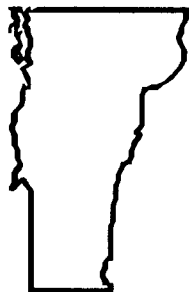


THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

SPRING 1993

VOLUME 20

NUMBER 1

The Vermont Geological Society
Spring Meeting
for the
Presentation of Student Papers

SATURDAY APRIL 24, 1993, 9 AM

Twilight Auditorium
MIDDLEBURY COLLEGE

Directions: The spring VGS student meeting will take place in Twilight Auditorium on the Middlebury College campus. Twilight Auditorium is housed in the old Grammar school, a three-story brick building located in the green between Franklin Street and College Street (downhill and east of the Science Center). Members may park in the parking lot behind the Science Center.

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PRESIDENT'S LETTER

Dear Members,

The Northeastern Section Meeting of the Geological Society of America (GSA) was held at the Sheraton in Burlington March 22-24 and was a success all around. Over 950 people registered for the meeting. There was a great assortment of professional talks about nearly all aspects of geology. Field trips to the Champlain Thrust at Lone Rock Point (yes, across the ice) proved very popular. A hardy few attended a field trip to Redstone Quarry. The highlight of the meeting for me, though, was the student poster sessions. The students showed remarkable talent, energy, thoughtfulness, artistic ability, and research skills in presenting their work. And what a wonderful opportunity it was for them to be included within the professional geologic community! Thanks to all involved in the meeting for an incredible amount of hard work!

Please note that *Vermont Geology*, Volume 7, was published last month by the Vermont Geological Society in conjunction with the GSA meeting. It contains the guides to the five field trips offered at the GSA meeting. The volume makes good reading for anyone wanting to add to his/her collection of geologically interesting places to go, with or without students, professors, or family members! If you are interested in a copy, send a check for \$8 (\$10 for nonmembers) to Steve Howe at UVM. For members disappointed by the cancellation of the longer GSA field trips due to snow cover, don't dismay. We are discussing running one or more of these trips as VGS field trips this season.

The Vermont Geological Society will next meet on Saturday April 24th at Middlebury College for the traditional Spring student research presentation. We are expecting students from Middlebury, UVM, and Union. Please note that there will be an executive committee meeting following the student presentations. All VGS members are invited to attend the executive committee meeting. Business we need to discuss at this meeting includes summer and fall field trips and a fall speaker. We have several ideas in mind for field trips but please bring any additional ideas you may have.

Please remember that if you are an undergraduate/graduate student or a secondary school teacher doing original research on Vermont geology, consider applying to the Vermont Geological Society Research Grant Program for funding. Deadline for applications is May 21, 1993. Contact me or Stephen Wright for an application or more information. Academic advisors—please remind your students of this opportunity!

I'm looking forward to seeing you at the Spring meeting! By then spring weather should be here for sure...but I'm betting on May before the ice is gone from the north side of our house!

Sincerely,

Lucy Harding
Middlebury, VT

SPRING MEETING PROGRAM

9:00 Coffee

9:30 Daniel M. Bissell: *Synthetic Seismogram Generation—A Study in the Antarctic Peninsula Region*

9:45 Rebekah Kneeshaw Condon: *South Mountain Structure and Stratigraphy, Bristol, Vermont*

10:00 Jessica Falkenberg & Charlotte J. Mehrtens: *A Re-evaluation of the Stratigraphy and Sedimentology of the Day Point Formation (Chazy Group)*

10:15 Robert E. Maranville: *Fission-track Dating of Detrital Zircons from Modern Rivers in the Pacific Northwest: Implications for the Provenance of the Olympic Subduction Complex, Washington State*

10:30 Brian C. Welch: *Mesozoic and Proterozoic Mafic Intrusions in the Adirondack Highlands: A Chemical and Petrographic Comparison*

10:45 Coffee Break

11:00 T. Jeffery Scott: *Shale Geochemistry as a Provenance Indicator of Mid-Cretaceous Terrane Accretion, Southern British Columbia*

11:15 Mary Ann Schlegel: *A Paleoenvironmental Study of the Southern Champlain Sea*

11:30 Hollistir S. Hodson: *Bottom Morphology of Southern Lake Champlain: Larabee's Point to Chipman Point*

11:45 Stephen Ruhl: *A Detailed Study of the Morphology, Behavior, and Formation of Sediment Furrows in the Buffalo River, Buffalo, New York*

12:00 Lunch: *Lunch is available at several restaurants within walking distance of the meeting.*

12:30 VGS Executive Committee Meeting: *All members are invited to attend!*

SPRING MEETING ABSTRACTS

SYNTHETIC SEISMOGRAM GENERATION— A STUDY IN THE ANTARCTIC PENINSULA REGION

Bissell, Daniel M., Department of Geology, Middlebury College, Middlebury, VT 05753

Many reflectors on high-resolution profiles result from the interference of fine-scale sediment layers rather than distinct lithologic horizons. Synthetic seismograms allow a detailed correlation between these high resolution seismic records and observed or measured physical properties of core sediments. Such a correlation provides insight into both the nature of the reflectors as well as the characteristics of the insonified sediments.

In this study, high-resolution seismics from a 3.5 kHz Huntec DeepTow system were correlated with five 9 m piston cores taken in and around the Antarctic Peninsula. To generate the synthetic seismograms, impedance and reflection coefficient profiles were calculated from sediment velocity and bulk density analyses measured at 5 cm intervals. The reflection coefficient was convolved with the seismic source signature and the resulting synthetic seismogram compared with the actual seismic records. In addition, magnetic susceptibility was measured on all cores and one core was analyzed for percent biogenic silica to determine whether density changes might be the result of biogenic silica peaks.

The results of the correlation show a strong inverse relationship between magnetic susceptibility and percent biogenic silica. We conclude that the fine-scale reflectors in this area are generally the result of either thin sand layers associated with turbidite deposits or changes in the relative composition of hemipelagic sediments as reflected by small-scale changes in bulk density. We interpret these density variations as resulting from changes in biogenic silica content as local biologic productivity varies.

SOUTH MOUNTAIN STRUCTURE AND STRATIGRAPHY, BRISTOL, VERMONT

Condon, Rebekah Kneeshaw, Department of Geology, Middlebury College, Middlebury, VT 05753

South Mountain lies at the northern end of the Lincoln massif, the northernmost in the chain of parallochthonous basement massifs of western New England. The field area lies in the Cambrian western cover sequence above the basement and includes the Pinnacle (?) Formation, the Fairfield Pond Formation, and the Cheshire Quartzite.

Preliminary results of mapping in Bristol Notch and along the Green Mountain front indicate that the Cheshire Quartzite appears to be at least 2500 feet thick with neither the top nor base exposed. As this is at least 2.5 times thicker than previous estimates to the north and south, these estimates will need to be confirmed with additional field work.

Near the base, the Cheshire Quartzite is typically a massive argillaceous feldspathic meta-sandstone containing recrystallized quartz and K-feldspar in a muscovite and biotite matrix comprising up to 25 percent of the sample. Of the remaining framework grains, K-feldspar makes up less than 10 percent with the balance being quartz. These lithologies grade upward through medium to thick bedded schistose feldspathic meta-sandstones to clean, massive 'quartzites' of the Green Mountain front which are coarse-grained, recrystallized feldspathic meta-sandstones containing less than 2 percent micas (usually biotite and chlorite) and up to 35 percent K-feldspar.

Hinge lines of F_1 folds on the east trend N20E while those on the west trend N05W. A pervasive east-dipping cleavage is folded on the east side of the mountain into east-verging F_2 folds. Based on lithologic, stratigraphic, and structural relationships, the rocks currently mapped as the eastern-most Cheshire Quartzite appear to belong to the Pinnacle Formation and are in fault contact with the Cheshire Quartzite.

A RE-EVALUATION OF THE STRATIGRAPHY AND SEDIMENTOLOGY OF THE DAY POINT FORMATION (CHAZY GROUP)

Falkenberg, Jessica & Mehrstens, Charlotte J., Department of Geology, University of Vermont, Burlington, VT 05405

The Day Point Formation (Chazy Group, Middle Ordovician) outcrops in the Champlain Valley of New York and Vermont. The stratigraphy of the Day Point Formation is complex, (encompassing) containing lateral changes in lithology, producing sequences that are unique at different localities around the Champlain Valley.

The formation exhibits seven lithofacies: (1) Highly bioturbated sandstone with symmetrical and bifurcating ripples; (2) Bioturbated, brachiopod-rich, wackestone facies; (3) Planar cross-bedded, interlayered sandstone and sandy packstone; (4) Interlayered sandstone and shale grading into sandstone and limestone layers; (5) Grainstone that contains mound-shaped bryozoan reefs at

some localities and at other localities contains thin, non-reefal, sheet-like layers of bryozoans. The grainstone also has planar laminated and cross-stratified beds; (6) Fine-grained, calcareous sandstone with planar and herringbone cross bedding, which in places contains small bryozoan reefs; (7) Planar cross-bedded packstone containing bryozoan reefs and thin sheet-like non-reefal layers. The thin reefal layers are found where the mound-shaped reefs are absent.

Bryozoa are found throughout the Day Point Formation in mound-shaped reefs and in thin non-reefal layers. In the lower portion of the Day Point Formation the bryozoan reefs and the non-reefal layers are often found on top of the sandstone beds or within the sandstone. In contrast, no sandstone is found in the upper section of the Day Point Formation, yet the bryozoan reefs flourish. This study has revealed more sandstone units in the lower portion of the Day Point Formation than was noted in previous studies.

In the Day Point Formation sandstone units are followed by deeper water carbonates which we interpret to be a series of transgressive cycles. Sedimentation of the sand ceased as a result of a rise in sea level. The deeper water induced the accumulation of carbonate sediments, causing the water depth to decrease and eventually allowing sand to accumulate again. Hydraulic variations may explain both the lithologic sequences and the faunal zonation observed in the Day Point Formation.

BOTTOM MORPHOLOGY OF SOUTHERN LAKE CHAMPLAIN: LARABEE'S POINT TO CHIPMAN POINT

Hodson, Hollistir S., Department of Geology, Middlebury College, Middlebury, VT 05753

In May 1992 the Lake Champlain Maritime Museum and Middlebury College imaged a six square kilometer section of southern Lake Champlain with a high resolution, dual frequency side-scan sonar system. These side-scan sonar profiles were used to identify the sediment bedforms and submerged cultural artifacts present from Larabee's Point south to Chipman Point. Several bottom morphologies including sediment waves, sediment furrows, features inferred to be sand ribbons, and linear groups of possible pockmarks and slump features were recorded and mapped. Most of these sediment features are found in conjunction with the cultural artifacts beneath Lake Champlain's surface and in the shallow regions of the northern portion of the study area.

Sediment waves range from several centimeters to 0.5 meters in height and have a wavelength of around four meters. These features are abundant around several cultural artifacts and in the shallower, near-shore parts of the survey area. The cultural artifacts act as an obstruction to the bottom current creating sediment waves. Sediment furrows have developed in groups of two or more around the Larabee's Point ferry cable and in the regions surrounding buoys 37 and 38. They are approximately 2 meters wide, up to 90 meters long, and have an average spacing of 10 to 20 meters. Furrows are evidence of a strong, stable bottom current in those regions. The sand ribbons found in this study area are

most likely a precursor to sediment furrows. The pockmarks/slump features are spread along the eastern slope of the lake north of Mt. Independence.

From the orientation of the sediment bedforms, the direction of the bottom currents in this study area and specifically around each of the cultural artifacts can be documented. The bottom current in this southern section of Lake Champlain behaves much like a river, flowing to the north and following the local bathymetry and topography. However, several sediment features do suggest possible bi-directional currents in the study area.

