THE GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

VGS Website: http://www.uvm.org/vtgeologicalsociety/

WINTER 2012	VOLUME 39	NUMBER 1

TABLE OF CONTENTS

PRESIDENT'S LETTER

It was a busy Fall between the unplanned Tropical Storm Irene and the long-planned NEIGC meeting hosted by Middlebury College. During the NEIGC it was exciting to see the large turnout for the three days of trips. Please see the State Geologist's Report, below, for more details.

The holidays are behind us and actual winter weather has finally arrived. Now it's time to catch up with your colleagues and friends in the geological community by attending the Winter meeting of the VGS on February 18 here at Norwich University. We'll have talks on a variety of topics, with at least a couple related to Tropical Storm Irene and its aftermath. I hope that many of you will be able to come and listen to the talks and participate in the discussions.

Respectfully submitted,
George Springston, President

TREASURER'S REPORT

The Society remains in good financial health, with a current balance of $3,552.68. Since the last Treasurer's Report in September 2011, we have received income of $60 in dues and $10 in contributions to the Research Grant Program. We have also spent $2,075 as follows:

- a Research Award of $675 to R. Nicholas Daly
- a Research Award of $700 to Diego Russell
- a Research Award of $700 to Emily McDonald

As most of you recognize, dues reminders were not sent out in a timely way, for which I apologize. Forms will be sent shortly for 2012 dues and contributions to the Research Grant Program.

Please join me in welcoming a new member, Matthew Stein, Senior Project Geologist at Sanborn, Head and Associates, Inc.

Respectfully submitted,
David S. Westerman, Treasurer

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

The Advancement of Science Committee received three applications to the Vermont Geological Society Research Grant Program by the October 1, 2011 deadline. Because of delays caused by Hurricane Irene, these grants were not reviewed and awarded until mid-December 2011. The names of the recipients, their affiliations, the titles of their proposals, and the awards are shown below:

-Nicholas Daly, Middlebury College undergraduate student, "Relationship of Bedrock Geochemistry and Groundwater Chemistry in the Fractured Bedrock Aquifer System of the Plainfield Quadrangle, Vermont", $675.00.

-Emily McDonald, Middlebury College undergraduate student, "An Analysis of Radionuclides in the Clarendon Springs Formation: Implications for Water Quality in Highgate, Vermont", $700.00.

-Diego Russell, Middlebury College undergraduate student, "Understanding the Relationship between Arsenic Content and Metamorphic Grade in Cambro-Ordovician Sedimentary and Metasedimentary Rocks in Northern Vermont and Southern Quebec", $700.00.

We look forward to presentations by all of these students at the April VGS Student Meeting

The next Vermont Geological Society Research Grant deadline is April 1, 2012. All applications must be postmarked by this deadline. Applications for Vermont Geological Society Grants should be sent to Jon Kim, Vermont Geological Survey, 103 South Main Street, Logue Cottage, Waterbury, VT 05671-2420.

Respectfully Submitted,
Jon Kim

VERMONT STATE GEOLOGIST'S REPORT

NEW BEDROCK GEOLOGIC MAP GOING TO PUBLICATION!

The long awaited publication of the new Vermont bedrock map is in its final stages. We are planning for a public presentation of the map at the Vermont State House in late March or early April, if all goes well. The Vermont Secretary of the Agency of Natural Resources, Deborah Markowitz, has reached out to the Governor's Office and they are very enthusiastic so we are working to involve the Governor in the presentation. We plan to notify the Society through an e-mail distribution when the time and place are set. The map is to have a 2011 publication date which is 150 years (sesquicentennial) since the first 1861 geologic map of Vermont and 50 years since the 1961 centennial geologic map of Vermont.

There are many accolades to go around when the map is released but let me at least list title information:

Bedrock Geologic Map of Vermont, 2011
By
Nicholas Ratcliffe (USGS), Rolfe Stanley (UVM, posthumous), Marjorie H. Gale (VGS), Peter Thompson (UNH) and Gregory Walsh (USGS)
With contributions by
Norman Hatch (USGS), Douglas Rankin (USGS), Barry Doolan (UVM), Jonathan Kim (VGS), Charlotte Mehrtens (UVM), John Aleinikoff (USGS) and J. Gregory McHone
Cartography by
Linda Masonic (USGS)
Technical Editor
Jim Estabrook (USGS)

Older GMGs on Line
Vermont Geology, Volumes 1-8 and most of the GMGs are now on-line at:
http://www.anr.state.vt.us/dec/geo/VGSociety.htm

Energy – Geothermal Grant First Year
We delivered on the first year of our three year geothermal grant through the U.S. Dept of Energy/Arizona Geological Survey. With the help of PJ Telep in ANR IT, a successful Web Map Service is set-up for the water well data. Database work by Siobhan Perricone (ANR-IT) plus the post-Irene push by Marjorie Gale and Wendy Kelly of the VGS accomplished the work.

We delivered the following via upload to the National Geothermal Data System (NGDS):
10/18/2011- 199 georectified images (87 georeferenced Environmental Geology maps, 58 VGS Bulletin maps and 54 original surficial geologic maps)
11/1/2011 – revised deeper well data metadata from older natural gas exploration; 7 records
11/7/2011 – metadata for digital GIS data uploaded to the NGDS site; 58 records
11/14/2011 – delivered metadata records and web links for miscellaneous mineral resource files
11/16/2011 – delivered metadata for 2700 bibliographic references

New England Intercollegiate Geologic Conference (NEIGC)
The Vermont Geological Survey and colleagues from Middlebury College, Norwich University, University of New Hampshire, and University of Vermont were very active in the recent New England Intercollegiate Geological Conference (NEIGC) hosted by Middlebury College from September 30 – October 2, 2011. The trip citations are listed below.

Dunn, R., Springston, G., and Wright, S., 2011, Quaternary Geology of the Central Winooski Watershed with Focus on Glacial Lake History of Tributary Valleys (Thatcher Brook and Mad River): in West, D., editor, New England Intercollegiate Geological Conference: Guidebook for Field Trips in Vermont and adjacent New York, 103rd Annual Meeting, Middlebury, Vermont, Trip C3, p. C3-1 – C3-32.

Kim, J., Klepeis, K., Ryan, P., Gale, M., McNiff, C., Ruksznis, A., and Webber, J., 2011, A Bedrock Transect Across the Champlain and Hinesburg Thrusts in West-Central Vermont: Integration of Tectonics with Hydrogeology and Groundwater Chemistry: in West, D., editor, New England Intercollegiate Geological Conference: Guidebook for Field Trips in Vermont and adjacent New York, 103rd Annual Meeting, Middlebury, Vermont, Trip B1, p. B1-1 – B1-35.

Springston, G., Dunn, R., Underwood, K., Schiff, R., Sheldon, A., McKinley, D., Donahue, N., and Pytlik, S., 2011, Fluvial Geomorphology of the Middlebury River Watershed: Geologic Controls, Assessment of Stream Channel Stability, and River Corridor Restoration: in West, D., editor, New England Intercollegiate Geological Conference: Guidebook for Field Trips in Vermont and adjacent New York, 103rd Annual Meeting, Middlebury, Vermont, Trip B5, p. B5-1 – B5-23.

Thompson, P., Gale, M., Laird, J., and Honsberger, I., 2011, Transect across the North-Central Green Mountains from the Carbonate Shelf to Ultramafic Slivers in the Taconian Subduction Zone: in West, D., editor, New England Intercollegiate Geological Conference: Guidebook for Field Trips in Vermont and adjacent New York, 103rd Annual Meeting, Middlebury, Vermont, Trip A1, p. A1-1 – A1-27.

West, D., Kim, J., Klepeis, K., and Webber, J., 2011, Classic Bedrock Teaching Localities in the Champlain Valley between Middlebury and Burlington, Vermont: in West, D., editor, New England Intercollegiate Geological Conference: Guidebook for Field Trips in Vermont and adjacent New York, 103rd Annual Meeting, Middlebury, Vermont, Trip C5, p. C5-1 – C5-23.

ANNOUNCEMENTS

ELECTION OF OFFICERS

The Society is looking for nominations for Officers. A slate of candidates will be proposed at the next Executive Committee meeting (Winter Meeting) and ballots will be included in the next GMG. If you are interested in serving please contact George Springston.

WINTER MEETING

The VGS Winter Meeting will be held on February 18th at Norwich University, in Northfield. The meeting will be approximately one half day in length, starting at 9:00 am. We will meet in Cabot 85, which is in the Math/Science complex near Kreitzberg Library.

Abstracts should be prepared using the style employed for abstracts submitted to Geological Society of America meetings (maximum of 2,000 characters without spaces). **Abstract deadline for the Winter Meeting is Friday, February 10th.** Email your abstract to George Springston at (gsprings@norwich.edu).

Oral presentations will be limited to 15 minutes with 5 additional minutes for questions. A computer projection system is available for PowerPoint presentations.

CALL FOR STUDENT ABSTRACTS

SPRING MEETING OF THE VERMONT GEOLOGICAL SOCIETY

The Vermont Geological Society will hold its Spring 2012 meeting on Saturday, April 28th, 2012, at Middlebury College. The meeting is dedicated to students conducting research in the geological sciences. Undergraduate and graduate students are encouraged to submit abstracts outlining the results of their research. Abstracts covering all aspects of the geological sciences are welcome and will be published in the Spring issue of the *Green Mountain Geologist*. The Charles Doll Award for the outstanding undergraduate paper will be presented. Cash awards for the top three papers will also be presented based on quality of the research, the abstract, and the presentation of the paper.

Abstracts should be prepared using the style employed for abstracts submitted to Geological Society of America meetings (maximum of 2,000 characters without spaces). We strongly encourage speakers to send their abstracts electronically as a Word file with a .doc extension attached to an e-mail message to Dave West (dwest@middlebury.edu).

Oral presentations will be limited to 12 minutes with 3 additional minutes for questions. A computer projection system is available for PowerPoint presentations.

Deadline for abstracts: Friday, April 2, 2012 at 5:00 pm

VERMONT GEOLOGICAL SOCIETY CALENDAR

Feb 18:	VGS Winter Meeting, Norwich University (see details above)
April 28:	VGS Spring Meeting, Middlebury College
March 18-20:	Northeast GSA, Hartford, CT

The **Vermont Geological Society** is a non-profit educational corporation.
The **Executive Committee** of the Society is comprised of the Officers, the Board of Directors, and the Chairs of the Permanent Committees.

