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# THE GREEN MOUNTAIN GEOLOGIST



NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

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## CALL for ABSTRACTS VGS Spring Meeting, April 21, 2001 Norwich University Abstracts Due by March 23, 2001

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## PRESIDENT'S LETTER

Dear Members,

News first. Dave Westerman indicated that Norwich was ready to take a turn at hosting the student papers spring meeting to be held at Norwich University on April 21, 2001. Students should submit abstracts for consideration for presentation at this meeting. Those students who wish to apply for financial assistance for their research should apply for grant funding. Information regarding where to send applications is elsewhere in this newsletter. Applications should be in by the stated deadline, as we will announce the winners at the spring meeting. Acceptance of this award assumes that the recipient will make a report to the Vermont Geological Society at the next spring meeting (in 2002).

Many thanks to members who volunteered during Earth Science Week 2000. The poster contest in October was a success again. Many students and parents attended the ceremony held at the Perkins Museum. I recently ran into a current geology student. I saw in him the same excitement that I remember from my undergraduate years. As an educator I found this to be very satisfying. In this new millennium, I trust that we all will find the time to plant that excitement and wonder in our students. We are all educators in some way, passing our combined knowledge and enthusiasm to future generations.

Welcome to the new millennium. I hope that this newsletter finds you all well and extend best wishes to you and yours.

Sincerely,

Shelley F. Snyder  
VGS President  
Mt. Abraham Union High School  
7 Airport Drive  
Bristol, VT 05443  
(802) 658-0575  
SSNYDER@mtabe.k12.vt.us

## EXECUTIVE COMMITTEE MEETING MINUTES

Fall Meeting, Saturday, September 23, 2000

Following an excellent field trip led by Stephen Wright, a meeting of the VGS executive committee meeting and general membership took place at Cafe Banditos in Jeffersonville. The election of executive committee members for 2001 was led by Marjie Gale. Election results are as follow.

President: Shelley Snyder

Vice President: Ray Coish

Secretary: Jeff Hoffer

Treasurer: Kristen Underwood

Board of Directors: Kent Koptuch, Kristen Underwood, and Stephen Wright

Committee chairs for 2001 are as follow.

Geological Education Committee Chair: Christine Massey

Public Issue Committee Chair: Larry Becker

Publications/Editorial Committee Chair: Marjorie Gale

Advancement of Science Committee Chair: Stephen Howe

Other business included a discussion of general issues such as the upcoming schedule for 2001, the spring student talks, VGS research grants, etc. A decision was made to send out a copy of the VGS bylaws with the Winter 2001 GMG (this issue). The Winter GMG will also put out a call for student research grants. The guidelines for the research grants will be sent as requested. Potential field trips for the spring and fall were discussed. Any volunteers or requests for specific field trips are welcome!

The meeting adjourned at 7:00 PM.

Respectfully submitted,  
Jeff Hoffer, VGS Secretary

## CALL FOR ABSTRACTS

Spring Meeting of the Vermont Geological Society  
Saturday, April 21, 2001, 8:30 AM

Spring 2001 Presentation of Student Papers  
Department of Geology, Norwich University  
Northfield, Vermont

The Vermont Geological Society will hold its Spring 2001 meeting at Norwich University in Northfield, 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 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 presentation of the paper. A copy of the evaluation form is included in this issue of the GMG.

Abstracts should be limited to one double spaced 8.5 x 11 inch sheet and can include figures. Font size should not be less than 10. Please submit both a paper and electronic copy (e-mail or disk; e-mail preferred) of abstracts, reviewed by the student's advisor, to the editor at the address given below. Disks should include both a formatted and "text only" version of the abstract (either Mac or IBM; IBM preferred).

Abstracts submitted by e-mail should be sent to [marjieg@dec.anr.state.vt.us](mailto:marjieg@dec.anr.state.vt.us)  
Oral presentations will be limited to 15 minutes with 5 minutes for questions  
Two slide projectors and an overhead projector will be available. Deadline for Abstracts: Friday, March 23, 2001. Send abstracts to:

Marjorie Gale  
Vermont Geological Survey  
103 South Main St., The Laundry Building  
Waterbury, VT 05671-0301  
E-MAIL: [marjieg@dec.anr.state.vt.us](mailto:marjieg@dec.anr.state.vt.us)

For additional information contact Shelley Snyder at 658-0575 or Marjie Gale at 241-3608 (o) or 899-5002 (h).

VERMONT GEOLOGICAL SOCIETY  
STUDENT PRESENTATION EVALUATION FORM

SPRING MEETING \_\_\_\_\_ Date \_\_\_\_\_

GRAD / UNDERGRAD \_\_\_\_\_

SPEAKER NAME: \_\_\_\_\_

ABSTRACT AUTHORS: \_\_\_\_\_

ABSTRACT TITLE: \_\_\_\_\_

Pre-Presentation

ABSTRACT CONTENT \_\_\_\_\_

ABSTRACT WRITING STYLE \_\_\_\_\_

Syn-Presentation

INTRODUCTION / BACKGROUND / PROBLEM STATEMENT \_\_\_\_\_

METHODS / APPROACH TO PROBLEM \_\_\_\_\_

DISCUSSION / CONCLUSIONS / RESULTS \_\_\_\_\_

Overall and Post-Presentation

ORAL PRESENTATION \_\_\_\_\_

VISUAL PRESENTATION \_\_\_\_\_

TALK MECHANICS (FORMAT, TIMING) \_\_\_\_\_

RESPONSE TO QUESTIONS / KNOWLEDGE OF SUBJECT \_\_\_\_\_

ORIGINALITY / RELEVANCE \_\_\_\_\_

POINT SYSTEM: \_\_\_\_\_ TOTAL \_\_\_\_\_

- WELL ABOVE AVERAGE 5
- ABOVE AVERAGE 4
- AVERAGE 3
- BELOW AVERAGE 2
- WELL BELOW AVERAGE 1

NAME OF JUDGE: \_\_\_\_\_

COMMENTS:

## GSA ANNUAL MEETING IN BURLINGTON!

The NORTHEASTERN SECTION of the GEOLOGICAL SOCIETY OF AMERICA 36TH ANNUAL MEETING will be held on March 12-14, 2001, at the Sheraton Conference, 870 Williston Road, Burlington VT, 05403. To register and find more detailed information, please see the GSA website:

[www.geosociety.org/sectdiv/northe/01nemtg.htm](http://www.geosociety.org/sectdiv/northe/01nemtg.htm).

The pre-registration deadline is February 2, 2001.

The hosts for the 2001 meeting are the University of Vermont, Middlebury College, Norwich University, Vermont State Colleges at Johnson, Lyndonville and Castleton, the State University of New York at Plattsburg, the Vermont Geological Society, and the Vermont Geological Survey. Meeting also at this time are the Eastern Section of SEPM, the Northeastern Section of the Paleontological Society (NEPS), the Eastern New England Sections of the National Association of Geology Teachers (NAGT), the Association of Women Geoscientists, and the council on Undergraduate Research Geology Division.

We hope to see many of you presenting or attending at this regional meeting. If you have any questions, please contact Tracy Rushmer, Program Chair, at the University of Vermont at (802) 656-8136 or [trushmer@zoo.uvm.edu](mailto:trushmer@zoo.uvm.edu).

### TECHNICAL PROGRAM

#### SYMPOSIA

1. Caledonian magmatism: Cross-Atlantic connections
2. Fault Zone Evolution and Convergent Tectonics - A Symposium in Honor of Rolfe Stanley.
3. Glacial Processes in New England: A Symposium in Honor of Fred Larsen.
4. Thermochronology From Apatite to Monazite: Deciphering Polymetamorphic Terranes.
5. Environmental Records from Large Estuaries along the Northeastern US Seaboard. Sponsored by the Northeast Section of SEPM.

GSA Continued...

6. Early and Middle Paleozoic sequence stratigraphy---Tectonic and eustatic signatures in eastern Laurentia. Sponsored by the Northeast Section of SEPM.

#### THEME SESSIONS

1. Terrestrial Records of Late Pleistocene and Holocene Climate Change.
2. Paleolimnological Records of Holocene Climate Change.
3. Deformation, Metamorphism and Melting: Interactions in the Crust.
4. Geologic Evolution of the Northern Appalachians; The Quebec - Vermont Connection.
5. Carbonate geology with a focus on the Trenton/Black River and Beekmantown. Sponsored by the Northeast Section of SEPM.
6. Geologic aspects of environmental problems in the Northeast.
7. K-16 Education: Earth and Environmental Science.
8. Undergraduate Research. Sponsored by the Geology Division of the Council on Undergraduate Research. (Poster)

#### SHORT COURSES

System Dynamic Modeling of Natural Environments: An Introduction to STELLA: Sunday, March 11 (9 a.m.- 5 p.m.)

New Advances in XRF Spectroscopy and their Applications to the Geological Sciences: Sunday, March 11 (9 a.m. - noon)

Full Pattern Rietveld Analysis Applied to Poly-Mineralic Phase Identification in Geology: A More Accurate Alternative to the Traditional Single Line Approach: Sunday, March 11 (noon - 4:00 p.m.)

Thermodynamic Modeling of Mineral Reactions. An Introduction to GIBBS. Monday, March 12 (6:00-9:00 p.m.)

#### STUDENT WORKSHOP

Roy Shlemon Mentor Program in Applied Geology. Practical advice for graduate and undergraduate students with career interests in consulting Monday, March 12, 11.30 a.m. to 1 30 p.m.

GSA Continued...

#### FIELD TRIPS

Sunday, March 11. The Stanley Outcrops. 9.00 a.m. - 5:00 p.m. Meet at the Sheraton Conference Center parking lot. Lunch provided.

Sunday, March 11. Teaching Hydrology in the winter, a hands-on field trip. Leaders: 7:30 a.m. - 5:00 p.m. Meet at the Perkins Building, University of Vermont. Lunch Provided.

Monday 12 and Tuesday, March 13. The Champlain Thrust at Lone Rock Point. (2-3 hour trip morning or afternoon). Further details will be available at the registration desk.

Monday, March 12, and Wednesday, March 14. The Salmon Hole/Redstone Quarry. (2-3 hour trip morning or afternoon). Further details will be available at the registration desk.

#### SPECIAL EVENTS

University of Vermont Perkins Geology Museum Open House. Monday, March 12, 5 - 7 p.m.

Map Blast IV. An informal session for display and discussion of newly published, unpublished, or in-progress geologic maps of any sort. Monday, March 12, 7:30-9:30 p.m.

GSA Northeast Section Reception and Banquet. Tuesday, March 13, 6-9 p.m.

## State Geologist's Report

### Geologists in the Parks

October 8-14, 2000 was the third annual Earth Science Week both nationwide and in Vermont. The week was a joint project of the Division, the Vermont Geological Society, Perkins Museum at the University of Vermont, and the American Geological Institute. The celebration featured a poster contest and open house at Perkins Museum, a mineral workshop at Vermont Marble Exhibit and in Springfield, and the Geologist-in-the-Parks activity at seven Vermont parks. Our primary focus this year was to present the parks activity for school groups, although we also coordinated activities, kept events current on our web site, recruited volunteers, sought the Governor's proclamation, made several mass mailings, and judged the poster contest. This year, acting upon a suggestion from Ginger Anderson of Forest and Parks, we held the Geologist-in-the-Parks day during the week instead. Marjorie Gale did a great job organizing the volunteers; keeping up with the schools and all the details.

Approximately 500 students attended, making the parks day a very successful one. The activities, in line with Vermont's standards for education, involved basic geology, geography, mapping, field methods, scientific method, historical and current land use, natural hazards (earthquakes, floods, volcanoes), water quality and provided site specific geologic information and interpretation. The connection made between scientists, school children and educators seemed important with some children noting that all scientists are not boring! For many guests, this was their first field science experience. The teachers and students came prepared with many questions and lots of enthusiasm. We will be soliciting feedback from teachers and volunteers so that we can improve on and hopefully expand this activity next year. With something that got so big so fast, there were a few logistical connections that will need improvement next year.

Many thanks to the geoscientists in the parks. Participation from so many members of the VT Geological Society is appreciated. We would especially like to recognize Robert Anderson and his students at Vermont Academy for their work at Mt. Ascutney. The students learned about the geology, prepared activity stations, and when the site geologist became ill at the last minute they rose to the occasion and served as guides for 85 elementary school guests on October 10th. Also, Bruce Amsden and Ginger Anderson

provided us with ideas and assistance, our State Parks were excellent hosts for the day, and Geoff Byerly in Montpelier helped plan for the Hubbard Park tours.

### Geology and State Lands Management Plans

The Vermont Survey transferred to Roy Burton, State Lands Forester, geologic information for the Roaring Brook Wildlife Management Area in the Brattleboro Quadrangle and Townshend State Forest. The information addresses: geologic sources of calcium for tree growth, the physical system that supports biodiversity, general geology for educational purposes, unique geologic sites, depth to bedrock, sand and gravel, other mineral resources including ground water, potential geologic hazards etc.

The State Geologist attended a field visit to the Sleepers River Watershed in Danville. A White Mountain National Forest geologist working with naturalist Charlie Cogbill is studying forest plots in association with trenches dug to analyze the C zone in soils (parent material). The search is for sources of calcium in relation to the plots association with bedrock types. The till plots will lead to information about enriched woods sites and the ability of maple to resist forest decline and as influenced by acid rain.