FISSION-TRACK DATING OF DETRITAL ZIRCONS FROM MODERN RIVERS IN THE PACIFIC NORTHWEST: IMPLICATIONS FOR THE PROVENANCE OF THE OLYMPIC SUBDUCTION COMPLEX, WASHINGTON STATE

Maranville, Robert E., Geology Department, Union College, Schenectady New York, 12308

A unique new tool for determining the provenance of clastic sedimentary rocks is fission-track (FT) dating of detrital zircons. Once a number of grain ages have been determined from a sample, statistical techniques can be used to fit Gaussian probability functions to the data to identify individual "peaks." These peaks presumably represent the cooling ages of rocks in the source terrain. This technique has recently been used to identify the provenance and date the sandstones that comprise the Eocene to Miocene Olympic Subduction Complex (OSC) in northwestern Washington State (Brandon and Vance, 1992). Workers have shown that there are several source terrains with distinct cooling histories for the sediment of the OSC and that the sediment was probably derived from a river system that drained either eastern Washington State and northern Idaho or eastern British Columbia (Brandon and Vance, 1992). By determining fission track ages of detrital zircons in sediments from modern river systems in the Pacific Northwest it is possible to identify the paleo-river system that most likely supplied sediment to the OSC.

Fission-track ages of thirty-four zircon grains from each of four sediment samples: two from major river systems in the Pacific Northwest (Fraser and Columbia) and two from the rivers draining the North Cascades (Nooksack and Skagit) are reported here. The peak-fitting method of Brandon (Brandon, 1992) was used to decompose the grain ages for each sample into distinct grain-age populations. Zircons from the Fraser and Columbia rivers have common peak ages of 42, 53, and 65 Ma and rivers draining the North Cascades have peak ages of 33, 53, and 73 Ma. The Fraser River sample also has significant peak ages of 33 and 92 Ma that are not present in the Columbia River samples; likewise the Columbia River sample has a peak age of 73 that is not present in the Fraser River sample. These distinct peaks in each sample allow sediment derived from the Fraser and Columbia rivers to be distinguished from each other. Ages of peaks for FT samples from the OSC are about 32, 43, 57, and 74 Ma (Brandon and Vance, 1992).

Considering data from modern sediment of this study, the Columbia River is excluded as a possible sediment source for the OSC because sediments from Columbia lack a peak near 32 Ma but this peak is present in Fraser River sediments. The most likely sediment sources for the OSC are the Fraser River and the North Cascades. The peak ages of 33, 42, 53 Ma from the Fraser sample and 33, 53, and 73 Ma from the North Cascades rivers closely match those of the OSC rocks and suggest these drainage areas as possible source terranes. These data, therefore, restrict the provenance of the OSC rocks to the North Cascades and eastern British Columbia (the drainage basin of the Fraser River).

A DETAILED STUDY OF THE MORPHOLOGY, BEHAVIOR AND FORMATION OF SEDIMENT FURROWS IN THE BUFFALO RIVER, BUFFALO, NEW YORK

Ruhl, Stephen, Department of Geology, Middlebury College, Middlebury, VT 05753

Since July of 1990, a Klein side-scan sonar unit has been employed annually on the Buffalo river, Buffalo, NY, as a means of monitoring the dynamics of the river bottom. The resulting profiles have revealed the presence of sedimentary furrows, which were previously thought to be restricted to lakes, estuaries and oceans. The primary field of furrows is located between Corps of Engineers markers 600 and 643 and has been studied in detail to document any changes over the past two years. The total length of the field is approximately 1300 meters and covers two adjacent reaches of the river as well as the meander that joins them. Furrows become dispersed and erratic in the meander section but are continuous in the river reaches. While no significant downstream migration took place, there was a dramatic rise in the overall number of furrows present in this study area over the two year period. The characteristic "tuning fork" pattern, where furrows join, can be seen in both upstream and downstream orientations in all areas of the field, implying bi-directional river flow. Tabulation of wind data for this two-year period shows that the dominant wind direction is from the WSW direction, with the strongest winds coming from that direction as well. The largest reach containing the furrow field and the long axis of Lake Erie both lie on this same axis. It seems that the furrow section of the Buffalo River is situated ideally with respect to wind such that the wind is able to a) generate the helical boundary layer currents which, in turn, create furrows, and b) create a pile-up of lake water at the mouth of the river which results in reversal of flow. Both phenomena may aid in creating furrows. The failure of other reaches with similar orientations to show furrow development may be a result of inadequate channel length, distance upstream with regards to flow reversals, and possibly other factors.

A PALEOENVIRONMENTAL STUDY OF THE SOUTHERN CHAMPLAIN SEA

Schlegel, Mary Ann, Department of Geology, University of Vermont, Burlington, VT 05405

Micropaleontological studies of piston-cored sediment from Lake Champlain reveal a post-Wisconsin marine inundation of the Champlain Basin known as the Southern Champlain Sea. On the basis of foraminifera and ostracodes, five ecological assemblages (Hunt and Rathburn, 1988) are defined for the 2500 year span. The C₂ zone, conformably overlying sediments of proglacial Lake Vermont, corresponds to the initial marine influx. The subsequent reappearance of freshwater ostracodes and the depletion of foraminifera during the C₁ interval records a basinal freshening. An increase in diversity and abundance of foraminifera and the presence of marine ostracodes heralds the return of euhaline to polyhaline conditions in the B₂ zone. Sediments of the overlying B₁ zone record an ameliorating climate and deteriorating marine conditions as deglaciation proceeded.

Cores M91-1 and M91-2 were retrieved from locations north of Juniper Island and south of Providence Island respectively. Micropaleontological analyses reveal foraminifera and ostracodes of the B₂ and B₁ ecological assemblages in both cores. In M91-2, faunas of the C₂ and C₁ assemblages underlie those of the B zones. The faunal stratigraphies observed in cores M91-1 and M91-2 support the evolution of the Southern Champlain Sea as outlined above.

Radiocarbon dating and oxygen isotope analyses of foraminiferal calcium carbonate will permit resolution of questions pertaining to the timing and magnitude of the paleoenvironmental changes suggested by the faunal stratigraphies. With this clarification, source, timing and magnitude of meltwater pulses into the Southern Champlain Sea may be deduced and definitive correlation of basinal horizons with regional and global events should thus be possible.

SHALE GEOCHEMISTRY AS A PROVENANCE INDICATOR OF MID-CRETACEOUS TERRANE ACCRETION, SOUTHERN BRITISH COLUMBIA
Scott, T. Jeffrey, Geology Department, Union College, Schenectady, NY 12308

Various models for the accretion of the Insular terrane to North America suggest that collision occurred in either the Middle Jurassic or mid-Cretaceous. The Tyaughton basin of southern British Columbia is located between the Insular terrane and Intermontane terrane and records events associated with their juxtaposition and subsequent accretion to North America.

Analyses of over 50 samples for first-row transition elements and REE using an ICP-MS have been used to determine geochemical signatures of individual units and to characterize source terranes. Elevated Cr (>300 ppm) and Ni (>200 ppm) values are present in the Albian-Cenomanian strata of the Dash conglomerate and Silverquick conglomerate, whereas Lower Albian and older

rocks have Cr and Ni concentrations of less than 80 ppm and 40 ppm respectively. Notably, Jurassic strata do not show elevated Cr and Ni concentrations which suggests that if the Jurassic was a time of terrane accretion, ophiolites were not involved in this area. Cr/Ni ratios of the Dash and Silverquick conglomerates (c. 1.3) are compatible with ratios of sediment derived from ultramafic rocks. These ratios, combined with the elevated Cr and Ni concentrations, are interpreted to represent the erosion of ophiolites during synorogenic sedimentation.

Rare Earth Element (REE) concentrations were used to ascertain the crustal provenance of fine-grained sediment in the basin because sediments derived from volcanic arcs and evolved continental crust have very different REE signatures. Pre-lower Albian strata do not show significant LREE enrichment; their REE signature and Ba/Nb ratio suggest an arc provenance. Lower Albian to Cenomanian strata show the first significant LREE enrichment, and the REE patterns suggest derivation from crust that has undergone substantial differentiation (*i.e.* continental crust). Rare earth element patterns in the Albian Taylor Creek Group show the most similarity to the North American Shale Composite, which represents average North American crust. Furthermore, clastic sediments of the Bridge River Complex, an accretionary complex with a poorly understood history, are significantly different from Triassic, Jurassic, and Early Cretaceous strata based on their REE abundances, transition element concentrations and Ba/Nb ratios. These clastic strata are most likely mid-Cretaceous in age and represent early orogenic strata subsequently imbricated with older rocks of the Bridge River Complex.

The above data suggest that the mid-Cretaceous strata record the uplift and erosion of ophiolites and an influx of fine-grained sediment from an enriched source (most likely continental crust) whereas neither LREE enrichment nor Cr/Ni anomalies occur in Jurassic strata.

MESOZOIC AND PROTEROZOIC MAFIC INTRUSIONS IN THE ADIRONDACK HIGHLANDS: A CHEMICAL AND PETROGRAPHIC COMPARISON

Welch, Brian C., Department of Geology, Middlebury College, Middlebury, VT 05753

The Adirondack Highlands have twice been invaded by mafic igneous intrusions, the first during Late Proterozoic rifting, and the second during Mesozoic rifting before the opening of the present Atlantic Ocean. Samples were taken from dikes of both ages cutting the Grenvillian-deformed Marcy Massif and Paleozoic limestones. These were then examined chemically and petrographically to find the differences between Mesozoic and Proterozoic intrusive events in this region.

Petrographic work shows the Proterozoic dikes to have olivine and pyroxene phenocrysts and essential plagioclase. Among the Proterozoic dikes there is significant chlorite and calcite alteration of the olivine and pyroxene phenocrysts, along with alteration of the plagioclase and groundmass. The

Mesozoic lamprophyres contain olivine and pyroxene phenocrysts as well as essential biotite and/or amphibole, but lack plagioclase. Chlorite and calcite alteration rims around the olivine and pyroxene phenocrysts are minimal in the Mesozoic dikes. Some of the dikes lack essential plagioclase, similar to the Mesozoic samples, but show extensive alteration typical of Proterozoic samples.

Whole-rock method major and trace element chemical analyses show the dikes to be high in TiO_2 , K_2O , and P_2O_5 . TiO_2 values range from 1.94 to 3.42 weight percent for Mesozoic, and 1.99 to 3.54 for Proterozoic dikes. The range of K_2O is higher among the Mesozoic samples while P_2O_5 is about the same for both ages. Discriminant plots of both Mesozoic and Proterozoic samples show them to be within-plate alkaline basalts. The Proterozoic dikes are mostly quartz or olivine normative, with a few nepheline normative samples. All Mesozoic dikes are nepheline normative.

Field observations show the Proterozoic dikes to have an average strike of N55E, while the Mesozoic dikes average N57E. It is suspected that the Mesozoic intrusions in the region were controlled partly by the earlier fracture zones, as stated by Isachsen (1977). The overall chemical similarities between the Mesozoic and Proterozoic dikes indicate little chemical variation in the sources that produced both ages of intrusion. High TiO_2 , Zr, and Y contents of both the Mesozoic and Proterozoic dikes would suggest derivation from either a deep mantle plume or an enriched mantle lithosphere source.

VERMONT GEOLOGICAL SOCIETY BUSINESS AND NEWS

Treasurer's Report

As of April 7, 1993, the Vermont Geological Society has 196 members, of which 17 are academic or corporate organizations. However, dues for 1993 have been received from only 69 members, which amounts to 35% of our membership. If you have not paid your dues yet, I urge you to do so as soon as possible. Your dues make it possible for the Society to publish *The Green Mountain Geologist*, *Vermont Geology*, and to continue its commitment to our newly instituted Student Research Grant program. So, fill up my mailbox (use the VGS address on the back of your GMG) and put a smile on my face! Thanks!

