



THE GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

WINTER 1994 VOLUME 27/0 NUMBER 4

The Vermont Geological Society's Winter Meeting

Cold Regions Research and Engineering Laboratory (CRREL)

Hanover, New Hampshire

Saturday February 26th

Tour of the CRREL Facilities after the Meeting

See inside for details.

Directions: To reach CRREL, exit I-91 at the Hanover, New Hampshire Exit (Exit 13), cross over the river and go through the only traffic light in the center of Hanover. Take the next left turn (north) around the village green and follow it (Route 10) north for approximately 2 miles. The CRREL facility is located on the west side of Rte. 10. Use the main entrance to the facility adjacent to the parking lot. Phone: 603-646-4100.

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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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ADDRESS CHANGE?

Please send it to the Treasurer at the above address.

-Printed on Recycled Paper-

If this box is checked, your VGS dues are unpaid.

PRESIDENT'S LETTER

20 December 1993

Dear Members,

The strength of every organization comes from its members applying their talents to accomplishing their organization's goals. We thank Sue Hadden for doing so last year as VGS secretary. We especially thank Lucy Harding, Bruce Wilson, Leslie Kanat, Stephen Howe, Ron Parker, Shelly Snyder, Rolfe Stanley, and Stephen Wright for their long-term commitment to the VGS. They have each served our Society for more than a year. Special thanks go to Ron Parker again for making the arrangements for our annual meeting and banquet in October, to Paul Bierman for being the guest speaker at the banquet, and to Dave Franzi for leading the October field trip. The dedication these members have displayed is required of us all to keep the VGS a viable organization with a solid future.

Continuing with this theme, I encourage you to commit yourself to your Society by volunteering for one or more of the following: Chairperson, Public Issues Committee; guest editor for the *Green Mountain Geologist*; the Nominating Committee; and, reviewer for VGS Research Grant proposals. Use your talents and make your VGS membership meaningful.

As a minimum, if you choose not to donate your talents to the VGS, the Society needs your financial support. One of our main goals is to advance the science and profession of geology by encouraging research. And one of the ways we accomplish that goal is through our VGS Research Grant Program which is supported by your dues. Please pay your dues.

Your Executive Committee will be working on the following items during the next year in addition to organizing the Winter and Spring Meetings and Summer and Fall field trips. We will revise the VGS Constitution and Bylaws so you can vote on them next fall. We will update the VGS membership directory and request that you ensure that the address we have for you is correct. We will explore establishing reciprocal agreements with the Maine and New Hampshire Geological Societies. I request that you contact any Executive Committee member with your input regarding these items.

The VGS winter meeting will be held on 26 February 1994 at the Cold Regions Research and Engineering Laboratory (CRREL) in Hanover, NH. Please plan to attend and be a contributing VGS member. Volunteer for your Society! Talents that remain unused are of no benefit to anyone.

Sincerely,

Larry Gatto

WINTER MEETING PROGRAM

Cold Regions Research and Engineering Laboratory
Hanover, New Hampshire
February 26, 1994

- 9:30 Coffee**
- 10:00 Stewart F. Clark, James B. Shanley, and Jon C. Denner:** *Groundwater, surface water, and soil moisture relations during the initial stages of snowmelt on a small forested hillslope*
- 10:20 Don Maynard:** *An inexpensive design for a vibratory sediment core sampler*
- 10:40 Lawrence W. Gatto:** *River bank conditions and erosion in winter*
- 11:00 Gregory J. McHone and Nancy W. McHone:** *Mantle xenoliths from the North Hartland dike and the origin of Mesozoic lamprophyres in Vermont*
- 11:20 TOUR OF CRREL FACILITIES BY LARRY GATTO**
- 12:15 Lunch**
- 12:30 VGS Executive Committee Meeting:** *All members are invited to attend!*

Treasurer's Report: Steve Howe reported a current balance \$2,048.70 in the VGS bank account and updated the status of the membership dues. VGS currently has 190 members on its mailing list. Of those 190, 110 members have paid their 1993 dues. Steve also reported that he will prepare the 1994 dues statement that will be directly mailed to all 190 members. Those members who have not paid their 1993 dues by 3/1/94 will be dropped from the mailing list. The 1994 dues notice will also include a call for abstracts for the Winter Meeting, a survey regarding the approval/disapproval of the current cost for VGS membership, and a request for information for the VGS membership directory. Three new members were approved.