### STATEMAP Geologic Map Advisory Committee

The projects for the STATEMAP grant proposal track the ANR Strategic Plan and both are supported by the Advisory Committee. A surficial geologic and hazard map for the Third Branch of the White River will provide the detailed information for town planning that is the goal of the hazard map initiative. The Third Branch project is coordinated with the White River Partnership and the DEC Watershed Coordinator. A bedrock geologic and naturally occurring radionuclide hazard map for the Colchester 7.5 minute quadrangle covers Milton/Colchester where domestic well water can exceed radionuclide standards by substantial margins in and near the Clarendon Springs Formation. A radionuclide susceptibility map will result that supports the Ground Water and Earth

Materials outcome of providing geologic hazard information through town and regional plans. Bill Bress, State Toxicologist of the Health Department wrote a letter of support In December, the Vermont Survey received preliminary notification that we are fully funded for the summer 2001 field work.

### Ground Water Quality

The Geologic Division met with Jeff Comstock of the VT Dept of Agriculture regarding the geologic context of nitrate contamination in bedrock wells in the East Montpelier area. A geologic report is forthcoming.

Jon Kim of the Geologic Division gave a talk titled "Bedrock Geology and the Quality of Drinking Water" as part of the November Environment 2000 Lecture Series at the Cyprian Leaning Center in Waterbury.

### HAZUS Damage Assessment

In September, Jon Kim of the Geologic Division gave a talk titled "Using HAZUS in Vermont" for the annual Northeast States Emergency Consortium HAZUS Users Group meeting. This talk summarized the HAZUS runs completed by the Geologic Division for Chittenden, Franklin, Lamoille, Caledonia, Windsor, and Orange counties. The HAZUS software program was developed by FEMA and is being used nationwide to estimate potential earthquake damage. Representatives from FEMA Region I and II offices, Massachusetts, Rhode Island, New Hampshire, and Vermont were in attendance. FEMA is currently developing a HAZUS Floods module that will be used in estimating flood damage.

Submitted By,  
Laurence Becker  
Vermont State Geologist

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**Earth Science Week 2000**

The participation of our membership in the Geologists-in-the-Parks days, the Poster Contest, Mineral Workshops and organization of the week is crucial for the success of Earth Science Week in Vermont. We appreciate the efforts of so many people and hope everyone is included on the thank you list. Many thanks to the following people for volunteering during Earth Science Week 2000:

Bob Anderson and students, Larry Becker, Alice Blount, Barry Doolan, Rob Farley, Marjorie Gale, Peter Gale, Ruth Gibbud, Tim Grover, Sue Hadden, Roger Haydock, Craig Heindel, Jon Kim, Kent Koptuch, Winslow Ladue, Laura Mallard, Helen Mango, Christine Massey, Shelley Snyder, Kristen Underwood, and John Warren

## GETIT!

The Geoscience Education Through Interactive Technology (GETIT) project produced scientifically accurate educational computer software that incorporates a set of interesting and realistic tools allowing students to gain an understanding of geoscience. In 1995, together with the Geological Society of America, Drs. Stuart Birnbaum, Leslie Kanat, and Alan Morris received a grant from the National Science Foundation (#9450251 for \$1.3 million) to develop GETIT, an earth science curriculum appropriate for middle and high school grade levels, and introductory college level classes. GETIT uses computers to provide a truly interactive teaching tool, and represents the future of geoscience education. Students must analyze and evaluate data, conduct experiments, and interpret their results. The software reflects our dedication to excellence in education and research through its emphasis on true interactivity and its incorporation of a minds-on and hands-on approach.

The underlying goal of the project is to teach students about energy transfer and the geosciences by focusing on Earth's internal and external energy sources. The nature of heat and the laws of thermodynamics are central to interpreting the physical evolution of the earth and the way in which natural systems operate. Solar energy drives oceanic and atmospheric circulation through the mechanisms of heat transfer. The Earth's internal energy, primarily in the form of heat, drives plate motions and is a cause of volcanism and seismicity. GETIT explores the results of energy transfer within and toward the Earth.

Volcanoes, earthquakes, and hurricanes are attention-grabbing topics sharing a common cause: energy transfer. GETIT used the attractive power of these catastrophic events to convey some of the intricacies of scientific inquiry and the fundamental driving force behind our planet's dynamism. Although GETIT is based around earth science topics, many mathematical tools are utilized and key physical science concepts are fully explored.

Closely allied with an emphasis on depth of understanding is an appreciation for the nature of science. It soon becomes clear to the student that science is not a seamless fabric of established facts, but a complex network of ideas and processes. Upon completion of GETIT, students will have experienced a richness of material and concepts and will have gained insight into the way the world works.

Whenever possible, GETIT research activities utilize an inquiry approach to learning, with exercises and investigations that closely simulate real-life research practices using real data. Real databases and appropriate mathematics integration help students see the importance of quantifiable phenomena, but the nature of science as a human endeavor is acknowledged. These research endeavors require active participation and allow and encourage students to build their knowledge using results of computer-based research and exploration.

The interactivity of GETIT activities varies along a continuum from strongly guided, step-by-step tasks to very open-ended, free-form explorations. The interactive nature of each activity is determined by the degree of prerequisite knowledge necessary to complete the research and the perceived difficulty of the concept addressed.

Although we emphasize the use of real data, and students do real science, we have developed a learning environment that can be summarized as "science with an attitude". We have created an entertaining, engaging and stimulating environment that draws students into the learning endeavor. To assist us in this we employ the omniscient animated characters, the host and hostess of Science Showtime, Professor Exactamundo and Throbby the Brain.

Learn more about GETIT at <http://cambrianSystems.com/getit>. The GETIT project, and associated Teachers' Guide, is currently being published by the Learning Team, Inc. (<http://learningteam.com>).

Submitted by:  
Dr. Leslie Kanat  
Johnson State College

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HELP!

1) Does anyone have a copy of Vermont Geology, volume 6?  
If so, please contact Marjie Gale at 241-3608 or e-mail  
[marjeg@dec.anr.state.vt.us](mailto:marjeg@dec.anr.state.vt.us).

## VGS Summer Meeting and Field Trip

About 20 VGS members and associated family and friends toured the facilities of the Cold Regions Research and Engineering Laboratory (CRREL) in Hanover, New Hampshire on Saturday, July 22, 2000. Part of the U.S. Army Corps of Engineers, CRREL's mission is to conduct research to better understand the behavior of materials in cold regions, particularly snow, ice, and frozen soil. The tour visited a variety of ice engineering, frost effects research, and ice-core laboratories, as well as a well-equipped library.

A short business meeting over lunch followed the CRREL tour. After the meeting, Steve Howe briefly described the geology and geochemistry of the Elizabeth Mine, an abandoned Cu-Pb-Zn mine near South Strafford, Vermont. About half of the original group then drove to the mine where Lori Barg led us on a tour of several large waste dumps and discussed the environmental implications of base metal-rich waters with very low pH draining into Copperas Brook and the West Branch of the Ompompanoosuc River, as well as attempts at remediation.

Our thanks go to Larry Gatto and Lori Barg for organizing this most interesting Summer field trip!

Cheers,  
Steve Howe  
Dept. of Earth & Atmos. Sciences  
State University at Albany  
1400 Washington, Albany, NY 12222-0001

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## 2001 VGS Student Research Grants

If you are an undergraduate or graduate student, or a secondary school teacher doing original research on Vermont geology, you are encouraged to apply for a Vermont Geological Society research grant. The deadline for 2001 is March 30, 2001. Please fill out a student grant application (enclosed), and mail to Stephen Wright, Department of Geology, University of Vermont, Burlington, VT, 05405-0122. Grants to be announced at the Spring Meeting

VERMONT GEOLOGICAL SOCIETY, INC.

**CONSTITUTION and BYLAWS**

**CONSTITUTION**

**Article I: NAME AND FORM**

The name of this organization shall be the Vermont Geological Society, Inc., a non-profit, non capital stock corporation

**Article II: PURPOSE**

The purpose of the Society shall be:

1. To advance the science and profession of geology and its related branches by encouraging education, research and service through the holding of meetings, maintaining communications, and providing a common union of its members.
2. To contribute to the public education of the geology of Vermont and to promote the proper use and protection of its natural resources.
3. To advance the professional conduct of those engaged in the collection, interpretation and use of geologic data.

**Article III: MEMBERSHIP**

Membership in the Society shall consist of Members with full voting rights, and other membership categories not having voting rights in Society proceedings.

**Article IV: MANAGEMENT**

The affairs of the Society shall be managed by the officers and board of directors elected at regular intervals from the voting membership of the Society. The officers and board of directors constitute the executive committee.

**Article V: ANNUAL CORPORATE MEETING**

The annual corporate meeting of the Society for the election of officers and board of directors and for such other business as may properly come before the meeting shall be held at such time and place as the executive committee may from time to time prescribe.

**Article VI: BYLAWS**

Bylaws not inconsistent with this Constitution or with the Certificate of Incorporation shall be adopted at the time of adoption of this Constitution and may be amended as therein provided.

**Article VII: AMENDMENTS**

Amendments to this Constitution may be made at any annual corporate meeting of the Society by a two-thirds vote of the members voting, due notice having been given each member of such proposed amendment at least four weeks before the annual corporate meeting

## VERMONT GEOLOGICAL SOCIETY, INC.

**BYLAWS****Article I. MEMBERSHIP****A. Member:**

Membership shall be open to any person who has a degree in geology or is professionally engaged in geology and whose application, filed in the proper manner, has been approved by the executive committee

**B. Associate Member:**

Associate membership shall be open to any person or organization interested in geology and its related branches whose application, filed in the proper manner, has been approved by the executive committee. Associate members shall enjoy the same rights and privileges as full members, except that they shall have no vote in Society proceedings nor be able to serve as officers.

**C. Student Member:**

Student membership shall be open to any student interested in geology, whose application, filed in the proper manner, has been approved by the executive committee. Student members shall enjoy the same rights and privileges as full members except that they have no vote in Society proceedings nor be eligible to serve as officers.

**D. Lifetime Member:**

A lifetime membership may be bestowed by the executive committee upon an individual who has made a significant contribution in Vermont geology.

**E. Honorary Non-Voting Member:**

An honorary membership may be bestowed by the executive committee on an individual who has made a significant contribution to the Society.

**Article II: DUES**

- A.** Dues for members and associate members shall be \$15.00 for each fiscal year of which \$5 shall be devoted to the Vermont Geological Society Student Research Grant.
- B.** Dues for student members shall be \$8.00 for each fiscal year of which \$3 shall be devoted to the Vermont Geological Society Student Research Grant.
- C.** Dues shall be due during the month of January
- D.** Changes in dues shall be recommended by the executive committee, but shall not become effective until voted by the members of the Society.
- E.** Any member, associate member, or student member whose dues remain unpaid for a one year period and who fails to pay said dues within 30 days after written notification of said arrears shall be dropped from membership.
- F.** The fiscal year shall be divided into quarters and initial dues for new members reflect the period remaining in the fiscal year

**Article III: FISCAL YEAR**

The fiscal year of the Vermont Geological Society shall be the same as the calendar year.

**Article IV: OFFICERS**

- A.** The officers of the Vermont Geological Society shall be a President, a Vice-president, a Secretary, and a Treasurer. These officers, together with the board of directors, consisting of three members and one representative from each of the four Permanent Committees, shall constitute the executive committee
- B.** The officers shall be elected for a term of one year each and two members of the board of directors, for a term of two years each, one being elected each year at the annual meeting. The third member of the board of directors shall serve a term of one year and shall be the immediate past President of the Vermont Geological

Society. If there is no immediate past President, the third member of the board of directors shall be elected at the annual meeting.

- C No person, with the exception of charter members, shall be eligible to serve as an officer or a member of the board of directors who has not been a member for at least one full year.

#### Article V: COMMITTEE ON NOMINATIONS

- A. A committee on nominations, consisting of three members, shall be appointed annually by the executive committee at the regular meeting following the annual meeting and shall serve until the regular meeting following the next annual meeting
- B. The committee on nominations shall.
  - 1 Select one nominee for each office to be filled at the next annual meeting.
  - 2. Report to the executive committee one month after the spring meeting, the names of nominees. Additional nominations should be submitted by members to the secretary by 31 August so that names can be published in the Fall Green Mountain Geologist.
  - 3. Mail a list of all nominees to all members not less than thirty (30) days prior to the annual meeting

#### Article VI: ELECTION OF OFFICERS AND DIRECTORS

- A. Method of Election:
  - 1. Officers and directors shall be elected at the annual meeting.
  - 2. Voting shall be by ballot at the annual meeting. Those persons who will not be able to attend the annual meeting should return the absentee ballot printed in the Fall Green Mountain Geologist to the secretary so as to be received prior to the annual meeting.
  - 4. Officers and directors shall assume their duties at the close of the meeting at which they were elected.
- B. Vacancies in Office:
  - 1. A vacancy in any office shall be filled for the unexpired term by a person elected by the executive committee.
  - 2. Voting shall be by ballot if there is more than one nominee for the office.
  - 3. A two-thirds vote of the members of the executive committee shall constitute an election.

#### Article VII: DUTIES OF THE OFFICERS AND DIRECTORS

- A. President:

The President shall:

  - a Preside at meetings of the Society and the executive committee.
  - b Be an ex-officio member of all committees except the nominating committee
  - c. Determine the duties of the Vice-president
  - d Coordinate the work of the officers and committees, in order that the objectives of the Society may be promoted
  - e Submit an annual report to the Society at the annual meeting.
- B Vice-President.

The Vice-President shall perform the duties of the President in the absence of the ability of that officer to serve, and those duties assigned by the President.
- C Secretary.

