

THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

VGS Website: www.uvm.org/vtgeologicalsociety/

WINTER 2006

VOLUME 33

NUMBER 1

*The Vermont Geological Society
Winter Meeting
February 18, 2006, 9:00AM
Cabot Science Building, Room 085
Norwich University, Northfield, Vermont*

TABLE OF CONTENTS

WINTER MEETING PROGRAM.....	2
ABSTRACTS	2
PRESIDENT'S LETTER	5
ANNUAL MEETING MINUTES & ELECTIONS.....	6
TREASURER'S REPORT	7
ADVANCEMENT OF SCIENCE COMMITTEE REPORT ...	7
VERMONT STATE GEOLOGIST'S REPORT	8
CALL FOR STUDENT ABSTRACTS	10
ANNOUNCEMENTS.....	11
VERMONT GEOLOGICAL SOCIETY CALENDAR	11
EXECUTIVE COMMITTEE.....	11

WINTER MEETING PROGRAM

- 9:00AM COFFEE & REFRESHMENTS
- 9:30AM David S. Westerman: AN ANALYSIS OF THE COX BROOK DRAINAGE BASIN: THE VALUE OF INTEGRATED SENIOR PROJECTS
- 9:50AM George E. Springston and Richard K. Dunn: SOME HIGHLIGHTS OF THE SURFICIAL GEOLOGY OF THE SOUTHERN WORCESTER MOUNTAINS, CENTRAL VERMONT
- 10:10AM Laurence R. Becker and Marjorie H. Gale: AN OVERVIEW OF THE VERMONT MINERAL INDUSTRY
- 10:30AM Andy McIntosh: THE CHANGING METAMORPHIC DEGREE OF THE SHELBURNE FORMATION THROUGHOUT CENTRAL AND NORTHERN VERMONT AND SOUTHERN QUEBEC
- 10:50AM Marjorie H. Gale, Peter J. Thompson, and Nicholas Ratcliffe: A PROGRESS REPORT FOR THE BEDROCK GEOLOGIC MAP OF VERMONT
- 11:20AM BREAK
- 11:30AM EXECUTIVE COMMITTEE MEETING

ABSTRACTS**AN ANALYSIS OF THE COX BROOK DRAINAGE BASIN: THE VALUE OF INTEGRATED SENIOR PROJECTS**

David S. Westerman, Department of Geology, Norwich University, 158 Harmon Drive, Northfield, VT 05663

Environmental Science and Geology seniors from Norwich University studied different aspects of the Cox Brook Drainage Basin in central Vermont during the fall of 2004. Projects included 1) geochemical analysis of underlying bedrock down the axis of the basin which trends across strike, 2) correlation studies of clast lithologies and fine-grained fraction geochemistry of overlying lodgement till, 3) hydrologic discharge efficiency of sub-basins in the system, 4) correlation analysis of water chemistry, bedrock and till distribution, and anthropogenic influences, 5) contaminant distribution from a compromised well field within the basin, 6) analysis of water quality from a wetland and pond downstream from the well field, and 7) analysis of that pond's ecosystem. Each student spent the first part of the study collecting data and analyzing it to identify anomalies or "mysteries". It was quickly apparent that each project required the results from other projects in the study. For example, students found that clasts in

till respond more quickly to changes in underlying bedrock composition than does the fine-grained fraction. Stream discharge varies with bedrock type and till cover. Stream chemistry is influenced by fault distribution, underlying bedrock and till composition, and development (roads and farms). Drilling additives are long-lived and traceable, but natural processes in wetlands and ponds are powerful in quickly modifying water composition and quality. As students work to prepare their final reports, each of them realizes the added value derived from building on the work of their colleagues.

