

THE GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY
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WINTER 2005

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*The Vermont Geological Society's
Winter Meeting
February 19, 2005, 8:30 AM at Norwich University*

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WINTER MEETING PROGRAM

**VERMONT GEOLOGICAL SOCIETY
Cabot Science Building, Room 085
Norwich University, Northfield, Vermont**

February 19, 2005

- 8:30 COFFEE & REFRESHMENTS
- 9:00 Greg Druschel: ACID MINE DRAINAGE: RESEARCH ON SULFIDE MINERAL OXIDATION PATHWAYS AND THE ROLES MICROBES PLAY IN SPEEDING UP THESE REACTIONS IN MINES FROM CALIFORNIA TO VERMONT
- 9:30 George Springston and Laurence Becker: LANDSLIDE AND RIVERINE EROSION HAZARD MAPPING IN THE MAD RIVER WATERSHED, CENTRAL VERMONT
- 9:50 Richard Dunn: GEOARCHAEOLOGY OF THE ROMAN CEMETERY AT KENCHREAI, GREECE, WITH EMPHASIS ON ROMAN USE OF THE LANDSCAPE AND NATURAL MATERIALS
- 10:10 Thelma Thompson: FROM BAKER STREET TO TENSLEEP: GEOLOGY IN THE DETECTIVE NOVEL
- 10:30 David Westerman: FORENSIC GEOLOGY AT NORWICH UNIVERSITY: A NEW COURSE WITH NEW CHALLENGES
- 10:40 FORENSIC GEOLOGY LAB EXERCISE: "THE CASE OF THE MIDDLE DISNEY MURDER" Norwich Geology Professor Dave Westerman will provide a lab exercise where interested participants will solve a "crime" based on the analyses of sediments from the crime scene, the suspects, and from their alibi sites
- 12:30 LUNCH and VGS Executive Committee Meeting - All members are invited to attend.

ABSTRACTS

ACID MINE DRAINAGE: RESEARCH ON SULFIDE MINERAL OXIDATION PATHWAYS AND THE ROLES MICROBES PLAY IN SPEEDING UP THESE REACTIONS IN MINES FROM CALIFORNIA TO VERMONT.

Greg Druschel, Department of Geology, University of Vermont, Burlington, Vermont 05405.
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Acid mine drainage (AMD) is a widespread environmental problem which is the result of exposing sulfide minerals such as pyrite (FeS_2) to atmospheric oxygen, yielding low pH, metal-laden waters. Research at the Iron Mountain Mine near Redding, northern CA, has probed some of the links between exactly how microbes are able to accelerate the rate of this process, deriving metabolic energy primarily from iron oxidation reactions cycled at the pyrite surface through transitions involving surface-bound sulfur species. I will review current models of pyrite oxidation pathways and discuss the dependence of specific geochemical parameters on the selection of specific pathways which affect both the acid production and rate of oxidation in abiotic and biotic systems. We will extend this thinking to work currently underway at the Ely Mine in central Vermont (and in the microbial geochemistry laboratory at the University of Vermont) as it pertains to the role of $\text{FeS}_{(\text{aq})}$ molecular clusters in the dissolution and oxidation of other sulfide minerals including pyrrhotite, mackinawite, and sphalerite.

LANDSLIDE AND RIVERINE EROSION HAZARD MAPPING IN THE MAD RIVER WATERSHED, CENTRAL VERMONT

George E. Springston, Department of Geology, Norwich University, Northfield, VT 05663,
gsprings@norwich.edu, and Laurence R. Becker, Vermont Geological Survey, 103 South Main St.,
Waterbury, VT 05671-0411, laurence.becker@anr.state.vt.us

The 144 square mile Mad River watershed in Washington and Addison Counties in central Vermont is the pilot location for testing new techniques for identifying areas susceptible to landslides and riverine erosion hazards.