Officers

President	George Springston	(802) 485-2734	gsprings@norwich.edu
Vice President	Keith Klepeis	(802) 656-0247	kklepeis@uvm.edu
Secretary	David West	(802) 443-3476	dwest@middlebury.edu
Treasurer	David Westerman	(802) 485-2337	westy@norwich.edu

Board of Directors

Richard Dunn	(802) 485-2304	rdunn@norwich.edu
Les Kanat	(802) 635-1327	les.kanat@jsc.edu
Jon Kim	(802) 241-3469	jon.kim@state.vt.us

Chairs of the Permanent Committees

Advancement of Science	Jon Kim
Geological Education	Christine Massey
Membership	David Westerman
Public Issues	Laurence Becker
Publishing	Richard Dunn

Vermont Geological Society
Department of Geology and Environmental Science
Norwich University
Northfield, VT 05663

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

Green Mountain Geologist, Quarterly Newsletter of the Vermont Geological Society
Vol. 39, no. 1

THE GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

VGS Website: http://www.uvm.org/vtgeologicalsociety/

SPRING 2012	VOLUME 39	NUMBER 2

The Vermont Geological Society's
Spring Meeting

April 28, 2012, 8:15 AM
McCardell Bicentennial Hall, Room 220
Middlebury College, Middlebury, Vermont

TABLE OF CONTENTS

2012 SPRING MEETING PROGRAM

8:15 AM COFFEE & REFRESHMENTS

8:45 AM Flora Weeks: MULTIFACETED ANALYSIS OF DRIFT B, LAKE CHAMPLAIN

9:00 AM Nicole Shufelt and Greg Druschel: PHOSPHORUS MOVEMENT AND REDOX FRONT MIGRATION AT THE SEDIMENT WATER INTERFACE IN SEDIMENT CORES (MISSISQUOI BAY, LAKE CHAMPLAIN)

9:15 AM Sandra Cronauer and Stephen Wright: MILLER BROOK INCISION HISTORY, NORTHWESTERN VERMONT

9:30 AM John Filoon: A HYDROLOGIC, STRUCTURAL, AND CARTOGRAPHIC ANALYSIS OF GROUNDWATER IN THE VICINITY OF THE CHAMPLAIN AND HINESBURG THRUSTS, WEST-CENTRAL VERMONT

9:45 AM Abigail Ruksznis, Jon Kim, Keith Klepeis, and Laura Webb: INTEGRATION OF STRUCTURAL ANALYSIS, AN EMI SURVEY, AND HYDROGEOLOGY IN THE PLAINFIELD QUADRANGLE, CENTRAL VERMONT

10:00 AM Emily McDonald, Peter Ryan, and Jon Kim: AN ANALYSIS OF RADIO-NUCLIDES IN THE CLARENDON SPRINGS FORMATION: IMPLICATIONS FOR WATER QUALITY IN HIGHGATE, VT

10:15 AM Nick Daly: RELATIONSHIP OF BEDROCK GEOCHEMISTRY AND GROUNDWATER CHEMISTRY IN THE FRACTURED BEDROCK AQUIFER SYSTEM OF THE PLAINFIELD QUADRANGLE, VERMONT

10:30 AM BREAK

10:45 AM Diego Russell, Peter Ryan, and Jon Kim: EVIDENCE FOR THE RELATIONSHIP BETWEEN ARSENIC AND METAMORPHIC GRADE AND IMPLICATIONS FOR BEDROCK AQUIFER GEOCHEMISTRY

11:00 AM Christine McNiff, Keith Klepeis, Laura Webb, and Jon Kim: GEOMETRIC VARIABILITY AND SPATIAL EXTENT OF AN ACADIAN DOME AND BASIN FOLD INTERFERENCE PATTERN IN NW VERMONT

11:15 AM Megan Scott: THE STRATIGRAPHY, LITHOFACIES, AND DEPOSITIONAL ENVIRONMENT OF THE MIDDLE ORDOVICIAN MIDDLEBURY FORMATION

11:30 AM Amanda Northrop and Char Mehrtens: USE OF LITHIUM HETERO-POLYTUNGSTATE HEAVY LIQUID IN CONDONT MICROFOSSIL

RECOVERY FOR BIOSTRATIGRAPHY FROM THE MIDDLEBURY FORMATION (MIDDLE ORDOVICIAN) OF WEST CENTRAL VERMONT

11:45 PM Alyssa Anderson: LOW-TEMPERATURE THERMOCHRONOLGY AND THE TOPOGRAPHIC EVOLUTION OF THE WHITE MOUNTAINS, NEW HAMPSHIRE

12:00 PM Franklin Hobbs and Peter Ryan: MINERAL REACTION PATHWAYS AND RATES IN A TROPICAL SOIL CHRONOSEQUENCE, NICOYA PENINSULA, COSTA RICA

12: 15 PM Britty Barrett: INTERPRETING THE GEOMORPHOLOGY AND HYDROLOGIC HISTORY OF DEVIL'S CORRAL, IDAHO

12:30 PM JUDGING & AWARDS PRESENTATION

ABSTRACTS

MULTIFACETED ANALYSIS OF DRIFT B, LAKE CHAMPLAIN

Flora Weeks, Geology Department, Middlebury College, Middlebury, VT 05753

Two lacustrine sediment drifts were located in Lake Champlain. Oceanic sediment drifts contain a nearly continuous sediment record, therefore providing significant paleoclimate data, which has been utilized in marine environments for decades. With few documented lacustrine sediment drifts, these Lake Champlain datasets will contribute new paleoclimate data for this lacustrine environment and continental NE North America since ~14K BP. Seismic profiles show that both Drift A and Drift B are built atop the same sediment package, indicating that they are very similar in age. Drift B was studied in the summer of 2011 using a Compressed High Intensity Radar Pulse (CHIRP) survey of 28 seismic lines, four piston cores, and five subsurface moorings equipped with Acoustic Doppler Current Profilers (ADCPs), temperature sensors, sediment traps, and Laser Suspended Sediment Sensors (LISSTs). Drift B is located atop a structural high and classified as a detached elongate drift. The sedimentation rates range between 0.10-0.13 cm/yr utilizing sediment trap accumulations. Back calculating an accumulation rate from the maximum thickness of 12m on the drift and using the base age of Drift A (8,700 yrs), results in a similar rate of 0.14 cm/yr. The LISSTs recorded higher volumes of sediment and finer grains on the west side of the drift, as compared to the east. This sediment distribution is potentially due to high velocity currents recorded on the east side of the drift (maximum: 54.6 cm/s). The center of the drift had the lowest maximum velocity (35.8 cm/s), making it conducive to sedimentation. Velocity differences across the drift are explained by impingement due to bathymetric highs north of the drift region. In all cores taken from within Drift B, the sediment properties were relatively consistent, with fairly poorly sorted grains of with mean grain sizes in the fine silt range (10-25 microns), and olive grey in color. These properties echo the general characteristics of Lake Champlain sediments. The sedimentation within Drift B provides information on the past 8,700 years of Lake Champlain's climatic history and provides a baseline from which to examine current and future climate changes.

PHOSPHORUS MOVEMENT AND REDOX FRONT MIGRATION AT THE SEDIMENT WATER INTERFACE IN SEDIMENT CORES (MISSISQUOI BAY, LAKE CHAMPLAIN)

Nicole Shufelt, Geology Department, University of Vermont, Burlington, VT 05446, and
Greg Druschel, Indiana University-Purdue University, Indianapolis, IN

Eutrophication, due to internal and external loading of nutrients, is a serious problem for Lake Champlain as cyanobacteria blooms dominate the ecosystem. Cyanobacteria blooms are able to influence their environment by creating anoxia in the water column, which can lead to a migration of the redox front (the boundary between oxic and anoxic conditions) out of the sediment and into the water column. Under oxic conditions at the sediment water interface (SWI,) phosphorus is sorbed to the iron oxides at the sediment surface. When the redox front migrates out of the sediment and into the water column, the iron oxides are broken down into soluble Fe (II) and the previously sorbed phosphorus is released into the water column. This can allow for an uptake of the limiting nutrient phosphorus by the bloom and result in a growth of the bloom. In order to observe this internal nutrient loading, experiments were done on sediment cores collected from the bloom prone Missisquoi Bay. These cores were manipulated by controlling headspace gas levels to provoke movement of the redox front across the SWI. Microelectrodes were used to determine the location of the redox front and the concentration of several dissolved ion species (O_2, Mn and Fe (II).) The mesocosm experiments showed that while the water column is oxygenated lower SRP and TP values were found due to phosphorus sorbing to the iron oxides in the sediment. Anoxia in the water column resulted in higher SRP and TP values in the overlying water column as the phosphorus was released from the iron oxide particles at the sediment surface.

MILLER BROOK INCISION HISTORY, NORTHWESTERN VERMONT

Sandra Cronauer and Stephen Wright, Geology Department, University of Vermont, Burlington, VT 05405

The Miller Brook Valley in northwestern Vermont is an eastward trending valley containing ice-contact and lacustrine sediments deposited during and after the retreat of the Laurentide ice sheet. Previous research suggests ridges in this area are esker deposits and that lacustrine deposits are from Glacial Lake Winooski. This study focuses on understanding the complex incision history of Miller Brook following the retreat of the ice sheet and draining of Glacial Lake Winooski using a detailed geomorphic map of terraces in a 0.3 km^2 area and the use of ground penetrating radar (GPR). The map was created with latitude, longitude, and elevation data collected by a GPS unit of approximately 5 meter accuracy. GPR was used along accessible landforms in an attempt to image subsurface geometries and examine the utility, penetration depths and resolution of GPR in different types of glacial materials. GPR transects were taken across a number of landforms including esker ridges, fluvial terraces incised into ice-contact sediments, and two possible lacustrine terraces. Profiles were taken using GSSI 200 and 400 MHz antennas accessed through the University of Vermont Geology Department. A profile over a lacustrine terrace showed reflectors reminiscent of what may be deltaic deposits. One transect along a road built on an esker ridge showed signs of curved reflectors that may indicate a channel cutting across it or sediments draped over underlying structures. Parabola curves change throughout some profiles suggesting that there are transitions in material type along transect. As would be expected for poorly sorted materials, the fluvial terraces incised into the ice-contact

sediments did not show continuous, well defined reflectors. When comparing the antennas the 200 MHz equipment was able to penetrate deeper than the 400 MHz could. Mapped terraces suggest that during incision the esker played a part in determining where stream channels flowed over time. Miller Brook currently loops around the large esker on its south side and it may have been dammed before breaking through and eroding sediment to create gaps between the ridges.

A HYDROLOGIC, STRUCTURAL, AND CARTOGRAPHIC ANALYSIS OF GROUNDWATER IN THE VICINITY OF THE CHAMPLAIN AND HINESBURG THRUSTS, WEST-CENTRAL VERMONT

John Filoon, Geology Department, Middlebury College, Middlebury, VT 05753

Multiple studies have shown that bedrock-derived groundwater contamination is a concern in some areas of Vermont, mainly in fractured bedrock aquifers composed of metamorphic rocks that house radionuclides and trace metals. The bedrock aquifer system in the vicinity of Hinesburg, Vermont has recently undergone numerous geochemical evaluations that indicate locally elevated uranium and alpha radiation, but little is known about the physical hydrology, particularly recharge and productivity. This project investigates the relationship between the region's structural characteristics and its groundwater flow patterns via several techniques.

Lineament and fracture correlation, determination of the potentiometric surface, and recharge analyses were all carried out using ArcGIS and freely available data. These analyses confirmed recent findings that suggested the bedrock aquifers of the upper plate of the Hinesburg Thrust are much less productive than those of the lower plate. Areas of with a high concentration of lineaments and/or course stratified drift were found to be extremely important in terms of local recharge, though high yield areas were often found to be located down the potentiometric gradient from these sites.

Groundwater samples retrieved from around the Hinesburg Thrust underwent CFC testing to determine the recharge ages of various parts of the aquifer. Results from this testing has revealed that water drawn from wells on either side of the thrust infiltrated the aquifer ~29 years ago, while wells that pierce the thrust contain water that infiltrated the aquifer ~38 years ago. These results alone offer insignificant evidence to determine flow patterns around the thrust fault, so recent geochemical data was investigated as well.