Winter Meeting: The 1994 Winter Meeting was discussed. This will be held at the CRREL facilities in Hanover, NH on February 26. Arrangements will be made for supplying morning refreshments only.

Reciprocal Agreements: Reciprocal agreements between the New Hampshire and Maine Geological Societies were briefly discussed. Stephen Wright reported that such an agreement does exist with the Maine Geological Society but was unsure of our arrangements with the New Hampshire Geological Society. More information regarding these agreements will be forthcoming at the next Executive Committee Meeting.

Guest Editors: Stephen Wright also requested recommendations for Guest Editor for the spring or summer GMG. It was decided to place a notice in the GMG inviting those interested in this opportunity to contact Stephen Wright or any member of the executive committee. It was suggested that there be only one guest editor for one issue per year.

Permanent Committee Reports: Education Committee Chair, Shelley Snyder, suggested that the teacher's hand-book for geologic information published by VGS be updated. Kent Koptiuch volunteered to help Shelley in this endeavor. Shelley was also interested in putting together a list of those VGS members who may be interested in allowing students to shadow them at their place of work.

Nominating Committee: A list of potential members of a Nominating Committee was created. Larry Gatto volunteered to contact these people to solicit their possible interest in serving on this committee.

The membership status of this committee will be discussed at the next executive committee meeting.

VGS Research Grant: Deadlines for the VGS Research Grants were discussed. It was suggested that there be two grant deadlines and awards each year (November and May). This change in the grant cycle would accommodate those students whose projects are planned in the fall semester and then initiated and completed during the spring semester. It was unclear if our dues could support the additional funding cycle. A decision will be made at the next Executive Committee Meeting.

Public Issues Committee Chair Vacancy: A recommendation was made for filling the post of Chair of the Public Issues Committee. Ron Parker agreed to contact a possible candidate for this position.

By-laws Changes: Larry Gatto recommended that the by-laws be updated. Suggested changes to the by-laws will be published in the GMG prior to the Fall Meeting.

VGS Posters: Larry also reported that he has gotten permission from CRREL to use their graphic design department to produce posters that will advertise the VGS Research Grant Program and that will encourage membership in VGS. These posters will be reviewed at the next executive committee. Recommendations will be made regarding color, size, quantity and cost.

Next Meeting: The Executive Committee will hold a luncheon meeting on February 26, 1994 at the CRREL facilities in Hanover, NH.

Meeting adjourned at 6:30 p.m.

Respectfully submitted

Nancy Keller
St.. Albans, Vermont

SEMINARS, MEETINGS, AND FIELD TRIPS

February 26: **Vermont Geological Society Winter Meeting** at the Cold Regions Research and Engineering Lab, Hanover, New Hampshire. See this issue of the *Green Mountain Geologist* for details.

February 28: University of Vermont Fall Seminar Series (4 P.M.): *"The Re-Os surprise at Mount Emmons, Colorado"* Dr. Holly Stein, U.S. Geological Survey.

March 14: University of Vermont Fall Seminar Series (4 P.M.): *"Assembling a Continent: Deep crustal processes at an Archean plate zone boundary, Snowbird Tectonic Zone, Saskatchewan"* Dr. Michael Williams, University of Massachusetts.

March 28–30: **Northeastern Section Geological Society of America Annual Meeting**, Binghamton. For information regarding the meeting contact H. Richard Naslund, Dept. of Geological Sciences, SUNY Binghamton, Binghamton, NY 13902; 607-777-4313.