Sincerely,

Stephen S. Howe

SEMINARS, MEETINGS, AND FIELD TRIPS

April 24: **Vermont Geological Society Spring Meeting:** Presentation of Student Papers, Middlebury College, Middlebury, Vermont.

April 27: **Institute of Electrical and Electronics Engineers Meeting,** Burlington, Vermont, 7:30 PM. Keynote Presentation by Mr. Robert E. Dakin, "*Plutonium Recovery and Soil Remediation of Johnston Island,*" Contact Robert E. Dakin for details (802-879-1742).

June 18: **The Ice Age in the White Mountains: The Geologic and Human History at the End of the Ice Age around Mount Washington** A Symposium Presented In Memory of Dr. Richard P. Goldthwait by the Mount Washington Observatory and its Education Center, Red Jacket Mountain View Motor Inn, North Conway, New Hampshire, Contact the Mount Washington Observatory, Box 2310, North Conway, NH 03860 (603-386-8345) for details.

Vermont Geology

Volume 7

"Field Trip Guidebook Number 3"

Editor: Stephen F. Wright

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**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. Mehrtens

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

Order from: Stephen Howe, Treasurer

Department of Geology

University of Vermont

Burlington, VT 05405

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ins Region,
on at Crown

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

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THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

SUMMER 1993

VOLUME 20

NUMBER 2

*The Vermont Geological Society
Summer Field Trip*

Geology of Camels Hump

Saturday July 10
(Rain Date: Sunday July 11)

*Leaders:
Peter and Thelma Thompson*

See inside for details.

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PRESIDENT'S LETTER

Dear Members,

We were treated to some excellent research at our annual symposium of students papers held at Middlebury College in April. Students from Middlebury and Union Colleges as well as the University of Vermont participated. Brian Welch from Middlebury College received the Charles G. Doll Award for his work on mafic dikes in the Adirondacks. Mary Ann Schlegel of the University of Vermont was recognized for her research on the glacial history of the Champlain Valley. We awarded a runner up prize to Robert E. Maranville from Union College for research on fission track dating of detrital zircons in Washington state. A special thanks is due to Larry Gatto, Ron Parker, and Shelly Snyder for judging the student papers. If you didn't make this year's spring meeting, come next year! The research presented by the students is high quality and the meeting is a wonderful time to celebrate the accomplishments of the next generation of geologists. They certainly need our support and encouragement.

I am happy to announce that we have awarded Russell Schuck of the University of Vermont a grant through the VGS Research Grant Program. Russ will be working on metal concentrations in sediments of Arrowhead Mountain Lake. The executive committee will meet in early fall to assess the effectiveness of the VGS Research Grant Program, now in its second year. In the meanwhile I would appreciate your comments. Is the grant application too complicated? Is the name of the program too cumbersome? Are applications due at a convenient time of year for your students? Should the program be broadened to include more kinds of academic pursuits? Please let me know your thoughts.

Our Summer VGS field trip is planned for Saturday July 10th. Stephen Wright has invited Peter and Thelma Thompson to lead a trip up Camel's Hump. The Thompsons have spent the last several summers in Vermont doing field work should so it should be great fun to see what they've been up to!

On behalf of all members I want to thank Stephen Wright for putting together this and every issue of the *GMG*. Steve also arranged the summer field trip. He is a devoted and selfless contributor to the VGS. We all owe him a special thank you.

Sincerely,

Lucy Harding
Middlebury, VT

SUMMER FIELD TRIP

Geology of Camels Hump

Saturday July 10

(Rain Date: Sunday July 11)

*Leaders***Peter and Thelma Thompson***Meeting Place:*

Meet at 8:30 AM at the trailhead parking lot for the "Burrows Trail" which ascends Camels Hump from the west side. To reach the trailhead, take the road east from Huntington Center (not Huntington) and follow this to its end. Small signs have been posted at most intersections (including the intersection with the main road in Huntington Center) to keep hikers heading in the right direction.

Equipment and Background Information:

Bring a lunch and water. Camels Hump and the trails we will be on are on the "Huntington, VT" 7.5 minute U.S.G.S. quadrangle. Further information about the geology of the area is available in Thompson and Thompson (1992), *Bedrock geology of the Camels Hump—Bolton Mountain area, north-central Vermont*, Vermont Geological Survey Special Bulletin No. 12. For ordering information see the note about this and other recent publications of the Vermont Geological Survey elsewhere in this issue of the *GMG*.

Planned Route:

6.3 miles, 2,300 feet vertical elevation. Burrows Trail to saddle, Long Trail to summit. Continue south along the Long Trail to Montclair Glen. Return on Forest City Trail and Cutoff Trail to Burrows Trail parking lot.

For more information contact Peter and Thelma Thompson (802) 888-5018.

Trip Description:

The main purpose of the trip is to see structural relationships among three units of the Late Proterozoic to Cambrian Camels Hump Group (Underhill, Hazens Notch, and Mt. Abraham Formations), and to note places where underlying rocks and structures control topography. Details of the stratigraphy and structure will be discussed on the trip.

The Burrows Trail starts out in the Hazens Notch Formation, typically rusty, sulfidic schists interlayered with black, graphitic schists. The first outcrops we see will be greenstones within the Hazens Notch. At about 2,950 ft elevation the trail steepens as it encounters the more resistant Underhill Formation (a silver-green schist usually recognized by abundant albite and

At the flat saddle where the Burrows Trail joins the Long Trail and Forestry Trail (elevation 3,830 ft.), we'll again see the Hazens Notch Formation, this time beneath the Underhill, but the Long Trail to the summit soon crosses back into the Underhill Formation. The summit of Camels Hump is located about one mile west of the the Green Mountain anticlinorial axis; thus the dominant foliation here is dipping west. On the summit we'll see many small-scale folds related to the (Acadian?) Green Mountain deformation. In the summit area, please remember to stay on the rocks, as the alpine vegetation is very fragile. The summit, and most of the bare ledges and cliffs seen from the summit, are Underhill Formation. The tall cliffs at the south end of the Hump are most likely due to glacial plucking.

Except for a few poorly exposed layers of Hazens Notch (the result of early folds?) we will see mainly Underhill Formation rocks as we follow the Long Trail south to Wind Gap. Mt. Abraham schist is exposed between Wind Gap and Montclair Glen Camp. Some of the best exposures are at the camp, with interesting fold interference patterns. The Mt. Abe is usually finer grained and less green than the Underhill, and lacks albite. In this area it is also more likely to contain garnet.

We will continue south on the Long Trail for a short distance beyond the camp to a notch with a good exposure of a post-peak-metamorphism fault. (To the north, the Forestry Trail crosses the same fault at 2,850 feet elevation, where big cliffs of Underhill overlie the Hazens Notch on the east side of Camels Hump.) Returning to Montclair Glen, we will head west, down the Forest City Trail, and cross an area of Hazens Notch interpreted as a window caused by erosion of the same fault.

Farther down the trail, just west of the cut off to the parking lot, greenstones within the Hazens Notch Formation are exposed in Brush Brook. These greenstones have a geochemical signature intermediate between that of greenstones in the Underhill to the west and greenstones in the Ottauquechee and Stowe Formations to the east, suggesting a tectonic setting of eruption intermediate between rift and drift. (People who want to see more of the Hazens Notch or take a dip in swimming holes in the brook may wish to continue down the Forest City Trail to the lower parking area—but it's a long hike back up the road to the upper parking lot.)

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 Winter *GMG* was published:

Laurel Adams	Marblehead, MA	Student, Salem State College
Thomas Villars	Woodstock, VT	Soil Scientist, Soil Conservation Service

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 June 19, 1993, dues for 1993 have been received from 78 of the 196 members of the Society. This amounts to only 40% of our membership! On April 24, 1993, the Executive Committee decided that we could no longer afford to continue to print and mail copies of the *Green Mountain Geologist* to those members who have not paid their dues. Those of you who are delinquent in payment are identified by a red mark in a box located on the back cover of this issue of the *GMG*. Please use the easily detachable dues statement found in the centerfold of the Winter *GMG* (Volume 19, Number 4). If your dues are not received by December 15, 1993, we will be forced to delete your name from our mailing list—a prospect guaranteed to please only the postal carrier's aching back!

Sincerely,

Stephen S. Howe

Executive Committee Meeting - 4/24/93 Minutes

The Executive Committee of the Vermont Geological Society met on April 24, 1993 at Middlebury College, Middlebury, Vermont. Members present included Larry Gatto, Steve Howe, Ron Parker, Shelley Snyder, Stephen Wright, and Lucy Harding. The meeting lasted about an hour.

We discussed possible field trips and speakers for the summer and fall VGS meetings. We felt that since the longer field trips prepared for the Spring GSA meeting in Burlington were cancelled due to snow cover, we would try to run those trips over the next several years through the VGS. A decision was made to ask Peter and Thelma Thompson to lead the summer field trip up Camels Hump or in the Winooski River Valley. The committee also decided to ask Dave Franzi to lead the fall field trip to the Altona Flat Rock area of northern New York. The

other field trips appearing in *Vermont Geology* #7 (Greg and Nancy McHone's trip in the Rutland area and Lucy's trip to Crown Point) could be run in 1994 if the authors of those trips are willing.

The due date for VGS Research Grant Program applications was chosen as May 21, 1993. This date is a little later than last year to allow more time for applicants. We agreed to publicize the program better to secondary school teachers.

Steve Howe reported that the VGS has \$1397.52 in its bank account as of today. We are owed about \$700 from the sale of publications at the GSA meeting and should receive this money soon. Many members have not sent in their 1993 dues. We have decided that their names will be dropped from the mailing list if dues are not received by the end of 1993.

Vermont Geology Volume 7 was published in March 1993 and is now available through Steve Howe at the new University of Vermont mailing address. All of the Society publications and records will soon be transferred from Northfield to Burlington.

Shelley Snyder suggested we might want to develop a bank of colleagues who could serve as resources to secondary school teachers, particularly in the area of local field trips.

Respectfully submitted

Lucy E. Harding

New Publications of the Vermont Geological Survey

Special Bulletin No. 12: Bedrock geology of the Camels Hump-Bolton Mountain area, north central Vermont; Peter J. Thompson and Thelma Barton Thompson, 32 p., 4 plates, 1992, \$12.00

Special Bulletin No. 13: Bedrock geology of the Fayston-Buels Gore area, central Vermont; Gregory J. Walsh, 74 p., 4 plates, 1992 \$12.00

Order these and other Survey publications from:

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Office of the State Geologist
103 South Main Street—Center Building
Waterbury, VT 05671-0301
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IS THE GREEN MOUNTAIN FRONT A MODERN TECTONIC FEATURE?

Paul A. Washington
1385 South West Broad Street Extension
Southern Pines, North Carolina 28387

The Green Mountain Front (GMF), the abrupt topographic break between the Green Mountains to the east and the Champlain and Vermont Valleys to the west, is one of the most prominent geomorphic features in Vermont. Most of us (myself included) have generally considered it to be a feature created by Taconian (or possibly Acadian) orogenesis and raised to its present geomorphic prominence by subsequent differential erosion. Although there is no doubt that the quartzites of the front are considerably more resistant than the carbonates and shales to the west, there are other geologic features that could support a hypothesis that the present topography has a recent (possibly active) tectonic origin.