INTEGRATION OF STRUCTURAL ANALYSIS, AN EMI SURVEY, AND HYDROGEOLOGY IN THE PLAINFIELD QUADRANGLE, CENTRAL VERMONT

Abigail Ruksznis, Geology Department, University of Vermont, Burlington, VT 05446, Jonathan Kim, Vermont Geological Survey, Waterbury, VT 05671, Keith Klepeis and Laura Webb, Geology Department, University of Vermont, Burlington, VT 05446

The Plainfield 7.5’ Quadrangle lies on the western side of the Connecticut Valley Trough (CVT)- a post-Taconian (Ordovician) extensional basin that was filled in with Silurian-Devonian sedimentary and volcanic rocks. The basin was deformed and metamorphosed during the Devonian Acadian Orogeny, and later intruded by post-orogenic granitoids of the New Hampshire Plutonic Series (NHPS). From oldest to youngest, the rocks in the field area consist of interlayered gray phyllites and impure marbles (Waits River Fm), interstratified gray phyllites

and phyllitic quartzites (Gile Mt. Fm), and biotite granites (NHPS). The Waits River Fm is further divisible into members with thick (DSwt) and thin (DSwl1) marbles, respectively. The degree of metamorphism ranges from biotite- staurolite grade.

We observed three distinct sets of topographic lineaments: the first set follows the dominant bedding-parallel cleavage (S1) that is pervasive in all metasedimentary lithologies. The second set follows the less prominent NW/SE trending fracture set. The third set follows E-W fractures that are orthogonal to the dominant foliation (S1). Whereas all three lineament sets are clearly expressed in the Waits River Fm, lineaments in the Gile Mt. Fm are dominantly E-W.

Because previous Electromagnetic Induction (EMI) surveys in an adjacent quadrangle showed a strong connection between brittle and ductile structures and groundwater flow, we conducted detailed (1:4000) EMI in specific areas of the Waits River Fm. These surveys demonstrated a direct correlation between linear zones of high conductivity and ~E-W fracture sets suggesting the fractures may be groundwater pathways. Both M-folds and Z-folds were identified in the EMI plots and correlated to locations on a cross section of the area, further evidencing the asymmetric east verging F2 fold geometry. It is hypothesized that the folds are most distinguishable in the surveys taken on days when the ground was not saturated because subtle variations in conductivity are easier to recognize.

These studies were summarized in a 3D conceptual model representative of the bedrock hydrogeology of the DSwt formation. The three scenarios of maximum yield were identified as: 1) down plunge of an F2 fold, 2) into a fractured marble member, or 3) into any thick marble unit with high porosity.

AN ANALYSIS OF RADIONUCLIDES IN THE CLARENDON SPRINGS FORMATION: IMPLICATIONS FOR WATER QUALITY IN HIGHGATE, VT

Emily C. McDonald, Peter Ryan, Geology Department, Middlebury College, Middlebury, VT 05753, and Jon Kim, Vermont Geological Survey, Waterbury, VT 057671

Groundwater produced from fractured bedrock of the Clarendon Springs Formation is enriched in uranium and alpha radiation in some areas of northwestern Vermont, but this issue has not been examined in all areas where the Clarendon Springs Formation occurs. Previous research by the Vermont Geological Survey in Chittenden County has indicated that the radioactivity in the Clarendon Springs Formation is associated with ‘black-chip’ breccia horizons that are speculated to be rich in U-bearing phosphorite minerals. NURE surveys from the 1970s identified uranium anomalies associated with the Clarendon Springs Formation in Franklin Country of northwestern-most Vermont, but no systematic study of bedrock and well water chemistry has been performed in this area. Accordingly, the purpose of this study is to determine if the concentration and distribution of radioactivity in the Highgate area is confined to the Clarendon Springs breccia horizons and whether or not the radioactivity is being mobilized into drinking water, resulting in elevated uranium and/or gross alpha in private bedrock wells.

61 bedrock samples have been collected across the Highgate area of the Clarendon Springs Formation as well as other formations. Using both ICP-AES and ICP-MS, geochemical data indicates a correlation between uranium concentration and phosphorus content particularly in localized Clarendon Springs Formation black chip breccias near the Vermont-Quebec border.

For example, bedrock in this area contains up to 9.85 % P_2O_5 and 79.6 ppm uranium. XRD analysis shows that the U rich phosphorite mineral in the black chip breccia in this area is flouroapatite. 27 domestic water samples were collected and 25 % contain elevated gross alpha (between 5 to 19 pCi/L).

We speculate that syndepositional tectonics that produced the down-dropped Franklin Basin in late Cambrian time led to the deposition of U-rich phosphorite minerals through marine upwelling currents that occur in the black chip breccias. Current research is examining mineralogy, mineral textures and chemistry by a combination of XRD, SEM-WDS and ICP-AES/MS in order to better understand the speciation of U in these rocks.

RELATIONSHIP OF BEDROCK GEOCHEMISTRY AND GROUNDWATER CHEMISTRY IN THE FRACTURED BEDROCK AQUIFER SYSTEM OF THE PLAINFIELD QUADRANGLE, VERMONT

Nick Daly, Geology Department, Middlebury College, Middlebury, VT 05753

Several studies over the past 5-10 years have demonstrated elevated levels of naturally occurring radionuclides and other contaminants in groundwater wells that tap the deep fractured bedrock aquifer systems in Barre, Marshfield and Peacham, Vermont. Many of these wells are completed in the Knox Mountain pluton, a large igneous intrusion. These studies implicate this rock unit as the likely source of contamination. This study uses a multidisciplinary approach to assess: (1) the groundwater chemistry and bulk rock geochemistry in the adjacent Plainfield and Montpelier Quadrangles; and (2) the lithologic, hydrologic and hydrogeologic factors controlling water chemistry and groundwater flow in this fractured bedrock system.

The bedrock geology of the study area was mapped in detail over the last year, and wells in the study area tap into three main units: (1) thick bedded Waits River Fm. (predominately impure marbles with minor phyllitic members); (2) thinly bedded Waits River Fm. (same as previous); and (3) Gile Mountain Fm. (phyllites with minor carbonate beds).

Twenty private wells were sampled representing the three main rock units. Each water sample was tested for a suite of metals, non-metals, anions, gross alpha (GA; test for radioactivity), temperature, pH, conductivity and oxidative reduction potential. Of the private wells tested in the study area, two samples demonstrated GA at or above the Vermont Department of Health action level of 5 pCi/L; which recommends further testing for radionuclides. Neither of these wells contained Gross Alpha above the EPA maximum contaminant level (MCL) of 15 pCi/L. Three of the twenty wells exceeded the secondary standard of 50ppb for manganese levels.

Gross Alpha levels did not correlate to one unit. Manganese levels are not unique to one formation and do not necessarily correlate to increases in GA. High well yields, and low residence times likely contribute to the observed low contaminant levels in this fractured aquifer system.

EVIDENCE FOR THE RELATIONSHIP BETWEEN ARSENIC AND METAMORPHIC GRADE AND IMPLICATIONS FOR BEDROCK AQUIFER GEOCHEMISTRY

Diego Russell, Peter Ryan, Geology Department, Middlebury College, Middlebury, VT 05753, and Jon Kim, Vermont Geological Survey, Waterbury, VT 05671

In northern New England and southern Quebec, elevated naturally-occurring As levels have been reported in bedrock wells completed in slates of the Taconic Allochthons (VT) and Central Maine Belt (ME), ultramafic rocks of the Rowe-Hawley Belt (VT), contact zones for granitic intrusions (NH and ME), and low grade metasedimentary rocks of the Connecticut Valley Trough (CVT) in Quebec. The most common lithologic sources of arsenic in Vermont bedrock aquifers is 1) authigenic pyrite which initially formed in geochemically-reduced marine sediments that have been lithified into shales or chlorite grade slates and 2) serpentine-group minerals in ultramafics. Through the plate tectonic cycle, marine shales may either be subducted or thrust onto a continental margin during orogenesis; in either case, the As may initially be metasomatically liberated during metamorphism and then resequestered (i.e. in ultramafics). Through the detailed geochemical analysis of rocks of different metamorphic grades in the Taconic Allochthons and CVT, we will assess the role that metamorphism plays in As mobility.

For example, low-grade slates (chlorite-illite) of the Giddings Brook slice in the Taconic Allochthons contain an average of 44.44 mg/kg As and 33 % of bedrock wells contain > 10 ppb As; by contrast, higher grade slates and phyllites (paragonite-chlorite-muscovite) of the Bird Mountain slice contain an average of 3.59 mg/kg As and only 4 % of wells contain > 10 ppb As. In the Rowe Hawley belt, biotite grade metapelites contain low concentrations of As (7 mg/kg) whereas ultramafics within the same belt have elevated As levels (93 mg/kg), suggesting that As was transferred from metapelites to ultramafics during subduction zone metamorphism and serpentinization.

Thus, based on these results, we hypothesize that for two pelitic rocks of initially equal arsenic concentration, the rock exposed to the greater degree of metamorphism will have a lower arsenic concentration. We are currently evaluating the As content of metapelites and metapsammites of the CVT (Gile Mountain Fm and Waits River Fm of VT) as a function of metamorphic grade and proximity to granitic intrusions of the New Hampshire Plutonic series. Existing data from biotite grade rocks of the CVT in Vermont indicate average arsenic concentration of 7 mg/kg; chlorite zone rocks from the Taconics contain 44 ppm As, whereas garnet and staurolite zone lithologies contain no detectable As. These data are compelling evidence for the influence of of prograde metamorphism on As in metapelites.

GEOMETRIC VARIABILITY AND SPATIAL EXTENT OF AN ACADIAN DOME AND BASIN FOLD INTERFERENCE PATTERN IN NW VERMONT

Christine McNiff, Keith Klepeis, Laura Webb, Geology Department, University of Vermont, Burlington, VT 05446, and Jon Kim, Vermont Geological Survey, Waterbury, VT 05671

Two east-dipping thrust faults that formed during the Ordovician Taconian Orogeny divide the bedrock geology of Vermont's Champlain Valley into lithotectonic slices. On the west, the Champlain thrust (CT) placed M. Cambrian – M. Ordovician sedimentary rocks over L. Cambrian – M. Ordovician sedimentary rocks. Farther east, the Hinesburg Thrust (HT) placed L. Proterozoic – E. Cambrian chlorite-sericite grade metamorphic rocks over rocks above the

CT. Subsequent deformation during the Devonian Acadian Orogeny resulted in the folding of both faults and other Taconian structures. Previous work recognized two sets of open, upright folds— a N-S-trending, asymmetric, open-tight fold set (F_3) and an E-W-trending, open fold set (F_4)— that create a dome and basin fold interference pattern. We report on the spatial extent and variable geometry of this pattern between the towns of Milton and Williston with the goal of understanding how it formed and its significance.

The dome and basin pattern is best developed in chloritic schists in the upper plate of the HT. This trend may reflect the presence of mica-rich lithologies, which are relatively weak and easily deformed. At Colchester Pond and central Williston, F_3 and F_4 are equally displayed. The folds trend N-S and E-W, respectively, and are associated with two steeply dipping, orthogonal crenulation cleavages (S_3, S_4) and related crenulation lineations (L_3, L_4). Between these locations, however, the two folds sets are not orthogonal. In Essex Junction, near the leading edge of the HT, F_3 is dominant whereas F_4 is weakly developed. Orientations also are different: S_4 is weak and strikes ESE whereas S_3 is penetrative and strikes to the north. The L_3 and L_4 lineations also form an oblique angle, suggesting they were rotated as F_4 folds formed. These observations suggest that the two folds sets formed approximately at the same time. Geometric changes toward the leading edge of the HT also raise the possibility that the pattern formed by an Acadian reactivation of the HT.

Ongoing analysis seeks to further resolve the relative ages and three dimensional geometry of the fold sets along strike of the thrust belt and resolve whether they reflect an Acadian reactivation of the HT.