The Secretary shall:

  - a Record the minutes of all meetings of the Society and the executive committee
  - b Be responsible for mailing to each member of the executive committee a copy of the minutes of all meetings of the Society and the executive committee.
  - c Conduct such correspondence as the Society, the officers, or the board of directors may direct

- d. Notify officers and standing committee chairmen of their election.
- D Treasurer:  
The Treasurer shall:
  - a Be a member of the budget committee
  - b Collect and record funds in accordance with the approved budget and/or upon direction of the executive committee.
  - c Present a financial statement at the annual meeting
  - d. Disburse funds and pay all bills by check when approved by the President
  - e. Present a financial statement at each meeting and at other times as requested by the President.
  - f. Close the books at the end of the fiscal year and submit them for audit to the budget committee
  - g. Send dues notices to members one month prior to the date that they are due.
  - h. The Treasurer shall be bonded in amounts determined by the executive committee. The expense of these bonds shall be paid for by the Society.
- E. All Officers and Directors:  
All Officers and Directors shall:
  - a. Perform the duties prescribed in the parliamentary authority in addition to those outlined in these bylaws and those assigned from time to time.
  - b. Deliver to their successors all official material within fifteen (15) days following the close of the annual meeting at which their term of office expires.

#### Article VIII: REGULAR MEETINGS

- A. Regular meetings shall be held three times a year. Normally these will be held during the academic year.
- B. A special meeting may be called in lieu of or in addition to a regular meeting.
- C. The date, time and place of each meeting shall be determined by the executive committee.

#### Article IX: ANNUAL MEETING

- A. The annual meeting shall be held within thirty (30) days of 15 October and shall be considered a regular meeting.
- B. The date, time and place of each annual meeting shall be determined by the executive committee.
- C. The annual meeting shall be the governing body of the Society.

#### Article X: VOTING BODY

- A The voting body of the meetings shall consist of the members of the Society.
- B. Each member shall have but one vote
- C At the annual meeting, those voting members present shall constitute a quorum, four of whom shall be members of the executive committee. Business may be conducted at other duly warned meetings without a quorum. All meetings shall be warned no less than two weeks prior to the meeting

#### Article XI: EXECUTIVE COMMITTEE

- A Membership:
  - 1 There shall be an executive committee comprised of the officers, two (2) members elected at large, the chairpersons of the four permanent committees and the immediate past President of the Society
  - 2. The executive committee shall meet at the call of the President or upon written request of two of its members
  - 3 A majority shall constitute a quorum
- B Duties:  
The executive committee shall
  - a Perform the duties delegated to it here and also elsewhere under these by-laws.
  - b Transact business referred to it by the membership.

- c. Receive and pass upon plans of work of chairmen of standing committees and authorize and direct the work of each
- d. Select the time and place of all meetings, including the annual meeting.
- e. Submit to the membership such recommendations as it deems advisable.
- f. Determine the amount and authorize payment of fidelity bonds for the treasurer of the Society.
- g. Take no action in conflict with that of the membership.

#### Article XII: PERMANENT COMMITTEES

##### A. Permanent Committees of the Society:

1. Four permanent committees are established to promote the purposes and carry out the work of the Society. These permanent committees are:

- Geological Education Committee
- Advancement of the Science Committee
- Public Issues Committee
- Publications/Editorial Committee

2. Each permanent committee shall consist of a chairperson and his/her appointees.
3. Any permanent committee may be dissolved or an additional permanent committee established only through two-thirds vote of members voting at any annual meeting of the Society.
4. A report summarizing the work and findings of each permanent committee must be made by the chair on or before the annual meeting of the Society.

##### B. Chairpersons of Permanent Committees:

###### 1. Nominations:

- a. Nominations for chair of each permanent committee shall be made by the committee on nominations, and shall be reported by the committee on nominations at the regular meeting prior to the annual meeting.

- b. Additional nominations may be made from the floor of this meeting.

- c. Only a member of the Society, whose consent has been secured, shall be eligible for chair.

###### 2. Election:

- a. The election of chairpersons of permanent committees shall be held at the annual meeting prior to the election of officers and directors.

- b. A majority of votes cast shall constitute an election.

###### 3. Term of Office:

The term of office for chair of each permanent committee shall be three years.

###### 4. Vacancies:

Vacancies will be filled by a person elected by the executive committee following procedures outlined in Article VI B. This person will serve until the next meeting of the Society.

###### 5. Duties:

The chair (or delegate of each permanent committee is also a member of the executive committee and performs duties as outlined in Article XI B of these bylaws

#### Article XIII: COMMITTEES:

##### A. Standing Committees

1. Standing committees may be created or dissolved by the executive committee as deemed necessary to promote the purpose and carry out the work of the Society.

2. Each standing committee shall consist of a chairperson and such other persons as may be appointed by the executive committee.

##### B. Nominations for Chairpersons

1. Nominations for chairpersons of standing committees shall be made by the committee on nominations, and shall be reported by the committee on nominations

at the regular meeting prior to the annual meeting

2. Additional nominations may be made from the floor of this meeting

3. Only a member of the Society, whose consent has been secured, shall be eligible for nomination for chairperson.

C. Election of Chairpersons.

1. The election of chairpersons of standing committees shall be held at the annual meeting prior to the election of officers and directors .

2. A majority of votes cast shall constitute an election.

D. Duties of Chairpersons.

The chairperson of each standing committee shall submit a plan of work to the executive committee for approval

E. Vacancies in Chairs:

If a vacancy occurs in the chair of a standing committee, the executive committee shall be empowered to fill such vacancies.

F. Special Committees:

Special committees may be created and appointed by the President or by the executive committee.

G. President Ex-Officio:

The President shall be an ex-officio member of all committees except the committee on nominations.

Article XIII: AMENDMENTS

These by-laws may be amended at any annual meeting of the Vermont Geological Society by two-thirds of the members voting, due notice having been given each member of such proposed amendment at least four weeks before the annual meeting.

*Editors Note: The Vermont Geological Society Constitution and Bylaws were originally adopted in February 1974, with various revisions since that time. Last revisions in October 1991.*

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PHOTOGRAPHS WANTED!

We received the following e-mail from Michael J. Smith, Director of Education at American Geological Institute.

We urgently need earth science photographs that you are willing to donate for use in EarthComm and IES (new Earth Science curriculum for high school and middle school). Submissions can come in print, slide, or electronic format. All submissions used will receive a photo credit in the commercial edition of the text. Slides and prints sent to AGI can be returned. We have identified specific photographs needed for the second module of EarthComm at the following web address.

<http://www.agiweb.org/earthcomm/photo/index.html>

If you have any questions, please contact Eric Shih at [es@agiweb.org](mailto:es@agiweb.org), or by phone at (703)379-2480. Thank you for your assistance

## VGS Calendar - 2001

- February 2: Pre-registration Deadline for NE GSA Meeting  
 March 12-14: NE Geological Society of America, Burlington, VT  
 March 23: Deadline for student abstracts for Spring VGS  
 March 23: Deadline for submission of articles for Spring 2001 GMG  
 March 30: Student Research Grant Proposals Due  
 April 10: Publish Spring GMG  
 April 21: Spring VGS Meeting, Norwich University, Northfield, VT  
 April 21: Student research grant money awarded  
 June 22: Deadline for articles and news items for Summer GMG  
 July: Spring/Summer Field Trip; details TBA  
 Sept. 4: Deadline for articles and news items for Fall GMG  
 Sept. 18: Publish Fall GMG  
 Oct. 7-13: Earth Science Week 2001

### Vermont Geological Society Student Research Grants

are designed to aid our future geologists investigate Vermont's geo-history.

Help the VGS to promote a deeper insight into Vermont Geology.

Students receiving assistance through the program will present their research results at the VGS Spring Meetings. Your generosity will help cover a lot of terrane!

To contribute to the **VGS Student Research Grant Program**, clip or copy this form and send it, along with your check or money order made payable to VGS, to:

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

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

**TOTAL GIFT:** \$ \_\_\_\_\_

**NAME:** \_\_\_\_\_

**ORGANIZATION:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

**CITY:** \_\_\_\_\_ **STATE:** \_\_\_\_\_

## TREASURER'S REPORT

December 28, 2000

Dear President and Board:

The financial condition of the Society remains strong. Please see the attached Income Statement for the period January 1, 2000 through December 28, 2000. The checking account balance is \$2,944.60 as of December 28, 2000. All bills received by me have been paid and are reflected in the above balance. I welcome feedback and suggestions from the Board and membership.

Sincerely,  
Kristen L. Underwood

### Income and Expenses 1/1/00 through 12/28/00

#### INCOME

|                                      |            |                   |
|--------------------------------------|------------|-------------------|
| Total Dues                           |            | \$1,609.00        |
| Dues-Family                          | \$140.00   |                   |
| Dues-Institution                     | \$15.00    |                   |
| Dues-Member                          | \$1,430.00 |                   |
| Dues-Student                         | \$24.00    |                   |
| Interest                             |            | ** \$21.84        |
| Student Research Grant Contributions |            | <u>\$514.00</u>   |
| <b>TOTAL INCOME</b>                  |            | <b>\$2,144.84</b> |

#### EXPENSES

|                                                |  |                          |
|------------------------------------------------|--|--------------------------|
| US Post Office (stamps, GMG Distribution)      |  | \$212.52                 |
| Minuteman Press (GMG Publishing)               |  | \$460.73                 |
| Earth Science Week Poster Awards               |  | \$90.00                  |
| Student Research Grant Awards (VGS Spring Mtg) |  | <u>\$155.00</u>          |
| <b>TOTAL EXPENSES</b>                          |  | <b>\$918.25</b>          |
| <b>TOTAL INCOME – EXPENSES</b>                 |  | <u><b>\$1,226.59</b></u> |

\*\* Interest income earned 10/27/00 through 12/28/00 not reflected in this total

**VERMONT GEOLOGICAL SOCIETY  
DUES STATEMENT 2001**

Dear VGS member:

Membership dues for 2001 are \$15.00 for Members and Associate Members, \$20.00 for a family membership with one newsletter subscription, and \$8.00 for Student Members. Membership dues are used to publish the *Green Mountain Geologist*, to finance our Student Research Grants, and to cover the costs associated with meetings and field trips. If your address, phone, or e-mail address has changed since last year, please fill in this information below, if not, leave the form below blank. A new membership directory will be published with the Summer *GMG*. Return this form with your check for the appropriate amount made payable to the Vermont Geological Society by March 30, 2001. Send your payment to Kristin Underwood, Treasurer; Vermont Geological Society; Department of Geology; University of Vermont; Burlington, VT 05405-0122. Thank you.

Name:

Date:

Street or Box:

City, State, ZIP:

Work Phone:

Home Phone:

e-mail address:

Fax No.:

Circle Type of Membership:

Member (\$15)

Student Member (\$8)

Family (\$20)

Amount Due: \_\_\_\_\_

Additional Contribution to VGS Research Grants: \_\_\_\_\_

Total Enclosed: \_\_\_\_\_

**THE GREEN MOUNTAIN GEOLOGIST**  
VERMONT GEOLOGICAL SOCIETY  
DEPARTMENT OF GEOLOGY  
UNIVERSITY OF VERMONT  
BURLINGTON, VERMONT 05405-0122

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

**Executive Committee**

|                |                   |          |
|----------------|-------------------|----------|
| President      | Shelley Snyder    | 453-2333 |
| Vice President | Ray Coish         | 443-5423 |
| Secretary      | Jeff Hoffer       | 476-2002 |
| Treasurer      | Kristen Underwood | 865-4288 |
| Board          | Kent Kophuch      | 878-1620 |
| of             | Kristen Underwood | 865-4288 |
| Directors      | Stephen Wright    | 241-3608 |

**Committees**

|                         |                                      |
|-------------------------|--------------------------------------|
| Advancement of Science  | Stephen Howe                         |
| Membership              | Stephen Wright                       |
| Public Issues           | Laurence Becker                      |
| Publications/Newsletter | Marjie Gale, Jeff Hoffer, Peter Gale |

**ADDRESS CHANGE?**

Please send it to the Treasurer at the above address.

-Printed on Recycled Paper-

## VERMONT GEOLOGICAL SOCIETY RESEARCH GRANT PROGRAM

### Policy and Procedures

The primary goal of the Vermont Geological Society (VGS) Research Grant Program is to promote and support original research on Vermont geology by undergraduate and graduate students and secondary school teachers (grades 7-12). The grant program does not seek to cover all of the researcher's expenses but instead should be viewed as a professional endorsement of the research endeavor. Requests for grants are judged on how well the proposed research will advance the science of geology and its related branches within the State of Vermont. Since the grant program budget is not anticipated to be large enough to fund every research proposal, the grants will be awarded on a competitive basis. The policy for applying for and awarding grants is outlined below.

### Eligibility

**Undergraduate and graduate students and secondary school teachers (grades 7-12) who are undertaking original research projects on Vermont geology and related disciplines are eligible for VGS research grants.**

VGS research grant applicants need not be members of the Vermont Geological Society. Graduate and undergraduate students must be currently enrolled in degree-granting institutions and their research must be part of a degree requirement. Secondary school teachers will ordinarily be teaching within Vermont. Post-graduate students, college or university faculty, primary school teachers, and institutions are not eligible. Institutions may not request that overhead costs be added to budgets. **The Vermont Geological Society strongly encourages women, minorities, and people with disabilities to participate fully in this research grant program.** The research proposals will be evaluated on the basis of the feasibility and scientific merit of the project, the abilities of the researcher, and the reasonableness of the budget. Students are eligible for only one VGS Research Grant per degree pursued.