SOME HIGHLIGHTS OF THE SURFICIAL GEOLOGY OF THE SOUTHERN WORCESTER MOUNTAINS, CENTRAL VERMONT

George E. Springston and Richard K. Dunn, Department of Geology, Norwich University, 158 Harmon Drive, Northfield, VT 05663; gsprings@norwich.edu, rdunn@norwich.edu

Surficial geologic mapping has recently been completed in the southern Worcester Mountains in parts of Middlesex and Waterbury as part of a Vermont Geological Survey pilot project to integrate surficial and bedrock geologic data for ground water resource evaluation. During this work we have uncovered evidence for a previously unrecognized glacial lake and additional evidence for a late Wisconsinan glacial readvance in central Vermont.

Besides the previously recognized glacial Lakes Winooski, Mansfield I, and Mansfield II, we have uncovered evidence for a glacial lake on the west side of the Worcester Mountains that we have named Lake Thatcher. Lake Thatcher was impounded between ice to the west and hills to the east and south and drained south via Middlesex Notch. The present-day elevation of the shoreline is roughly 1,230 feet. An extensive sand and gravel deposit south of the notch appears to have been deposited by outflow from Lake Thatcher. Collapse features in the sand and gravel suggest deposition on a tongue of ice in the Winooski valley at a time coeval with Lake Winooski.

Two sites with dense, silt-matrix diamict overlying lacustrine deposits are interpreted to be the result of a glacial readvance. Other sites in the field area are also suggestive of readvance. Although the field research is still ongoing, these are the latest in a series of sites that we and other researchers have encountered in recent years that suggest that there was at least one substantial glacial readvance in central Vermont. We speculate that the readvance sites described here may correlate with the 11.9 ka ¹⁴C Middlesex Readvance described by Fred Larsen in the Montpelier quadrangle.

AN OVERVIEW OF THE VERMONT MINERAL INDUSTRY

Laurence R. Becker and Marjorie H. Gale, Vermont Geological Survey, Waterbury, VT 05671; laurence.becker@state.vt.us, marjorie.gale@state.vt.us

In the early 21st century, Vermont's extractive industries are focused on the industrial mineral sector. Granite, marble, and slate are sold as dimension stone. Crushed product as an industrial filler is obtained from marble and talc sources. Within haul distances that are economically feasible, aggregate for road and construction purposes comes from a variety of rock types and

sand and gravel. The USGS in cooperation with the Vermont Geological Survey collects data on the State's mineral industry. Vermont mining production grew almost 70 percent between 1993 and 2003, but most of the growth came from increased mining of sand, gravel, and crushed rock. With extraction goes the reclamation of lands in response to today's environmental concerns. New quarry applications address operational and water quality considerations, set backs, final contours, and aesthetic considerations.

THE CHANGING METAMORPHIC DEGREE OF THE SHELBURNE FORMATION THROUGHOUT CENTRAL AND NORTHERN VERMONT AND SOUTHERN QUEBEC

Andy McIntosh, OMYA, Inc., 61 Main Street, Proctor, VT 05765

[Abstract unavailable at press time]

A PROGRESS REPORT FOR THE BEDROCK GEOLOGIC MAP OF VERMONT

Marjorie H. Gale, Vermont Geological Survey, Waterbury, VT 05671, marjorie.gale@state.vt.us; Peter J. Thompson, University of New Hampshire, Durham, NH 03824, pjt3@cisunix.unh.edu; and Nicholas Ratcliffe, U.S. Geological Survey, Reston, VA 20192, nratclif@usgs.gov

The Vermont Geological Survey (VGS), the U.S. Geological Survey (USGS), the University of Vermont and contractors have participated since the early 1980's in a cooperative venture to produce the new bedrock geological map of Vermont, first through the COGEOGMAP program, and later through the STATEMAP programs. The map incorporates detailed field studies conducted over 30 years by more than 60 geologists, including many students mentored by Stanley, Doolan, and Mehrstens.