THE STRATIGRAPHY, LITHOFACIES, AND DEPOSITIONAL ENVIRONMENT OF THE MIDDLE ORDOVICIAN MIDDLEBURY FORMATION

Megan Scott, Geology Department, University of Vermont, Burlington, VT 05446

The Middlebury Formation is a Middle Ordovician limestone deposited on the margin of Laurentia during the collision of the Ammonoosuc Arc with Laurentia. The field area for this study includes the towns of Middlebury and Orwell, Vermont. Cross sections from both the northern and southern part of the field area are characterized by north trending tight asymmetric folds dissected by thrust faults. These geometries are part of a larger structure, the Middlebury Synclinorium. The thickness of the Middlebury Formation within the synclinorium can be up to 800 feet. The cross sections enable the placement of each outcrop in its relative stratigraphic position. The motivating questions for this project include: what depositional environment do the lithofacies of the Middlebury Formation represent and how does the stratigraphy of the Middlebury Formation reflect tectonic processes, if at all? Six lithofacies are present in the Middlebury Formation. The dominant lithology is a gray laminated mudstone. On the basis of field observations and petrography, well sorted quartz sand grains and recrystallized allochems are identified in the heavily bioturbated mudstones, which is interpreted to record deposition in a lagoonal setting on a restricted marine platform.

USE OF LITHIUM HETEROPOLYTUNGSTATE HEAVY LIQUID IN CONDONT MICROFOSSIL RECOVERY FOR BIOSTRATIGRAPHY FROM THE MIDDLEBURY FORMATION (MIDDLE ORDOVICIAN) OF WEST CENTRAL VERMONT

Amanda Northrop and Char Mehrtens, Geology Department, University of Vermont, Burlington, VT 05446

During the Middle Ordovician (~480-450 mya), what is now western New England was a tropical continental shelf. The shelf, subjected to tectonic forces originating to the east during the Taconic Orogeny (~460 mya), was fragmented and moved through a variety of bathymetries before finally being buried beneath ocean muds. The overall timing of the orogeny has been fairly well constrained; however, specific timing of its onset is less well constrained. The Middlebury Formation, a rock unit comprised of multiple limestone and dolostone layers in west-central Vermont, was deposited on the eastern portion of the shelf. The presence or absence of evidence of faulting in the Middlebury formation can give a more constrained age to the Taconic Orogeny if the absolute age of the formation is known. To date, studies have yielded only a relative age of the Middlebury Formation. In my study, I attempted to use fossil biostratigraphy in order to determine the absolute age of the Middlebury Formation by identifying conodont species within the Middlebury Formation and surrounding rock units and comparing those conodont species to species found in rock units of known age. I collected 30 two kilogram samples from the Middlebury, Glens Falls, Crown Point and Beekmantown Formations, crushed them to 1cm fragments, dissolved them in dilute acetic acid and used heavy liquid separation in order to extract and identify conodont fossils. I used lithium heteropolytungstates, a new and less toxic heavy liquid, and a major outcome of my study was refinement of the separation protocol. My samples yielded few, highly fragmented and unidentifiable conodonts and consequently, I was unable to assign an absolute age to the Middlebury Formation.

LOW-TEMPERATURE THERMOCHRONOLGY AND THE TOPOGRAPHIC EVOLUTION OF THE WHITE MOUNTAINS, NEW HAMPSHIRE

Alyssa J. Anderson, Geology Department, Middlebury College, Middlebury, VT 05753

Are the White Mountains we see today the eroded remnants of old Paleozoic orogenies, or are they the result of accelerated exhumation occurring during the Mid-Miocene or at the onset of Northern Hemisphere glaciation? The purpose of this project is to examine the topographic evolution of the White Mountains, NH using low-temperature thermochronometry. Samples from a ~3,000 ft drill core of Conway granite from Conway, NH were analyzed using apatite (U-Th)/He dating and $^{4}He/^{3}He$ thermochronometry. Lab results were compared to AHe ages computed from *t*-T paths produced by Pecube, a numerical model that simulates crustal heat transfer with changing topography. Modeled AHe ages indicate that the effect of grain size must be taken into account when interpreting results from the region. AHe ages ranged from ~126 Ma at 0.515 km elevation to ~52 Ma at the base of the core. The AHe ages of the core samples are the youngest ages reported in the region, yet the $^{4}He/^{3}He$ profiles show that samples did not pass through the apatite He PRZ recently enough to record Mid-Miocene or glacial exhumation. AHe ages and model results indicate that one possible exhumation history for Conway, NH involves slow erosion, 0.009 km/myr, from 180 to 75 Ma followed by a period of accelerated erosion, 0.045 km/myr, from 75 to 50 Ma and a return to slow erosion, 0.01 km/myr, from 50 Ma to the

present day. Given these erosion rates, ~2.57-2.7 km of rock has been exhumed over the past 180 Ma. Passage over the Great Meteor Hotspot is interpreted to be the driving factor behind this Late Cretaceous-Early Paleocene accelerated exhumation at which time a close approximation of the modern topography likely developed.

MINERAL REACTION PATHWAYS AND RATES IN A TROPICAL SOIL CHRONOSEQUENCE, NICOYA PENINSULA, COSTA RICA

Franklin W.C. Hobbs, and Peter Ryan, Geology Department, Middlebury College, Middlebury, VT 05753

Chemical weathering and strong leaching in moist tropical environments tend to produce kaolinite-rich soils that are depleted in base cations characterized by low Si:Al ratios. These soils often reach steady state conditions within 100 – 200 ka; however, the rates and pathways to these steady state clay conditions can be varied and often consist of intermediate/metastable minerals such as smectite and/or interstratified kaolin-smectite (K-S) phases. Some studies have observed that, with increasing soil maturity, metastable smectite transitions to interstratified K-S phases which in turn give way to kaolinite or halloysite. The rates and pathways of such reactions are important for understanding nutrient cycling in tropical soils as well as to applying understanding of reaction rate to interpreting landscape evolution (e.g. uplift rates). The field area for this study, the southeastern tip of the Nicoya Peninsula in northwestern Costa Rica, provides an ideal environment for the study of soil chronosequences due to the terraced landscape produced by uplift associated with subduction at the Mid-America Trench.

Accordingly, the purpose of this study is to examine the mineralogy and geochemistry of parent materials (beach deposits) as well as soils on uplifted beach terraces with a particular focus on determining reaction rates and sequences of mineral reactions as well as details of clay mineral structures. Preliminary X-ray diffraction results indicate a full weathering sequence from parent materials rich in rock and fossil fragments to 10 ka soils rich in pedogenic smectite with relict primary minerals (including calcite) to a kaolin-dominated assemblage in 80 to 125 ka soils. Intermediate age soils show evidence of interstratified kaolinite-smectite, and Fourier-transform infrared analysis data demonstrate a decreasing Si:Al ratio consistent with the breakdown and leaching of tetrahedral layers in the transition of parent materials to smectite to K-S to kaolin. Quantification of %K using DTA-TG and XRD has revealed a delay in the smectite to kaolinite transitions followed by the rapid silica tetrahedral leaching to a steady state kaolinite-rich soil. The resulting stair-step weathering pathway hopes to be explained through leachate buffering by interlayer cations and amorphous aluminosilicates.

INTERPRETING THE GEOMORPHOLOGY AND HYDROLOGIC HISTORY OF DEVIL'S CORRAL, IDAHO

Brittany Barrett, Geology Department, Middlebury College, Middlebury, VT 05753

Much ambiguity surrounds the geomorphology and hydrology of the Snake River Plain (SRP) in southern Idaho. Many geomorphic features on the SRP are attributed to the Pleistocene Bonneville flood that drastically reconfigured the landscape. Several enigmatic canyons along the Snake River canyon wall are unique due to the absence of drainage systems or modern rivers

flowing through them. Devil's Corral is an especially interesting canyon because it contains a huge number of angular boulders that cover the canyon floor. It is debated whether the canyon formed during the Bonneville megaflood at ~17.5 kyr, or during a pre-Bonneville flood event.

Through field mapping, boulder measurement, and cosmogenic ^{3}He analysis, this study shows that the current canyon geometry was formed during the Bonneville flood event. Boulder measurements compared with estimates of peak shear stresses during the flood show that much of the present canyon geometry can be attributed to plucking of boulders during flood recession.

PRESIDENT'S LETTER

By the time you read this, the new *Bedrock Geologic Map of Vermont* will have been unveiled at a Montpelier ceremony. It's the work of a couple of generations of dogged researchers and will certainly serve as a springboard for future research into the geology of our state. The term "map" used to be simple and easy to understand. A map was "a drawing or representation, usually on a flat surface, of part or all of the surface of the earth...indicating a specific group of features, as land masses, countries...." (Random House Dictionary of the English Language, unabridged edition, 1967). In most cases, it was printed on a piece of paper. That was it. It existed in one form at one scale. If you wanted a copy you traced the paper map, photographed it, or crammed it onto the bed of a copy machine.

The technology of map production has, of course, changed greatly over the years. The 1861 *Geologic Map of Vermont* was printed via the lithography process using a specially prepared slab of limestone (a process that is exquisitely appropriate for a geologic map!). The framed copy on my wall at home is colored, but those colors came via the painstaking hand-application of watercolors to the black-and-white lithographic print (I'd like to know what nameless person did this work and how much they got paid per map). The 1961 *Centennial Geologic Map of Vermont* was compiled and drafted by hand and then printed in full color by means of four-color printing from separates produced by wet photographic processes. The newest map was produced using the latest digital technology and it "exists" in both the hard copy form of the printed paper maps but also (and perhaps primarily) as digital files.

This introduction of the digital version is perhaps the greatest change of all. Many of us already make heavy use of such digital map files in our geographic information systems, and I would be the last one to say that they are not immensely versatile, but I do think something is lost if we give up on having complete, stand-alone maps which can be spread out on a table and pored over. With the big maps it's all there--you can't get away from the big picture, even as you peer in at the details of a small area. The big paper maps enable your eye to roam around and explore intriguing parts you didn't know you were looking for. I hope that the future will still hold some room for these great monuments to the geologist's and the printer's science and craft. At the very least, we will have this grand geologic and cartographic product to treasure for many years to come.

On a more mundane note, we have a Geological Society to run. In the last newsletter I stated that we would have an Executive Committee meeting prior to the upcoming Spring Meeting. It looks like that will have to be postponed until after the Spring meeting. We need nominations for

officers and need to plan out spring and perhaps fall field trips. Above all, we truly need to get more of our members involved in running the society. If you can devote a little time to helping the organization, it will be much appreciated! I hope to see many of you at the Spring meeting.

Respectfully submitted, George Springston

ANNUAL MEETING MINUTES

The Executive Committee did not meet over the Winter.

TREASURER'S REPORT

The Society continues to find itself good financial health, thanks to the generous support from its members. Cash on hand as of April 15 is balance of $6,154.50. Dues for 2012 were solicited late, and to date we have received $1,270 with a number of prominent members still in arrears. (You know who you are, and that stamped envelope is on the refrigerator). We have also received $610 in contributions to the Research Grant Program. We have also spent $243.20 on mailing with a substantial inventory of "forever" stamped envelopes on hand.

Please join me in welcoming the following new members:

Will Amidon, Middlebury College
Cynthia Norman, Lake Champlain Basin Program
Paul Wagenhofer, New Zealand Oil and Gas
John Moore, George Mason University
Jeff Pelton, retired – (welcome back Jeff)
Dagan Murray, Lincoln Applied Geology, Inc.
Peter Valley, USGS

Respectfully submitted, David S. Westerman, Treasurer

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

The committee received no research grant applications for the April 1st deadline.