### Research Grant Guidelines

Individual grants will not ordinarily exceed \$500, although a higher sum may be awarded based on merit and number of grant applications received. One or two (see below) confidential letters of recommendation are required for each grant applicant. These letters should be either sent directly to the Vermont Geological Society or included with the grant application in sealed envelopes to preserve confidentiality.

#### Graduate students:

Priority will be given to graduate students who are ready to begin their research. Graduate students need to submit a completed application form and *two* letters of recommendation. These letters will ordinarily come from the student's academic or thesis advisor and from one additional faculty member.

#### Undergraduate students:

Due to different schedules at different institutions for senior work, research should be scheduled to begin within 9 months the grant award. Undergraduate grant applicants need *one* letter of recommendation which will ordinarily come from the student's academic or thesis advisor.

#### Secondary school teachers:

Research should be scheduled for sometime during the summer or the school year. Secondary school teachers will need *two* letters of recommendation from people able to evaluate the applicant and the proposed research.

### Rules for the Use of VGS Research Grant Funds

Grants are to be used for expenses directly associated with the research proposed. For example research funds may be used for field expenses (travel, meals, lodging), materials and supplies (sample bags, base maps, air photos, film and developing costs, etc.). Travel to professional meetings will not be funded. Funds requested for equipment, computer time and software, thin-sections, chemical and isotopic analyses, and the purchase of services must be fully justified. Research grants may not be used for salaries or tuition but may be used to pay a field assistant or technician. Upon completion of the research, equipment and materials purchased with a VGS research grant become the property of the department in which the student is enrolled or the school where the teacher is employed and are expected to be available to help additional students/teachers with their research.

### Responsibilities of Recipients

Grant recipients are encouraged to present their results at professional meetings as well as to publish them. In both cases support by the Vermont Geological Society should be acknowledged. Recipients who cannot undertake or complete their project must return any unused funds along with a written explanation of expenses incurred. Grants may be subject to tax by the IRS and the grant recipient is responsible for determining this.

**Within 1 year of receiving their grant, all VGS research grant recipients are expected to 1) submit a written abstract of the results of their research to be published in the Green Mountain Geologist, and 2) present their research at the Spring Meeting of the Vermont Geological Society.**

### Applications

Use the application on the reverse side of this sheet. For additional information, please write to the Vermont Geological Society Research Grant Program, c/o Stephen Wright, Department of Geology, University of Vermont, Burlington, VT 05405, e-mail: [swright@moose.uvm.edu](mailto:swright@moose.uvm.edu), or by calling 802-656-4479. The application should be typed and signed and submitted together with the letters of recommendation. Each application will be reviewed by the Research Grant Committee of the Vermont Geological Society. The decisions of this committee are final.

# Vermont Geological Society Research Grant Program

## Application for 2001-2002

Please follow the format below and submit **signed** application to arrive by March 30 2001. Please send completed application to: **Vermont Geological Society Research Grant Program, c/o Stephen Wright, Department of Geology, University of Vermont, Burlington, VT 05405.**

1. Name of Applicant:

Address:

e-mail:

Telephone numbers and hours that are best to reach you:

2a If you are a student, to which degree will this research lead?

At which college/university?

Expected degree completion date:

Project supervisor and address/phone/e-mail (students only):

2b. If you are a secondary school teacher, how does this project fit into your professional development?

3. Project title:

4. Statement of problem. Please include in your statement how this work will further our understanding of Vermont Geology.

5. Concisely state how you plan to accomplish your investigation.

6. Give a brief bibliography of the most important papers related to your proposed research.

7. Duration of investigation (dates):

8. Budget: (If you are only asking the Vermont Geological Society to support part of your budget, specify those parts. Calculate mileage at a rate of \$0.25 per mile.)

9. Budget justification:

10. Other support for this project, both applied for and received. For support applied for, include dates you expect to know outcome:

11. Have you received a previous VGS research grant? If yes, give year and title of project.

12. Signature:

Date:

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# THE GREEN MOUNTAIN GEOLOGIST



NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

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Spring 2001

VOLUME 28

No. 2

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## STUDENT PRESENTATIONS VGS Spring Meeting April 21, 2001, 8:30 AM Norwich University

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## **DIRECTIONS TO SPRING MEETING AT NORWICH**

Norwich University is located on VT Route 12 a mile south of the center of Northfield. It can be reached from I-89 by taking Exit 5 and following Route 64 west to Route 12, and then north to the university. Coming from the north, it's a toss up which is easier/quicker, using the interstate or taking Route 12 south from Montpelier.

The Geology Department is located in Cabot Science, the southeasternmost 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.



**SPRING MEETING OF THE  
VERMONT GEOLOGICAL SOCIETY**

**Annual Presentation of Student Papers  
Room 085, Cabot Science Bldg.,  
Norwich University, Northfield, VT**

**April 21, 2001**

**PROGRAM**

8:30 Coffee

9:00 Sharon A. Wilson, Middlebury College: GEOCHEMICAL ANALYSIS OF SILURO-DEVONIAN MAFIC DIKES IN EAST-CENTRAL VERMONT

9:15 Margaret Sullivan, Middlebury College: GEOCHEMICAL ANALYSIS OF SEDIMENTS IN THE OMPOMPANOOSUC RIVER NEAR THE ELIZABETH MINE, SOUTH STRAFFORD, VERMONT

9:30 Joshua E. Gutierrez, Middlebury College: THE "GENERAL" POCKMARK, BURLINGTON BAY, LAKE CHAMPLAIN, VERMONT

9:45 Angela Conlan, University of Vermont: SPATIAL EXTENT OF SEDIMENT PULSES IN LAKE MOREY, FAIRLEE, VT.

10:00 Nathan West, Middlebury College: A BASIC SLOPE STABILITY ANALYSIS OF ROUTE 125 ALONG THE LEMON FAIR RIVER: CORNWALL, VERMONT

10:15 Ian Hodgdon, University of Vermont: EXPOSED GLACIAL DEPOSITS WITHIN A LANDSLIDE IN THE SMUGGLERS NOTCH SKI AREA CONTAINING A SAPROLITE, TILLS, AND HIGH LEVEL LAKES WITHIN THE BREWSTER RIVER DRAINAGE BASIN

10:30 Matthew D. Whitcomb, Middlebury College:  
PEDOGENESIS ALONG THE FLANKS OF MOUNT SAINT  
HELENS

10:45 BREAK

11:00 Andrew McKinney, Keith Klepeis, Djordje Grujic, and  
Lincoln Hollister, University of Vermont: STRUCTURAL  
AND KINEMATIC EVOLUTION OF AN OROGENIC  
WEDGE: THE INTERPLAY BETWEEN THRUST  
FAULTING AND NORMAL FAULTING IN EASTERN  
BHUTAN

11:15 Dale Walker, Andrew Claypool and Keith Klepeis, University of  
Vermont: COMPARISON OF EXHUMATION PROCESSES OF  
LOWER CRUSTAL GRANULITES IN FIORDLAND, NEW  
ZEALAND

11:30 Andrew Nichols, Middlebury College: MINERALOGICAL  
EVIDENCE FOR HYDROTHERMAL ORIGIN OF THE  
BRANDON RESIDUAL FORMATION AND THE EAST  
MONKTON KAOLINS

11:45 Dagan A. Murray, Norwich University: THE SILURIAN  
BRAINTREE COMPLEX, VERMONT: BIMODAL PLUTONISM  
WEST OF THE RMC

12:00 Nathan P. Donahue, Norwich University: A TOTAL FIELD  
MAGNETIC SURVEY OF THE BRAINTREE COMPLEX,  
VERMONT

12:15 Break followed by announcement of awards

12:30 VGS Executive Committee Meeting



## STUDENT ABSTRACTS

### GEOCHEMICAL ANALYSIS OF SILURO-DEVONIAN MAFIC DIKES IN EAST-CENTRAL VERMONT

Sharon A. Wilson, Geology Department,  
Middlebury College, Middlebury, VT 05753

In the Woodsville and Newbury quadrangles in east-central Vermont and west-central New Hampshire, Siluro-Devonian mafic dikes intrude metasedimentary rocks of the Vermont and New Hampshire Sequences. The dikes are thought to be related to a diorite-gabbro complex, dated at ~420Ma.

In this study, we focus on four previously unstudied outcrops where mafic dikes intrude the Albee Formation. In particular, petrography and geochemistry, including major, trace and rare earth elements, are used to interpret the magmatic and tectonic origin of the dikes. Preliminary geochemical data indicate the dikes have basaltic compositions. Furthermore, linear trends between MgO vs Ni, Zr vs Ti and MgO vs TiO<sub>2</sub> suggest that the dikes have retained original igneous signatures despite metamorphism associated with the Acadian Orogeny. Dikes from the four localities are all related geochemically. Moreover, there are well-defined chemical trends among the dikes that can be accounted for by differing amounts of crystal fractionation from the same parent. Trace element tectonic discriminant diagrams, e.g. Ti-Zr-Sr, Ti-Zr and Fe-Mg-Al, indicate the dikes may have formed in a continental extensional environment. The dikes are also geochemically similar to dikes in the Comerford Dike Complex, about 40 km northeast.

The dikes are interpreted to be part of a regional swarm that formed by partial melting of sub-continental, asthenospheric mantle. They intruded the crust in an extensional tectonic environment between the time of Taconic and Acadian orogenies.

GEOCHEMICAL ANALYSIS OF SEDIMENTS IN THE  
OMPOMPAOOSUC RIVER NEAR THE ELIZABETH MINE,  
SOUTH STRAFFORD, VERMONT

Margaret Sullivan, Geology Department,  
Middlebury College, Middlebury, VT 05753

The Elizabeth Mine, an abandoned copper mine in South Strafford, Vermont is leaching highly acidic runoff into the West Branch of the Ompompanoosuc River from a forty-acre tailings pile. The mine is included in the massive sulfide deposits of the Vermont copper belt, which consists of stratabound and stratiform pyrrhotite, chalcopyrite and minor sphalerite and pyrite within metasedimentary and mafic metavolcanic rocks of Silurian to early Devonian age. Discovered in 1783, the mine originally produced copperas (iron sulfate) from pyrrhotite and later (1830-1958) produced copper from chalcopyrite. The main objective of this study is to assess spatial variations in metals concentration and speciation in sediments in the West Branch of the Ompompanoosuc River.

Inductively Coupled Argon Plasma (ICAP) spectrometry indicates that the river sediments are acting as a sink for metals. ICAP analysis of trace elements shows elevated levels of metals at the confluence of Copperas Brook-Ompompanoosuc River, including copper (7.2x-16.6x), cobalt (2.8x) and zinc (2.9x-12.7x). These levels remain slightly elevated downstream, between 2.0x and 6.4x. The only major element to exhibit significant increases is iron oxide, which was elevated 5.8x-7.9x at the entrance of Copperas Brook and remains as high as 2.3x downstream. In contrast to water analysis, metal concentrations in sediments measured 7.7 km downstream from Copperas Brook were as high, or slightly higher than previous sampling sites, implying that Lords Brook is serving as an additional source of contaminants to the river. A correlation diagram comparing copper and iron oxide concentrations has a correlation coefficient of 0.5703. This implies that in addition to iron oxide, other factors such as the solubility of copper, the presence of iron in chlorite and the ability of carbonates to control copper are also controlling the mobility of copper. X-ray diffraction analysis of bulk and <2 $\mu$  fractions indicate that the sediments are dominated by chlorite, illite, feldspar, mica, albite and hornblende. Additionally, broad peaks at 4.7Å and 2.1Å suggest the presence of poorly crystalline iron oxides. Finally, an acetic acid chemical extraction failed to leach significant percentages of metals, indicating that the metals are not readily available under ambient conditions.

THE "GENERAL" POCKMARK,  
BURLINGTON BAY, LAKE CHAMPLAIN, VT

Joshua E. Gutierrez, Geology Department,  
Middlebury College, Middlebury, VT 05753

The "General" pockmark is roughly 40 meters in diameter, 4 meters in depth and is located in Burlington Bay, Lake Champlain between Shelburne Point and Lone Rock Point. It is one of the largest pockmarks found in Lake Champlain. Pockmarks form as the result of upward migrating fluid or gas. As this fluid or gas is released into the water column, fine-grained sediments become suspended in the water column and can therefore be easily removed by currents while coarse-grained sediments remain behind forming a crater like depression. The goal of this study was to determine whether or not this large pockmark was actively venting fluid or gas into the water column during an 11-month field program from September 2, 1999 to July 25, 2000.

Five sediment cores (2 inside, 1 on the edge and 2 outside of the pockmark) were collected and analyzed for magnetic susceptibility, physical properties and  $^{210}\text{Pb}$  dating. Also, a mooring was placed in the deepest section of the pockmark (27.7m). The mooring was placed September 2, 1999 and retrieved July 25, 2000. The mooring was equipped with an Acoustic Doppler Current Profiler (ADCP), temperature chains (sensors every 4m) running horizontally along the lake floor and vertically from the center of the pockmark, a bottom mounted 35 mm stereo image camera and a Savonius rotor current meter located .3m above the lake floor. Differences between the physical properties of cores taken from within and without the pockmark are evident. Bottom photographs show episodic events of suspended sediment. Initial analysis of the temperature data suggests the presence of anomalous temperatures near the wall of the pockmark. ADCP data is presently being examined for possible correlations with these episodic events.