April 16 or 23: Vermont Geological Society Spring Meeting for the presentation of Student Papers. University of Vermont.

April 18: University of Vermont Fall Seminar Series (4 P.M.): *"Risk Assessment: Using earth sciences for safety decisions"* Dr. Richard Bernknopf, U.S. Geological Survey.

Vermont Geology

Volume 7

"Field Trip Guidebook Number 3"

Editor: Stephen F. Wright

Contents

Cretaceous Intrusions in the Northern Taconic Mountains Region, Vermont

J. Gregory McHone & Nancy W. McHone

Depositional Environments in the Mid-Ordovician Section at Crown Point, New York

Brewster Baldwin & Lucy E. Harding

The Altona Flat Rock Jack Pine Barrens, Altona, New York

David A. Franzi & Kenneth B. Adams

The Champlain Thrust Fault, Lone Rock Point, Burlington, Vermont

Rolfe S. Stanley

Stratigraphy of the Cambrian Platform in Northwestern Vermont

Charlotte J. Mehrrens

Price: \$8.00 (members), \$10.00 (non-members)

Order from: Stephen Howe, Treasurer

Department of Geology

University of Vermont

Burlington, VT 05405

WINTER MEETING ABSTRACTS

GROUND WATER, SURFACE WATER, AND SOIL MOISTURE RELATIONS DURING THE INITIAL STAGES OF SNOWMELT ON A SMALL FORESTED HILLSLOPE

Clark, Stewart F., James B. Shanley, and Jon C. Denner
U.S. Geological Survey, Montpelier, Vermont 05602

Ground water, surface water, and soil moisture were monitored during the 1993 snowmelt period at Sleepers River Research Watershed in Danville, Vermont. In mid-March, the snowpack reached maximum depth (95 cm) and water equivalent (20 cm). On March 16, the air temperature rose from -16 °C to +2 °C, dipped to -1 °C overnight and rose to +2 °C on March 17, when 6 mm of rain fell between 8:00 a.m. and 11:00 a.m. Soil moisture increased from 0.33 to 0.37 (volume fraction), ground-water level rose 19 cm, and stream discharge increased from 0.71 to 2.55 liters per second, within 4 hours of the start of rainfall. Colder temperatures (-5 °C to 0 °C) returned on the night of March 17 and persisted until March 23. During this period, streamflow recession followed the ground-water recession.

A thaw, lasting several days, began on March 23. Although the temperature pattern on March 23-24 was very similar to that of March 16-17, there was no rainfall and no response in streamflow. On March 25, diurnal streamflow cycles began with successively higher daily peaks. Ground-water levels also increased in stepwise fashion during the same diurnal cycle. Initially, the daily ground-water response lagged the stream response, but by March 28, the responses coincided.

Rain on snow and snowmelt caused increases in ground-water levels and streamflow. Despite a dry snowpack, the rapid response of soil water, ground water, and streamflow suggests preferential flowpaths through the snowpack. The timing of increases in soil moisture with depth shows that water is infiltrating to the saturated zone from the land surface. The timing of stream and ground-water response is consistent with the timing of moisture increases in the vertical array of moisture probes. Comparison of oxygen-18 in snowmelt, streamwater, and ground water suggests that ground water is the dominant component of streamflow. Increased streamflow during snowmelt is largely the result of increased recharge to, and discharge from the ground-water system.