Previous VGS research grant recipients Nick Daly, Emily McDonald, and Diego Russell (all from Middlebury College) will present their work at the 2012 VGS spring meeting on Saturday April 28th.

We are currently looking into the possibility of running a summer VGS field trip that will integrate bedrock and surficial geology and ecology/botany in the Plainfield Quadrangle (parts of the towns of Calais, East Montpelier, Marshfield, Plainfield). Details to follow in the summer GMG.

Respectfully Submitted, Jon Kim

VERMONT STATE GEOLOGIST'S REPORT

The Governor brought the presentation of the New State Bedrock Geologic Map into his Executive Office in the State House on April 11, 2012. Approximately 40 people from the geologic and interested community trooped in to hear the presentation with the State House Press Corps in attendance. He noted that "Every 50 years or so something big happens, this is one of them".

Please see various documents below that relate to this exciting day.

I wanted to make special commendation for Marjorie Gale's work on behalf of the Vermont Geological Survey and the citizens of Vermont. One cannot say enough about her commitment, her science, her ability to balance and illuminate the geologic ideas that are represented on the Map especially in Northern VT. She served as a conduit for the Vermont Survey and UVM authors and contributors bringing their submissions to the final map while working the compilation between USGS primarily in southern VT and the VGS and the University in northern VT. Peter Thompson, now at UNH, gave much of his time and effort over the years in field mapping and as an author. He like Marjorie is a link to the legacy of Rolfe Stanley. Jon Kim contributed his mapping from the many projects he has undertaken in Vermont since his arrival in 1996.

Our USGS partners put years of work into the product led by Nick Ratcliffe. As lead author he was ultimately responsible for the compiled and integrated product along with his co-authors. He has been involved since the beginning bringing his geologic ideas up from mapping in the Massachusetts Precambrian in the 1980's covering countless outcrops in the subsequent years to get us to the final map.

Charlotte Mehrtens as present day UVM faculty and contributor of geology maps from the Champlain Valley represented the University at the event with Barry Doolan in attendance. They are also the link to Rolfe Stanley a mentor to many and a posthumous author.

More below:

<u>Acknowledgements for Agency of Natural Resources Secretary Deborah Markowitz Introduction</u>

The Map before us is a cooperative project between the Agency of Natural Resources/ Vermont Geological Survey, the United State Geological Survey, the University of Vermont and other academic partners – published by the USGS in Cooperation with the Vermont Geological Survey in the Agency of Natural Resources.

The authors of the map are: Nicholas Ratcliffe USGS, Rolfe Stanley UVM (Posthumous), Marjorie Gale VGS, Peter Thompson VGS (now with the University of New Hampshire), and Gregory Walsh USGS.

Other contributors included Norman L. Hatch, Jr.*, USGS; Douglas W. Rankin, USGS; Barry L. Doolan, UVM; Jonathan Kim, VGS; Charlotte J. Mehrtens, UVM; John N. Aleinikoff, USGS;

and J. Gregory McHone, Wesleyan University. Linda M. Masonic, USGS, was responsible for the cartography.

The map has been in development during the tenure of three State Geologists: Charles Ratte', Diane Conrad, and Laurence Becker

I also want to acknowledge the role Greg Walsh of USGS and ANR's GIS group played in developing digital map data over the course of this project.

We want to acknowledge two geologists no longer with us that would have been thrilled with this celebration, Rolfe Stanley of UVM and Norman Hatch of the USGS. Through their work in Vermont and New England, both were instrumental in developing many of the geologic ideas that went into the initial start up and development of the new map.

Press Release

NEW GEOLOGIC MAP OF VERMONT UNVEILED

APRIL 11 - MONTPELIER – *A new bedrock geologic map of the state was unveiled in a ceremony at the Vermont State House today, bringing a critical tool to land managers involved in natural resource planning and environmental assessment.*

The event, hosted by Gov. Peter Shumlin, included the Secretary of the Agency of Natural Resources Deb Markowitz; Peter Lyttle of the U.S. Geological Survey; Laurence Becker, Vermont Agency of Natural Resources; and Char Mehrtens of the University of Vermont. These three organizations were the main collaborators to produce this updated, highly detailed map. The state's last map of this kind was produced in 1961, with the first geologic map of the state being produced 150 years ago.

"Through the balanced work of all the partners, Vermonters now have a comprehensive map that will help us better understand and plan for issues like groundwater, energy, hazards, infrastructure development, and environmental protection for years to come," Gov. Shumlin said. "Such up to date information is crucial to the State when addressing the economic and environmental concerns of citizens, lawmakers, government, business, and local communities."

Geologic maps enable resource managers and land management agencies to identify and protect aquifers, evaluate resources and land use, and prepare for natural hazards, such as earthquakes and land subsidence, for example. Geologic maps are also critical tools for choosing safe sites for solid and hazardous waste disposal and for protecting sensitive ecosystems.

Understanding where different rock types are located provides important clues about where groundwater and mineral resources exist. The map provides a template for future studies in a variety of disciplines -- not only geologic, tectonic and hydrologic studies, but also economic and environmental evaluations.

"It was an incredible tour de force to bring this level of detail to the new bedrock map on account of the many intense geologic events that have left their mark on the state of Vermont over the eons," said USGS Director Marcia McNutt from the bureau's headquarters in Reston,

Va. "Without the steadfast and enduring partnership of the USGS, the Vermont Geological Survey, and the University of Vermont, this achievement would not have been possible."

Vermont's new map shows an uncommon level of detail for state geologic maps. Mapped rock units are based on lithology, or rock type, rather than traditional rock formations that may include multiple rock types. This map identifies more than 486 different types of rock throughout the state of Vermont, a design feature intended to facilitate use by multiple disciplines. During the project, scientists also discovered many fault lines, advancing understanding about how and where water travels through the underground rock formations and providing clues about where underground aquifers -- an important source for potable fresh water -- may be located.

"The Vermont map is the visual presentation used to communicate data, ideas and interpretations. New map patterns developed through years of field and laboratory studies led to recognition of terranes from different geologic settings. Most importantly, understanding these settings gives us predictive capabilities for the sub-surface including areas where rocks are covered by glacial deposits," said Laurence Becker, the 13th Vermont State Geologist. "The bedrock geology, in conjunction with the overlying glacial deposits, form the geologic system crucial to understanding economic and environmental issues that face our state"

Vermont's new geologic map substantially builds upon the state's previous geologic map – created in 1961– by incorporating the theory of plate tectonics, which had not yet been developed 50 years ago. The Green Mountains form the backbone of Vermont. Their geologic history, spanning more than 1.4 billion years, attests to a complex series of plate tectonic events including the formation of corals reefs, ocean basins and volcanic arcs punctuated by periods of Appalachian mountain building.

"The new bedrock geologic map of Vermont changes the way we look at the geologic history of the state because we can now see relationships between rock types and structures that were obscured on the old map," said Char Mehrtens, contributing author of the map and professor of Geology at UVM. "The level of detail provided by the new map is also a huge help to geoscience educators because we can now design student projects to utilize the three dimensional information it contains. The significance of this map can't be understated; it places us in the national conversation about the origin and evolution of mountain belts, particularly because the National Science Foundation-funded Earth Scope project will be working in New England starting in 2013. The new bedrock map sets the stage for collaborative studies of University of Vermont geologists with their national and international colleagues."

The process for creating a geologic map for an entire state is very field intensive, and The Bedrock Geologic Map of Vermont has been in development since the 1980s.

VT House of Representatives passed the following Resolution on April 11, 2012. Representative David Deen following the reading and affirmative vote asked the State Geologist, and the authors and contributors in attendance (Nick Ratcliffe, Marjorie Gale, Peter Thompson, Greg Walsh, Barry Doolan, Jon Kim, Charlotte Mehrtens) to stand at the front of the House and be recognized

House concurrent resolution thanking the staff of the agency of natural resources, academic and scientific institutions, and community members who contributed to the development of the new Bedrock Geologic Map of Vermont

Offered by: Representatives Deen of Westminster and Klein of East Montpelier

Offered by: Senator Lyons

Whereas, the publication of the new Bedrock Geologic Map of Vermont incorporates 30 years of new approaches to the science of geologic mapping and the technologies that support it, and

Whereas, the 2011 publication of this invaluable map occurred on the sesquicentennial anniversary of the first Vermont geologic map's issuance in 1861 and 50 years after the 1961 Centennial Geologic Map of Vermont was released, and

Whereas, this new map is the first Vermont state map published to include interpretations of geologic history based on the emergence of plate tectonic theory in the 1960s, and

Whereas, through its incorporation of a fundamental data layer, the map is a showpiece of the present-day understanding of Vermont's geology, and

Whereas, the map provides a primary geological science base to be used for years to come that will help us address Vermont's environmental issues, and

Whereas, protection of our state's natural resources will be easier when working on matters related to groundwater protection, energy development and use, hazardous waste, infrastructure development, and environmental protection, and

Whereas, this map's development and publication is an excellent example of cooperation between the state of Vermont, the federal government, and the academic and scientific community represented by the Vermont Geological Survey, the agency of natural resources, the United States Geological Survey, and the primary academic partner, the University of Vermont, now therefore be it

Resolved by the Senate and House of Representatives:

That the General Assembly thanks the staff of the agency of natural resources, academic and scientific institutions, and community members who contributed to the development of the new Bedrock Geologic Map of Vermont, and be it further

Resolved: That the Secretary of State be directed to send a copy of this resolution to Secretary of Natural Resources Deborah Markowitz.

ANNOUNCEMENTS

Field trips: The Society is always looking for field trips, so please contact any Executive Officer if you have an idea.

33rd Annual Champlain Valley Gem and Mineral Show, July 28-29. See the full announcement below.

Middlebury College is hosting the Champlain Valley Clay Symposium, June 1st. See the full announcement below.