The evidence that the GMF is merely an erosional remnant of ancient orogenesis is actually quite minimal. Thrust faults (presumed to have formed in the Paleozoic) have been mapped along much of the base of the front (e.g., Dale, 1920; Cady, 1945; Brace, 1953; MacFadyen, 1956; Hewitt, 1961; Thompson, 1967; DiPietro, 1983; Harding and Hartz, 1987; Hartz, 1987; Taylor, 1988). This thrusting is structurally compatible with the Taconian and Acadian deformation to the east and west. On the other hand, there is no compelling evidence to refute the possibility that there could have been some recent reactivation of these thrust faults.

In fact, there is evidence of recent brittle deformation along the GMF. At the south end of the Bristol Cliffs Wilderness Area, there is a small graben-like feature (best viewed from Rte. 116 just north of the New Haven River bridge) cutting east-west across the quartzites of the GMF. The edges of this feature are quite sharp, suggesting that there has not been significant erosional modification; as a result, it would seem that this feature is quite recent, possibly post-Pleistocene. Similar features can be seen several places along the length of the GMF, although none is quite as clearly of structural origin.

When considering these features, it should be remembered that post-Paleozoic extension has been proposed within the Champlain Valley (Quinn, 1933; Welby, 1961; Stanley, 1980; McHone, 1987). Additional evidence of extensional features include previously unreported normal faults exposed near Bennington (exit ramp roadcut at exit 3 on U.S. Rte. 7), in the Taconics near Fair Haven (roadcuts on U.S. Rte. 4 and in several slate quarries), and in the Champlain Valley (e.g., a stream cut just northwest of Weybridge Elementary School). The age of these features is uncertain, but their orientations and

apparent offsets are consistent the faults associated with Mesozoic extensional events related to continental breakup or subsequent igneous activity (Stanley, 1980; McHone, 1987; Washington, 1988a, b), or with the active uplift of the Adirondacks (Isachsen, 1975; Barnett and Isachsen, 1980). I have recently suggested (Washington, in press) that there may have been some post-Pleistocene east-west extension along the Otter Creek gorges north of Middlebury, but this could be attributed to post-glacial rebound.

In contrast to these features, the GMF does not exhibit evidence of major east-west extension. Therefore, I do not propose that it fits into any of the established post-Paleozoic tectonic schemes. At the same time, I believe that the GMF appears to be topographically incompatible with certain nearby features. Most obvious, though least conclusive, is the topography of the primary Green Mountain ridge. Although few would argue that the Cheshire Quartzite of the GMF (at least south of Hinesburg) is the most resistant formation in the region, the main Green Mountain ridgeline generally lies a few kilometers to the east of the primary exposures of Cheshire and is mostly underlain by less resistant lithologies. Although it could be argued that the resistance of the quartzites of the front have protected these less resistant lithologies to the east from erosion, the main ridgeline is bounded to the east by deep valleys (valley bottoms are nearly as low as the Champlain Valley adjacent to the front). The valley morphology of eastern Vermont (i.e., narrow valley incised into high plateaus), as in much of the current Appalachian geomorphic system, indicates recent uplift (probably within the last 5 million years). Because the controlling base-level is nearby (i.e., the Atlantic margin), the uplift of eastern Vermont must have occurred with that same time frame.

Recent uplift of the entire Green Mountain region with rapid erosion of the Champlain Valley and incision of river valleys in eastern Vermont would be a quite acceptable proposal if it were not for the existence of numerous Mesozoic or Tertiary sedimentary deposits within the Champlain and Vermont Valleys adjacent to the GMF. Most prominent among these is the Brandon lignite, but there are also several unconsolidated kaolinite and related sedimentary deposits (Burt, 1930) scattered along the base of the front just west of the boundary thrusts (mostly south of Brandon). The ages of these deposits, including that of the Brandon lignite (Stockwell and Washington, 1990), are not well constrained. It is generally accepted, however, that all of these deposits are pre-Pleistocene, probably being either Cretaceous or Early to Middle Tertiary. Thus, it is likely that these deposits are considerably older than the valleys of eastern Vermont. Because of their proximity to the GMF, there is no reasonable explanation that can place these deposits in their present positions and explain the GMF as the product of active erosion.

So, how do I explain the juxtaposition of young mountains with old, unconsolidated/semi-consolidated sediments lying in an adjacent lowland? I would propose that the Green Mountains have recently been thrust, or are currently being thrust, upward and westward along reactivated

Taconian/Acadian thrust faults. The Green Mountain Front appears to be the western edge of the resulting uplift, so it is possible that the boundary thrust faults are the surfaces along which the movement has occurred.

In support of this proposal, I would point out that this model would place the Brandon lignite and the various kaolinite deposits farther from major topographic relief at the time they were deposited. Considering the total lack of high energy facies in these strata, this model makes better sedimentologic sense. I will concede that scenarios that would permit large areas of low-energy deposition adjacent to the GMF (which would possibly allow us to consider the GMF to be an older feature) could easily be devised, but we would still be faced with the young geomorphology to the east. It should be noted that the proposal is also consistent with current regional tectonic stress field (Zoback and Zoback, 1989; Zoback et al., 1991) in which the principal compression is oriented roughly east-west.

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SEMINARS, MEETINGS, AND FIELD TRIPS

July 8: Burlington Time Path Bicycle Ride sponsored by the Perkins Museum of Geology. Join Museum curator and VGS member Jeff Howe for a ride through geologic time along the Burlington bicycle path. Meet at the north end of the path (at the Winooski River lookout) at 5:30 PM. Easy riding pace of one-million years per second.

July 10: Vermont Geological Society Summer Field Trip: *Geology of Camels Hump*.

July 17: Field Trip to Devil's Bowl sponsored by the Perkins Museum of Geology. Discussion of the glacial and metamorphic history of rocks outcropping in Joiner Brook, just above the intersection of Route 2 and the road to the Bolton Valley Ski Area. Meet behind Perkins Geology Hall at 9:30 AM to car pool or at the dirt parking lot at the intersection of the road to Bolton Valley Ski Area and Route 2 at 10:15 AM.

July 31: Geology of Mount Philo hike sponsored by the Perkins Museum of Geology. Meet behind Perkins Geology Hall at 9:30 AM to car pool or at the base of Mount Philo at 10:30 AM.

August 7-8: 14th Annual Champlain Valley Gem and Mineral Show sponsored by the Burlington Gem and Mineral Club. Theme: Minerals and Mines of Maine. South Burlington High School, 10 AM-6 PM Saturday, 10 AM-5 PM Sunday.

October 9: Vermont Geological Society Fall Field Trip with David Franzi: *The Altona Flat Rock Jack Pine Barrons, Altona, New York*.

October 25-28: Geological Society of America Annual Meeting, Boston Massachusetts. For information regarding the program, field trips, short courses, housing, and registration call (800) 472-1988. A complete description of the meeting is contained in the June 1993 issue of *GSA Today*.

THE GREEN MOUNTAIN GEOLOGIST

VERMONT GEOLOGICAL SOCIETY
%DEPARTMENT OF GEOLOGY
UNIVERSITY OF VERMONT
BURLINGTON, VERMONT 05405

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

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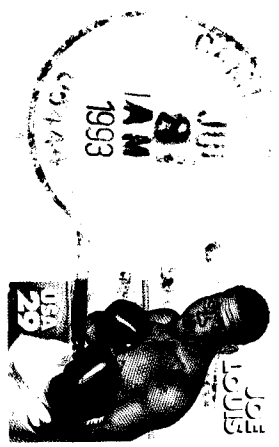
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THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

FALL 1993

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The Vermont Geological Society's Fall Field Trip

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

Saturday October 9th

Leader: David Franzi

Annual Meeting and Banquet: Burlington, Vermont

Guest Speaker: Paul Bierman

**"Glaciers, Groundwater, and Garbage in Western,
Massachusetts"**

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PRESIDENT'S LETTER

13 September 1993

Dear Members,

First of all, I want to thank you for the opportunity to be your president this year. I found the planning for the meetings, field trips, dinners, speakers etc. easy because of Stephen Wright's willingness to help and because of the large numbers of geologists who are willing to lead the activities. I really enjoyed the opportunity being president gave me to work with Stephen Wright, Larry Gatto, Ron Parker, Steve Howe, Bruce Wilson, and others on the Board of Directors and Permanent Committees. Their dedication to the Vermont Geological Society deserves special recognition and their concern for the organization will keep it alive and well for many years to come. I look forward to continuing to make contributions to our society and to joining the ranks as a past president!

In July, Peter and Thelma Thompson led approximately 20 VGS members on a stimulating field trip up Camel's Hump. The extremely hot, humid air that had plagued Vermont during the previous week cleared out on the way up and we were all treated with wonderful views, comfortable hiking and a fresh look at the structural complexities of the metamorphic rocks so beautifully exposed there. Thank you, Peter and Thelma.

Coming up very soon is our fall field trip followed by dinner, the annual meeting, and a speaker. The field trip will be led by Dave Franzi from SUNY Plattsburgh. He will take us to New York to show us some glacial geology in the northwestern Champlain Lowland. *Vermont Geology* Volume 7, published last March, contains a detailed guide to Dave's field trip. You may want to bring your copy along on the trip. Dinner and the annual meeting will follow in at the Perkins Geology Building on the UVM campus in Burlington. Paul Bierman, a geomorphologist and new faculty member in the geology department, will be our guest speaker.

We've had a very successful year. Highlights include the Geological Society of America meeting in Burlington hosted by the Geology Department at UVM and the summer hiking trip up Camel's Hump. The VGS Research Grant Program is running smoothly. Stephen Wright continues to put an enormous amount of time into the *Green Mountain Geologist* and we owe him yet another round of thanks. Thank you again, Steve, for everything that you do.

Sincerely,

Lucy Harding
Middlebury, VT

FALL FIELD TRIP

**Altona Flat Rock Jack Pine Barrens:
A Legacy of Fire and Ice**Saturday October 9th*Leader***David Franzl**Center for Earth and Environmental Science
State University of New York
Plattsburgh, New York 12901***Meeting Place:***

Meet at the New York ferry dock of the Grand Isle Ferry at 9:30 AM. We can car pool on the Vermont side of the Ferry to reduce the cost of the ferry ride. If there is sufficient participation from members of the UVM community, a Geology Department van may be available for the trip and members can meet either at the Perkins Geology Building or at the Grand Isle Ferry Dock. Call Stephen Wright if you are interested (656-4479).

Equipment and Background Information:

Bring a lunch and something to drink. The background geology and the field trip stops are all described in a field trip guide published in Volume 7 of *Vermont Geology*. Ordering information for this volume is given on the last page of this *GMG*. Steve Howe will also bring along copies that can be purchased by participants on the field trip. The Altona Flat Rock area is approximately 5 km west of West Chazy, New York.

***Trip Description*¹**

Altona Flat Rock is the largest (approximately 32 km²) of a discontinuous, 5-kilometer wide belt of bare sandstone areas that extend approximately 30 km southeastward into the Champlain Valley from Covey Hill, near Hemmingford, Québec. Created by catastrophic floods from the drainage of glacial Lake Iroquois and younger post-Iroquois proglacial lakes in the St. Lawrence Lowland more than 12,000 years ago (Denny, 1974; Clark and Karrow, 1984; Pair et al., 1988), the exposed sandstone today provides habitat for one of the largest jack pine (*Pinus banksiana*) barrens in the eastern United States. The relatively low-diversity jack pine community is maintained by fire, which has an

¹Taken from the field trip guide by Dave Franzl and Kenneth Adams (1993), published in Volume 7 of *Vermont Geology* (p. 43).

important role in ecosystem regeneration in this nutrient-poor, drought-prone environment.