New and existing geologic, soils, and elevation data are analysed using Geographic Information System (GIS) techniques. The surficial geology was mapped at 1:24,000 scale in 2002 and 2003 by Rick Dunn, Nathan Donahue, and George Springston. The fluvial geomorphology was mapped in 2002 by Lori Barg of Step By Step and Mike Blazewicz of the Friends of Mad River following protocols established by the River Corridor Management Section of the Vermont Department of Environmental Conservation (RCMS). Bedrock locations are available for much of watershed from recent bedrock mapping projects and the surficial geologic mapping and fluvial geomorphic assessments. Soils data from the Natural Resources Conservation Service includes depth to bedrock, erodibility coefficient, hydrologic group, and slope class. The following digital elevation models (DEMs) were used in the analysis: National Elevation Dataset (30 meter spacing) and Vermont Mapping Program (90 meter spacing plus break lines).

GEOARCHAEOLOGY OF THE ROMAN CEMETERY AT KENCHREAI, GREECE, WITH EMPHASIS ON ROMAN USE OF THE LANDSCAPE AND NATURAL MATERIALS

Richard K. Dunn, Department of Geology, Norwich University
Northfield, VT 05663

Classical scholars presume that a cemetery of antiquity reflects the cultural fabric of the city. The location, layout and grave or tomb design are constructs of the cultural identity. To help test this premise, geoarchaeological investigation was undertaken at the cemetery of the Roman site of

Kenchreai, located on the Saronic Gulf. Kenchreai was the sister city of ancient Corinth and was a major port for trade between the eastern Aegean and the Gulf of Corinth. The cemetery consists of many cist graves and 27 rock-cut tombs arranged upon a ridge adjacent to the ancient port. Cist graves are shallow pits excavated into bedrock. Tombs consist of a rock-cut entryway (dromos) leading into a large room (ca. 4 x 4 m). All of the tombs have been looted, from antiquity to the present, and thus the tombs contain variable sedimentary fills related to colluvial slope wash, wind-blown deposition, and roof and wall collapse.

A major goal was to reconstruct the Roman landscape. At present, the cemetery sits at the edge of a coastal cliff, overlooking the Saronic Gulf. Kenchreai is located on the hanging wall of a major east-west normal fault system and the site has undergone at least two major co-seismic subsidence events in the late Roman and modern times, combining for nearly two meters of subsidence.

A detailed geologic map was made of the site, with tombs providing excellent subsurface detail. Pliocene-Pleistocene marl is overlain by Pleistocene nearshore marine sandstone and conglomerate. These units are dissected by several Pleistocene valley fill deposits. Numerous faults across the site show no offset for the post-Roman era.

Submerged wave-cut features, submerged beachrock, and projection of the existing slope suggest <25 m of coastal retreat since the Roman era. Given the nature of the lithologic units it is probable that a coastal cliff has existed here, though seaward, since pre-Roman time.

A thick (0.75-1.50 m) and pervasive pedogenic calcium carbonate horizon ("caliche") has developed on the ridge, regardless of the underlying bedrock lithology. Numerous groundwater "flow textures" in caliche are natural and do not represent, as previously suggested, artistic application of mortar and plaster on tomb walls.

Construction style for tombs was strongly influenced by local geology, as tomb builders favored the exceptionally well-lithified caliche horizon for tomb ceilings, the height and slope of which vary with caliche depth. The location of the tombs was also dictated by the local geology. The dromos to 90% of the tombs begins in the oldest valley fill deposit, which is a restricted unit that is fine-grained and homogenous; criteria apparently favored in tomb construction due to ease of excavation and resistance to collapse.

The tombs of Roman Kenchreai certainly reflect cultural associations, but tomb location and construction were equally dictated by local geology. For the Romans, the geomorphology was also important. The cemetery was situated near a coastal cliff, overlooking both the port and the approach from the sea, making it a prominent feature in the Roman landscape. Additionally, during the geological study the remains of what is likely a Greek Temple of Aphrodite were discovered, revealing that the ridge has been the site of ritual and worship for millennia.

