THE

GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

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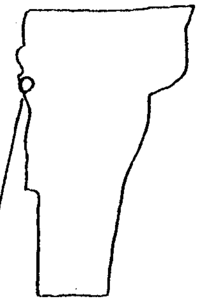


Come to the seventh annual spring meeting

THE VERMONT GEOLOGICAL SOCIETY

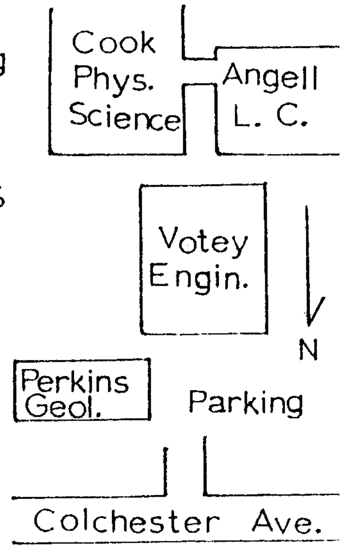
A PRESENTATION OF STUDENT PAPERS

26 APRIL, 1980 9:00 A.M.

Angell Lecture Center

University of Vermont

Burlington, Vermont



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NOTE FROM THE PRESIDENT

Time certainly has gone by fast since the winter meeting! Since then we have been making progress on the new publication of the Society, Vermont Geology. Many of the papers from the symposium are being reviewed, a few are still anticipated, and Jeanne Detenbeck is collecting needed information on publication costs. This information will be available for the spring meeting.

The winter meeting on the Champlain Basin was very successful despite the visit of one of the few snowstorms of the year. The papers were interesting and the discussion stimulating. Stewart Clark and Chuck Rattè are to be congratulated for their fine efforts in arranging the meeting. Next year we hope to sponsor another symposium which will be held at the University of Vermont, hosted by the Department of Geology. Several topics have been proposed such as:

a) Plate tectonic interpretations for western New England and Quebec (emphasis would be on recent work that is relative to these interpretations),
b) The Champlain Basin, Chapter 2,
c) Applied geology in Vermont.

The subject is still very much open for discussion so come to the spring meeting prepared with ideas.

Our spring meeting looks very interesting with many potentially fine papers from students at Middlebury College and University of Vermont. We looked for contributions from other schools but none arrived on my desk - maybe next year... Dave Bucke and Stewart Clark will chair the two sessions. We look for modestly good weather and a full turn-out from the Society and the Burlington area. See you then.

[signature]
President

SUMMER MEETING

The Vermont-New Hampshire Chapter of the Soil Conservation Society of America invites members of the Vermont Geological Society to attend the summer meeting of the VT-NH Chapter, The summer meeting will consist of a two-day session dealing with land use and water issues in the Lake Champlain area, mainly the Burlington area. The conference will be held at the Sheraton Inn, South Burlington, June 19-20. Cost per person for the two-day session, including overnight lodging, will be $38. This price includes lodging plus 3 meals. For further details and reservations, please contact Dick Gallo, Soil Conservation Service, One Burlington Square, Suite 205, Burlington, VT 05401. Tel. No. 951-6795.

Vermont Geological Society plans to hold its summer business meeting early Friday evening, June 20, after the sessions of the SCSA meeting. The first week in June, we will mail an announcement giving details of the summer meeting, and further information about the program of the SCSA meeting and costs of individual meals for that meeting.

PROGRAM

ROOM B112 ANGELL LECTURE CENTER, UVM CAMPUS

Registration (no fee) - Coffee and donuts 8:45

MORNING SESSION David Bucke presiding 9:15

1. Lisa Senior: A structural and lithologic study of the Precambrian and Lower Cambrian rocks in the vicinity of Lincoln, Vermont 9:20
2. Sarah Roeske: Structural and metamorphic history of Cheshire-Underhill contact, Baldwin Creek, west-central Vermont 9:40
3. William Couch: Structural history of the Hancock Member of the Pinney Hollow Formation 10:00
4. Raymond Poyner: The geochemistry and consequent tectonic implications of the Pinney Hollow metabasalts, central Vermont 10:20
5. Robin Bell: Paleomagnetic poles from two Cambro-Ordovician greenstone bodies in central Vermont 10:40
6. Mark Nyman: Geology and petrography of the Olive Pond region, Eastman, Quebec 11:00
7. Phil Winner: Comparison of field relations between Chagnon Mountain, Quebec, and selected "ultramafic" bodies near North Troy, Vermont . . 11:20
8. Peter Gardner: Chemistry of chromite in an ultramafic body, Rochester, Vermont 11:40

Lunch break (Executive committee meets) 12:00

AFTERNOON SESSION Stewart Clark presiding

9. Marjorie Gale: Tectonic stratigraphy in the Belvidere Mountain area, Eden and Lowell, Vermont 1:00
10. Joseph Hedal: An analysis of the structural history of the Tibbet Hill volcanics 1:20
11. Kate Mooney: Postglacial sediments of Addison County, Vermont 1:40
12. Lynne Wommack: A structural analysis of the Shelburne Marble belt within the eastern limb of the Middlebury synclinorium 2:00
13. Bruce Hill: The Plio-Pleistocene deformation of the Central Range, Southern Taiwan 2:20
14. Jill McCarthy: Gravity and magnetics near Hancock, Vermont 2:40
15. Steve Speyer: Lower Ordovician (Canadian) peritidal carbonate sedimentation: a paleo-environmental model for the Fort Cassin Formation-Providence Island Dolostone interval . 3:00

Business meeting 3:20

Presentation of awards 3:45

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ABSTRACTS

PALEOMAGNETIC POLES FROM TWO CAMBRO-ORDOVICIAN GREENSTONE BODIES IN CENTRAL VERMONT

Bell, Robin E., Department of Geology, Middlebury College, Middlebury, Vermont 05753

Two Cambro-Ordovician greenstone bodies within the metamorphic belt on the east flank of the Green Mountain anticlinorium, were sampled for paleomagnetic study.