Editors for the Vermont map are Nicholas Ratcliffe and Rolfe Stanley (posthumous). Associate Editors are Marjorie Gale and Peter Thompson. The one-degree sheets were compiled by Nicholas Ratcliffe, Rolfe Stanley, Barry Doolan, Charlotte Mehrstens, Norman Hatch, Douglas Rankin, Peter Thompson, Marjorie Gale, Jonathan Kim, and Greg Walsh. Vermont State Geologists involved in the project include Laurence Becker, Diane Conrad and Charles Ratte. Many other geologists have made significant contributions to the new map and it is important to share the progress of the map as we move towards review.

The 1:100000 scale map is based on mapping at scales of 1:5000 to 1:100000. More than 55 1:24000 scale quadrangles have been mapped, with additional reconnaissance mapping at a scale of 1:100000. During the past 12 years, many of the 1:24000 scale maps have been digitized and released as open file reports, thereby bringing new mapping to the public within a 1-2 year time frame. A brief comparison of the new map with the 1961 Centennial Geologic Map of Vermont will reveal many similarities yet highlight the greater detail throughout the state and the newly mapped faults and lithotectonic packages in northern Vermont.

A draft of the map was presented at VGS in 2001 and at NEGSA in Virginia in 2004. Since that time we have completed the correlation of units chart (CMU), generated a single set of unit

descriptions (DMU) and common nomenclature, reduced the number of units from over 800 to over 400, compiled the Mesozoic dikes and generated drafts of 5 cross-sections. New 1:24000 scale mapping from the Montpelier, Colchester, and Highgate areas has been added and Ratcliffe completed the compilation of the Taconics. The Silurian-Devonian section of Vermont, compiled by Norman Hatch, has been prepared digitally for review including the CMU and DMU. The review drafts of the NW and SW sheets, now with the USGS production staff and Chief Editor N. Ratcliffe in Reston, VA, are hand-drafted and hand-colored. Remaining tasks include final cross-sections which are consistent from north to south, a tectonic map, a map of references, and compilation/publication of geochronological and geochemical data.

PRESIDENT'S LETTER

Hello all,

As I write this, my first "President's Letter", winter is trying to make a comeback, and recently we have had flooding (Dog and Mad Rivers locally) and landslides (downtown Montpelier), and with recent earthquakes and other natural hazards in the news, people are acutely aware of Earth as a dynamic place. Perhaps the apparent increase in natural hazards is just an increase in the media coverage, and the fact that we can get global news on the Internet, but whatever the reason, I hope that we as earth scientists are taking this opportunity of increased awareness and curiosity to educate our communities and to try and increase the number of geoscience students at our educational institutes.

Last summer's field trip on bedrock and surficial geology and its relation to water resources in the southern Worcesters, led by Jon Kim, Marjie Gale, George Springston and myself was well attended and spurred us to complete some of our work. The Fall Field Trip to Highgate Falls Gorge, to be led by Adam Schoonmaker, was cancelled due to high water and submerged rocks, but we hope to reschedule it sometime this year, so keep an eye out for a date on that. No field trip meant no Executive Meeting, but we did manage to decide by email that we would take the GMG to pdf format to save costs, and I urge you to select that option if you haven't already. We are looking for a summer field trip, so please think about volunteering some of your time and rocks.

Last year I served as the first VGS Lecturer and I was invited to talk at three Vermont colleges, Essex High School and the University of Maine-Farmington. We are looking for the next Lecturer, so please, if you have some recent research to share, volunteer for this, or nominate a colleague. I had a wonderful experience.

The Winter Meeting is just around the corner and I look forward to seeing you all here at Norwich. Lastly, thank you to Tim Grover, past President, for two great years of leadership.

Best wishes,
Rick Dunn, President

ANNUAL MEETING MINUTES & ELECTIONS

Due to the cancellation of the Summer Field Trip to Highgate Falls Gorge, the Annual Meeting was also cancelled. The Executive Committee conducted its business electronically instead. I, acting as temporary secretary for Dave West, have summarized the discussions that took place by e-mail as the minutes to the Annual Meeting.