FROM BAKER STREET TO TENSLEEP: GEOLOGY IN THE DETECTIVE NOVEL

Thelma Thompson, Government Documents and Maps Librarian and Liaison to Geography and Earth Sciences Departments, University of New Hampshire Library, Durham, NH 03824

Dr. Watson rated Sherlock Holmes' abilities as a geologist in *A Study in Scarlet* as "Practical, but limited". Holmes demonstrated his keen observation of various geological features in several of Sir Arthur Conan Doyle's classic stories. Since Doyle's time, there have been occasional mystery novels that use geologists as key characters, or that contain plots depending on geologic interpretations to solve the central mystery. Novels in which the natural setting is of paramount importance, such as Tony Hillerman's mysteries set in Navaho Country, often convey a vivid sense of the landscape and its geology. However, it is relatively recently that geologists have been the main characters in popular mystery series. Sarah Andrews' character, Em Harris, former-petroleum-geologist-turned-

forensic-geologist, is now on her ninth adventure in *Earth Colors*, and Susan Cummins Miller has recently published her second book featuring a geologist named Frankie MacFarlane.

FORENSIC GEOLOGY AT NORWICH UNIVERSITY: A NEW COURSE WITH NEW CHALLENGES

David S. Westerman, Geology Department, Norwich University, Northfield, VT 05663

The experiment is to use Forensic Geology as an introductory lab science to meet a General Education course that provides “literacy in current scientific knowledge and theories and develop an appreciation of the natural world”. Motivations to try this approach included: 1) to take advantage of the popularity of forensic shows on television, 2) to provide a course of high interest for students in the largest major at Norwich (Justice Studies), and 3) because the idea met the criteria of being great fun. Obstacles included the need to avoid course duplication while still teaching fundamental geology, and the fact that service courses can’t carry prerequisites. The resulting model was to divide the semester into blocks defined by a combination of categories of earth materials and analytical techniques, and to then use case studies representing examples of how criminal cases have been solved using these materials and techniques. Format for laboratories called for a new “crime” to be committed every week, calling for analysis of materials from the crime scene, materials from the suspects, and materials from their alibi sites. Students analyzed the materials using selected techniques that led them to conclusions they could use as “expert” witnesses. Examples of labs included sediment size analysis from the “Case of the Middle Disney Murder”, x-ray analysis of wheel-well material from the “Botched Kidnapping”, fossil identification from the “Dutch Hand Grenade Scam”, and water analysis from the “Paine Creek Drowning” (in which the victim drowned in a bathtub full of Union Brook water out of the Moretown Formation before the body was dumped in Paine Creek which runs over the calcareous Waits River and Northfield Formations). The most significant result of this teaching experiment was the extraordinary effort that students made to “solve” the puzzle for each lab, and the quality of their reports. They expressed the notion that they felt as if they were working “in a real lab”.

PRESIDENT’S LETTER

Hi All,

I hope everyone is enjoying our winter weather. The theme of our winter meeting, Forensic Geology, is a fascinating one. I know I am looking forward to learning more about it. I just wanted to remind everyone that topics such as forensic geology, landslides, and tsunamis provide us with a wonderful opportunity to promote and discuss the significance of geology.

That’s it from here. As always, if anyone has any suggestions for the VGS please feel free to send them to anyone on the advisory board. I’m looking forward to seeing everyone at the upcoming meeting. Have a great winter.

Happy Trails,
Tim Grover

ANNUAL MEETING MINUTES

Saturday, October 26, 2004, East Middlebury, Vermont

The annual meeting followed an excellent field trip led by Rick Dunn, George Springston and Nathan Donahue. The trip focused on the surficial geology and Quaternary history of the Middlebury River basin. In addition, Andy McIntosh of OMYA provided access and information on the bedrock

geology of the East Middlebury quarry for trip participants. The formal portion of the Executive Committee meeting was called to order by Vice President Rick Dunn (in the absence of President Tim Grover). The first order of business was the election of the following officers to the Executive Committee:

Tim Grover - President
Rick Dunn - Vice President
Dave West - Secretary
Steve Howe - Treasurer
Helen Mango – Board of Directors

Treasurer Steve Howe indicated that the financial condition of the Society is sound and that members will have the option to receive the *Green Mountain Geologist* as a PDF file attached to an e-mail beginning with the Winter, 2005 issue. Steve, as Chair of the Advancement of Science Committee, reported that he had received one proposal to the Research Grant Program. Marjie Gale noted that Earth Science Week was a success with several “Geologist in the Park” volunteers reporting good attendance and the OMYA Quarry Open House in East Middlebury drawing 800 visitors.