We will visit several sites in the southeastern portion of Altona Flat Rock on property owned by the William H. Miner Agricultural Research Institute. The area contains the remains of the "Million-Dollar Dam," part of a failed hydroelectric project begun by William Miner in 1910. This trip will address ongoing efforts to understand the linkages between the hydrogeology and ecology of the jack pine barrens and will document the recent history of anthropogenic development in this unique ecosystem.

FALL DINNER, ANNUAL MEETING, & KEYNOTE ADDRESS**Perkins Geology Building, University of Vermont
Burlington, Vermont**

This year's Annual Meeting, Dinner, and Keynote Address will occur at the Perkins Geology Building on the University of Vermont Campus. October 9–10 is Parent's weekend at UVM and we were not able to schedule a dinner at a formal restaurant. We will instead have dinner catered and members will be able to eat, socialize, and tour the newly redesigned and refurbished Perkins Museum of Geology and in an informal setting. The cost of the dinner will be \$10.00, considerably less than it has been in previous years and we hope more of you will consider coming. You can pay for the dinner during or after the field trip. Please make checks out to the Vermont Geological Society and give them to Stephen Howe.

We hope to return to Burlington from the Fall Field Trip between 5 and 5:30 PM. Following dinner we will have a brief business meeting to elect new officers. We are pleased to nominate four members for positions within the VGS executive committee. Larry Gatto is nominated for President after serving as a dedicated Vice President during this last year. Larry is a research geologist at the Cold Regions Research and Engineering Laboratory (CREEL). Kent Koptiuch has been nominated to be Vice President. Kent is a hydrogeologist and owns and operates Matrix Environmental Technologies in Essex Junction. Nancy Keller has been nominated as Secretary and is an Earth Science teacher at the Winooski High School. She has been one of the instructors for the NSF-funded Teacher Enhancement Project during the past three summers. Helen Mango has been nominated for the Board of Directors. Helen is a professor at Castleton State College with research interests in economic geology.

Our guest speaker is Paul Bierman, a geomorphologist and new faculty member at the University of Vermont. Paul will present a talk centering on glacial geology and groundwater exploration in western Massachusetts. Paul will be initiating field research in Vermont in the very near future and is anxious to meet other members of the geological community here. Please come and welcome him here and enjoy his presentation.

5:00–7:00 PM: Social Hour/Dinner

(No need to make reservations—\$10/person)

7:00–7:30 PM: Business Meeting: Election of new officers

Note: Members not attending the field trip or dinner *are welcome* to come late to hear Paul Bierman's talk and to participate in the business meeting. An absentee ballot is included in this *GMG*. Members unable to attend the business meeting are urged to send their ballot to Steve Howe at the address listed on the ballot.

7:30–8:30 PM: Paul Bierman, University of Vermont

"Glaciers, Groundwater, and Garbage in Western Massachusetts"

STATE GEOLOGIST'S REPORT

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

The Vermont Geological Survey continues to be a busy place. We currently are comprised of three programs including geology, radioactive waste management, and the Agency of Natural Resources' Geographic Information System program. The Survey employs eight people, including geologists, engineers, technical and administrative staff.

The geology program has prospered in the last two years. With the ratification by Congress of the Geologic Mapping Act, we were able to continue our joint effort with the U.S.G.S. to complete a new bedrock map for the state. Funding for that project, which requires 50 percent state matching funds, has increased significantly. We are funding several geologists at UVM and Castleton State College to contribute to the new mapping project. The new map is scheduled to be published in 1996, with interim products made available open file on a yearly basis. We have successfully undertaken a pilot project to digitize a geologic map produced by Greg Walsh from the U.S.G.S.. The project was a learning experience and will benefit both us and the U.S.G.S. in undertaking future GIS work.

In addition, we were able this year to assist in providing a curator for the geologic collection housed at the newly refurbished Perkins Geology Museum at UVM. As some of you may remember, a flood "disassembled" the state collection years ago. Restoring the collection will allow better use and display of these valuable samples.

The Survey has applied for a grant from the U.S.G.S. and the Federal Emergency Management Agency to fund a project which will "piggyback" on an earthquake hazard study being conducted by Weston Observatory at Boston College on behalf of Vermont's Emergency Management Division. The Weston study will consider the risk of earthquakes in various regions in Vermont. If the grant application is successful, the Survey will develop an education program and curriculum for earthquake risk based on the Weston study, and will conduct a GIS study to identify seismic risk to vital structures within areas identified as higher risk by the Weston study.

Our cooperative effort with Vermont's mining industry continues, with the Survey assisting with review of Act 250 applications and providing expert testimony as needed. We continue to receive numerous requests for geologic information. Our information specialist, Diane Vanecek, handled 400 requests in 1992, and 170 from January to May, 1993. Most recently, there has been a

renewed interest in gold mining in Vermont, which has been reflected in the number of information requests regarding gold collecting locations in the state.

The biggest news in the Radioactive Waste Management program is that Vermont has successfully negotiated an agreement with Texas to dispose of Vermont's low-level radioactive waste at a site in west Texas near El Paso. The compact between Texas, Vermont and Maine was passed by both the Legislatures of Texas and Maine. Vermont will introduce legislation in early January to formalize the agreement here. When the Vermont law passes, Congress must ratify the compact. The 50 year agreement calls for a payment by Vermont and Maine of \$27.5 million each, with a total of \$5 million dollars benefitting the nearby community of Sierra Blanca. The site will be located on the Faskin Ranch in the area of the Eagle Flat basin, a closed basin with groundwater at 750-800 feet below the surface. Vermont will provide representation on the Texas Commission and information to Texas as required by the Compact.

The Agency GIS program has been progressing. We cooperated with the rest of state government in the Vermont Information Strategy Plan to provide direction and a timetable for automating state government. GIS provides computer assistance, digitizing skills and general information management for the Agency. We recently completed a joint project with the New England Governors' Conference to digitize sand and gravel deposits in Vermont. A report on the distribution of sand and gravel in New England will soon be available through NEGC and will include Vermont's digital information.

The Survey participated in the recent NEGSA conference held in Burlington, selling publications, maps, and T-shirts and hats with our newly designed logo. These items are still available by contacting Diane Vanecek at 241-3601.

VERMONT GEOLOGICAL SOCIETY BUSINESS AND NEWS

New Members

We are pleased to welcome the following new member who has joined the Vermont Geological Society since the Summer *GMG* was published:

Rebekah Condon

Vergennes, VT

Geologist

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 September 13, 1993, dues for 1993 have been received from 92 of the 193 members of the Society. This amounts to only 48% of our membership! On April 24, 1993, the Executive Committee decided that we could no longer afford to continue to print and mail copies of the *Green Mountain Geologist* to those members who have not paid their dues. Those of you who are delinquent in payment are identified by a red mark in a box located on the back cover of this issue of the *GMG*. Please use the easily detachable dues statement found in the centerfold of the Winter *GMG* (Volume 19, Number 4). If your dues are not received by February, 1994, we will be forced to delete your name from our mailing list—a prospect guaranteed to please only the postal carrier's aching back!

On a happier note, I would like to acknowledge the donation made recently by one of our members in addition to her regular dues payment. Your generosity is much appreciated!

Sincerely,

Stephen S. Howe

Executive Committee Meeting—9/13/93**Minutes**

The Executive Committee of the Vermont Geological Society met on September 13, 1993 at the University of Vermont, Burlington, Vermont. Members present included Larry Gatto, Steve Howe, Ron Parker, Stephen Wright, and Lucy Harding. The meeting lasted about an hour and a half.

We approved Rebekah K. Condon and a new member. Becky is a recent Middlebury College graduate in geology.

Steve Howe reported that the VGS has \$1939.91 in its bank account as of today. No major expenses are expected in the near-term. Steve also reported that although we have 193 members on the mailing list but only 92 of those members have paid their dues for 1993. This amounts to 47% of members who have paid dues and 53% who have not. We discussed whether this situation is a result of the manner in which we notified members of dues last year, the increase in membership fees to \$15, or whether the Society no longer interests or serves members of the geologic community. We decided that the 1994 dues notice will be a separate mailing with an addressed, pre-stamped envelope enclosed rather than the unsuccessful, although inexpensive, centerfold in the *Green Mountain Geologist*. All 193 members will receive a dues notice and past due dues will be indicated. Members who haven't paid up by the time the 1994 Winter *GMG* is sent out will be dropped from the membership list.

We discussed ways to attract new members and decided that we should print and distribute membership applications to schools and businesses that might have persons who would be interested in joining. Steve Howe has new membership applications and is happy to mail them upon request.

We will publish a membership directory in the 1994 Winter *GMG*. The committee agreed that the Constitutional and Bylaws of the VGS need editing and revising and that the first step is to get them on the computer. Lucy Harding said she would get this done.

The upcoming fall field trip, banquet, annual meeting, and speaker were discussed. Stephen Wright said that Dave Franzi has planned a field trip that is very similar to the one he describes in *Vermont Geology Number 7* which VGS published last March for the GSA meeting. Ron Parker agreed to organize the banquet.

We discussed the upcoming vacancies in the offices of Vice-President, Secretary, and one place on the Board of Directors and identified a short list of members who might be interested in filling those vacancies.

The idea of having two deadlines each year (spring and fall) for grant applications through the VGS Research Grant Program was mentioned briefly. Action was postponed until the results of next year's dues notice could be ascertained. Financing for the Research Grant Program is entirely dependent on membership dues.

We agreed to look into forming a reciprocal membership agreement with the New Hampshire Geological Society and reestablishing that agreement with the Maine Geological Society. The agreement would consist of publicizing each others meetings, field trips, speakers, etc.

The 1994 Winter meeting was briefly discussed and we agreed that it will be an open meeting in mid-February. Larry Gatto suggested the CREEL facilities in Hanover as a meeting place and has since confirmed that space is available in mid-February.

We agreed that the next Executive Committee meeting will be in January.

Respectfully submitted

Lucy E. Harding
Middlebury, Vermont

Focus Conference on Eastern Regional Ground Water Issues

The National Ground Water Association (NGWA)—formerly known as the National Water Well Association (NWWA)—will host the 10th annual **Focus Conference on Eastern Regional Ground Water Issues** on September 27–29 at the Radisson Hotel in Burlington. The Focus conference is held in different cities of the northeast and usually attracts about 300 ground water professionals. Burlington hosted the 4th annual Focus Conference in 1987. The conference consists of dual sessions presenting professional papers on ground water related topics. Topics include:

- Aquifer Restoration and Remedial Action
- Sparging/Bioremediation/Heat Injection/UV/Oxidation
- DNAPL Investigations
- Unsaturated Zone Investigations and Remediation
- Environmental Regulations
- Ground Water Investigations
- Ground Water Modeling
- Surface Geophysics
- Contaminant Movement in Fractured Bedrock
- Agricultural Impacts on Ground Water
- Eastern Ground Water Management
- Appalachian Ground Water Issues
- Quantitative Studies of Ground Water Flow in Fractured Bedrock
- Ground Water/Surface Water Interaction
- Ground Water Impacts from Waste Management Units

Also featured at the conference is a special 2-hour seminar sponsored by U.S. EPA Region I on the RCRA Corrective Action Program. The cost of attendance is \$395 for members, \$445 for non-members and \$100 dollars for students (with proof required). To register contact the NGWA Registration Department at (800) 551-7379.

SEMINARS, MEETINGS, AND FIELD TRIPS

September 24-26: **New York State Geological Association Annual Meeting** with Field Trips, St. Lawrence University, Canton, New York. Contact John Bursnell for details: 315-379-5432.

