February 29, 2008, the checking account balance was $6,934.47. Three Research Grants totaling $1,190.00 were awarded during the latest round of review. As indicated below, one student recipient will not be able to complete his research and has returned the entire award of $460.00 to the Society, per our Bylaws. Steve noted at the time that the Society had 111 dues-paying members (106 individual or family memberships and 5 institutions). Although most members had paid their dues, membership renewal forms were still coming in, even though the deadline for renewal was January 31, 2008. He said that reminder notices would be sent shortly by e-mail and postal mail. Tax-deductible contributions to the Research Grant Program totaled $555.00, approximately equal to last year's level at a comparable point in the renewal cycle.

Steve Howe, as Chair of the Advancement of Science Committee, reported that three students were awarded research grants following the October 1, 2007 application deadline: Danielle Kerper, Harvard University; Melissa Whitehead, Middlebury College; and Robert Zimmermann, University of Vermont. Recent telephone and e-mail exchanges between Steve and Keith Klepeis, Robert Zimmermann's advisor, have indicated that Robert will not be able to complete his research before he enters the College of Education in late May to pursue his teaching certification. Robert felt it was appropriate that he return the entire amount of funds awarded back to the Society, and Steve and Keith concurred. Steve noted that the deadline for the next round of applications to the Research Grant Program is April 1, 2008, as indicated on the calendar page of the Society's website. Steve alerted the Committee that all issues of the *Green Mountain Geologist* (GMG) from 1994 through Winter 2007 had been archived as .pdf files on the Society's website and that remaining issues published since 1974 were in the process of being scanned.

Steve Howe, as Chair of the Publishing Committee, reported with enthusiasm that members appear to have strongly embraced the electronic GMG delivery option. Of the 106 non-institutional members, 85 have elected to receive the GMG electronically, while 21 have opted to receive a paper copy mailed to them. He remarked that there is room for additional members to elect to receive the GMG electronically as at least 94 members have an e-mail address. Steve noted that the publication of the GMG continues to proceed smoothly with editing, formatting, layout, and .pdf file creation and mailing being handled by Steve and Kathy Howe, while photocopying and postal mailing of paper copies is handled by Dave West. Reduction in the number of paper copies produced and mailed should particularly benefit Dave. Steve reported that Volume 6 of *Vermont Geology* has been reprinted. Orders for partial and complete sets of *Vermont Geology* continue to trickle in, with the most recent being a request for Volume 4.

Steve Howe relayed information from John Van Hoesen, who was in Italy at the time of the meeting, about the new VGS ListServ administered by Green Mountain College. An announcement about its availability will be made to the membership of the Society at a later date.

Steve reminded everyone that the Spring Meeting will be held on April 26, 2008 at Middlebury College and that the deadline for submission of student abstracts is April 7, 2008.

Jon Kim volunteered to lead the Society's Summer Field Trip, likely either to the Hinesburg, Vermont area or to the Worcester Mountains. A date for the trip and additional details will be determined at the Executive Committee Meeting after the Spring Meeting's student presentations.

Steve reported that Jon Kim is scheduled to present two talks at the University at Albany on April 2nd and 3rd in his capacity as the VGS Lecturer for 2008. The Department of Atmospheric and Environmental Sciences will pay for the cost of Jon's overnight lodging, but his mileage and meal costs will be borne by the Society. Jon remarked that Stephen Wright volunteered to serve as the VGS Lecturer for 2009.

Respectfully submitted,
Stephen S. Howe

TREASURER'S REPORT

The financial condition of the Society is extremely strong. As of March 28, 2008, the Society's checking account balance was $7,094.47. To my knowledge, there is one outstanding bill of $180.42 to be paid to Jon Kim to reimburse him for travel-related expenses incurred during a recent trip to Albany, New York in his capacity as the Society's Lecturer for 2008, and one modest outstanding bill to be submitted to me shortly by George Springston to reimburse him for the refreshments served at the Winter 2008 meeting.