The Committee tentatively set the Winter 2005 meeting for Saturday, February 26th at Norwich University. In the coming months, members of the Executive Committee will be working on a theme (e.g., geologic mapping in Vermont, forensic geology, mineral resources) and keynote speaker for the Winter Meeting. The Spring 2005 meeting will be held at the University of Vermont in the new Geology Department facilities (Delehanty Hall). The Committee also discussed possibilities for the summer field trip and Marjie Gale and Jon Kim have tentatively agreed to lead a trip on the Bedrock and Surficial Geology of the Southern Worcester Mountains in central Vermont. Dates for the Spring meeting and Summer field trip will be finalized at the Winter meeting.

Respectfully Submitted,
Dave West, Secretary

STATE GEOLOGIST’S REPORT

New State Bedrock Map – Background and Update

Creation and publication of the new State Bedrock Map of Vermont is a long-term joint project between the Vermont Geological Survey (Division of Geology), the US Geological Survey and the University of Vermont. The majority of detailed field mapping was completed several years ago, although some recent field mapping (1:24000 scale) in the Montpelier, Colchester and southern Worcester Mountains has been integrated into the compilation (1:100,000 scale). The map project was originally designed with VGS and UVM personnel responsible for northern Vermont and USGS responsible for southern Vermont and the NH border area. For the past several years, the map Editors (Nick Ratcliffe and Rolfe Stanley, post humus) and Associate Editors (Marjorie Gale and Peter Thompson) have focused on bringing those areas together into a scientifically consistent and defensible map of the State. The linework for the new map is complete and drafts are posted in the Division office. Much detailed work remains as the map is prepared for scientific review. Major tasks include completion of the correlation of units charts and construction and drafting of cross-sections. Prior to entering scientific review, the map will need all components complete - linework, unit descriptions, correlation chart, dike rocks coverage, references, fossil age and radiometric age control, and cross-sections. In order to move the project forward, Marjorie Gale spent the week of December 13 in Reston, VA in a joint work session with Nick Ratcliffe. The correlation of units chart was drafted to scale for the first time and places all the Vermont map units (rock types) in a single chart with appropriate age assignments.

Arsenic and Geo Mapping

The State Toxicologist attended the Vermont Geological Survey's Statemap Advisory Committee meeting to help set priorities for the summer 2005 field season. The Committee supported the Health Department's request to conduct mapping in the Stowe area where there are high readings of arsenic in drinking water for two domestic users. Other projects supported were in Brandon, Woodstock, and Williston. These are basic geologic mapping projects combined with water well data to provide town-wide information for groundwater resource identification and protection.

Sheldon, VT – Large Farm and Nitrates in Bedrock Wells

On October 5, Jon Kim of the Vermont Geological Survey met with Jeff Comstock of the Dept. of Agriculture at a large farm operation in Sheldon where nitrate contamination of bedrock wells has become a problem. Jon conducted a reconnaissance-level geologic survey of the farm area and is currently preparing a memo for distribution to the Dept. of Agriculture, farmer, and affected homeowners that summarize the findings. The memo is intended as a compilation of objective information for all parties.

Radioactivity in Groundwater

On September 13, Jon Kim of the Geology Division presented a talk titled "Elevated Naturally-Occurring Radioactivity in Ground Water from Three Fractured Bedrock Settings: Implications for the State of Vermont" at the 2004 U.S. EPA/National Groundwater Association Fractured Rock Conference in Portland, Maine. The State Geologist was a co-author on the talk for this National groundwater meeting.

Middletown Springs

On November 11, 2004, the State Geologist met with the Board of the Middletown Springs Elementary School. The purpose was to request School participation in the study of the transport and fate of radionuclides in wastewater systems to be conducted by the University of New Hampshire. The State Geologist is conducting scientific oversight for the EPA/Vermont funded study. Naturally-occurring radionuclides have passed through a septic tank to the schools new leach field and an older leach field was in operation from 1973 – 1996.

State Curator's Request

The State Curator of Buildings requested that the State Geologist investigate the stone found at the top of the steps at 116 State Street in Montpelier. Through visual inspection and research the evidence strongly suggests that the stone is "Bluestone" most probably from the Hudson River Valley in New York State. The intent is to restore all the steps of 116 State Street to the original stone type.