33RD ANNUAL CHAMPLAIN VALLEY GEM, MINERAL & FOSSIL SHOW

2012 Show Theme: The Minerals of Canada

July 28-29, 2012
Saturday and Sunday 10 AM - 5 PM

Sponsored by the Burlington Gem and Mineral Club

2012 Show Dealers
Canadian Minerals | Cardinal Minerals | Circle of Stones | Crystal Cache Minerals
Ewing's Lapidary | Fantasy in Gemstones | Global Pathways | Gold-N-Gems
Green Mountain Minerals | JNL Minerals | Lake Champlain Minerals and Jewelry
Mineral Connection | Phoebe Designs | Vermont Amber Designs

Citrine Geode—Image similar to Raffle prize

Raffle tickets are available at the Show
Tickets: $1 each or 6 for $5

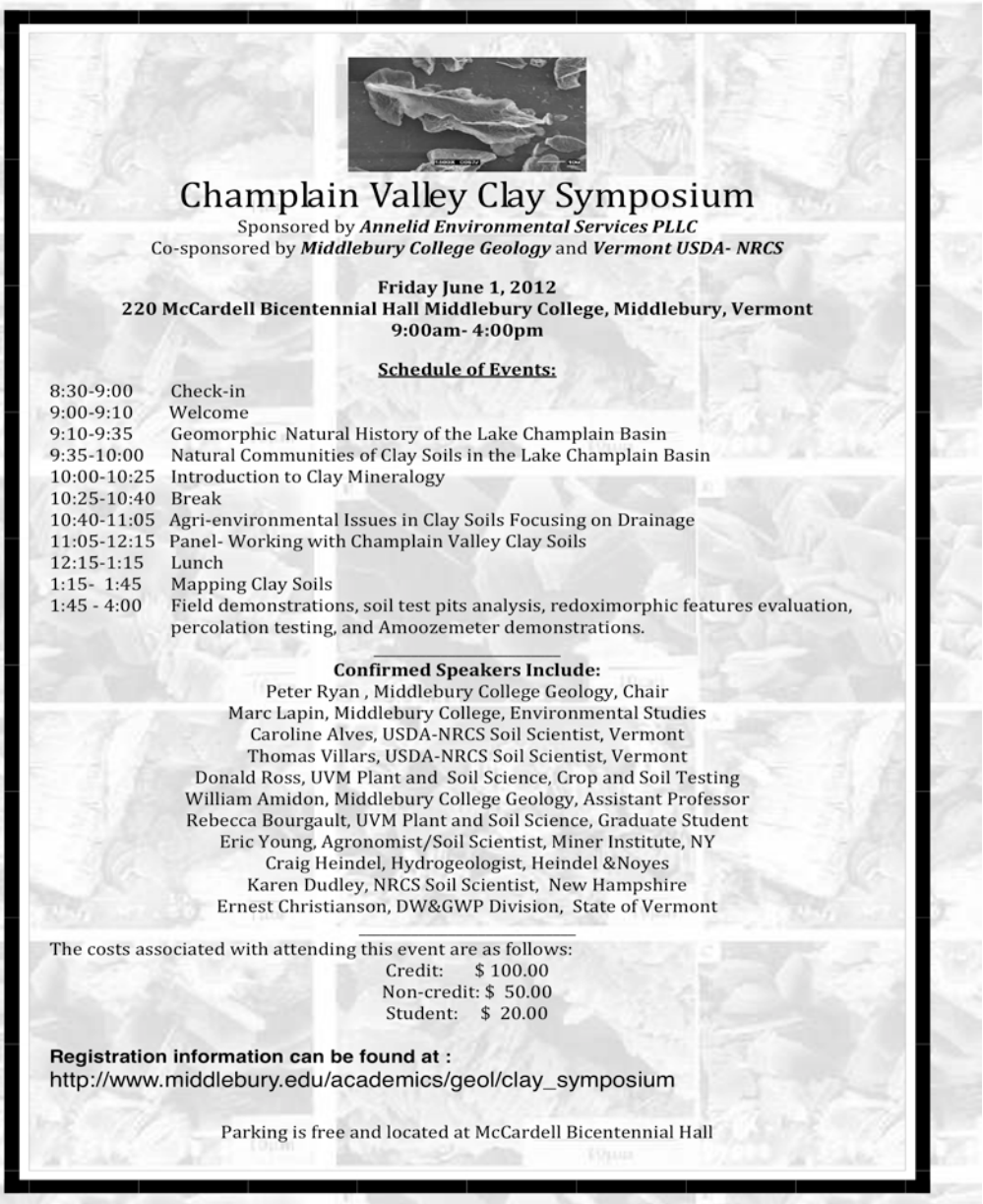
We will have an exciting slate of speakers lined up for our lectures at the Show!
Lecture schedule and topics to be added later.

Quality dealers offering minerals, fossils, gems, jewelry, lapidary equipment and supplies. Lectures, exhibits, raffle, hourly door prizes, silent auction, demonstrations, and fish pond for kids (catch a cup of minerals for a quarter). Refreshments available.

Tuttle Middle School
500 Dorset Street (near Kennedy Drive)
South Burlington, Vermont
FREE PARKING

Admission: $3.00 for Adults
$2.00 for Students (6-16) and Seniors
Children under 6 FREE

Come visit us, have a fun day with the entire family



Champlain Valley Clay Symposium

Sponsored by ***Annelid Environmental Services PLLC***
Co-sponsored by ***Middlebury College Geology*** and ***Vermont USDA- NRCS***

Friday June 1, 2012
220 McCardell Bicentennial Hall Middlebury College, Middlebury, Vermont
9:00am- 4:00pm

Schedule of Events:

8:30-9:00	Check-in
9:00-9:10	Welcome
9:10-9:35	Geomorphic Natural History of the Lake Champlain Basin
9:35-10:00	Natural Communities of Clay Soils in the Lake Champlain Basin
10:00-10:25	Introduction to Clay Mineralogy
10:25-10:40	Break
10:40-11:05	Agri-environmental Issues in Clay Soils Focusing on Drainage
11:05-12:15	Panel- Working with Champlain Valley Clay Soils
12:15-1:15	Lunch
1:15- 1:45	Mapping Clay Soils
1:45 - 4:00	Field demonstrations, soil test pits analysis, redoximorphic features evaluation, percolation testing, and Amoozemeter demonstrations.

Confirmed Speakers Include:
Peter Ryan , Middlebury College Geology, Chair
Marc Lapin, Middlebury College, Environmental Studies
Caroline Alves, USDA-NRCS Soil Scientist, Vermont
Thomas Villars, USDA-NRCS Soil Scientist, Vermont
Donald Ross, UVM Plant and Soil Science, Crop and Soil Testing
William Amidon, Middlebury College Geology, Assistant Professor
Rebecca Bourgault, UVM Plant and Soil Science, Graduate Student
Eric Young, Agronomist/Soil Scientist, Miner Institute, NY
Craig Heindel, Hydrogeologist, Heindel &Noyes
Karen Dudley, NRCS Soil Scientist, New Hampshire
Ernest Christianson, DW&GWP Division, State of Vermont

The costs associated with attending this event are as follows:
Credit: $ 100.00
Non-credit: $ 50.00
Student: $ 20.00

Registration information can be found at :
http://www.middlebury.edu/academics/geol/clay_symposium

Parking is free and located at McCardell Bicentennial Hall

VERMONT GEOLOGICAL SOCIETY CALENDAR

April 28: Spring Meeting, VGS, Middlebury College. See announcements within this newsletter.

October 1: Student Research Grant Program applications due, to Jon Kim. Please see the website for format information. Jon can be reached at the phone and email listed below.

The **Vermont Geological Society** is a non-profit educational corporation.
The **Executive Committee** of the Society is comprised of the Officers, the Board of Directors, and the Chairs of the Permanent Committees.

Officers

President	George Springston	(802) 485-2734	gsprings@norwich.edu
Vice President	Keith Klepeis	(802) 656-0247	kklepeis@uvm.edu
Secretary	David West	(802) 443-3476	dwest@middlebury.edu
Treasurer	David Westerman	(802) 485-2337	westy@norwich.edu

Board of Directors

Richard Dunn	(802) 485-2304	rdunn@norwich.edu
Les Kanat	(802) 635-1327	les.kanat@jsc.edu
Jon Kim	(802) 241-3469	jon.kim@state.vt.us

Chairs of the Permanent Committees

Advancement of Science	Jon Kim
Geological Education	Christine Massey
Membership	David Westerman
Public Issues	Laurence Becker
Publishing	Richard Dunn

Vermont Geological Society
Department of Geology and Environmental Science
Norwich University
Northfield, VT 05663

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

Vermont Geological Society
Spring Meeting
April 28, 2012, 8:15 AM
McCardell Bicentennial Hall, Room 220
Middlebury College, Middlebury, Vermont

THE GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

VGS Website: http://www.uvm.org/vtgeologicalsociety/

SPRING 2012	VOLUME 39	NUMBER 3

The Vermont Geological Society's
Summer Field Trip

August 11, 2012, 9:00 AM
Meeting location:
Park and Ride, Plainfield, VT

TABLE OF CONTENTS

With people scattered for the summer it was not possible to obtain all regular items for this issue of the GMG. We will be back to normal publishing in the Fall. - RKD

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

Awards given at the Vermont Geological Society **Spring Meeting** April 28, 2012

Best Talks:

1. Nicole Shufelt (UVM graduate student), PHOSPHORUS MOVEMENT AND REDOX FRONT MIGRATION AT THE SEDIMENT WATER INTERFACE IN SEDIMENT CORES (MISSISQUOI BAY, LAKE CHAMPLAIN).

2. Alyssa Anderson (Middlebury College undergraduate), Doll Award for best undergraduate talk, LOW-TEMPERATURE THERMOCHRONOLGY AND THE TOPOGRAPHIC EVOLUTION OF THE WHITE MOUNTAINS, NEW HAMPSHIRE.

3. Emily McDonald (Middlebury College undergraduate), AN ANALYSIS OF RADIONUCLIDES IN THE CLARENDON SPRINGS FORMATION:IMPLICATIONS FOR WATER QUALITY IN HIGHGATE, VT
(Vermont Geology Society Research Grant recipient).

Summer Field Trip

The summer field trip for the Vermont Geological Society will be run on Saturday August 11 and is entitled:
"Rocks, Dirt, and Plants: Integrating Geology and Plant Ecology". This trip will examine the close relationship that exists between bedrock and surficial geology and plant ecology. We will have five stops that will accent these relationships.
Please RSVP to Jon Kim @ jon.kim@state.vt.us if you plan to attend.

The trip leaders are:
Jon Kim- Vermont Geological Survey
George Springston- Norwich University
Eric Sorenson and Everett Marshall- Natural Heritage Inventory, Vermont Fish and Wildlife Department

Meet at 9:00 am on Saturday August 11 at the Park and Ride in Plainfield.

See next page for Directions.

Directions:
-Turn off of Route 2 at the flashing light in Plainfield (a right if you are coming from the west and a left if from the east)
-Bear left onto the Main Street Extension (Positive Pie Pizza will be on your left)
-Turn left after ~250 meters into the Plainfield Park and Ride lot

Student Research Grants

The fall grant deadline is October 1st. For consideration, all applications must be postmarked by October 1, 2012. Address: Jon Kim, Vermont Geological Survey, 103 South Main Street, Logue Cottage, Waterbury, Vermont 05671-2420

For information about this program and the research grant form:
http://www.uvm.org/vtgeologicalsociety/grantpolicy.html

VERMONT STATE GEOLOGIST'S REPORT

State Geologists Report, July 2012 (Summer)
More on New State Bedrock Map
The VT State Geologist was asked to speak at the annual meeting of the Association of American State Geologist in Austin Texas on June 12. For a session on the "National Cooperative Geologic Mapping Program – Twenty Years and Counting" he presented "Successes with State Geologic Maps" and related the 30 year cooperative effort between Vermont, USGS, UVM and other academics; complex metamorphic geology at 1:100,000 and post plate tectonics representation; USGS printing and digital file representation; 50 years since the last map and 150 years since the first; and viewing the map convinced administration for State House presentation with the Governor.

Highgate Radionuclide Study
On May 24, Middlebury College Student Emily McDonald presented to the Health Department an ANALYSIS OF RADIONUCLIDES IN THE CLARENDON SPRINGS FORMATION: IMPLICATIONS FOR GROUNDWATER COMPOSITION IN NORTHWESTERN VERMONT. The Vermont Geological Survey has been working with Middlebury College to focus on extending our knowledge of naturally occurring radioactivity in Vermont bedrock. Of the first 16 samples collected (analysis funded by the Health Dept.), 25 % contain elevated gross alpha (between 5 to 19 pCi/L) in the study area.

Brandon Class II Groundwater Designation: The State Geologist attended a ceremony on May 8, 2012 with the Governor and ANR Secretary Markowitz honoring Brandon's accomplishment. The Vermont Geological Survey partnered with Brandon to produce a modern surficial geologic map (author Dave DeSimone) for the Town. The map, geologic interpretations, and cross sections are integral parts of the science that went into the designation put together by Eric Hansen (then a hydrogeologist with Vermont Rural Water). No. R-327. House concurrent resolution congratulating Brandon Fire District #1 Superintendent Ray Counter and the Brandon Fire District #1 Prudential Committee on the district's designation as a Class II water system,

mentions the Vermont Geological Survey and the funds obtained "to map the surface geology and produce maps for groundwater resources".