Robert Zimmermann of the University of Vermont, one of three students awarded a Research Grant last fall, has decided to leave the Department of Geology and pursue his teaching certification in the College of Education. As he will not be able to complete his research, Rob has returned his entire award of $460.00 back to the Society.

The following member has rejoined the Society since the last report: James Ashley, Danville, Vermont.

Respectfully submitted,
Stephen S. Howe, Treasurer

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

The Society's Winter Meeting, with the theme "Holocene Climate Change," was well attended despite less than optimal weather. Our Keynote speaker was Tom Armstrong, Senior Advisor for Global Change Programs at the U.S. Geological Survey, who spoke about the role of the Department of the Interior in climate-change research and decision-making. Tom was followed by Jon Kim, who discussed the Hinesburg Thrust in Williston, Vermont, and George Springston, who covered terrain analysis in Williston using LIDAR. The meeting concluded with Stephen Wright's talk on the channels and potholes of Shattuck Mountain in northern Vermont. As always, members are encouraged to contact me with any suggestions they may have for topics or presenters for next year's meeting.

Robert Zimmermann of the University of Vermont, one of three students awarded a Research Grant last fall, has decided to leave the Department of Geology and pursue his teaching

certification in the College of Education. As he will not be able to complete his research, Rob has returned his entire award of $460.00 back to the Society, as is required by our Bylaws.

The Committee received no applications to the Society's Research Grant Program by the deadline of April 1, 2008. Applications for the second round are due October 1, 2008. 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
Jeanne C. Detenbeck
Albert W. Gilbert, Jr.
Carey Hengstenberg
Barbara L. Hennig
Jefferson P. Hoffer
Jon Kim
Carl Koteff
Eric T. Lapp
Frederick D. Larsen
J. Gregory and Nancy W. McHone
Alexis P. Nason
George Springston
Sharon Strassner
Art Stuckey
Peter J. and Thelma B. Thompson
Roger and Terry Thompson
David West

Respectfully submitted,
Stephen S. Howe, Chair

VERMONT STATE GEOLOGIST'S REPORT

Base and Applied Science – Information Development Cycle

The Vermont Geological Survey (Division of Geology) submits abstracts for a regional geology meeting as an impetus to pull together the previous field season's base and applied science. The Vermont Geological Survey geologists and project collaborators are authors on five papers presented March 27-29, 2008 at the 43rd Annual Meeting of the Northeastern Section of the Geological Society of America in Buffalo, New York. Four posters and one oral presentation include basic bedrock geologic studies, applied studies relating to groundwater resources, and surficial geology. Collaborators include the University of Vermont, Norwich University, and the University of Buffalo. The meeting is a way, in part, to vet the science while testing ways to present to the scientific community and the public. The outcome is that projects have been developed with base science so when applied to the protection of health, safety, and the general welfare the underlying science is defensible. The public wants to know that the base science is sound but focuses on the societal outcome.

GROUNDWATER RESOURCES IN THE TOWN OF WILLISTON, NORTHWEST VERMONT, BECKER, Laurence[1], KIM, Jonathan[2], DE SIMONE, David[2], GALE, Marjorie[2], and SPRINGSTON, George E.[3], (1) Vermont Geological Survey, 103 South Main St., Logue Cottage, Waterbury, VT 05671, laurence.becker@state.vt.us, (2) Vermont Geological Survey, 103 South Main Street, Logue Cottage, Waterbury, VT 05671-2420, (3) Department of Geology and Environmental Science, Norwich Univ, 158 Harmon Drive, Northfield, VT 05663

THREE DIMENSIONAL MODELING OF AN ANCIENT THRUST FAULT SURFACE IN THE TOWN OF WILLISTON, NORTHWESTERN VERMONT, DERMAN, Karen, Geology, University of Vermont, Delehanty Hall, Trinity Campus, 180 Colchester Ave, Burlington, VT 05405-1758, karen.derman@uvm.edu, KIM, Jonathan, Vermont Geological Survey, 103 South Main Street, Logue Cottage, Waterbury, VT 05671-2420, and KLEPEIS, Keith, Geology, Univ of Vermont, Burlington, VT 05405