SPATIAL EXTENT OF SEDIMENT PULSES  
IN LAKE MOREY, FAIRLEE, VT

Angela Conlan, Dept. of Geology,  
University of Vermont, Burlington, VT 05405

Lake Morey, located in Fairlee, VT is a ~12m deep lake with steep surrounding topography. Two cores were taken from the lake. One core was taken close to a delta that collects sediments from a steep drainage basin; the second was taken further from the delta in deeper water.

The two cores were analyzed using five different methods: magnetic susceptibility, x-radiography, visual logging, loss on ignition (LOI), and grain size analysis using a laser diffraction unit. Each of these methods uses different means to detect a change in the type of material throughout the core. This research focuses mainly on the deep-water core, comparing it with the core closer to the delta.

The susceptibility test for the deep-water core shows a slight increase of magnetic susceptibility with depth, from 2 SI units at the top of the core to 5 SI units at 500cm. There were no significant peaks in SI units throughout the entire core. When plotted against depth, the LOI data show a decrease in percent LOI from approximately 22% at the top of the core to 12% at 500cm. The LOI data also show no significant peaks throughout the core. The mean particle size throughout the deep-water core is approximately 9.5 $\mu$ m. The mean value does not change with depth. However, there are 5 significant peaks in the core made up of particles that range in size from 20-30 $\mu$ m, as well as several smaller peaks. These larger grains are evidence of hydrologic events that have transported terrestrial sediments into the pond. The mean particle size of the core taken closer to the delta is approximately 18 $\mu$ m, twice that of the core taken from deeper water, with particle sizes as large as 66 $\mu$ m deposited during significant hydrologic events. Grain size analysis identified 7 significant hydrologic events, and several smaller events in the core taken closer to the delta.

These results show that grain size analysis using a laser diffraction unit is far more sensitive to changes in sediment input than the other methods. The changes in grain size throughout the deep-water core are large enough to identify some of the same events as found in the core taken from the delta, but the particles are significantly smaller than those found closer to the delta, making lower energy hydrologic events undetectable in the core taken further from the delta.

A BASIC SLOPE STABILITY ANALYSIS OF ROUTE 125  
ALONG THE LEMON FAIR RIVER: CORNWALL, VERMONT

Nathan West, Geology Department,  
Middlebury College, Middlebury, VT 05753

The stability of natural earthen slopes is dependent primarily on moisture and the strength properties of the soils present. Certain soil types and moisture conditions can cause catastrophic slope failure. Conversely, considered application of engineering concepts can restore slopes to a stable condition. Some of the parameters that influence the landslide-related behavior of soils are: [1] moisture content; [2] grain size distribution; [3] cohesive properties (liquid and plastic limit, shear strength); and [4] the mass of material bearing down upon the soil. One primary region of failure has been identified between Route 125 and the Lemon Fair River. It is on the order of hundreds of meters in size and extends well into the existing roadway. Investigation by the Vermont Department of Transportation has yielded numerous soil borings and laboratory tests of the subsurface at this site and the surrounding area in preparation for bridge construction south of the subject site.

In order to determine the causes of observed slope failure northwest of Cornwall, VT, along a section of Route 125, further study of the subsurface and its properties is necessary. Boring logs, inclinometer data, and laboratory tests were studied in order to calculate parameters of slope failure. The paper discusses in general the parameters of slope failure and their specific effect on this site. The potential contribution of soil properties and moisture conditions to the existing area of failure, are discussed, and the probability of continued failure at the site is estimated based on a variety of possible events.

EXPOSED GLACIAL DEPOSITS WITHIN A LANDSLIDE  
IN THE SMUGGLERS NOTCH SKI AREA  
CONTAINING A SAPROLITE, TILLS, AND HIGH LEVEL LAKES  
WITHIN THE BREWSTER RIVER DRAINAGE BASIN

Ian Hodgdon, Dept. of Geology,  
University of Vermont, Burlington, VT 05405

A recent landslide in North Central Vermont 1 km south of the Smugglers Notch Ski Area exposes an orange saprolite overlain by a gray till which is overlain by glacially dammed lake sediments (clay) which is overlain by a third till deposit.

At the landslide, the orange saprolite is 5 m thick and contains a range of clast sizes, which due to the severity of weathering, all are easily broken with bare hands. Well data collected from the Smugglers Notch Ski Area indicate the saprolite extends at least 1.6 km to the north and has a maximum thickness of 47 m (150 ft). The saprolite exposed in the landslide was caused by subaerial weathering rather than hydrothermal alteration. This was concluded because the intact bedrock just below the saprolite along the contact shows no signs of hydrothermal alteration. Analysis of similar saprolites by J. S. Wright from Scotland and LaSalle from Quebec, indicate weathering for long times or under warm and humid conditions. This suggests that saprolite formation possibly occurred at the end of the Tertiary.

The gray till, deposited by a Laurentide glacial advance, overlies the saprolite, and contains very few striated cobbles. This till is comprised mostly of silt, sand, and pebbles. Clay deposits overlying the gray till were deposited when a glacial lake was created during ice sheet retreat. The outlet for this elevated lake was to the south through Smugglers Notch at an elevation of 652.9 m (2,070 ft), until the glacier retreated far enough to the north to allow the lake to drain along the valley wall to the west. The clay deposit has been deformed, indicative of another glacial advance. There is a third till that overlies the clay deposit and is composed of clasts of sizes ranging from fine sand to rocks 24 cm in length. This till appears to have undergone very little weathering due to the fresh appearance of the sediment. The landslide occurs on a tributary of the Brewster River drainage basin. Within this drainage basin are four stream terraces. Terrace 1 is at an elevation of 481.7 m (1,527 ft), Terrace 2 is at an elevation of 458.6 m (1,454 ft), Terrace 3 is at an elevation of 425.8 m (1,350 ft), and Terrace 4 is at an elevation of 413.5 m (1,311 ft). These are believed to be fluvial terraces because to date, there have been no deltas found to correlate with the terraces that would suggest they were lake derived.

PEDOGENESIS ALONG THE FLANKS OF  
MOUNT SAINT HELENS

Matthew D. Whitcomb, Geology Department,  
Middlebury College, Middlebury, VT 05753

On May 18th, 1980 Mount Saint Helens experienced an eruption that changed the surrounding land irreversibly. Recumbent trees, hummocky topography, and deep, sedimentary lahar deposits are visible 20 years later as if the eruption were yesterday. However, on a smaller scale the monument's sub-alpine soil was affected in a more subtle manner. With vegetation temporarily destroyed by the scorching heat of tephra deposition, soils would no longer develop at rates influenced by species richness and the rain of the Pacific Northwest. Rather, a layer of tephra ranging in thickness from several centimeters to several meters would serve as the primary influence for new pedogenic rates within the monument.

A paper by Ugolini, Drago and LaManna (1997) discusses the compositions of these andisols, namely the presence of vermiculite, as affected by tephra depositions. Results of my study are similar in that soil samples also contain trioctahedral vermiculite, as proven by XRD analysis. However, because my samples are taken from a variety of microclimates within the monument, data include pedogenesis within both tephra and lahar deposits. Scanning electron microscope analysis will be used to further assess mineralogical compositions and weathering sequences. Ultimately, pedogenic rates in soils collected in August 2000 will be compared with pedogenic rates in soils just outside of the monument and blast/ash fall zone. The comparison soils were also collected in 2000.

Thus far, XRD analysis of several locations including both lahar and ash depositions indicate an abundance of fresh plagioclase feldspar. In addition, the ash deposits contains vermiculite and the lahar contains vermiculite and halloysite as well as kaolinite/smectite. The presence of halloysite and kaolinite/smectite indicates that the lahar is undergoing more advanced or rapid weathering in comparison to the tephra zones. What causes this? Continued SEM analysis will provide the information to determine whether the feldspar is weathering into vermiculite, halloysite, and kaolinite/smectite or whether all three are detrital and formed on the volcano prior to the eruption.

STRUCTURAL AND KINEMATIC EVOLUTION OF AN  
OROGENIC WEDGE: THE INTERPLAY BETWEEN THRUST  
FAULTING AND NORMAL FAULTING IN EASTERN BHUTAN

Andrew McKinney<sup>1</sup>, Keith Klepeis<sup>1</sup>, Djordje Grujic<sup>2</sup>,  
and Lincoln Hollister<sup>3</sup>

(1) Geology, Univ. of Vermont, Burlington, VT 05405, (2) Dalhousie  
Univ., Dept Earth Sciences, Halifax, NS B3H 3J5, Canada, (3)  
Geosciences, Princeton Univ, Princeton, NJ 08544

The High Himalayan Crystalline Belt (HHC) of eastern Bhutan preserves a near continuous section of high-grade gneisses, leucogranites, and Tethyan facies metasedimentary rocks that were deformed by different styles of faulting during the Late Tertiary collision between India and Asia. Early top-up-to-the-south ductile thrust faulting along the Main Central Thrust (MCT) placed garnet-kyanite-sillimanite-bearing aragneisses and leucogranites on top of less deformed garnet-stauroilite-bearing rocks of the Late Precambrian Daling-Shumar Group near Tashigang. This deformation produced a penetrative north-dipping foliation and north-plunging mineral lineations within the high-grade rocks of the HHC. Top-up-to-the-south thrusting also occurred either simultaneously with or preceding development of a regional-scale ductile normal fault that accommodated top-down-to-the-north displacements structurally above the MCT. Together, the MCT and this normal fault form the lower and upper boundaries, respectively, of an orogenic wedge. Following development of this wedge, both the MCT and normal fault were folded by tight inclined folds that form a type 1 interference pattern (domes and basins) at the scale of the mountain range. These folds form three sets that plunge gently and moderately to the northwest, northeast, and east. We have identified domains where each of these sets are dominant and mutually affect one another. Following folding, a major out-of-sequence thrust fault (the Kakhtang thrust) was emplaced across the top of the structural pile. The Kakhtang thrust is not folded. Finally, top-down-to-the-north displacements along the South Tibetan Detachment Fault and top-up-to-the-south displacements along the Main Boundary Thrust also post-date folding of the MCT and emplacement of the Kakhtang thrust. Our data suggest that periodic top-down-to-the-north normal faulting alternated in time with top-up-to-the-south thrust faulting and constriction-related folding during growth of an orogenic wedge in Bhutan. The styles of thrust faulting and normal faulting we observed are kinematically compatible with the southward extrusion of deep crustal rocks between slabs of colder crustal material composed of Tethyan facies cover rocks.

## COMPARISON OF EXHUMATION PROCESSES OF LOWER CRUSTAL GRANULITES IN FIORDLAND, NEW ZEALAND

Dale Walker, Alexander Claypool, Keith Klepeis

Dept. of Geology, Univ. of Vermont, Burlington, VT 05405

High-pressure (14-16 kbars) granulite and amphibolite facies orthogneisses exposed in the Fiordland belt of southwestern New Zealand record a polyphase history of Early Cretaceous to Late Tertiary tectonism. Northern Fiordland is dominated by subvertical, NNE-striking foliation (S1) defined by amphibole, garnet, clinopyroxene and plagioclase assemblages formed at lower crustal depths (>45 kms) during Early Cretaceous convergence along the margin of Gondwana. Southern Fiordland is dominated by shallowly dipping, ENE-striking foliation defined by similar high-grade mineral assemblages as seen in Northern Fiordland.

At the northwestern boundary of the granulite belt, a NNE-striking subvertical shear zone (the Anita shear zone) truncates S1 and separates high pressure rocks from Paleozoic cover rocks to the west. Both the Anita shear zone and S1 are reactivated by regional strike-slip faults that include, from west to east, the Alpine fault, the Pembroke fault and the Harrison-Kaipō (HK) fault. This latter fault zone forms the eastern boundary of the granulite belt. At the southern end of the HK fault zone, en echelon dextral faults strike to the NE and offset lithologic contacts in a step-wise geometry. At its northern end, this fault zone curves to the north, and intersects and merges with the NE-striking Pembroke fault. Faults at this intersection accommodated reverse displacements. Elsewhere, the dominant NE-striking fault zones record bulk dextral strike-slip kinematics. Our data strongly suggest that northernmost Fiordland was affected by a regional-scale Late Tertiary dextral transpressional restraining bend formed by curved faults that separate the Fiordland granulites from weakly unmetamorphosed rocks to the north, west, and east. Our data also suggest that final Late Tertiary exhumation of the granulites in northern Fiordland was controlled by dextral transpressional tectonics and erosion. This mechanism contrasts with the granulites of south-central Fiordland where exhumation processes involved mid-Cretaceous ductile normal faulting. In contrast to the north, southern Fiordland was dominated by extensional tectonics. These results show that processes leading to the exhumation of lower crustal granulites in Fiordland were highly variable within the belt, and had widely different effects on its evolution across the region.

MINERALOGICAL EVIDENCE FOR HYDROTHERMAL ORIGIN  
OF THE BRANDON RESIDUAL FORMATION  
AND THE EAST MONKTON KAOLINS

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

The Brandon Residual Formation (Brandon, VT) and the East Monkton kaolins (East Monkton, VT) are part of a discontinuous chain of kaolin deposits trending along the Green Mountain Front from Bennington to Monkton, Vermont. The unlithified sediments of the Brandon Residual Formation unconformably overlie the contact between the Cambrian Cheshire Quartzite and Dunham Dolomite, and are associated with extensive lignite deposits. Paleobotanical evidence derived from fossil flora found within the lignite deposits indicates an Early Miocene age and a climatic environment similar to that of the present day Gulf Coast, USA. The kaolin deposits therefore may be linked with an intense weathering environment. The East Monkton kaolins are found entirely within the Cheshire Quartzite, and may be associated with the weathering of phyllitic layers within the quartzite.