1. Steve Howe reported that Adam Schoonmaker was willing to run his Highgate Falls Gorge field trip again during the summer or fall of 2006. The Committee tentatively agreed that the trip would be best run in the fall, especially if an overnight canoe trip on the upper Connecticut River proposed by Dave Westerman at the Winter 2005 Meeting for the summer came to fruition.
2. February 18, 2006 was selected as the date for the upcoming Winter Meeting to be held at Norwich University. Although it was agreed that the theme this year would be "mineral resources," the Committee also suggested that personnel from the Vermont Geological Survey be encouraged to discuss their progress on the new bedrock geologic map of Vermont at the meeting.
3. Steve Howe reported that the Society had awarded over \$1,300 to four students who had applied to the Research Grant Program by the October 1, 2005 deadline. He indicated that the Society would be able to support the Program up to \$1,000 for the next round, the deadline of which is April 1, 2006.
4. A new publishing committee was established to handle the creation, printing, and mailing of the *Green Mountain Geologist* (GMG) for the next calendar year. Kathy Howe will handle acquiring all of the material from contributors and formatting both the paper and electronic versions of each issue. Steve Howe will review the content of each issue and send out the electronic version to members who have elected to receive it as a pdf file. Dave West will have the paper version printed and will mail it to members who have elected to receive a paper copy.

The GMG will also be modified so that it will be printed back-to-back on 8-1/2x11 inch paper, making formatting each issue much less time-consuming. The issue will be stapled once at the upper right and folded in half prior to mailing.

The Executive Committee also agreed strongly that efforts to urge members to opt to receive the GMG electronically as a pdf file should continue, emphasizing the significant savings in cost and effort to produce and mail an electronic version compared to a paper version, to say nothing of the environmental benefits of reducing paper consumption.

5. Membership renewal and directory information forms for 2006 were mailed out by the end of December to all members. It was agreed that dues would not be increased, despite the proposed increase in postal service rates in early January. The deadline for payment of dues was January 31, 2006.
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6. April 29, 2006 was selected as the date for the upcoming Spring Meeting to be held at Middlebury College this year.
7. The entire slate of Officers proposed for 2006 was voted for unanimously by a combination of e-mail messages from Executive Committee members and absentee ballots sent in to the Secretary by Society members. Immediate past-President Tim Grover was appointed to the Board of Directors for a one-year term, replacing Shelley Snyder whose long service to the Board was gratefully acknowledged. The Officers and Board of Directors assumed their duties at the close of the Annual Meeting.

Respectfully submitted,
Stephen S. Howe

TREASURER'S REPORT

The financial condition of the Society continues to be very strong. As of February 1, 2006, the Society's checking account balance was \$5,054.86. As indicated in the Advancement of Science Committee report, four Research Grants totaling over \$1,300 were awarded during the latest round of reviews. I expect to be able to support the Research Grant Program at a similar level for the next two rounds, but it is possible that, given the relatively flat income from dues, additional research grant contributions, and other sources, future support beyond next year may be slightly more constrained. To my knowledge, there are no outstanding bills.

The 2006 membership renewal and directory information form was mailed to all members before December 31, 2005. The deadline for renewal is January 31, 2006. Many members have already returned their forms with their payments, including a number with additional contributions to the Research Grant Program, but there are still quite a few members who have not yet returned their forms. Please help the Society keep expenses to a minimum by renewing your membership promptly.

Despite the increase in postal service rates, I have recommended that dues remain at the same level as last year. I urge as many members as possible to consider receiving the *Green Mountain Geologist* electronically as a pdf file to help keep the Society's publication and mailing costs low, which will, in turn, allow us to keep membership in the VGS the bargain that it already is.

Respectfully submitted,
Stephen S. Howe, Treasurer

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

The Committee has been busy with two projects since its last report, reviewing applications to the Research Grant Program and soliciting abstracts for the Winter Meeting.

Four applications to the Research Grant Program were received by the October 1, 2005 deadline from students at Dartmouth College, Green Mountain College, Middlebury College, and the University of Vermont. The Committee was very impressed with the quality of the applications and awarded over \$1,300 in Research Grants to all four students.