Respectfully submitted,
Laurence R. Becker, State Geologist, Vermont Geological Survey, 103 South Maine Street,
Waterbury, VT 05671

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

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

The Winter Meeting is shaping up to be an exciting one, with its timely focus on “forensic geology.”

One application to the Research Grant Program from a student at the University of Vermont was received by the October 1, 2004 deadline. The Committee awarded a Research Grant to this student, but the amount of the award has yet to be fixed pending revision of the proposal’s budget.

Respectfully submitted,
Stephen S. Howe, Chair

TREASURER’S REPORT

The financial condition of the Society continues to be very strong. As of January 24, 2005, the Society’s checking account balance was \$5,970.95. As indicated in the Advancement of Science Committee report, one Research Grant was awarded during the latest round of reviews, but the amount of the award has yet to be fixed pending revision of the proposal’s budget. To my knowledge, there are no outstanding bills.

The 2005 membership renewal and directory information form was mailed to all members before December 31, 2004. The deadline for renewal is January 31, 2005. Many members have already returned their forms with their payments, including a number of 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.

Respectfully submitted,
Stephen S. Howe, Treasurer

EARTH SCIENCE WEEK 2004: Living on a Restless Earth

The week of October 10-16, 2004 was the seventh annual celebration of Earth Science Week. The week provides an opportunity to expand public awareness and understanding of geology and its role in water and land use decisions, ecological issues, resource issues, and hazard mitigation. Vermont’s Governor, James Douglas, issued the annual Earth Science Week Proclamation.

Earth Science Week is a national project jointly sponsored by the Vermont Geological Society, Vermont Geological Survey at the Agency of Natural Resources, and the American Geological Institute. Numerous individuals, organizations and businesses sponsor activities during the week. The Vermont Geological Survey focused on hosting and staffing Geologists-in-the-Parks. OMYA, Inc. hosted a successful Open House for the fourth year. Attendance was estimated to be about 800 visitors. The Vermont Marble Exhibit and OMYA were the main sponsors of the poster contest, with support from the VT Geological Society and the VT Geological Survey. The American Geological Institute sponsored national art contests.

EARTH SCIENCE WEEK POSTER CONTEST

The 2004 Earth Science Week Poster contest was sponsored by OMYA Industries Inc., the Vermont Marble Museum, and the Vermont Geological Society. Many thanks to Christie Harris and Cathy Miglorie of OMYA, Inc. and Robert Pye of the Vermont Marble Museum for taking the leadership role in organizing and running the poster contest. A beautiful poster was produced and distributed to announce the contest. Eleven Vermont students were honored as winners of the Poster Contest. Entries were judged on creativity, artistic ability and how well the theme of “Living on a Restless Earth” was addressed. The awards ceremony was held at Omya’s Middlebury Quarry Open House on

October 16. Laurence Becker, Vermont State Geologist, was also on hand for the ceremony. Prizes were provided by OMYA, Inc. and the Vermont Marble Museum.

All winners received a trophy, a mineral or fossil specimen, and a framed Earth Science Week poster. In addition, the four First Place winners each received \$50 cash. The winners are: Bethany Miglorie, Proctor Elementary School, Grade 2; Kristofer Rauti, Barre Town Middle School, Grade 6; Catherine Pierattini, Mt. Abraham Union High School, Grade 9; and Bobbie Denko, Proctor High School, Grade 10.

Three Second Place winners and three Third Place winners received a trophy, a mineral or fossil specimen, and a framed Earth Science Week poster. The Second Place winners also received \$30.00 cash and the Third Place Winners received \$20.00 cash. The Second Place winners: Catherine Concannon, Holy Family Catholic School, Grade 3; Robin Williams, Proctor Elementary School, Grade 4; and Nat Hays, Edmunds Middle School, Grade 7. The Third Place winners are: Kaitlyn Stokarski, Holy Family Catholic School, Grade 2; Johnny Powers, Williston Central School, Grade 5; and Grace Bouton, Edmunds Middle School, Grade 7.