X-ray diffraction (XRD) analyses of both oriented and randomly oriented clay samples associated with the Brandon Residual Formation and East Monkton kaolins were performed to assess the origin of the kaolin deposits. XRD patterns show sharp basal peaks indicating that the kaolins are primarily well-ordered, well-crystalline, and show few defects. XRD patterns also indicate a predominance of well-crystalline kaolinite coexisting with minor amounts of potassium feldspar, illitic mica, and plagioclase. Several samples also show R1-ordered illite/smectite (rectorite). SEM analyses show the presence of well-crystalline kaolinite, and more poorly crystalline smectite.

The presence of well-ordered and well-crystalline kaolinite coexisting in apparent equilibrium with illite and potassium feldspar according to the  $K_2O-Al_2O_3-SiO_2-H_2O$  phase diagram, and the existence of R1 illite/smectite in several samples are most consistent with a hydrothermal origin for the Brandon Residual Formation and the East Monkton kaolins. If this is true it implies Mesozoic or Paleozoic origin of the kaolins, and might indicate that Miocene coal forming swamps formed atop a previously existing, clay-rich substrate.

## PRESIDENT'S LETTER

Dear Members,

The Northeastern Geological Society of America meeting is over. The presentations, workshops and poster sessions were all very exciting. After this feast of high level intellectual stimulation, the society is turning its attention to April 21 when the student papers will be presented. I hope that you all can make it. The students are working hard to finish their research and I am sure that they will be interesting.

In the realm of pre-college activities, Earth Science Week (Oct 7-13) planning has started. On April 4, several members met to begin planning. You will hear more about that later. The goal is to stimulate interest in studying the earth sciences and to expand public awareness of geology and its role in water and land use decisions, ecological issues, and hazard mitigation. As with the spring student papers meeting, Earth Science Week is designed to support and encourage the study of earth sciences. We all can contribute in some way whether we talk to a class of students or share a favorite field site.

Sincerely,  
Shelley F. Snyder  
Mt. Abraham Union High School  
Bristol, VT 05443  
802-453-2333  
ssnyder@mtabe.k12.vt.us

## EARTH SCIENCE WEEK 2001

First call for Earth Science Week volunteers. Here's a sampling of the enthusiastic response to last year's Geologist-in-the-Parks program.

"What a day on Ascutney! A good time was had by all! My educational objectives for my students were accomplished completely and beyond! We received some very positive feedback from the teachers of Flood Brook, Elm Hill and Sherburne schools. All in all about 85 students, parents and teachers filed through my students' stations which covered topics ranging through volcanoes, mineralogy, weathering, erosion xenoliths and more. The weather was so bad it was great! Several of the teachers said that they would like to do this again."

"The program was very useful and interesting to me and my students. We loved it! It even interested my students in becoming geologists."

"Have you set times and locations for next fall? I am interested in attending this program next year. Please let me know the dates and places as soon as possible."

"I wanted to thank you again for this wonderful program. The three geologists that worked with us were incredible."

We need you to make this happen again! Please contact Marjie Gale (241-3608) if you can spend a day in a park with some great kids during the week of Oct. 7-13, 2001.

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### Vermont Geological Survey Website:

[www.anr.state.vt.us/geology/vgshmpg.htm](http://www.anr.state.vt.us/geology/vgshmpg.htm)

Check out some geologic scenery in the Montpelier Quadrangle:

[www.anr.state.vt.us/geology/glacialmontp.htm](http://www.anr.state.vt.us/geology/glacialmontp.htm)

## STATE GEOLOGIST'S REPORT

Laurence Becker, State Geologist  
103 South Main St., The Laundry Bldg.  
Waterbury, VT 05671  
802-241-3496

Many thanks to the Geology Department at the University of Vermont for hosting the Geological Society of America Northeast Section 36th Annual Meeting. Tracy Rushmer, General Chair of the meeting, Andrea Lini, Technical Chair, and their colleagues did an excellent job coordinating all aspects of the meeting. The official hosts for the meeting were: University of Vermont, Middlebury College, Norwich University, Vermont State Colleges at Johnson, Lyndonville, and Castleton, the State University of New York at Plattsburg, the Vermont Geological Society, and the Vermont Geological Survey. 850 geoscientists convened at the Sheraton to share results of current research through both oral presentations and poster sessions. Topics discussed in symposia and theme sessions included geologic aspects of environmental problems in the northeast, paleobiology, climate change, tectonics, glacial processes, magmatism, and education.

In terms of the Survey, we were active at this year's meeting, participating in a variety of sessions as well as exhibiting maps and hazard information at our booth. Stephen Wright (UVM) and Larry Becker (VGS) co-convened a special symposium on glacial processes in honor of Fred Larsen, recently retired professor from Norwich University. Keith Klepeis (UVM) and Marjorie Gale (VGS) co-convened a special symposium on fault zone evolution and convergent tectonics in honor of Rolfe Stanley. Barry Doolan (UVM), Jon Kim (VGS), Sebastien Castonguay (GSC) and Alain Tremblay (INRS) co-convened a session on the geologic evolution of the northern Appalachians. Jon was the lead author on three papers, one on radionuclides co-authored with Larry, one on mafic complexes in Vermont co-authored with Marjie and Jo Laird, Peter Thompson, and Wallace Bothner, contract mappers from the University of New Hampshire, and one on geochemistry co-authored with Ray Coish of Middlebury College. Jon and Marjie were also co-authors on a poster focused on the geology of Belvidere Mountain and Tillotson Peak presented by Jo Laird, Wally Bothner, Peter Thompson, and Thelma Thompson. Finally, both Jon and Marjie served as judges for student

presentations, and the Survey, in conjunction with the US Geological Survey and the University of Vermont, posted a draft of the new bedrock map during the Map Blast. This was the first opportunity for other geologists to see the current draft of the bedrock map for the entire state.

It was rewarding to see presentations from Survey contractors and the quality of research conducted by student mappers funded through Statemap and the AASG Mentored Student Program. Stephen Wright and students Andrew Bosley (AASG program), Megan McGee (AASG program), Ian Hodgson and Adam Spangler presented a talk summarizing their investigations in the Jeffersonville area (site of the 1999 landslide), Fred Larsen presented a talk and poster on his recent mapping in the Montpelier area, and David DeSimone and Alan Baldvieso from Williams College presented a poster on applied hydrogeology in the Arlington quadrangle. Lori Barg and George Springston focused their poster session on land use and channel evolution in the Great Brook Watershed.

The meeting provided the opportunity to attend a variety of talks, to learn about current geologic problems and issues being addressed at universities and other surveys, and to connect with our colleagues from the northeast. Thanks again UVM and GSA.

### **RADIONUCLIDE UPDATE**

The State Geologist and Jon Kim represented the Division at a Health Department sponsored meeting on radionuclides in drinking water in the Milton/Colchester area. Our part of the meeting focused on the studies completed to date using existing information and our plans for field work and testing this summer. The Division also received questions about how we will identify areas of concern in other parts of the State. We did learn that some wells were tested for radionuclides in the 1980's that did not show elevated levels then but now exceed standards. The Division announced that we would be looking for cooperation on access to property and well testing. The Health Officers will help us with local access. The work will better define areas of concern and locate regions with negligible radioactivity as potential aquifers. The following abstract, presented at NE GSA, summarizes current issues concerning radionuclides in groundwater in Vermont.

## GEOLOGIC CONTEXT OF ELEVATED RADIONUCLIDE OCCURRENCES IN NW VERMONT

By Jonathan Kim and Laurence Becker,  
Vermont Geological Survey

Elevated naturally-occurring radionuclide levels have recently been found in bedrock water wells from Milton/Colchester, and St. George, Vermont. Although both areas are found in the Champlain Valley geologic province, the geologic "landscape" of the Milton/Colchester radionuclide problem is significantly different than that of St. George.

A cooperative study in 2000 between the Dept. of Health, Geological Survey, and towns of Milton and Colchester was initiated in response to the discovery of elevated gross alpha levels in private bedrock water wells in a new Milton housing subdivision. Since previous radiometric studies in the Milton/Colchester area (e.g. USGS, 1951; NURE, 1976; Whitten, 1988) had identified general areas of elevated radioactivity within the Clarendon Springs Formation (CSF), additional radiometric analyses were conducted on wells within or in close proximity to the CSF; eight well clusters were subsequently identified that exceed EPA gross alpha standards. Secondary radiometric testing has implicated the  $^{238}\text{U}$  decay series in this problem.

Uranium-bearing minerals in the Cambro-Ordovician Clarendon Springs Formation dolomites have both primary and secondary origins. Detrital zircon, apatite, monazite, and sphene can be found disseminated throughout the dolomite in certain locations whereas secondary sphalerite, galena, and pyrite are found associated with fractures (Parker, 1988; Whitten, 1988). The highest radiometric readings are related to secondary U-bearing minerals occurrences (Parker, 1988; Whitten, 1988). The northern extension of the Hinesburg Synclinorium (HS) folds the CSF and is truncated by the Champlain and Hinesburg thrusts to the west and east, respectively.

The St. George Trailer Park (SGTP) lies near the convergence of the Paleozoic Hinesburg Thrust Fault and the Mesozoic St. George Normal Fault. These faults primarily juxtapose Cambrian metasedimentary rocks (Fairfield Pond Fm and Cheshire Qtzite) with Ordovician Limestones (Bascom Fm). The primary water supply for the SGTP was found to have elevated gross alpha levels in 1999; this bedrock well appears to have penetrated an outlier of the Hinesburg Thrust. Reconnaissance bulk-rock geochemistry of lithologies surrounding the SGTP

demonstrate that the Fairfield Pond Fm phyllite and Cheshire Quartzite have Th abundances that significantly exceed those of average continental crust. Syn and post-tectonic fluid migration along these major fault zones is inferred to be responsible for concentrating radionuclides in some bedrock wells.

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### **VGS CALENDAR 2001**

- April 21: Spring VGS Meeting, Norwich University, Northfield, VT  
April 21: Student research grant money awarded  
July 10: Deadline for articles and news items for Summer GMG  
July 21: Spring/Summer Field Trip  
Sept. 10: Deadline for articles and news items for Fall GMG  
Sept. 18: Publish Fall GMG  
Sept. 21-23: NEIGC in New Brunswick  
Oct. 7-13: Earth Science Week 2001  
Nov. 5-8: GSA in Boston
- 

### **VGS SUMMER FIELD TRIP Saturday, July 21, 2001**

George Springston and Lori Barg will lead a trip "Surficial Geology and Fluvial Geomorphology of the Great Brook Watershed, Plainfield, VT." Bring lunch and be prepared to cross the brook several times.

Meet in downtown Plainfield at 9:30 am. Specific meeting place and directions will be in the summer issue of GMG. Please pre-register with George at 241-4232(w) or 454-1220(h).

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## TREASURER'S REPORT

March 23, 2001

Dear President and Board:

The financial condition of the Society remains strong. Please see the attached Income Statement for the period January 1, 2001 through March 23, 2001. The checking account balance is \$3,347.97 as of March 23, 2001. All bills received by me have been paid and are reflected in the above balance. I welcome feedback and suggestions from the Board and membership.

Sincerely,  
Kristen L. Underwood

### Income and Expenses 1/1/01 through 3/23/01

|                                        |              |
|----------------------------------------|--------------|
| INCOME                                 |              |
| Total Dues                             | \$280.00     |
| Dues-Family                            | \$40.00      |
| Dues-Institution                       | \$0.00       |
| Dues-Member                            | \$240.00     |
| Dues-Student                           | \$0.00       |
| Interest                               | ** \$2.71    |
| Publications                           | \$22.00      |
| Student Research Grant Contributions   | \$225.00     |
| TOTAL INCOME                           | \$529.71     |
| EXPENSES                               |              |
| Post Office (stamps, GMG Distribution) | \$0.00       |
| Minuteman Press (GMG Publishing)       | \$131.20     |
| Earth Science Week Poster Awards       | \$0.00       |
| Student Res Grants (VGS Spring Mtg)    | \$0.00       |
| TOTAL EXPENSES                         | \$131.20     |
| <br>TOTAL INCOME – EXPENSES            | <br>\$398.51 |

\*\* Interest income earned 1/28/01 through 3/23/01 not reflected in this total.

The Society gratefully acknowledges the generous contributions to the Student Research Grant funds received from the following members during the first quarter of 2001: Lawrence W. Gatto, Barbara L. Hennig, Jeanne Detenbeck, Alexis P. Nason, Larry Becker, and Jeff Hoffer. THANKS!

## Vermont Geological Society Student Research Grants

are designed to aid our future geologists investigate Vermont's geo-history.

Help the VGS to promote a deeper insight into Vermont Geology.

Students receiving assistance through the program will present their research results at the VGS Spring Meetings. Your generosity will help cover a lot of terrane!