The theme of the Winter Meeting this year is “mineral resources.”

Respectfully submitted,
Stephen S. Howe, Chair

VERMONT STATE GEOLOGIST’S REPORT

Thanks to those who wrote the Agency of Natural Resources in support of geology, the earth sciences and the need for science in decision making. Comments are still being accepted by contacting:

John Sayles, Director for Policy Research and Planning
Agency of Natural Resources, 103 South Main St., Waterbury, VT 05671
802-241-3957; john.sayles@state.vt.us

Some recent examples of the uses of basic geologic data are described below:

Manchester Quadrangle

Surficial geologic mapping and groundwater resource derivative maps for Manchester in September 2004 led to a funded special project to determine how water may be contributed to the Town wells in Manchester from the far side of the Battenkill River. The maps completed by Dave DeSimone were further employed in the review of a proposed development in Manchester near Bourn Brook and Richville Road. Depth to groundwater as it relates to a stormwater retention basin is at issue and static levels from located water wells and surficial geologic mapping gave a picture of the water table. Comments to regulators and the Town also incorporate lessons learned from the groundwater level monitoring study. Both these science efforts relating to groundwater protection issues are prime examples of the importance of understanding the groundwater resource through geologic mapping.

Montpelier Rockslide

Jon Kim and Marjorie Gale have mapped in the Montpelier Quadrangle including the formation in which the December 26th rockslide occurred. The Vermont Survey met with Montpelier’s geotechnical consulting firm, Golder Associates. Tom Eliassen of the Highway Department and the Assistant City Engineer were in attendance having been the first to address the problem. The Division provided a briefing to Golder on the base geologic information and recent post slide structural geology measurements taken by Jon Kim. Golder is designing the stabilization plan and always uses detailed geologic information to insure long-term stability of the geotechnical engineering design and construction.

Groundwater Resource Mapping – Williston

On October 25, 2005, the State Geologist presented to the Williston Planning Commission the results of a hydrogeologic study prepared by the Vermont Survey for select areas in the Town using existing information. One of the selected areas is often reported to have low yields and located water well data confirm the difficulties home owners face in the area when drilling for adequate yields to meet domestic demand. The maps and well data can assist future homeowners and the Town when planning to mitigate the low yield issue.

Westmore Route 5A Rock Slides

Sam Lewis, Agency of Transportation (AOT) Operations Director, called a meeting at the District Garage serving the Route 5A section that is east of Lake Willoughby and below steep slopes and talus of Mt. Pisgah. The purpose was to better understand a recent rockslide and get a historical perspective on other events. The AOT geologist, Tom Eliassen, and Jon Kim of the Vermont Survey both presented on the subject and a discussion was held with Mr. Lewis, the District Chief, local emergency responders, geologists, and the State Geologist to consider prudent follow-up steps.

Moretown Landfill and Geology

The State's Waste Management Division (WMD) contacted the Vermont Survey about bedrock geology in the vicinity of the Moretown landfill. An application to expand the landfill is in technical review. Geology is mapping the northern portion of the Waterbury quadrangle and has mapped an inactive, steep, thrust fault in the area. The fault mapped is near the western edge of the landfill property. Marjorie Gale of the Vermont Survey visited the site with WMD and the landfill consultant to describe the bedrock geology and the fault zone. WMD asked the applicants to include a discussion about the bedrock geology in their site characterization, specifically how it may relate to movement of contaminants through groundwater and their groundwater-monitoring plan.