RIVER BANK CONDITIONS AND EROSION IN WINTER

Gatto, Lawrence W., Geological Sciences Branch, Cold Regions Research and Engineering Laboratory, Hanover, NH 03755-1290

Winter in cold climates is a season when some of the well-documented processes that contribute to riverbank erosion have either slowed or are inactive. For example, river hydraulic forces are often minimal and usually affect only the upper portion of the river bed, not the riverbank directly, because river stage and discharge are frequently at an annual low and rivers are often completely or partially ice-covered. Precipitation usually falls as snow, which minimizes overland flow down the bank face during precipitation events as well. However, numerous field observations show that bank erosion does not cease during the winter. Freeze-thaw cycling and the formation of ground ice in riverbanks disrupt bank soil structure, thereby reducing soil strength, which often results in in-situ bank sediment being dislodged and moved down slope via gravity. Sublimation of ground ice at the bank face during the winter also releases ice-bonded bank sediments, and when ground ice melts in the spring a saturated zone of bank face sediment remains that is unstable and susceptible to slides. River ice can abrade and transport in-situ bank soils and any sediments that have accumulated along the bank face and toe as river stage rises in the spring. If the freezing and thawing, ground ice processes, and river ice actions do not directly remove bank soils, they can individually or collectively disturb the soils sufficiently to make them more susceptible to erosion by processes that are active during other seasons. Thus, year-round measurements are needed to determine the seasonal extent of erosion, including the quantitative effects of winter factors. Only from such studies will we improve our current inadequate capability to predict riverbank recession.

AN INEXPENSIVE DESIGN FOR A VIBRATORY SEDIMENT CORE SAMPLER

Maynard, Donald M., The Johnson Company, 5 State Street, Montpelier, Vermont 05602

The Johnson Company, Inc. has designed a vibratory sediment core sampler that can be constructed for under \$5,000. With two technicians, the sampler can collect a five foot long, three inch diameter sediment sample in fewer than 20 minutes. The sampler penetrates through saturated silts, sands, and fine gravel, and has been used in up to 40 feet of water. Over 175 successful sediment cores have been collected, with a typical core recovery of more than 70% of penetration depth.

The sediment sampler uses a 10,000 vibration per minute gas powered vibrator. The vibrator was originally design for use in concrete placement. The vibrator is attached to 1.5 inch diameter aluminum AW drill rod. The rod in turn is threaded into the check valve assembly of the core barrel. The design utilizing the rigid rods has significant advantages over a cable operated design. The rods allow precise control over the penetration and location of the sampler, even under conditions of high waves or high water velocity. The core barrel is standard 3.5 inch NQ steel casing with

machined threads. The barrel and tip of the sampler are machined to match ASTM D4823-88 specifications. A plexiglass or Lexan[®] liner is used inside the core barrel. The liner helps to prevent cross contamination between sampling points, and maintains the sample in its original condition and stratigraphy.

A stable platform and a winch are necessary for performing sediment sampling on lakes or rivers. The absolute minimum equipment that is necessary is a 16 foot pontoon boat and a winch and boom assembly rated for 1600 pounds pull. Three anchors are recommended for platform stability. Determining the precise location of each sample point can be performed in at least three ways. The most accurate method is to use a surveyor stationed onshore and a stadia rod held in the boat. Another method is to use a global positioning system (GPS). The GPS can theoretically provide ± 10 foot accuracy when used with a sub-meter antenna and double-difference differential processing. A third, less expensive method is to measure the distance and bearing from the sample point to several onshore objects. The distance measurement can be performed with a calibrated rangefinder. The bearing measurement requires a marine or automobile compass.

MANTLE XENOLITHS FROM THE NORTH HARTLAND DIKE AND THE ORIGIN OF MESOZOIC LAMPROPHYRES IN VERMONT

McHone, J. Gregory, Graduate Liberal Studies Program, Wesleyan University, Middletown, CT 06459, and McHone, Nancy W., Geological and Natural History Survey, Dept. of Environmental Protection, 79 Elm Street, Hartford, CT 06106

A Cretaceous (133 ± 6 Ma) camptonite dike in the spillway of the North Hartland flood control dam displays abundant inclusions of spinel lherzolites and lesser amounts of dunite, harzburgite, and clinopyroxenite, as well as quartz plagioclase granulites and other xenoliths. The inclusions range up to fist-sized and are concentrated in bands through the middle part of the intrusion. Other Mesozoic dikes in the Northeast contain high-grade metamorphic crustal inclusions, but dikes with ultramafic (mantle) xenoliths are rare. Electron microprobe analyses of mantle minerals from North Hartland include enstatite, diopside, low-Ti augite, Mg-rich olivine, brown chromian spinel, and rare phlogopite, with compositions that are generally comparable to mantle minerals from four other New England and Québec lamprophyres. Geothermometer calculations using the North Hartland analyses indicate equilibrium temperatures that are somewhat lower than those from other sites.