To contribute to the **VGS Student Research Grant Program**, clip or copy this form and send it, along with your check or money order made payable to VGS, to:

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

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

**TOTAL GIFT:** \$ \_\_\_\_\_

**NAME:** \_\_\_\_\_

**ORGANIZATION:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

**CITY:** \_\_\_\_\_ **STATE:** \_\_\_\_\_



## GEOLOGY HUMOR LINKS ON THE WEB

[www.ic.ucsb.edu/~georx/geohumor.htm](http://www.ic.ucsb.edu/~georx/geohumor.htm)

[home.earthlink.net/~bcrabtree/n7e.html](http://home.earthlink.net/~bcrabtree/n7e.html)

[www.crocoite.com/faultline/](http://www.crocoite.com/faultline/)

[www.marshfield.k12.wi.us/science/museum/jokes.htm](http://www.marshfield.k12.wi.us/science/museum/jokes.htm)

[www.earthsciences.uq.edu.au/~geosciences/jokes.html](http://www.earthsciences.uq.edu.au/~geosciences/jokes.html)

## EDITOR'S CHOICE!

[www.esci.keele.ac.uk/geology/howlers.html](http://www.esci.keele.ac.uk/geology/howlers.html)

## VERMONT GEOLOGICAL SOCIETY DUES STATEMENT 2001

Dear VGS member:

Membership dues for 2001 are \$15.00 for Members and Associate Members, \$20.00 for a family membership with one newsletter subscription, and \$8.00 for Student Members. Membership dues are used to publish the *Green Mountain Geologist*, to finance our Student Research Grants, and to cover the costs associated with meetings and field trips. If your address, phone, or e-mail address has changed since last year, please fill in this information below, if not, leave the form below blank. A new membership directory will be published with the Summer *GMG*. Return this form with your check for the appropriate amount made payable to the Vermont Geological Society ASAP (due date was March 31, 2001). Send your payment to Kristin Underwood, Treasurer; Vermont Geological Society; Department of Geology; University of Vermont; Burlington, VT 05405-0122. Thank you.

Name:

Date:

Street or Box:

City, State, ZIP:

Work Phone:

Home Phone:

e-mail address:

Fax No.:

Circle Type of Membership:

Member (\$15)

Student Member (\$8)

Family (\$20)

Amount Due: \_\_\_\_\_

Additional Contribution to VGS Research Grants: \_\_\_\_\_

Total Enclosed: \_\_\_\_\_

**THE GREEN MOUNTAIN GEOLOGIST**  
VERMONT GEOLOGICAL SOCIETY  
DEPARTMENT OF GEOLOGY  
UNIVERSITY OF VERMONT  
BURLINGTON, VERMONT 05405-0122

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

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| President      | Shelley Snyder    | 453-2333 |
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|                         |                                     |
|-------------------------|-------------------------------------|
| Advancement of Science  | Stephen Howe                        |
| Membership              | Stephen Wright                      |
| Public Issues           | Laurence Becker                     |
| Publications/Newsletter | Marie Gale, Jeff Hoffer, Peter Gale |

**ADDRESS CHANGE?**

Please send it to the Treasurer at the above address.

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# THE GREEN MOUNTAIN GEOLOGIST



NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

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Fall 2001

VOLUME 28

No. 3 & 4

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**ANNUAL MEETING &  
Fall Field Trip  
October 20, 2001, 10:15 AM  
Middlebury, Vermont  
(see page 5 for details)**

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## PRESIDENT'S LETTER

Dear Members:

April meeting had a wonderful meeting of student papers. The judges, Christine Massey, Alan Liptak, and Marjorie Gale had a difficult task in choosing the best papers presented. Dale Walker, COMPARISON OF EXHUMATION PROCESSES OF LOWER CRUSTAL GRANULITES IN FIORDLAND, NEW ZEALAND, won second place. Andrew Nichols, MINERALOGOLOGICAL EVIDENCE FOR HYUDROTHERMAL ORIGIN OF THE BRANDON RESIDUAL FORMATION AND THE EAST MONKTON KAOLINS, won first place. Sharon Wilson, GEOCHEMICAL ANALYSIS OF SILURO-DEVONIAN MAFIC DIKES IN EAST CENTRAL VERMONT, won the Charles Doll Award for excellence in student-conducted geo-research. Congratulations to all who presented.

The executive committee and interested members had an animated conversation about the College Board and the possibility of an Advanced Placement (AP) geology course offering. The College Board will not proceed in developing this opportunity for high school students unless there is an interest both in high schools and university faculty members and professionals. If you have interest in registering your concern, visit the website: [www.collegeboard.org/ap/newssubjects/geology.html](http://www.collegeboard.org/ap/newssubjects/geology.html). This will bring you to a survey, which is important to the College Board to gather information.

In other discussion, the committee for the Advancement of Science will review research grants as part of the regular duties. There will be another attempt to have a winter meeting. This year, the location will be at Norwich.

Although I could not go, I hear the summer field trip was a good one. Thank you George Springston for sharing with the group. Thank you to the Nominating Committee for putting a slate of officers together for the fall election. Thank you Helen Mango for agreeing to serve as vice president for incoming president Ray Coish. Finally, thank you all for helping me to stumble along for two years.

Sincerely,

Shelley F. Snyder  
ssnyder@mtabe.k12.vt.us

## **EARTH SCIENCE WEEK October 7-13, 2001**

For a complete list of VT activities go to  
<http://www.anr.state.vt.us/geology/vgshmpg.htm>

Many thanks to all the VGS members, geologists, organizations and businesses that are participating in Earth Science Week this year. The annual event truly depends on the VGS for volunteer support and organization. Each year new groups join us to contribute to the effort to bring Earth Science to schools and the general public. Each year the demand for activities also increases. Below is the list of activities for Earth Science Week 2001, followed by our list of thanks to people who participated in planning and /or as volunteers.

Oct. 9- 11, Geologist-in-the-Parks at Groton State Forest, Button Bay, Branbury, Mt. Philo, Little River, Elmore, Townsend, and Lake Willoughby. Contact: Marjorie Gale, (802) 241-3608; [marjieg@dec.anr.state.vt.us](mailto:marjieg@dec.anr.state.vt.us)

Oct. 9, Perkins Museum Open House for Teachers  
Geology Dept., UVM Burlington Campus (off Colchester Avenue); 2 p.m.- 4:30 p.m. Contact: Christine Massey, (802) 656-8694; [cmassey@zoo.uvm.edu](mailto:cmassey@zoo.uvm.edu)

Oct. 10, Glaciers, Moraines and Meltwater: Alaska to Vermont  
Larry Becker will present a slide show about glaciers and glacial geology, Skylight Conference Room, Agency of Natural Resources, 103 South Main St., Waterbury, VT. Noon - 1:00 pm. Contact: Larry Becker, State Geologist, (802) 241-3496; [larryb@dec.anr.state.vt.us](mailto:larryb@dec.anr.state.vt.us)

Oct. 9-12, Fleming Museum Tours  
Special tours to examine geologic materials used in objects and exhibits at UVM's Fleming Museum. Contact: Chris Fearon, Fleming Museum Education Specialist, (802) 656-0750

Oct.12, Poster Contest Due Date with award ceremony on October 23  
This year's theme is "Vermont Geologic Resources: What we use in our everyday lives!" Contact: Christine Massey, (802) 656-8694  
[cmassey@zoo.uvm.edu](mailto:cmassey@zoo.uvm.edu)

**Oct. 13, Open House at OMYA's Marble Quarry \*\***

As part of the National Earth Science Week celebration, a special open house will take place on October 13th from 10:00 a.m. to 3:00 p.m. at OMYA's marble quarry. Modern mining equipment will also be available for inspection.

Contact: Alice Blount, (802) 770-7267; [alice.blount@OMYA.com](mailto:alice.blount@OMYA.com)

\*\*Andy McIntosh will do a special tour for VGS on the 20<sup>th</sup> at our annual meeting.

**Oct. 10 -27, On the Rocks: Geology Mini-Course**

VINS North Branch Nature Center geology course for beginners will be taught by NBNC Educators Chip Darmstadt and Peter Watt and State Geologist, Laurence Becker. Fee: \$65.00 for members, \$75.00 for non-members. Contact: Nikki Parker, (802) 229-6206; [nparker@vinsweb.org](mailto:nparker@vinsweb.org)

Oct. 23, Earth Science Week Poster Contest Awards Ceremony at Perkins Museum, 5:00 pm in the Perkins Museum, Geology Dept., University of Vermont, Burlington, VT 05405-0122 (off Colchester Ave. near the Fleming Museum). Posters will be on display.

Contact: Christine Massey, (802) 656-1344; [cmassey@zoo.uvm.edu](mailto:cmassey@zoo.uvm.edu)

Earth Science Week planning kits are available from:

The American Geological Institute, a not-for-profit federation of 32 professional organizations in the Earth Sciences, at AGI, 4220 King Street, Alexandria, VA 22302 or by visiting the web site at [www.earthsciweek.org](http://www.earthsciweek.org).

The general public and Vermont teachers and students appreciate the efforts we are making to share our excitement and knowledge about Earth Science. Thanks to everyone for planning, volunteering, and being involved in Earth Science Week:

Laurence Becker, Alice Blount, Andy McIntosh, Ray Coish, Jon Kim, Carey Hengstenberg, Rob Farley, Shelley Snyder, Christine Massey, Kent Koptiuch, Ginger Anderson, Peter Gale, Jeff Hoffer, Rodney Pingree, Chris Fearon, Peter Thompson, Craig Heindel, George Springston, and Kristin Underwood.

**Vermont Geological Society  
Annual Meeting  
and Election of Officers**

**Saturday, October 20, 2001  
10:15 AM**

Andy McIntosh, quarry geologist with OMYA, will lead a tour of the Middlebury quarry.

Meet at the quarry around 10:15 am. After the tour, we will meet at the Geology Dept. in Bicentennial Hall on the Middlebury College campus for the Annual Meeting and Elections. Absentee ballots are enclosed in this newsletter and need to be received by VGS Secretary Jeff Hoffer before October 19.

**Directions:**

The OMYA Middlebury Quarry road is on US7, (southbound) 2.5 miles south from the *Middlebury Inn* and (northbound) 1 mile north of junction of 125/116 East Middlebury turnoff. The quarry road is on the east side of US7 between *Standard Register* and *Foster Motors*, and the green street sign is labeled *1975 Private Road*. Continue straight on this road past the first stop sign. The second stop sign is at the quarry. Please park where instructed.

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**Open Letter To Ms. Snyder and the Members of the  
Vermont Geological Society**

Thank you for your generous grant to offset the costs of thin section preparation associated with the completion of my Master's Thesis. These thin sections are vital to the success of my project and our understanding of the evolution of the Green Mountains. Thank you again.

Sincerely,  
Chris Lamon

## STATE GEOLOGIST'S REPORT

### Fall 2001

All of Vermont State Government and the Agency of Natural Resources (ANR) which includes the Vermont Survey are facing budget difficulties. At this stage, the Vermont Survey is holding its own because of federal sources from STATEMAP, the Federal Emergency Management Agency and some EPA dollars. The danger for the Survey is that other parts of the Agency have severe shortfalls and these programs are searching for funds. Our top administrators will prioritize projects and may shift dollars or even personnel, perhaps to meet perceived short term needs. If you care about the importance of geologic information to a range of environmental and resource issues, the time may soon approach when your voice should be heard. It never hurts to let the powers that be know how important geology is to our environment and economy.

*With the tragic events of September 11<sup>th</sup> our hearts go out to those that have lost relatives and friends. As the country recovers from the shock and grieves, it is our fervent hope that safety and security will be restored.*

### Surficial Maps Completed

Three surficial mapping projects funded through the cooperative agreement between the Vermont Geological Survey and the US Geological Survey STATEMAP program were delivered to USGS in September. This is our third year deliverable of surficial maps. Each of the three basic surficial mapping projects included an applied geology focus and addressed: landslide hazard in the Jeffersonville quadrangle; watershed studies for flood hazard mitigation in the Great Brook Watershed; and aquifer/recharge area identification in the Arlington quadrangle. All the projects are field-based and labor intensive, are original geologic research, funded through a competitive grant, and involve students working with professional geologists. The maps will be useful for development of groundwater supplies, seismic hazard assessment, slope instability assessment, sand and gravel resources, and general land use planning. The products contribute to the goals of our long range plan for mapping in Vermont.

In the Jeffersonville quadrangle, field work was conducted in the summers of 2000 and 2001, with maps submitted and digitized in the fall of 2001. In addition to geologists Stephen Wright and Jon Kim, three University of Vermont students (Matthew Guerino, Megan McGee, and Kristin Miller) participated in the project, one with funding through the AASG Mentored Field Study program. Products delivered were the plotted maps of digital files of the surficial geology, a preliminary hazard map, and a spreadsheet of pertinent well log locations and data.

George Springston and Lori Barg conducted surficial mapping and used both quantitative and qualitative methods of geomorphic analysis to assess the mainstem and tributaries of the Great Brook watershed in Plainfield, Vermont for hazard potential. They also presented a summary of criteria for defining erosion hazards in the Great Brook Watershed. The products delivered were plotted maps of the digital files of the surficial geology, a preliminary hazard map, and a well log database which provides sub-surface information.

The purpose of the mapping in the Arlington quadrangle was to provide reference information to be used for land use planning with resource management implications. The project focused on the surficial geology and hydrogeology. Alan Baldvieso, a student from Williams College, worked with the professional geologist David DeSimone. Products delivered were a plotted surficial geologic map of the digital files, digital database and plotted paper map of available water well and boring logs, and an Aquifer Recharge Potential Map and Carbonate Aquifer Piezometric Surface map. A report, written specifically for non-geologists, promoted "understanding the distribution of the surficial deposits in order to understand the land we place our septic systems in and the movement of water through the deposits to our water wells. With this better understanding, it is hoped that officials and residents of Arlington will appreciate the susceptibility of their landscape to possible contamination and will use the report and maps to guide future development in a way best suited to the local environment."