Dry Fuel Storage at Vermont Yankee

The State Geologist is advising the Agency of Natural Resources on review of a dry cask storage proposal at Vermont Yankee. Storage of high-level radioactive waste in concrete canisters is proposed to begin in 2007. The planned testimony focuses on seismic and liquefaction questions and the State Geologist directed his attention to groundwater levels and geologic materials as they relate to liquefaction potential beneath the storage pad. Cooperation with UVM geotechnical engineering professor Mandar Dewoolkar led to his testimony (November 2005) on seismic soil intersection studies, a cask sliding analysis, seismic slope instability, and liquefaction issues. The liquefaction technical issues focus on the use of blow counts from individual wells vs. averaging blow counts for all the overburden under the dry fuel storage pad.

New Location

The move is complete so please stop by and visit. The Logue House is out front along the horseshoe shaped entrance to the Waterbury State Office complex. The new address is:

Vermont Geological Survey
Division of Geology and Mineral Resources
Vermont Dept. of Environmental Conservation
103 South Main Street
Waterbury, VT 05671-2420

Respectfully submitted,
Laurence R. Becker, State Geologist

CALL FOR STUDENT ABSTRACTS

SPRING MEETING OF THE VERMONT GEOLOGICAL SOCIETY SATURDAY, APRIL 29, 2006

The Vermont Geological Society will hold its Spring 2006 Meeting in Bicentennial Hall Room 220 at Middlebury College in Middlebury, Vermont. 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 attachment to an e-mail message sent to Kathleen Howe at khowe@uvm.edu

If electronic submission is not possible, please mail your abstract well in advance of the deadline to:

Kathleen Howe
University of Vermont
Office of Health Promotion Research
1 South Prospect Street, Room 4428A
Burlington, VT 05401

Oral presentations will be limited to 15 minutes with 5 additional minutes for questions. A computer projection system for PowerPoint presentations will be available as well as slide and overhead projectors.

Deadline for abstracts: Monday, April 10, 2006

For additional information regarding capabilities for presentations at the meeting, contact Dave West at (802) 443-3476 or dwest@middlebury.edu

ANNOUNCEMENTS**STUDENT RESEARCH GRANT APPLICATIONS
DUE APRIL 1, 2006**

Students and secondary school teachers are encouraged to apply to the VGS Research Grant Program by April 1, 2006. Downloadable Research Grant Program Applications are available from the Society's website at www.uvm.org/vtgeologicalsociety/. For those without Internet access, forms may be obtained by writing to Stephen Howe at the Dept. of Earth and Atmospheric Sciences, University at Albany, ES-351, 1400 Washington Avenue, Albany, NY 12222-0001. Tel: (518) 442-5053; e-mail: showe@albany.edu

VERMONT GEOLOGICAL SOCIETY CALENDAR

- April 1: Student Research Grant Program Applications due
- April 10: Student abstracts for Spring Meeting due
- April 10: Executive Committee reports due
- April 29: Spring Meeting, Middlebury College

The **GREEN MOUNTAIN GEOLOGIST** is published quarterly
by the Vermont Geological Society, a non-profit educational corporation.

Executive Committee

President	Richard Dunn	802-485-2304	rdunn@norwich.edu
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of	Tim Grover	802-468-1289	grovert@castleton.edu
Directors	Helen Mango	802-453-1478	mangoh@castleton.edu

Committees

Advancement of Science	Stephen Howe
Education	Christine Massey
Membership	Stephen Wright
Public Issues	Laurence Becker
Publishing	Kathleen Howe, Stephen Howe, and David West

**Vermont Geological Society
Winter Meeting
February 18, 2006, 8:30 AM
Cabot Science Building, Room 085
Norwich University, Northfield, Vermont**

Directions to Norwich University:

Norwich University is located on VT Route 12, one mile south of the center of Northfield. It can be reached from I-89 by taking Exit 5 and following VT Route 64 west to Route 12, and then north to the University. The Geology Department is located in Cabot Science Building, the southeastern most brick building on campus, just west of Route 12. The entrance is near the northeast corner of the very large white Kreitzburg Library, which can't be missed. The easiest parking for the meeting will be in the commuter lot opposite the Science/Engineering complex on the east side of Route 12.

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

ADDRESS CHANGE?

Please send it to the Treasurer at the above address