Xenolith occurrences are important to studies of tectonic features and the origin of igneous rocks in the region. Geochemical data from the North Hartland and other xenolith sites show that the Cretaceous mantle had little variation across terrain boundaries in the region, with vertical heterogeneity but relatively good lateral homogeneity of mantle rock types. Volatile-rich compositions are rare in the xenoliths, with little evidence for chemical enrichment with mobile elements in their source areas. Such enrichment may be required for the generation of alkaline basalt melts that

ascended as lamprophyre dikes, and which also puddled into chambers that became plutons such as Ascutney Mountain. Vermont lamprophyre rare-earths show a possible equilibrium with deeper, garnet-bearing and enriched source rocks, and so the xenoliths may represent incidental mantle material not related to lamprophyre genesis and mantle enrichment processes.

STATE GEOLOGIST'S REPORT

Diane L. Conrad
 Vermont State Geologist and Director
 Vermont Geological Survey

The Vermont Geological Survey continues to promote the geological sciences in Vermont. We currently employ seven professionals—geologists, engineers, and technical and administrative staff—who work in three programs: geology, radioactive waste management and the Agency of Natural Resources' Geographic Information Systems. The GIS program recently reformed as "Information Management Services" to better reflect its role in the Agency as the coordinator of the use of this technology.

The geology program has contracted with geologists from the University of Vermont and Castleton State College to contribute to the bedrock mapping project currently in progress for the state. The map is scheduled to be published early in 1997, with interim products made available open file annually in paper and digital format. In mid-January, we submitted our latest STATEMAP proposal to the U.S. Geological Survey for mapping northern and central Vermont, part of the longer term goal of the new state geologic map. This proposal allows us to expand the program and contract with more Vermont and U.S.G.S. mappers.

Information Management Services is currently developing a methodology for creating a digital bedrock geology map. Digitizing geologic maps is largely unprecedented, and no standard symbology or method exists to guide mappers in map preparation or IMS staff in digitization. V.G.S. staff have collaborated with U.S.G.S. and UVM geologists on two pilot projects—Dr. Charlotte Mehrtens' work in northwest Vermont and the work of Dr. Nick Ratcliffe and Greg Walsh in the Mount Holly and Ludlow 7.5 minute quadrangles—that will result in a set of guidelines for contract mappers to use when preparing maps to be digitized. These guidelines will shorten the time required to digitize these maps.

Last year, Diane Vanecek, information specialist, fielded more requests for geologic information than ever before. Of the people she helped, 305 telephoned, 116 wrote, and 62 walked in; a 50% increase over 1992. Late Winter usually heralds numerous requests for where to find gold in Vermont, and she is ready to help. Orders for Survey publications have increased too, and we still have T-shirts and hats for sale with our *Pirates of the Paleozoic* logo on them. Diane thinks they're destined to become collectors' items. Can you afford *not* to own one? Call her at 241-3601 to place your order.

As we write, the Vermont State Legislature is considering a bill to dispose of Vermont's low-level radioactive waste at a site in Hudspeth County in West Texas. Once Vermont's law passes, Congress must ratify the compact, a three-state agreement between Vermont, Maine, and Texas. The 50-year agreement calls for a payment by Vermont and Maine of \$27.5

million each, with a total of \$5 million to benefit the nearby town of Sierra Blanca. The site is located in the Eagle Flat basin, a closed basin where the groundwater table is located 800 feet below the surface.