## **Hazard Mapping**

Following the successful studies in the Great Brook watershed, other hazard map projects are planned and/or underway. In the Third Branch of the White River, George Springston, Norwich Prof. Fred Larsen, Prof. Richard Dunn, and students Nathan Donahue and Fiona Johnstone are mapping the surficial geology. Lori Barg and UVM student Angela Rogers are collecting the fluvial data. With funding from the Vermont Survey, the White River Partnership, a local watershed group, provided volunteers trained by Lori Barg to perform rapid geomorphic assessments of some tributaries to identify areas for detailed study by the mapping team.

The Vermont Survey will receive funding from the Lamoille County Regional Planning Commission to do surficial geology and fluvial geomorphology studies of the Wild Branch of the Lamoille River for a landslide/riverine erosion hazard map.

## **Arrowhead Lake Slide and Other Events**

The Vermont Survey was contacted by Emergency Management in response to the Town of Georgia's concern over a slide at the north end of Arrowhead Mountain Lake. A house close to the edge of a failed block of fine sandy material is in danger and the residents have moved to another location. The failure plane near the house shows about eight feet of displacement. The length of this failure plane along the top of the bank is very significant in that it extends hundreds of feet in either direction. The Division was the first responder for the Agency of Natural Resources and consulted with Emergency Management (on site) concerning risks. Given the size of this failure plane further analysis would aid the Vermont Surveys' understanding of slope failure as it relates to developing hazard mapping concepts.

Other areas of slope instability visited include a failure that blocked Route 5 in Windsor, Slate Avenue in Northfield, erosion that in part contributed to the train derailment in Westminster, and the rockfall onto Rte 5A in Westmore.

## **Naturally Occurring Radioactivity in Rocks and Drinking Water**

This summer the Vermont Survey began a bedrock geology project in the towns of Milton and Colchester in an attempt to understand the geologic conditions responsible for elevated radionuclides in numerous private wells. This study involves conventional mapping techniques coupled with 2- and 3-dimensional gamma ray spectrometer surveys, radiometric testing of water wells, and airphoto analysis. Jon Kim of the Vermont Survey and contractor Peter Thompson of the University of New Hampshire are the principal investigators. The ultimate goal of this investigation is to develop a radioactivity susceptibility map that will be useful at the town and regional planning commission levels.

## **Hazard Presentations**

The State Geologist, with support from VT Emergency Management, gave a paper at the annual conference of the Association of State Floodplain Managers in Charlotte, North Carolina. The presentation focused on scientific studies conducted or managed by the Vermont Survey as a base for flood erosion hazard mapping and storm water management.

Jon Kim gave a talk titled "Geologic Hazards in Vermont" at the 2001 NEIWPC Annual Meeting in February. This talk highlighted the Division's work with physical hazards such as landslides and erosion as well as geochemical hazards such as naturally-occurring radionuclides. Representatives of all New England states and New York were in attendance.

## **Earth Science Education**

The State Geologist met with the State Science Coordinator at the Department of Education on June 13. The purpose was to learn more about the earth science education standards in Vermont. The Survey is now more aware of how to approach schools when doing educational outreach and designing inquiry based concepts for field education. On June 15, the State Geologist met with Marcia Davis of the new Vermont Granite Museum of Barre to discuss the developing plans for the geology exhibit area. Ms. Davis requested a review of the plans and

asked the State Geologist to serve on the educational outreach committee for the Museum. This is consistent with the Vermont State Geologist serving as chair of the Association of American State Geologists Educational Committee and serving on the American Geological Institute Educational Outreach Committee. Such affiliation can help the Vermont Granite Museum when funds are sought to develop programs. Marjorie Gale received an achievement award from the Department of Environmental Conservation for her work coordinating the October 2000 Earth Science Week "Geologists in the Park" program. In June, Jon Kim gave a geologic training session at Lake Willoughby for State Park Naturalists who will be serving visitors to Vermont this summer.

### **Background Geochemistry**

On August 20-21 the Geology Division participated in a joint project with the Geological Survey of Canada at Belvidere Mountain to understand the geochemistry of ultramafic rocks which are associated with the asbestos deposits at the nearby mine. The geochemical analyses of samples taken will be conducted at the Geological Survey of Canada (GSC) labs in Ottawa and Quebec City and the data will augment the Geologic Division's background geochemistry database. Further collaboration is planned in the future. The Division is also cooperating on an age dating project with the GSC. Because of these cooperative efforts, the State Geologist serves on the Association of American State Geologist's International Relations Committee.

Submitted By,  
Laurence Becker  
Vermont State Geologist

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The Society gratefully acknowledges the generous contributions to the Student Research Grant funds received from the following members during the **second & third quarters of 2001**: Roger & Terry Thompson, Greg & Nancy McHone, and Sharon Strassner

Thank You!

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## THE CREATION/EVOLUTION CONTINUUM

by John Klimenok, Jr.

The creationism vs evolution controversy continues to be a major topic of discussion among lay people as well as professionals. Many think that there are only two points of view: (1) God created the universe and all life in it in essentially the forms we see today in a period of 6 days not more than 10,000 years ago (creationism) and (2) life has changed gradually over billions of years by natural, physical processes (evolution). This dichotomy of thinking is in actuality too simplistic. There is a continuum of different views.

The Creation/Evolution Continuum (information from the Reports of the National Center for Science Education, Volume 19, Number 4), with the most strict creationists on the left end and the most materialistic evolutionists on the right, can be diagramed as:

Flat Earthers>Geocentrists>Young Earth Creationists>Old Earth Creationists>Evolutionary Creationists>Theistic Evolutionists>Materialist Evolutionists.

There are several subcategories in the Old Earth Creationists, including: Gap Creationists>Day>Age Creationists>Progressive Creationists>Intelligent Design Creationists.

At the left end of the spectrum are members of the Flat Earth Society who believe, based on a literal interpretation of passages in the Old Testament of the Bible, that the earth is circular and flat, not spherical. This group has about 200 members and does not figure significantly in the movement for creationism and against evolution. Geocentrists agree that the earth is a sphere, but that it, not the sun, is at the center of the solar system. Both this group and the Flat Earthers believe that the heavens are held up by a dome (firmament in Biblical terms) and that waters above the firmament were the source of Noah's Flood. This group is also very small.

Most creationists are Young Earth Creationists whose founder and leader is Henry Morris, recently retired president of the Institute of Creation Research (ICR). This group rejects most modern physics, chemistry, geology, and astronomy. They believe that the earth is

between 6,000 and 10,000 years old and that God created all forms of life in six days, essentially in the form we see them today. Humans are a special creation by God and macroevolution never occurred. Some do accept microevolution to explain minor differences between some species. Most of the creationist literature is from the ICR and this group is at the forefront to get creationism into the public classrooms on an equal footing with evolution. Creationists disbelieve evolution because it does not explain every detail of life's origins and development and because it is contrary to what is contained in the Book of Genesis.

Old-Earth Creationists accept the ancient age of the earth and the universe, but they believe in a God who was and is personally involved in the creation of the universe. There are several sub-groups of Old-Earth Creationists. Gap or Restitution Creationists, formed during the latter part of the 18th century, think that there was a large span (gap) of time between Genesis 1:1 and 1:2. That is, there was a pre-Adam creation that was destroyed prior to Genesis 1:2 after which God recreated the world, including Adam and Eve. This accommodates an old earth, but with God as the creator. Day-Age Creationism, which was more popular in the 19th century and the beginning of the 20th, accepts both modern science and the Biblical creation story by saying that the six days of creation were not literally 24 hour periods of time, but rather indeterminate lengths of time which could be in the millions of years. They see a rough parallel between evolution and Genesis where plants appeared before animals and humans were created last.

Progressive Creationists are the majority of the Old-Earth Creationists today. One of their defenders is Dr. Hugh Ross of Reasons to Believe ministries. An astronomer who obtained his PhD at the University of Toronto, Dr. Ross accepts the reality of the Big Bang and believes that it is direct evidence of the creative power of God. However, modern biology is essentially not part of this belief system. This group thinks that God created a "kinds" of animals sequentially at different times and that the fossil record is an accurate representation of paleontological history. Evolution does not occur, except within a "kind", which roughly corresponds to a Family. This corresponds to microevolution where the processes of mutation and recombination, natural selection, genetic drift, and speciation occur. For example, the

cat "kind" had enough genetic variability to "evolve" into lions, tigers, and house cats. The apparent Cambrian explosion is evidence of Special Creation by God. God, then, is seen as acting through natural law as well as through direct intervention.

The most recent form of Old-Age Creationists are the Intelligent Design Creationists (IDC). This group descended with little modification from William Paley's *Argument from Design* in 1803. Simply put, proof of an all-powerful creator/designer can be found in the order and purposeful design in the world. Paley's example was the watch, the existence of which required a watchmaker who had a design in mind. Another example was the vertebrate eye which he felt was "too complex to have evolved by chance". Although some microevolution is accepted by this group, mutation and natural selection are not because they believe that even the simplest life forms are too complex to have formed by accident or chance. This conclusion requires an intelligent designer - God. Many of the same arguments used by Young Earth Creationists are used by this group and Biblical beliefs are disguised by the use of questionable science.

Although most IDCers are not scientists, there are a few scientists who are considered sympathetic to this group. Lehigh University biologist, Michael Behe, who wrote *Darwin's Black Box*, introduced the phrase "irreducible complexity". This refers to processes or structures in cells or organisms, such as the blood clotting cascade or the rotor motor of a microorganism's flagellum, which he thinks cannot be separated into individual components that function by themselves and, therefore, cannot be explained by the gradual process of natural selection. He concludes that these complexities can be explained only by a special creation and that they are proof of the existence of an intelligent designer.

Peer reviews of Behe's publications have pointed out flaws in his reasoning concerning natural selection and have been highly critical of his conclusions. One obvious rejoinder is that, although at this time we do not understand how these complexities came to be, we may understand in the future how they did evolve naturally. While Behe, himself, is not a creationist per se (he believes that the earth is billions of years old and that natural selection can account for much of life's diversity), others, like Phillip Johnson, a professor of law at the

University of California, use currently unexplained aspects of the origin of life to promote creationism in his book, *Defeating Darwinism by Opening Minds*, in an attempt to debunk evolution.

Evolutionary Creationists and Theistic Evolutionists are very similar in their beliefs. Both accept the notion that God uses evolution to "create" the universe according to his plan. Both accept the revelations of astronomy, geology, and biology in terms of evolution by natural selection, up to a point. They do vary from each other in the amount God intervenes in the process of evolution. Evolutionary Creationists tend to be more conservative Christians while Theistic Evolutionists are usually mainstream Protestants. The latter view is also the official position of the Roman Catholic Church which believes that humans did evolve from simian ancestors, but that God introduced the human soul.

At the other end of the continuum are the Materialist Evolutionists. When the term "evolution" is used, it is usually this group being referred to. Here, the approach to understanding the universe and life in it is through methodological materialism which invokes natural causes involving matter and energy. People who accept this idea separate science and religion as two distinct entities. This view is neutral to religion and supernatural agents because they are outside the field of view of this group. They may exist, but they are irrelevant. Philosophical materialism, however, proposes that the laws of nature are all there is; no supernatural entities exist. Modern science, as most think of it, uses methodological materialism. Atheists accept philosophical materialism, but it is not a prerequisite to do science. Some Materialist Evolutionists do believe in God.

Where do place yourself on the Creation/Evolution Continuum? Do you feel that evolution is unacceptable to a religious person or can there exist a separation between science and religion? How do or can religious beliefs affect or interfere with scientific thought and research?

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## VGS TREASURER'S REPORT

September 17, 2001

Dear President and Board:

The financial condition of the Society remains strong. Please see the attached Income Statement for the period January 1, 2001 through September 17, 2001. The checking account balance is \$3,194.04 as of September 17, 2001. All bills received by me have been paid and are reflected in the above balance. I welcome feedback and suggestions from the Board and membership.

Sincerely,  
Kristen L. Underwood

### Income and Expenses 1/1/01 through 9/17/01

#### INCOME

|                                      |          |                   |
|--------------------------------------|----------|-------------------|
| Total Dues                           |          | \$773.00          |
| Dues-Family                          | \$120.00 |                   |
| Dues-Institution                     | \$0.00   |                   |
| Dues-Member                          | \$645.00 |                   |
| Dues-Student                         | \$8.00   |                   |
| Interest                             |          | \$11.78           |
| Publications                         |          | \$22.00           |
| Student Research Grant Contributions |          | <u>\$305.00</u>   |
| <b>TOTAL INCOME</b>                  |          | <b>\$1,111.78</b> |

#### EXPENSES

|                                           |                        |
|-------------------------------------------|------------------------|
| US Post Office (stamps, GMG Distribution) | \$85.40                |
| Minuteman Press (GMG Publishing)          | \$279.20               |
| Earth Science Week Poster Awards          | \$0.00                 |
| Research Grant Awards                     | \$347.60               |
| Student Awards (VGS Spring Mtng)          | <u>\$155.00</u>        |
| <b>TOTAL EXPENSES</b>                     | <b>\$867.20</b>        |
| <b>TOTAL INCOME - EXPENSES</b>            | <b><u>\$244.58</u></b> |

**THE GREEN MOUNTAIN GEOLOGIST**  
VERMONT GEOLOGICAL SOCIETY  
DEPARTMENT OF GEOLOGY  
UNIVERSITY OF VERMONT  
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**ADDRESS CHANGE?**

Please send it to the Treasurer at the above address.

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