Winner of the "People's Choice" award, judged by visitors to the Vermont Marble Museum last week is Dylan Peters, Williston Central School, Grade 6. Winner of the Teacher/Coordinator award, given to the teacher who submits the most student entries, is Daryl Kuhn of Edmunds Middle School. She received two North African fossil specimens.

Christie Harris, Cathy Miglorie and Rob Pye are excited about next year's contest and have already begun planning for the event. If any Society members are interested in helping with the poster contest, please contact Christie at 802-770-7214.

GEOLOGISTS-IN-THE-PARKS

Geologists-in-the-Parks hosted approximately 150 students this year at Mt. Philo and Little River State Parks. Marjorie Gale, Jon Kim and Sarah King staffed the parks events. The students enjoyed hiking and hands-on learning about the geologic history of the parks.

GUEST SPEAKER

Laurence Becker, Vermont State Geologist, presented "Natural Gifts: Earth Resources from Vermont's Geologic Landscape" at the Agency of Natural Resources in Waterbury. The event was well received by the general public and ANR employees.

QUARRY OPEN HOUSE

OMYA, Inc. hosted a very successful Open House at the Middlebury quarry on October 16. An estimated crowd of 800 people attended the 4th annual event. Many thanks to Alice Blount, Ruth Gibbud, Shannon Foster, and OMYA, Inc. for bringing this event to the public. Visitors tour the quarry, inspect the large quarrying equipment, and learn about the marble industry.

If any members have ideas for next year's Earth Science Week celebration and want to organize an activity, please contact Marjorie Gale at 802-241-3608. Thanks to all the Society members for their support of Earth Science Week. Some of the colorful posters and other photographs from Earth Science Week are posted on the Vermont Geological Survey web site at <http://www.anr.state.vt.us/dec/geo/esweek04.htm>. We hope you enjoy them.

Respectfully submitted,
Marjorie Gale

CALL FOR ABSTRACTS
SPRING MEETING OF THE VERMONT GEOLOGICAL SOCIETY
SATURDAY, APRIL 23, 2005, 8:30 A.M.

The Vermont Geological Society will hold its Spring 2005 meeting in Delehanty Hall at the University of Vermont in Burlington, VT. 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 outstanding undergraduate paper will be presented. A cash award for “Best Paper and/or 2nd place” will also be presented based on quality of the research, the abstract, and the presentation of the paper, including abstract content and style, presentation clarity and thoroughness, and the student’s mastery of the subject matter.

Abstracts should be prepared using the style employed for abstracts submitted to Geological Society of America meetings (maximum of 2000 characters without spaces). We strongly encourage speakers to submit their abstracts electronically as a Word file attachment to an e-mail message – and send the message to: David West at dwest@middlebury.edu

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

David West
Department of Geology
Middlebury College
Middlebury, VT 05753

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 projectors and an overhead projector.

Deadline for abstracts: Monday, April 4, 2005.

For additional information regarding abstract submission or capabilities for presentations at the meeting, contact Dave West at 802-443-3476 or the e-mail address above.

ANNOUNCEMENTS

STUDENT RESEARCH GRANT APPLICATIONS
DUE APRIL 1, 2005

Students and secondary school teachers are encouraged to apply to the VGS Research Grant Program by April 1, 2005. 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@csc.albany.edu

MEMBERSHIP RENEWALS WERE DUE
on January 31, 2005

Downloadable Membership forms are available from the Society’s website at www.uvm.org/vtgeologicalsociety/. Renewal notices were mailed to members in December. Please send your dues to Treasurer, P.O. Box 1224, St. Albans, VT 05478-1224. Thanks.

CALENDAR

- January 31: VGS membership dues deadline
February 19: **VGS Winter Meeting, Norwich University**
 March 14-16: NEGSA meeting in Saratoga Springs, NY
 April 1: Student grant applications due
 April 4: Student paper abstracts due
 April 4: Submit executive committee reports to GMG
April 23: **VGS Spring Meeting, University of Vermont**

THE GREEN MOUNTAIN GEOLOGIST
 VERMONT GEOLOGICAL SOCIETY
 P.O. Box 1224
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The *GREEN MOUNTAIN GEOLOGIST* is published quarterly by the Vermont Geological Society, a non-profit educational corporation.

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