The recent earthquakes in southern California remind us that they could happen here, too. A pamphlet from the New England States Earthquake Consortium (NESEC) states that there is a 19%–28% probability of a damaging (magnitude 5 or greater) earthquake in New England within a 20-year period. New England's hard-rock base transmits seismic waves over an area 4 to 40 times greater than in California; significant damage could result from even a moderate earthquake. NESEC has produced a 20-minute videotape entitled *New England's Next Earthquake: The Writing on the Wall*. We have a copy in our library and would be glad to lend it to any interested party. Call Diane Vanecek for details.

A new U.S.G.S. report, *Geologic Radon Potential of EPA Region 1*, states that the radon potential of Vermont is generally moderate, but varies across the state. The open-file report, No. 93-292-A, goes on to say that several types of rocks in Vermont—granitic and micaceous metamorphic rocks, granite plutons, graphitic and carbonaceous phyllites, slates and schists—have the potential to produce high radon levels. Nevertheless, this is a generalized assessment, and is inappropriate for use in identifying the radon potential of small areas such as neighborhoods, individual building sites, or housing tracts. A copy of the report and accompanying map of radon potential across the U.S. are available through the Survey library.

Andrew V. Raiford (1937-1993)

Andy WAS geology at Castleton State College. He came here in 1970, and single-handedly built up the geology program. For 16 years he was the only geologist in the natural sciences department. Despite this, he ran a complete major (he filled in the few gaps by requiring his majors to go to two field camps) and turned out many successful geologists. He was a native of New Orleans, receiving a Bachelors degree in geology from Louisiana State University and a Masters degree in geology from Tulane. Before coming to teach at Castleton, he taught earth science in the Jefferson Parish school district in Louisiana, was a geophysicist for Gulf Oil International and Conoco Oil, and worked for Boeing Aerospace, where he designed the silk screen process to put the U.S. flag on the Saturn booster. Andy was deeply committed to geology and to his students. He was easy to spot on field trips run by V.G.S., N.E.I.G.C. and others by the flock of Castleton students around him. Andy Raiford died on December 4, 1993 after a long and difficult struggle with a rare form of bone-marrow cancer.

Helen Mango
Castleton, Vermont

VERMONT GEOLOGICAL SOCIETY BUSINESS AND NEWS

New Members

We are pleased to welcome the following new members who have joined the Vermont Geological Society since the Fall *GMG* was published:

| | |
|-------------------------|--------------------------|
| Paul Bierman | Burlington, VT |
| David Laing | White River Junction, VT |
| Ground Water of Vermont | Burlington, VT |

Treasurer's Report

Your dues make it possible for the Vermont Geological Society to publish the *Green Mountain Geologist*, *Vermont Geology*, and to continue its commitment to our newly instituted Student Research Grant program. As of February 11, 1994, only three weeks before the March 1st payment deadline, dues for 1994 have been received from 86 of the 194 members of the Society. This amounts to 44% of our membership. Those of you who have not sent in your payment are identified by a red mark in a box located on the back cover of this issue of the *GMG*. Please use the dues statement and self-addressed stamped envelope that were sent to you on January 10, 1994.

I would like to acknowledge the donations in excess of yearly dues made recently by several of our members to support our Student Research Grant. Your generosity is much appreciated!

Your thoughtful comments concerning VGS dues have been most useful. I will have a statistical breakdown in my report in the Spring *GMG*, but a large majority of you feel that the cost of membership in the VGS is appropriate. A few of you even considered it a bargain! Despite postal costs that are slated to rise soon, we will endeavor to hold down our expenses so that we may postpone an increase in dues for as long as possible.

Sincerely,

Stephen S. Howe

Executive Committee Meeting—1/3/94

Minutes

The Executive Committee of the Vermont Geological Society was called to order at 5:35 p.m. on January 3, 1994 at the University of Vermont, Burlington, Vermont. Members present included Larry Gatto, Steve Howe, Stephen Wright, Ron Parker, Shelley Snyder, Kent Koptiuch, and Nancy Keller.