Northeastern States Emergency Consortium (NESEC)
The Northeast State Geologists met on May 16th in Brunswick, Maine to discuss further ways and funding to collect shear wave velocity measurements in support of seismic hazard mapping. The meeting chaired by the VT State Geologist also included a presentation on work sponsored by the Vermont Geological Survey in the Burlington/Colchester area (presented by Mandar Dewoolkar, John Lens of UVM and George Springston of Norwich University) to show how these measurements can be used to develop seismic amplification hazard maps. The group also heard about landslide hazard assessment and USGS landslide hazard alerts triggered by larger precipitation events. Fluvial geomorphic studies were discussed from New Hampshire and Massachusetts. On May 17, the Maine and Vermont State Geologist presented to the full NESEC Board made up of the Directors of Emergency Management from the eight states.

Senator Leahy Signs Earthquake Monitoring Letter: Led by Senator Collins of Maine, four other Senators (VT, Conn, and two Senators from Mass) signed a letter to Marcia McNutt, Director of the USGS, with concerns about the loss of New England Seismic Network services previously provided by Weston Observatory of Boston College. The main topics are: reporting threshold; archiving of events; and access to seismologists. NESEC and the New England State Geologists are discussing these issues with USGS through the USGS Associate Director for Hazards, David Applegate, William Leith and John Filson

ANNOUNCEMENTS

Field trips: The Summer field trip is being held on August 11. Please see the details in the report of the Advancement of Science Committee, above. And, please RSVP Jon Kim if you will be attending.

The Society is always looking for field trips, so please contact any Executive Officer if you have an idea.

VERMONT GEOLOGICAL SOCIETY CALENDAR

August 11: VGS Summer Field Trip; "Rocks, Dirt and Plants: Integrating Geology and Plant Ecology. Details in the Advancement of Science Committee's report, above.

October 1: Student Research Grant Program applications due, to Jon Kim. Please see the website for format information. All applications must be postmarked by October 1, to: Jon Kim, Vermont Geological Survey, 103 South Main Street, Logue Cottage, Waterbury, Vermont 05671-2420
Jon can be reached at the phone and email listed below.

The **Vermont Geological Society** is a non-profit educational corporation.
The **Executive Committee** of the Society is comprised of the Officers, the Board of Directors, and the Chairs of the Permanent Committees.

Officers

President	George Springston	(802) 485-2734	gsprings@norwich.edu
Vice President	Keith Klepeis	(802) 656-0247	kklepeis@uvm.edu
Secretary	David West	(802) 443-3476	dwest@middlebury.edu
Treasurer	David Westerman	(802) 485-2337	westy@norwich.edu

Board of Directors

Richard Dunn	(802) 485-2304	rdunn@norwich.edu
Les Kanat	(802) 635-1327	les.kanat@jsc.edu
Jon Kim	(802) 241-3469	jon.kim@state.vt.us

Chairs of the Permanent Committees

Advancement of Science	Jon Kim
Geological Education	Christine Massey
Membership	David Westerman
Public Issues	Laurence Becker
Publishing	Richard Dunn

Vermont Geological Society
Department of Geology and Environmental Science
Norwich University
Northfield, VT 05663

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

Vermont Geological Society
Summer Field Trip
August 11, 2012, 9:00 AM
Park and Ride, Plainfield, VT

THE GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

VGS Website: http://www.uvm.org/vtgeologicalsociety/

FALL 2012	VOLUME 39	NUMBER 4

The Vermont Geological Society's
Fall Field Trip

October 27th, 9:30 AM
Cavendish Gorge
Meeting time and place will be announced (see information below)

TABLE OF CONTENTS

PRESIDENT'S LETTER

This fall I'll be stepping down as President of the VGS and I'd like to leave you with a couple of parting ideas. This organization has been very effective at promoting the advancement of geology in Vermont and in outreach to the public. To see this, just browse over the last few issues of the Green Mountain Geologist. The list of accomplishments, even in only the last 10 years, is long. The interesting thing about this is that those accomplishments are mostly the result of a very few active participants.

Our organization is, at the moment, limping along with too few members who are willing to participate in organizing activities, giving talks, leading field trips, and putting together the newsletter. This means that some of those who are participating end up have to take on too many tasks. I'm not asking every member to devote vast amounts of time to the Society. That's not what's needed. Instead, we simply need more members who will step up for a season or two and take on the tasks. None of it is hard and much of it is fun and satisfying (at least to people like us who are endlessly curious about the natural world). Indeed, many of you have participated in a most excellent fashion. However, we do need more helpers to take turns at the various tasks.

I'll step down from my present role as soon as we can hold an election and certify the results. I'll be on the Board of Directors and will certainly remain involved in this wonderful volunteer organization.

Sadly, I have to note the untimely death of one of our stalwart members, John Carmola. See the note by Jon Kim elsewhere in this issue. He clearly had a great love for the natural world and a passion for geology. There was no telling where I would run into him. Once I was on a site visit to a large landslide on the Missisquoi, way out back of the farm fields and far from the highway, and who should I see kayaking by but John, grinning from ear to ear. Another time I was leading a Green Mountain Club hike up Burnt Rock Mountain in Fayston and up on the summit ridge there was John (and one or two other members of the informal "Church of the Rock"), crouched down and closely examining the schist with a hand lens. I'll miss his pleasant and active participation in so many meetings and field trips and I extend my deepest sympathies to his family and friends.

Respectfully submitted, George Springston

MINUTES of the EXECUTIVE COMMITTEE MEETING

The Executive Committee met over the summer at UVM.

Issues of the GMG and Vermont Geology are scanned (excluding 1998 and 2004 GMG, soon to come) and can be found at the Vermont Geological Survey website.

There was discussion about the membership of the executive committee and nominations were accepted. It was agreed that we would use Survey Monkey, or similar, for the voting process.

Marjorie Gale of the Vermont Geological Survey has agreed to be our newest VGS lecturer. The VGS lecturer was set up to provide lectures, at low to no cost, to institutes around the state. Please contact Marjorie at the State Survey if you'd like to invite her. Her talk is titled "The Bedrock Geologic Map of Vermont: Highlights, Transitions and Notes about the Journey."

We would like to get more students interested in joining the Society. Rick Dunn has a flier that he can provide to others to use as a template for advertising the Society.

There was discussion of the winter meeting. It was settled upon that we will invite a speaker, that there may be a theme for other talks, and we will have a potluck meal.

TREASURER'S REPORT

The finances of the Society remain strong, thanks to the generous support from its members. Cash on hand as of September 20 is $6,288. Despite the late solicitation this year, we have received $1,400 in dues for 2012, and $630 in contributions to the Research Grant Program. New research awards will be going out for the fall as students submit proposals for review. It's not too late to pay your dues. (Remember that the Society's policy is to stop sending the GMG after a brief grace period; look for that stamped envelope on the refrigerator). No expenses have been incurred since the last Treasurer's report.

Please join me in welcoming the following new members:

Laurie Grigg, Dept. Geology & Env. Sci., Norwich University
Francis Tucker, Mt. Abraham Union High/Middle School
Miles Waite, Waite Environmental Management

Respectfully submitted, David S. Westerman, Treasurer

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

Loss of a VGS Member

As I prepared maps for the Vermont Geological Survey summer 2012 field trip approximately a week prior, I thought about the faces I would see at the park and ride in Plainfield, prior to the start of the trip. Over the past few years, one of my favorite groups was "The Church of the Rock", a spirited group of close friends from St. Albans, who had developed a love for geology external to their professional lives, and had recently initiated some field research of their own. This group was comprised of John Carmola, a retired physician, J.D. Thoren, a retired pharmacist, and Paul Madden, a building contractor. Our informal ritual was to gather in a circle and bow to each other as the great outdoors was indeed "The Church", and laugh. I looked forward to the meeting.

Shockingly, I received a voicemail from J.D. Thoren a couple days later telling me that John Carmola had drowned in a swimming accident in North Carolina. These events are so hard to process because one's mind mourns at its own pace, which often is a number of days behind. I was so grateful that J.D. Thoren and a friend attended the field trip and that we were able to reminisce some about John. I remember that John would often ask difficult questions that I really had to dig deep to answer; they would often start with "Yeah, but how do you know that"? In addition to his family and friends, the Vermont Geological Society will greatly miss John Carmola, particularly his enthusiasm and laugh. We will, however, look forward to seeing brothers J.D. and Paul and hopefully new brothers (and sisters) of "The Church" at all future VGS events.

Research Grants

Applications for Vermont Geological Society Research Grants must be ***postmarked*** by October 1st, 2012 and sent to:

Jon Kim
Vermont Geological Survey
103 South Main Street, Logue Cottage
Waterbury, VT 05671

See our website for application forms.

Guest Lecturer Program

Marjorie Gale has agreed to be the Vermont Geological Survey Guest Lecturer for the upcoming year. She is offering a lecture entitled: "The New Bedrock Geologic Map of Vermont: Highlights, Transitions, and Notes about a Journey". Contact Marjorie directly at marjorie.gale@state.vt.us if you would like to arrange a lecture for your institution.

Summer 2012 Field Trip

On Saturday August 11, 2012, the Vermont Geological Society ran its summer field trip entitled "Rocks, Dirt, and Plants- Integrating Geology and Plant Ecology". The leaders of this trip were: Jon Kim of the Vermont Geological Survey, George Springston of Norwich University, and Eric Sorenson and Everett Marshall of the Heritage Inventory, at the Vermont Dept. of Fish and Wildlife. Nineteen attendees set out from the Plainfield park and ride to look at the following four stops (all photos that follow by Erica Mitchell):

1) Low Diversity Forest grown on soils derived from glacial till and the underlying biotite granite of the Middle Devonian Knox Mountain pluton in Marshfield. Because the calcium content of the granite is so low, the plant diversity is low and favors the following: Sugar Maple, Beech and White and Yellow Birch trees.

2) Intermediate Diversity Forest grown on soils derived from glacial till and the underlying interlayered gray phyllites and quartzites of the Early Devonian Gile Mountain Formation in the Marshfield Town Forest. The diversity of trees and plants is intermediate because of calcium contributions from: A) rock fragments of impure marble in glacial till derived from the nearby

Waits River Formation and B) isolated layers of impure marble that occur in the Gile Mountain Formation. The plant diversity is intermediate and favors the following: Sugar Maple, Beech and Hemlock trees. A few plants that prefer calcium-rich soils were found such as False Melic Grass.

3) High Diversity Forest grown on soils derived from glacial till and the underlying interlayered gray phyllites and impure marbles of the Early Devonian Waits River Formation on Eric Sorenson's land in Calais. The diversity of trees and plants is high because of calcium contributions from: A) rock fragments of impure marble in the glacial B) abundant layers of impure marble (1-30' thickness) that occur in the Waits River Formation. The plant diversity is high and favors the following: Sugar Maple, Basswood, Butternut, and Ash trees. There are a number of calciphile plants present such as Leatherwood, Silvery Glade Fern, and Bulblet Fern.