September 29: **Burlington Time Path Bicycle Ride** sponsored by the Perkins Museum of Geology. Join Museum curator and VGS member Jeff Howe for a ride through geologic time along the Burlington bicycle path. Meet at the north end of the path (at the Winooski River lookout) at 5:00 PM. Easy riding pace of one-million years per second.

October 4: University of Vermont Fall Seminar Series (4 P.M.): "*Structural and Geochemical Constraints on Volume Loss in Slates*" Dr. Arthur Goldstein, Colgate University.

October 9: **Vermont Geological Society Fall Field Trip and Annual Meeting** with David Franzi: *The Altona Flat Rock Jack Pine Barrens, Altona, New York*. See this issue of the *Green Mountain Geologist* for details.

October 17: **Field Trip to the Willsboro, New York Wollastonite Mine:** Sponsored jointly by the Perkins Museum of Geology and the Burlington Gem and Mineral Club. Meet at the Essex (New York) Ferry Landing at 10 AM. Please call in advance to confirm (656-8694).

October 18: University of Vermont Fall Seminar Series (4 P.M.): "*Exsolution in Minerals*" Dr. Howard Jaffe, University of Vermont.

October 23: **Field Trip to Lone Rock Point:** sponsored by the Perkins Museum of Geology. Meet behind Perkins Geology Hall at 10 AM to car pool.

October 25-28: **Geological Society of America Annual Meeting**, Boston Massachusetts. For information regarding the program, field trips, short courses, housing, and registration call (800) 472-1988. A complete description of the meeting is contained in the June 1993 issue of *GSA Today*.

November 1: University of Vermont Fall Seminar Series (4 P.M.): "*Paleoecology of Convergent Margin Fossil Cold Seeps*" Dr. Kathrine Campbell, University of Southern California.

December 6: University of Vermont Fall Seminar Series (4 P.M.): "*The Flora and Implications of the Miocene Brandon Lignite*" Dr. Bruce Tiffney, University of California, Santa Barbara.

ABSENTEE BALLOT: 1993
Vermont Geological Society

Officers:

President	Larry Gatto	_____

Vice-President	Kent Koptiuch	_____

Secretary	Nancy Keller	_____

Treasurer	Stephen Howe	_____

Board of Directors (2-year term):

	Helen Mango	_____

If you will not be attending the VGS Annual Meeting in Burlington, please complete this ballot and return it in an envelope marked with the word "BALLOT" in the lower left hand corner and your name and address in the upper left hand corner to:

Stephen Howe, Treasurer
Department of Geology
University of Vermont
Burlington, VT 05405

To be counted, this ballot must be received by October 8, 1993.

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. Franzl & 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. Mehrtens

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

Order from: Stephen Howe, Treasurer

Department of Geology

University of Vermont

Burlington, VT 05405

THE GREEN MOUNTAIN GEOLOGIST

VERMONT GEOLOGICAL SOCIETY
%DEPARTMENT OF GEOLOGY
UNIVERSITY OF VERMONT
BURLINGTON, VERMONT 05405

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

Executive Committee

President	Lucy Harding	388-3711 ext 5444
Vice President	Larry Gatto	603-646-4273
Secretary	Sue Hadden	875-3562
Treasurer	Stephen Howe	656-0388
Board of Directors	Bruce Wilson '93	257-7757
	Leslie Kanat '93	635-2356
	Ron Parker '94	860-6065

Permanent Committees

Geological Education Committee	Shelly Snyder
Advancement of Science	Rolfe Stanley
Public Issues Committee	
Publications/Editorial Committee	Stephen Wright
Editor/Publisher	Stephen Wright
	656-4479 or 644-5031

ADDRESS CHANGE?

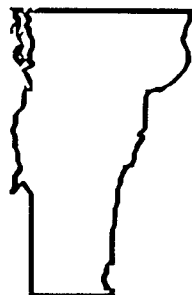
Please send it to the Treasurer at the above address.
-Printed on Recycled Paper-

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



Diane L. Conrad
175 Towers Rd. Extension
Essex Junction, VT 05452-2621

THE GREEN MOUNTAIN GEOLOGIST



QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

WINTER 1993

VOLUME 19

NUMBER 4

Northeastern Section Meeting of the Geological Society of America

Sheraton Conference Center
Burlington, Vermont

March 20-24, 1993

Detailed Program Inside

Volunteers Needed!

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PRESIDENT'S LETTER

Dear Members,

I begin my year as president of the Vermont Geological Society by thanking Bruce Wilson for the work he did on behalf of VGS last year. Under his leadership the Student Research Grants program became a reality and we awarded a total of \$2000. Bruce also continued the program of guest editors for the *Green Mountain Geologist* which resulted in very interesting issues with Larry Gatto (Spring), Ron Parker (Summer), and Shelley Snyder (Fall) as guest editors. A special thank you is also due to Stephen Wright for his continuing efforts with *The Green Mountain Geologist* and to last year's executive committee for all their hard work.

On November 7th my husband and I became parents to a healthy baby boy we named Andrew. Because of Andrew's imminent arrival I didn't attend the fall field trip or annual meeting. However I spoke with Bruce Wilson about the day and he sent in the following to be included in this letter:

"This fall's field trip was a success any way it was measured. The weather was sunny and seasonably mild, though recent rains made the quarry floors somewhat mucky. Over 50 people were along for at least part of the day, including a van load of students each from Lyndon State and Keene State. And Lance Meade and Eric Lapp had organized a varied and interesting introduction to verde antique, crushed marble, and talc quarrying operations, plus a bit of history of the old iron mining and smelting industry in the area. They deserve a lot of credit for a smooth-running and educational trip.

A smaller group assembled at Chuckles Restaurant in Ludlow for the annual meeting which followed. After dinner, the slate of officers was approved by voice vote. John Williams of the Maine Low-Level Radioactive Waste Authority finished the day with an entertaining presentation on the geological issues involved in siting a disposal facility for low-level radioactive waste in Maine. Nor did he leave out the political aspects of the process, which are significant. His talk was well received and sparked a lively question and answer session following."

Thank you, Lance Meade and Eric Lapp, for leading the fall field trip and John Williams, for giving a presentation. We also want to thank Mike Hussey of OMYA/Vermont Marble and Art Pfenning of the Brandon Historical Society for serving as leaders on several of the stops. And thank you for arranging the dinner and the speaker, and the very informative report, Bruce.

With no winter meeting to organize, the attention of the Vermont Geological Society is currently focused on the Northeastern Section Meeting of the Geological Society of America, to be held in Burlington March 22-24, 1993. Stephen Wright is including information in this issue on how VGS members can help. For example, we need members to help with a VGS table during the meeting.

The next meeting of the Vermont Geological Society will be on April 24th at Middlebury College. This meeting will be a forum for students doing research on Vermont and other geology from area colleges and universities to present their results. We also welcome area professionals who have research they want to present, especially research not presented at the March GSA meeting. Students, please remember that we will be awarding the Charles C. Doll award for the best undergraduate and graduate papers presented at the meeting. Abstracts of talks presented at the meeting will be published in the Spring *Green Mountain Geologist* and are due on Steve's desk April 2, 1993.

If you are an undergraduate/graduate student or a secondary school teacher doing original research on Vermont geology, please consider applying to the Vermont Geological Society Research Grant Program for funding. Deadline for applications is May 21, 1993. Please contact me or Stephen Wright for an application or more information.

I'm looking forward to serving the Vermont Geological Society this year. Feel free to contact me at any time with questions or concerns.

Sincerely,

Lucy Harding
Middlebury, VT

Lament for Brewster Baldwin

Robert V. Cushman
20 Court St.
Middlebury, VT 05753

In the passing of Brewster Baldwin the fraternity of geologists and would-be geologists in Middlebury and Vermont has lost a unique member. Here, indeed, was a "man for all seasons."

He was educated in the old school of geology but was eager to be swept up by the tectonic revolution of the '60s. He struggled to learn all he could about the Earth, its creation and the moulding of its surface.

He had the enviable ability to explain the most complex of geologic processes in the simplest of terms. For this he was in great demand as a speaker and field trip guide to groups who were lay people to geology. He gave endless time to this extracurricular activity, even to leading a field trip of laymen in the Shelburne area only four weeks before his death.

Brew taught geology at Middlebury College for 30 years. That geology department is well known across the country and is marked for its excellence in the profession. Its graduates have held long and distinguished careers in higher education, government, and industry.

The thread that runs through this productive history has been Brew. He was tireless in seeking ways to make his students and colleagues learn and solve problems in their lives as well as the science of geology. And always, always, his teaching was sprinkled with a great deal of wit and humor.

This we remember perhaps more than anything else about him. In the words of one of his colleagues, he always met life with a childlike exuberance that was infectious. He never lost this exuberance and excitement and wonder about life and the universe that he lived in.

For all of us privileged to have known him, we will find it hard to believe he has gone and we will look for him—plaid shirt, bolo tie, and a knapsack full of books. We will await again his caustic wit, his endless humor, his commentary on Earth processes and on life in general.

I can see Brew now, standing before his maker waiting to answer God's query as to how we geologists are making out at fathoming his universe. Without hesitation, Brew will reply—"Comme ce, comme ça, and there is much unraveling yet to do!" God will laugh, the door will open, for God, too, will enjoy Brew's company.

This letter was originally published in the Addison Independent, August 20, 1992.

Geological Society of America Meeting Update

Stephen Wright

The Northeastern Section of the Geological Society of America will hold its annual meeting in Burlington, Vermont in March of 1993 at the Sheraton Hotel (near the intersection of Route 2 and I-89). Listed below is a detailed program of the short courses, technical sessions, symposia, field trips, and other related events associated with the meeting. Members interested in attending any of the events associated with the meeting must register. Significant discounts are given to those registering by February 22. A registration form is included in the centerfold of this issue of the *GMG*. Please note the description of the National Association of Geology Teachers (NAGT) events described elsewhere in this issue.

Volunteers Needed!

Vermont Geological Society members are needed as volunteers to help with several facets of the meeting that include: (1) Working at the registration desk (some special training will be offered to familiarize volunteers with the software we are using, printing badges, etc.); (2) Operating the slide projectors (changing trays between talks, changing burnt bulbs, etc.) during the the talks; (3) Selling VGS publications and answering questions about the Society at the Vermont Geological Society booth in the Exhibit Hall; (4) Manning the VCR in the Science Theater where an assortment of geology films will be presented; and (5) Standing guard in the Hospitality room of the Hotel. All of these activities will be assigned to volunteers during half-day time blocks. Volunteers helping with any of the above activities, except the VGS booth, during one of the half-day time blocks will be offered free registration to the meeting. Members who are interested in volunteering should leave a message for Char Mehrstens at UVM (656-0267) by the first week of March. Be sure to leave your name, phone number, and what activity and time slot(s) you are interested in volunteering at. Use the program printed below to schedule yourself to volunteer for a session you are particularly interested in or to avoid committing yourself at time when an activity of special interest is taking place. Students from a number of local colleges and universities will also be volunteering for these same jobs.

G.S.A. Program of Events

Saturday, March 20, 1993
Short Course:

Hydrogeochemistry	8:00 a.m.–5:00 p.m.
Ski Trip to Bolton Ski Area	9:00 a.m.–5:00 p.m.

Sunday, March 21, 1993
*Morning**Short Courses*

Kriging: Theory and Application for the Novice User	9:00 a.m.–5:00 p.m.
Cathodoluminescence in Sedimentary Petrology	9:00 a.m.–5:00 p.m.
System Dynamics in Geology, Water Resources, and the Life Sciences	9:00 a.m.–5:00 p.m.