TERRAIN ANALYSIS USING LIDAR TOPOGRAPHIC DATA: A CASE HISTORY FROM WILLISTON, NORTHWEST VERMONT, SPRINGSTON, George E**.**, Department of Geology and Environmental Science, Norwich University, 158 Harmon Drive, Northfield, VT 05663, gsprings@norwich.edu

FIELD EVIDENCE FOR READVANCES – THE LUZERNE EXAMPLE, DE SIMONE, David J**.**, VT Geological Survey & De Simone Geoscience Investigations, 957 Babcock Lake Rd, Petersburg, NY 12138, hawkeye272david@yahoo.com

WHAT THE CRATON CAN TELL US ABOUT APPALACHIAN TECTONICS FROM IAPETAN OPENING THROUGH THE TACONIC OROGENY, JACOBI, Robert D**.**[1], AGLE, Paul[1], LOEWENSTEIN, Stuart[2], MITCHELL, Charles[1], SMITH, Gerald[2], KIM, Jon[3], GALE, Marjorie[3], and BECKER, Larry[3], (1) Geology, University at Buffalo, Buffalo, NY 14260, rdjacobi@geology.buffalo.edu, (2) Nornew, 1404 Sweet Home Rd, Suite 12, Amherst, NY 14228, (3) Vermont Geological Survey, Waterbury, VT 05671

Respectfully submitted,
Laurence R. Becker, State Geologist

ANNOUNCEMENTS

VERMONT GEOLOGICAL SOCIETY LECTURER PROGRAM

The goal of the Vermont Geological Society Lecturer Program is to offer local colleges, universities, and high schools the opportunity to invite a member of the VGS to speak at their institution on timely topics within the broad realm of earth and environmental sciences. The program is primarily intended to reach those departments which either do not hold a regularly scheduled seminar series or whose finances do not permit them to invite external speakers to present talks on a regular basis. Any costs associated with the Lecturer's travel, lodging, and meals are borne entirely by the Vermont Geological Society.

Jon Kim, Ph.D., Geologist/Environmental Scientist, at the Vermont Geological Survey in Waterbury, Vermont, is our 2008 Lecturer. Jon is offering the following two lecture topics: "Nitrate Contamination of a Bedrock Aquifer in Central Vermont" and "Application of Tectonics to Groundwater Problems in Vermont." For scheduling information, see the Society's website at *www.uvm.org/vtgeologicalsociety/lecturer_program.html*

Stephen Wright, Ph.D., Department of Geology, University of Vermont, will be our 2009 Lecturer.

VGS SUMMER FIELD TRIP

Jon Kim will be leading the summer field trip, with the date and location to be determined later.

STUDENT RESEARCH GRANT APPLICATIONS

Students and secondary school teachers are encouraged to apply to the VGS Research Grant Program by October 1, 2008. Downloadable Research Grant Program applications are available from the Society's website at *www.uvm.org/vtgeologicalsociety/grantpolicy.html*

VERMONT GEOLOGICAL SOCIETY CALENDAR

April 26, 2008:	Spring Meeting, Middlebury College
Summer 2008:	Summer Field Trip *[details TBA]*
October 12-18, 2008:	Earth Science Week
October 5-9, 2008:	Geological Society of America Annual Meeting

Vermont Geological Society
P.O. Box 1224
Saint Albans, VT 05478-1224

ADDRESS CHANGE?
Please send it to the Treasurer at the above address

Vermont Geological Society
Spring Meeting
April 26, 2008, 8:30 AM
McCardell Bicentennial Hall, Room 220
Middlebury College, Middlebury, Vermont

Directions to Middlebury College:

From the town green in Middlebury, take Route 125 west, past the Catholic Church, and up the hill through the College. Go over the crest to the bottom of the hill as it flattens to a valley. Turn right onto Bicentennial Drive and follow the winding driveway to the large parking lot on the west side of McCardell Bicentennial Hall. The meeting will be held in Room 220.