4) Thick Surficial Deposits on the Winooski River Plant communities that grow in soils derived from Pleistocene clays and sands of Glacial Lake Winooski. This site was ideal for summarizing the successional plant communities that develop in a former pasture. The severe erosion of the high banks of the Winooski River that occurred during severe storms during the last 2 years (May and August of 2011) was also emphasized. Plants such as Goldenrod, Wild Carrot, and Willow shrub were observed.

View to the east of the Knox Mt. Granite Pluton from stop 2.

Jon Kim performs the acid test on Waits River Fm. marbles at stop 3.

George Springston explains his cross section at stop 3.

Eric Sorenson augering into soils at stop 3.

Everett Marshall discussing Willow shrubs at stop 4.

Marginal Woodfern at stop 3.

Indian Pipes at stop 3.

Bulblet Fern at stop 3. Note bulblet at top.

VERMONT STATE GEOLOGIST'S REPORT

Essex Jct, Pico Peak and Northfield Quads

The Vermont Geological Survey (VGS) delivered paper copy maps and digital (GIS) data to the USGS on August 30, thus completing the mapping projects funded through the STATEMAP grant and returning us to an annual mapping schedule. Materials submitted include results from surficial geologic mapping in the Pico Peak quadrangle and bedrock mapping in the Essex Junction quadrangle. Digital data for legacy bedrock maps from the Champlain Valley and for the surficial geology of the Northfield quadrangle were also delivered. All maps and data are

posted on the VGS web site and also accessed from the National Geologic Map Database (NGMDB) web site. Stephen Wright from the University of Vermont mapped the Pico Peak area. Marjorie Gale and Abigail Ruksznis of the VGS completed digitization and digital cartography. Abigail Ruksznis and George Springston of Norwich University digitized the legacy Northfield map. The Essex Junction bedrock mapping project (M. Gale, J. Kim and A. Ruksznis of the Division) included digitization of the bedrock legacy data and completes a significant portion of northwest Vermont at a scale of 1:24,000. During the past decade, digital geologic maps have become the standard and most geologic analyses rely on digital data. Requests from the public and the consulting industry for digital data in northwestern Vermont highlighted the need to produce digital maps at 1:24,000 from the legacy map projects. The VGS continues to develop groundwater resource maps using the framework geologic map data.

Paper Accepted for Publication by Geological Society of America

The VT State Geologist is the lead with the State Geologists of Maine, Massachusetts, Connecticut, and the Northeastern States Emergency Consortium (NESEC) Executive Director on a volume chapter to be published by the Geological Society of America in Denver, Colorado. The paper (chapter) accepted on June 20, 2012 is entitled: *"Seismic Hazard Assessment in New England through the use of Surficial Geologic Maps and Expert Analysis"* in volume: "Recent Advances in North American Paleoseismology and Neotectonics East of the Rockies". These coauthors also delivered to USGS on Sept 1, 2011 entitled: *Utilizing the Surficial Geology of the Northeast United States to Improve NEHRP Site Effect Classifications in HAZUS-MH: Collaborative Research with NESEC and the NESEC State Geologists.*

Act 163 – Testing of Potable Water Supplies

Jon Kim of the VGS in cooperation with Pete Ryan of Middlebury College have worked diligently for science informing public policy through very careful collection and application of data, and knowledge transfer. The work of the VGS and Middlebury was invaluable in leading to the passage of Act 163. The legislature has been wrestling with the best way to address this Health issue. S.77 passed in 2011; however, the Governor was concerned with some aspects of the bill. S.183 passed the legislature with modification in 2012 and the Governor signed on May 17, 2012. The Health Department has primary responsibility but the VGS is to receive testing data from State Certified Labs. The intent is to use the data to develop mapping and a clearinghouse identifying groundwater contamination locations for such constituents of concern as radionuclides and arsenic. Geology has been and continues to be involved in this effort and is integrating data coming in from multiple sources.

Energy – Geothermal

On July 24, Jon Kim in cooperation with Plattsburgh State University in NY began the well testing program associated with the VGS geothermal grant from DOE. Professor Edwin A. Romanowicz ran a testing rig known as a Mount Sopris unit taking water temperature data and performing other logging functions on a 1000 foot well at the Champlain College campus in Burlington. The well does not yet have a pump installed for geothermal use and the College approved the testing regime. A second well was tested at Champlain College and a third well at the Spafford well drilling company in Jericho. All now have bottom hole temperature data to apply to the study that hopes to uncover the nature of temperatures in deeper wells to better understand the potential for geothermal resources in VT.

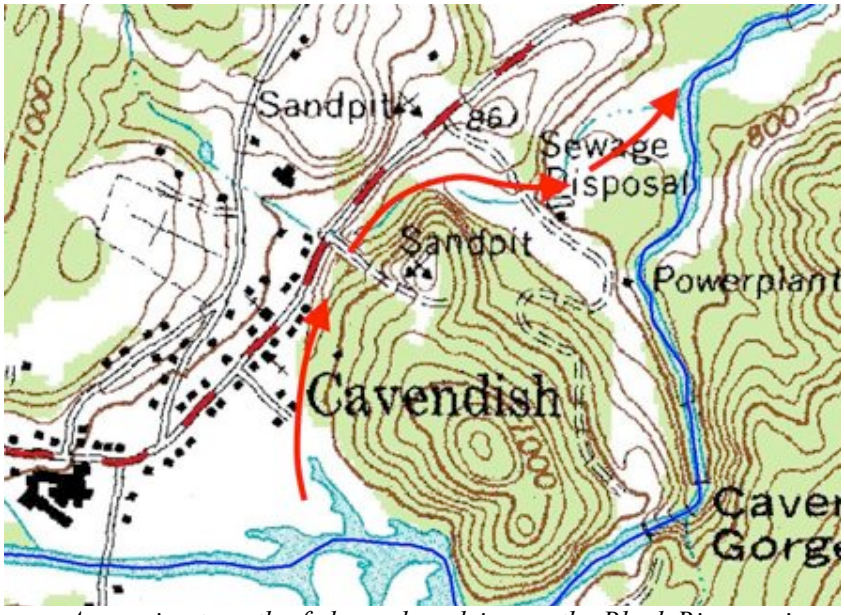
ANNOUNCEMENTS

Fall 2012 VGS field trip
History of Flooding at the Cavendish Gorge
Saturday, October 27, 2012 - 9:30 AM to Noon

Kristen Underwood has organized a trip to the Cavendish Gorge hydro facility located on the Black River in Cavendish, Vermont. The impoundment and hydroelectric station are managed by Green Mountain Power (previously Central Vermont Public Service). A guided tour of the hydro station will be offered along with a discussion of the history of the dam and associated mill buildings.

During the historic flood of record in 1927, floodwaters bypassed the gorge and carved a wide and deep gully along Rt 131. Several homes were washed downstream. During Tropical Storm Irene, floodwaters again occupied this gully and washed out the road. Pictures and maps of historic floods will be reviewed, and more recent impacts from Irene will be summarized. Following the facility tour, we will examine the extensive flood deposits within the avulsion channel and downstream along the Black River channel. George Springston will also be on hand to contribute to the discussion of the surficial geology.

Please RSVP to Kristen Underwood at southmountain@gmavt.net if you will be attending the field trip. Parking is somewhat limited at the hydro station; depending on the number of interested persons, we may assemble at a nearby location (to be announced) and carpool to the hydro station. Stay tuned for a future email providing directions.



Approximate path of channel avulsion on the Black River main stem during the 1927 flood, Cavendish, VT.

ANNOUNCEMENTS

VT ASCE SECTION MEETING
VT GEO-INSTITUTE CHAPTER MEETING

WHERE: MILANO BALLROOM NORWICH UNIVERSITY, NORTHFIELD, VT WHEN:
October 10, 2012
Bar opens at 5:45 PM - Dinner at 6:30 PM

SPEAKER: JOHN KASTRINOS
Lead Hydrogeologist
Haley & Aldrich, Inc, Manchester, NH

Geothermal Heating and Cooling

John Kastrinos ASCE Haley & Aldrich, Inc.
340 Granite Street, 3rd Floor Manchester, NH. 03012 (603) 361-0397

The presentation will describe the use of geothermal heating and cooling (also known as ground-source heat pumps) to save energy and reduce the use of fossil fuels and production of greenhouse gases in commercial and institutional buildings, which consume a tremendous amount of energy. Geothermal systems are playing an important part in producing new energy-efficient buildings, and improving the efficiency of existing buildings, including government buildings that are being rehabilitated through "energy conservation upgrades" that help to promote green energy. Mr. Kastrinos will provide an overview of the basics of the technology, financial analysis, design parameters and some potential pitfalls citing some specific case studies he has been involved with in New England.

$35 per person/$20 within 5 years of graduation/$10 per student
ASCE Life Members are Free (no shows will be billed)

1 PDH credit earned for attendance
Send Reservations by October 2 to John Stevens at
stevens@norwich.edu

Dinner will be barbecue chicken, beef brisket, and portabella mushroom with salad, barbecue beans, and cornbread with peach cobbler and apple crisp. There will be a wine and beer bar.
Come Hungry!

EXECUTIVE COMMITTEE BALLOT

Please take a moment to vote in the Society's election of Executive Committee members. Very soon you will receive an email from the Vice President, Keith Klepeis, requesting that you complete an online ballot at Survey Monkey. The current slate of members can be found on the following page. If you are unable to use the online option, please fill out the ballot below and mail it to Rick Dunn (Dept. of Geology, Norwich Univ., Northfield, VT 05663).

BALLOT
One vote per position

President
Jon Kim _____
Other member (write in) _____

Vice President
Keith Klepeis _____
Other member (write in) _____

Secretary
Dave West _____
Other member (write in) _____

Treasurer
Dave Westerman _____
Other member (write in) _____

Board Member (G. Springston will move to the Board as past President, per the *by laws*, joining Les Kanat)
Kristen Underwood _____
Other member (write in) _____

Chair of Publications Committee
Marjorie Gale _____
Other member (write in) _____

VERMONT GEOLOGICAL SOCIETY CALENDAR

October 1: Student Research Grant Program applications due, to Jon Kim. Please see the website for format information. All applications must be postmarked by October 1, to: Jon Kim, Vermont Geological Survey, 103 South Main Street, Logue Cottage, Waterbury, Vermont 05671-2420
Jon can be reached at the phone and email listed below.

October 27: VGS Fall Field Trip, led by Kristen Underwood. Please see information in the Announcements, and please RSVP Kristen as soon as possible.

The **Vermont Geological Society** is a non-profit educational corporation.
The **Executive Committee** of the Society is comprised of the Officers, the Board of Directors, and the Chairs of the Permanent Committees.

Officers

President	George Springston	(802) 485-2734	gsprings@norwich.edu
Vice President	Keith Klepeis	(802) 656-0247	kklepeis@uvm.edu
Secretary	David West	(802) 443-3476	dwest@middlebury.edu
Treasurer	David Westerman	(802) 485-2337	westy@norwich.edu

Board of Directors

Richard Dunn	(802) 485-2304	rdunn@norwich.edu
Les Kanat	(802) 635-1327	les.kanat@jsc.edu
Jon Kim	(802) 241-3469	jon.kim@state.vt.us

Chairs of the Permanent Committees

Advancement of Science	Jon Kim
Geological Education	Christine Massey
Membership	David Westerman
Public Issues	Laurence Becker
Publishing	Richard Dunn

Vermont Geological Society
Department of Geology and Environmental Science
Norwich University
Northfield, VT 05663

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

Vermont Geological Society
Fall Field Trip
October 27, 2012, 9:30 AM
Cavendish Gorge, VT
Please RSVP Kristen Underwood (southmountain@gmavt.net)
Further directions will arrive via email