Field Trips

Altona Flat Rock, Jack Point Barrens: A Legacy of Fire and Ice	8:30 a.m.–5:00 p.m.
Early Cretaceous Igneous Features in the Northern Taconics	9:00 a.m.–5:00 p.m.
Crown Point Section, Crown Point, New York	9:00 a.m.–5:00 p.m.
Ski Trip to Bolton Ski Area	9:00 a.m.–5:00 p.m.

Afternoon

Registration	1:00 p.m.–10:00 p.m.
<i>Field Trip</i>	
Champlain Thrust at Lone Rock Point	1:00 p.m.–3:30 p.m.
NE—GSA Management Board Meeting	4:30 p.m.–6:00 p.m.
Welcoming Reception	6:00 p.m.–10:00 p.m.

Monday, March 22, 1993
Morning

Registration	7:00 a.m.–9:00 p.m.
Exhibits	8:00 a.m.–5:00 p.m.
Spouse/Guest trip to Montreal	8:00 a.m.–6:00 p.m.
Science Theater	8:00 a.m.–5:00 p.m.
NAGT Business Meeting and Awards Luncheon	12:00 noon–1:15 p.m.

Symposia

Advances in the Geology of Vermont and Adjacent Regions: A Tribute to Norman L. Hatch, Jr. (I)	8:00 a.m.–12:00 noon
The Glacial, Lacustrine, and Marine Environment in the St. Lawrence and Champlain Lowlands	8:00 a.m.–12:00 noon

Monday, March 22, 1993*Morning (Continued)**Theme Sessions*

Applied Environmental Geology	7:50 a.m.–12:00 noon
New Advances in Earth Science Education K–12	8:10 a.m.–12:00 noon

Technical Sessions

Structure	8:00 a.m.–12:00 noon
Clastic Sediments and Sedimentary Rocks	8:20 a.m.–11:40 a.m.

Poster Session I:

Undergraduate Research I	8:00 a.m.–12:00 noon
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NAGT Business Meeting and Luncheon

12:00 noon–1:15 p.m.

*Afternoon**Symposia*

Practical Methods for Evaluation of Groundwater in Fractured Bedrock	1:00 p.m.–5:00 p.m.
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Advances in the Geology of Vermont and Adjacent Regions: A Tribute to Norman L. Hatch, Jr. (II)	1:15 p.m.–5:00 p.m.
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Comparison of Glacial-Marine and Glacial-Lacustrine Environments (SEPM)	1:15 p.m.–5:00 p.m.
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Mineralogy and Geochemistry of Precambrian Gneisses: In Honor of Howard W. Jaffe	1:30 p.m.–5:00 p.m.
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Technical Sessions

Carbonate Rocks and Stratigraphy	1:20 p.m.–4:40 p.m.
Application of Geochronology to Tectonic Problems	1:20 p.m.–5:00 p.m.

Field Trips

Champlain Thrust at Lone Rock Point	1:00 p.m.–3:30 p.m.
Salmon Hole and Redstone Quarry	1:00 p.m.–3:30 p.m.

Poster Session II

Undergraduate Research II	1:00 p.m.–5:00 p.m.
New Advances in Earth Science Education K–12	1:00 p.m.–5:00 p.m.

Evening

Eastern Section of SEPM Annual Business Meeting and Address by President Harry Cook	5:00 p.m.
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Public Forums

Earth Science Education: Where We Are and Where We Are Going (NAGT)	5:00 p.m.
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Groundwater Contamination: Does Public Policy Ignore Science?	7:00 p.m.–9:30 p.m.
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Ad Hoc Committee Special Meeting: Registration of Geologists Working in the Public Sector	5:30 p.m.–6:30 p.m.
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Joint Local Committee 1993 and 1994 Dinner	6:00 p.m.
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Entertainment	9:00 p.m.–midnight
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Tuesday, March 23, 1993*Morning*

Registration	7:00 a.m.–9:00 p.m.
Association of Women Geoscientists Breakfast	7:00 a.m.–9:00 a.m.
Exhibits	8:00 a.m.–5:00 p.m.
Spouse/Guest trip to Stowe, Vermont	8:00 a.m.–6:00 p.m.
Science Theater	8:00 a.m.–5:00 p.m.
<i>Symposia</i>	
Rivers and Lakes: A Tribute to Brian Rust (I)	7:50 a.m.–12:00 noon
Bedrock Studies in the Northern Appalachians: (In Honor of Philip Osberg)	8:00 a.m.–12:00 noon
Exceptional Fossil Assemblages of Eastern North America: Evolutionary and Ecological Significances	8:15 a.m.–12:00 noon
<i>Theme Session</i>	
The Use of Geochemistry in Understanding Tectonics of the Appalachians (I)	8:30 a.m.–12:00 noon
<i>Technical Session</i>	
Tectonics	9:00 a.m.–11:40 a.m.
<i>Poster Session III</i>	
General Geology	8:00 a.m.–12:00 noon
Undergraduate Research III	8:00 a.m.–12:00 noon
Northeastern Section of the Paleontological Society Luncheon	
	12:00 noon–1:15 p.m.

Afternoon

<i>Symposia</i>	
Allochthonous Terranes in the Northern and Central Appalachians: (In Honor of E-an Zen)	1:00 p.m.–5:00 p.m.
Rivers and Lakes: A Tribute to Brian Rust (II)	1:00 p.m.–5:00 p.m.
Bedrock Studies in the Northern Appalachians: (In Honor of Philip Osberg)	1:15 p.m.–5:00 p.m.
<i>Theme Session</i>	
The Use of Geochemistry in Understanding Tectonics of the Appalachians	1:30 p.m.–4:40 p.m.
<i>Technical Session</i>	
Metamorphic Petrology and Economic Geology	1:00 p.m.–5:00 p.m.
<i>Field Trip</i>	
Champlain Thrust at Lone Rock Point	1:00 p.m.–3:30 p.m.
<i>Poster Session IV</i>	
Paleontology and Quaternary Geology	1:00 a.m.–5:00 noon
Undergraduate Research IV	1:00 a.m.–5:00 noon

Evening

NE—GSA Annual Banquet	7:00 p.m.–9:00 p.m.
Banquet Speaker: James McLelland, Chairman NE—GSA, "Island Arcs, Anorthosites, and Himalayan Mountain Ranges: The Mid-to-Late Proterozoic Evolution of Eastern North America"	

VERMONT GEOLOGICAL SOCIETY DUES STATEMENT—1993

Dear Member:

Membership dues for 1993 are as follows:

Members and Associated Members	\$15.00
Student Members	\$8.00

Please fill out the information requested below, enclose a check made out to the Vermont Geological Society and mail this statement to:

Stephen Howe, Treasurer
Department of Geology
University of Vermont
Burlington, VT 05405

Preregistration Form

GSA Northeastern Section
 Burlington, Vermont • March 22-24, 1993

IMPORTANT

1. PREREGISTRATION MUST BE RECEIVED NO LATER THAN February 22, 1993.
2. Full payment must accompany all preregistration. Purchase orders are not acceptable.
3. Cancellation deadline: March 1, 1993. No refunds after this date.
4. Register only one person per form. A receipt for your payment will be in your packet at the registration desk.

PLEASE PRINT OR TYPE

Name (last, first) _____

Name for badge _____

Affiliation for badge _____

Mailing Address _____

City _____ State _____ ZIP _____

Membership Affiliation:
 A. _____ GSA Member no. _____ SEPM _____
 B. _____ NAGT C. _____ SIA F. _____ AWG
 D. _____ PS E. _____ SIA F. _____ AWG
 G. _____ GSA Student Associate
 Nonmember Affiliation _____
 Student Verification _____

Signature
 department head or GSA Campus Representative

Business Phone _____
 Home Phone _____

PREREGISTRATION

Professional Member	\$ 70
Professional, Nonmember	\$ 70
K-12 Science Teacher	\$ 25
Student Member	\$ 20
Student, Nonmember	\$ 30
One day, Professional, Member	\$ 30
One day, Professional, Nonmember	\$ 40
One day, Student Member	\$ 15
One day, Student, Nonmember	\$ 25

Guests
 Full Day
 1. Early Crataceous/Igneous Features in the Northern Taconics

Postmarked on or before February 22, 1993 Postmarked after February 22, 1993

	\$ 55		\$ 75		\$
	\$ 70		\$ 90		\$
	\$ 25		\$ 35		\$
	\$ 20		\$ 30		\$
	\$ 30		\$ 40		\$
	\$ 30		\$ 45		\$
	\$ 40		\$ 55		\$
	\$ 15		\$ 25		\$
	\$ 25		\$ 35		\$

\$110

\$110

Sun., March 21, \$ 12 \$ _____

2 Crown Point Section, Suwan Point, New York	Sun., March 21	Professional	\$ 32	\$
3 Altona Flat Rock, Jack Pine Barrens	Sun., March 21	Student	\$ 30	\$
Half-day (2.5 hours), shuttles provided				
4 Champlain Thrust Fault at Lone Rock Point	Sun., March 21	Professional	\$ 10	\$
5 Champlain Thrust Fault at Lone Rock Point	Mon., March 22	Professional	\$ 10	\$
6 Salton Hotel/Redstone Quarry	Mon., March 22	Professional	\$ 10	\$
7 Champlain Thrust Fault at Lone Rock Point	Tues., March 23	Professional	\$ 10	\$
8 Salton Hotel/Redstone Quarry	Wed., March 24	Professional	\$ 10	\$

SHORT COURSES

Hydrogeochemistry	Sat., March 20	Professional	\$ 70	\$
Kriging	Sun., March 21	Professional	\$ 35	\$
Cathodoluminescence in Sedimentary Petrology	Sun., March 21	Student	\$ 35	\$
Systems Dynamics in Geology, Water Resources, and Life Sciences	Sun., March 21	Professional	\$ 70	\$
		Student	\$ 35	\$

SPECIAL EVENTS

Welcoming Reception	Sun., March 21	FREE	\$	\$
Combined Eastern Section and New England Section of NAGT Business Meeting and Luncheon	Mon., March 22	\$ 15	\$	\$
Public Forum: "The Crisis in Science Education: Ramifications for Geology"	Mon., March 22	FREE	\$	\$
Eastern Section of SEPM Annual Business Meeting—Presidential Address by Harry Cook	Mon., March 22	FREE	\$	\$
Public Forum: "Ground-Water Contamination: Does Public Policy Ignore Science?" 7:00 p.m.	Mon., March 22	FREE	\$	\$
Association for Women Geoscientists Breakfast, 7:00 a.m.	Tues., March 23	\$ 10	\$	\$
Northeastern Section of Paleontological Society Luncheon, 12:00 noon	Tues., March 23	\$ 15	\$	\$
28th Annual GSA Northeastern Section Reception and Banquet, after-dinner talk by President James McLelland, "Island Arcs, Anorthositic and Himalayan Mountain Ranges: The Mid- to Late Proterozoic Evolution of Northeastern North America"	Tues., March 23			
Dinner choices for banquet (indicate choice when preregistering):				
Prime rib of beef au jus, baked potato, seasonal vegetables		\$ 27	\$	\$
Chicken St. Jean, rice, seasonal vegetables		\$ 23	\$	\$
Pasta primavera		\$ 23	\$	\$

TOTAL FEES

\$ _____

MAIL TO:

Rolfe Stanley
 Perkins Hall, Department of Geology
 University of Vermont
 Burlington, VT 05405-0211
 (802) 656-0247

Check events you or your spouse/guest are interested in: Skiing 3/20 <input type="checkbox"/> Skiing 3/21 <input type="checkbox"/> Skiing* 3/22 <input type="checkbox"/> Ice Hockey* 3/23 <input type="checkbox"/> Fun Run 3/24 <input type="checkbox"/> *Only if enough interest is expressed.
--

Name:

Address:

Is this a new address? _____

Wednesday, March 24, 1993*Morning*

5 km Fun Run	6:30 a.m.–8:00 a.m.
Registration	7:00 a.m.–11:00 p.m.
Exhibits	8:00 a.m.–12:00 noon
Science Theater	8:00 a.m.–12:00 noon

Symposia

Tectonics of the Appalachians, Cordillera, the Earth, Moon, Mars, and Other Celestial Bodies: (In honor of Donald U. Wise)	8:00 a.m.–12:00 noon
Graphic Correlation: The Method and Its Application	8:15 a.m.–12:00 noon

Theme Sessions

Magma Genesis in the Appalachians	7:50 a.m.–12:00 noon
Studies of Recent Lakes, cosponsored by the Lake Champlain Research Consortium	8:00 a.m.–12:00 noon

Technical Session

Quaternary Geology and Geomorphology	8:00 a.m.–12:00 noon
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Poster Session V

Environmental Geology, Marine Geology, Sedimentary Rocks, and Quaternary Geology	8:00 a.m.–12:00 noon
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*Afternoon**Field Trip*

Salmon Hole and Redstone Quarry	1:00 p.m.–3:30 p.m.
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Vermont Geological Society Business and News

New Members

We want to welcome the following new members who have joined the Vermont Geological Society since the Spring *GMG* was published:

Jared Smith Burlington, VT Graduate Student, UVM

Marcia G. Wolosz Plattsburgh, NY Geologist, Adirondack Envir. Assoc.

Address Change

We are changing our mailing address to the Geology Department at the University of Vermont. With both the editor and the new treasurer (Stephen Howe) based at UVM, it is no longer practical to collect mail from the Montpelier post office box. All of the Vermont Geological Society Publications are also being moved to UVM. All correspondence with the Society should be addressed to:

Vermont Geological Society
Department of Geology
University of Vermont
Burlington, VT 05405

Spring Meeting

The annual spring meeting and presentation of student papers will be on April 24th at Middlebury College. In addition to the regular student talks, the results from students awarded Vermont Geological Society Research Grants in 1992 will also be presented. Please note that the executive committee of the Society will meet either during the lunch break or after the meeting. Members wishing to have notes or articles published in the spring issue of the *Green Mountain Geologist* are requested to submit material to the editor by the **last week of March, 1993.**

1993 Vermont Geological Society Research Grants

If you are an undergraduate or graduate student or a secondary school teacher doing original research on Vermont geology, please consider applying to the Vermont Geological Society Research Grant Program for funding. **Deadline for applications is May 21, 1993.** Please contact Lucy Harding at Middlebury College or Stephen Wright at the University of Vermont for an application.

Dues Statement

A dues statement for 1993 is affixed to the center fold of this issue of the *Green Mountain Geologist*. There will be no increase in the dues for 1993.

National Association of Geology Teachers News

Leslie Kanat, New England NAGT President
Department of Environmental Sciences
Johnson State College ; Johnson, VT 05656
802/635-2356, Ext. 346, FAX: 802-635-9745
KANATL@vscnet.bitnet

NAGT Special Event For K-12 Science Teachers

The Eastern and New England Sections of the National Association of Geology Teachers and the Geological Society of America's *SAGE* Foundation are co-sponsoring a unique program for K-12 science teachers in conjunction with the Northeastern Section of the Geological Society of America. We invite all interested K-12 science teachers to participate in the two day event running from Sunday to Monday, 21-22 March 1993.

The program begins with field trips in the Burlington area, led by professional geologists, and a welcoming reception on Sunday evening. A full day of activities are scheduled for Monday and include both talks and poster sessions, workshops, and demonstrations. We urge all K-12 science teachers to attend any of the events that are of interest to you at special reduced rates.

You may come as a passive observer or an active participant... it is up to you! Opportunities are still available for you or your team of teachers to present a poster session, lead a demonstration, or run a workshop concerning the advancement of science education in the K-12 grades. The program will enable you to catch up on what is going on outside your school, view science videos, look over the assembled literature, visit fine vendor exhibits, and communicate with other earth science teachers from the eastern U.S. and Canada. For those of you wishing to make an active effort to participate in all events through a two-day course, you may register for a one credit Master's Level course offered through Johnson State College (EDU 520: New Advances in Earth Science Education).

Participants wishing to present a poster session, lead a demonstration, or run a workshop directed toward earth science education on levels K-12 and/or those wishing to register for the full 2-day NAGT event for one college credit should contact either: Dr. Leslie Kanat, Environmental and Health Sciences, Johnson State College, Johnson, Vermont 05656 (802/635-2356 Extension 346) or Dr. Russell Agne, College of Education and Social Services, University of Vermont, Burlington, Vermont 05405-0160 (802/656-3356).

Student Membership Awards

The New England Division of the National Association of Geology Teachers (NAGT) is offering fifteen free memberships in the Association to college students in New England. Membership includes a one-year subscription to the *Journal of Geological Education* and the New England Section's newsletter. Nominations are accepted for students with the following qualifications:

- Enrolled college student with junior standing
- Expressed interest in geological education
- Demonstrated academic excellence

Each geology department chair throughout New England may submit the name of one (1) qualified individual; the chair does not have to be a member of NAGT. Please submit the following information regarding the nominee: name, address, and a brief discussion of the student's qualifications for the award. Nominations for the award will be accepted until 14 February 1993.

Winners will be chosen, at random, at the combined spring meeting of NAGT (New England and Eastern Sections) and the Northeastern Section of the Geological Society of America. For more information about this joint meeting see articles elsewhere in this issue of the *Green Mountain Geologist*.

Summer Field Course Scholarships

NAGT also offers Summer Field Course Scholarships to qualified undergraduate students; for further information please see the November 1992 issue of the *Journal of Geological Education*.

Outstanding Earth Science Teacher Award

The New England section of the National Association of Geology Teachers (NAGT/NE) is in the process of selecting an outstanding earth science teacher (OEST) in New England and identifying outstanding teachers on the state level. Deadline for submission of nominations is 1 March 1993; NAGT/NE board members are not eligible for this award. Contact Leslie Kanat for details.

Conference on Ground Water

Vermont Ground Water Association, in cooperation with
Department of Civil Engineering, University of Vermont

Friday, March 5, 1993, Kalkin Hall, Room 3, University of Vermont

This meeting is being organized to provide a forum for presentation and discussion of technical and professional issues and information concerning ground water and the ground water industry. It is intended that this be the first of a series of regular meetings and events designed to strengthen the communication between and among hydrogeologists, water well contractors, monitoring well contractors and others interested in groundwater. There is no registration fee for this meeting. The program is listed below.

8:30 Coffee and Donuts

9:00 *Welcome:* George Spear, Vermont Ground Water Assoc.
Dr. George Pinder, Dean, College of Engineering, UVM

9:10 *The Woburn Trial: Groundwater Computer Simulation*
Dr. George Pinder, Dean, College of Engineering, UVM

9:45 *Decisions in Management of Ground Water Supplies for Large Cities:
Lima, Managua, Mexico City, and Waterloo Region*
Dr. Robert Farvolden, Senior Scientist, National Ground Water Assoc.

10:30 Coffee Break

10:45 *1992 Darcy Lecture (Video): Contaminant Flow in Micromodels*
Dr. John Wilson, New Mexico Institute of Mining and Technology

11:30 Discussion of National Ground Water Association International
Initiative Project, Future Ground Water Forums, Vermont Ground
Water Association Goals and Membership

11:45 Break for Lunch (lunch not provided)

1:00 *Ground Water Development in Esker Aquifers*
Brad Caswell, President, Caswell, Eichler, and Hill

1:40 *A Survey of Agricultural Impacts on Farm Water-Supplies*
Jeff Comstock, Vermont Department of Agriculture

2:10 *Closure of Abandoned Monitoring Wells*
Jim Ashley, Vermont Department of Environmental Conservation

2:50 *Visit to the Votey Environmental Engineering Laboratory*
Dr. Nancy Hayden, Department of Civil Engineering, UVM

New Publications: United States Geological Survey

Compiled by Greg Walsh, U.S.G.S, Reston, VA

Concord Quadrangle:

Hatch, N.L., Jr., 1990, Reconnaissance bedrock geologic map of the rocks northwest of the Monroe fault, Concord quadrangle, Vermont; U.S. Geological Survey Open-File Report 90-283, scale 1:24,000.

Ludlow (partial) and Mount Holly Quadrangles:

Ratcliffe, N.M., 1992, Preliminary bedrock geologic map of the Mount Holly quadrangle, and western part of the Ludlow quadrangle, Vermont; U.S. Geological Survey Open-File Report 92-282, scale 1:24,000.

Mount Snow and Readsboro Quadrangles:

Ratcliffe, N.M., 1992, Bedrock geologic map of the Mount Snow and Readsboro quadrangles, Bennington and Windham counties Vermont; U.S. Geological Survey Miscellaneous Investigation Series, Map I-2307, scale 1:24,000.

Randolph Center Quadrangle:

Hatch, N.L., 1991, Reconnaissance bedrock geologic map of the Randolph Center quadrangle, Vermont; U.S. Geological Survey Open-File Report 91-275, scale 1:24,000.

South Royalton Quadrangle

Hatch, N.L., Jr., 1989, Reconnaissance bedrock geologic map of the South Royalton quadrangle, Vermont; U.S. Geological Survey Open-File Report 89-288, scale 1:24,000.

Stratton Mountain Quadrangle:

Ratcliffe, N.M., and Burton, W.C., 1989, Preliminary bedrock geologic map of the Stratton Mountain quadrangle, Vermont; U.S. Geological Survey Open-File Report 89-200, scale 1:24,000.

The following two recent papers on revisions to the stratigraphy and nomenclature of Vermont rocks are worth noting:

Hatch, N.L., Jr., 1991, Revisions to the stratigraphy of the Connecticut Valley trough, eastern Vermont, *in* Stratigraphic Notes, 1989-90; U.S. Geological Survey Bulletin 1935: 5-7.

Ratcliffe, N.M., 1991, Revisions to the nomenclature of some Middle Proterozoic granitic rocks in the northern Berkshire massif, Massachusetts, and the southern Green Mountains, Vermont and Massachusetts, *in* Stratigraphic Notes, 1989-90; U.S. Geological Survey Bulletin 1935: 9-26.

The above publications are available from:

U.S. Geological Survey; Map Distribution; Box 25286; Federal Center;
Denver, CO 80225; (303) 236-7477

SEMINARS, MEETINGS, AND FIELD TRIPS

- March 1: University of Vermont Spring Seminar Series (4 P.M.):
"Hydrothermal systems at the Mid-Atlantic Ridge" Dr. Kathryn M. Gillis, Woods Hole Oceanographic Institute.
- March 5: Conference on Groundwater, Kalkin Hall, University of Vermont, see note elsewhere in this issue.
- March 15: University of Vermont Spring Seminar Series (4 P.M.):
"Dynamic simulation modeling for understanding environmental systems" Dr. Eugene A. Cassell, University of Vermont.
- March 21–24: Geological Society of America Northeastern Section Meeting, Burlington, Vermont (*See this issue for details*).
- April 5: University of Vermont Spring Seminar Series (4 P.M.):
"Facts and fantasies about asteroids, dinosaurs, extinction: A view from Antarctica" Dr. William J. Zinsmeister, Purdue University.
- April 24: Vermont Geological Society Spring Meeting: Presentation of Student Papers, Middlebury College, Middlebury, Vermont.

THE GREEN MOUNTAIN GEOLOGIST

VERMONT GEOLOGICAL SOCIETY
DEPARTMENT OF GEOLOGY
UNIVERSITY OF VERMONT
BURLINGTON, VERMONT 05405

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

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