The Hancock Member of the Pinney Hollow Formation appears to have undergone two metamorphic events during which it was completely recrystallized. A characteristic magnetization was isolated for 26 of 64 samples collected, after alternating field demagnetization. The magnetic component is probably from the magnetite which forms rims around chalcopyrite. The paleomagnetic pole, 154.81° E longitude and 20.33° N latitude, agrees with the published Upper Ordovician pole for North America. A fold test and the replacement of chalcopyrite by magnetite suggest that the pole was set during the second event.

A greenstone body within the Stowe Formation, north of Moretown, was also sampled. The results from 12 samples taken from two sites yield a similar pole. Structural corrections for the large warp observed in the metamorphic belt produced a pole, 158.91° E longitude and 20.54° N latitude, which agrees with both the pole from the Hancock Member and the Upper Ordovician pole for North America. This implies that the large warp in the metamorphic belt may be post-Ordovician.

STRUCTURAL HISTORY OF THE HANCOCK MEMBER OF THE PINNEY HOLLOW FORMATION

Couch, William A., Department of Geology, Middlebury College, Middlebury, Vermont 05753

The Hancock Member of the Pinney Hollow Formation is a greenstone that outcrops for 400 feet along Branch Brook, approximately one mile west of Hancock along Route 125. It is bounded to the east and west by muscovite schist of the Pinney Hollow Formation.

The greenstone was analyzed structurally to determine its history of metamorphic and deformational events. Field work was completed in the fall of 1979. Detailed analysis along Branch Brook through mapping , photographing, hand samples and thin sections was supplemented by reconnaisance sample and data collecting along the ridge south of the river and in the Hancock Tunnel. Samples and thin sections were also taken from the eastern contact along Branch Brook.

The Hancock Member of the Pinney Hollow Formation is an albite-epidote-quartz-chlorite-calcite schist with occasional muscovite. It has been metamorphosed twice. The first metamorphism was not greater than epidote-amphiboloite facies. Associated with this metamorphic event was the development of

a schistosity. The first event is preserved in epidote inclusion trains of albite porphyroblasts which grew during the beginning of the second metamorphic event. The second metamorphic event recrystallized the minerals. The original schistosity was transposed. The resulting schistosity strikes between approximately N20^{o}E and N15^{o}W. The variance is a result of inhomogeneities in the rock which become apparent during strain. The second metamorphic event also has associated with it parasitic folds, kink folds and isoclinal folds which are axial planar to the schistosity.

The region near the Appalachian Gap has been observed to have an older tectonic event than those which I have seen and two younger events than I have seen in the Hancock Member of the Pinney Hollow Formation.

TECTONIC STRATIGRAPHY IN THE BELVIDERE MOUNTAIN AREA, EDEN AND LOWELL, VERMONT

Gale, M. Hollis, Department of Geology, University of Vermont, Burlington, Vermont 05405

The Belvidere Mountain area is located within the serpentine belt in the towns of Eden, Eden Mills and Lowell, Vermont. The Belvidere Mountain complex, comprised of serpentinite, coarse-grained amphibolite, fine-grained amphibolite, greenstone and muscovite schist, was previously mapped as part of a normal stratigraphic sequence younging from west to east based on the structural control of the Green Mountain anticlinorium (Cady and others, 1963). The ultramafic rock at Belvidere Mountain was most recently interpreted as a solid intrusion of mantle material emplaced into overlying eugeosynclinal sediments during subcontinental rifting (Chidester and others, 1978). In contrast with these early interpretations, detailed mapping at Belvidere Mountain exposes a tectonic stratigraphy characterized by fault contacts between three structural slices which do coincide with the previously mapped formations: Hazens Notch Formation, Belvidere Mountain complex and Ottauquechee Formation. The faults are recognized on the basis of truncation of units along a common surface, fault slivers along contacts and truncation of fold structures along a surface.

Contacts between units of the Belvidere Mountain complex are definitive fault contacts. The fault deformation within the Belvidere Mountain complex is best characterized by the successive underplating of the mafic rocks and the muscovite schist (containing blocks of structurally higher units) at the base of the serpentinite during transport. These faults are closely associated with early fold structures (F_1), and together these structures constitute the earliest recognized deformation (D_1). D_1 predates the final emplacement of the Belvidere Mountain complex onto the underlying metasedimentary rocks, as is evidenced by the truncation of the early folded faults against albite gneiss and rusty schist of the Hazens Notch Formation. Three additional fold events (F_2, F_3, F_4) deform the early fault and fold structures.

CHEMISTRY OF CHROMITE IN AN ULTRAMAFIC BODY, ROCHESTER, VERMONT

Gardner, Peter J., Geology Department, Middlebury College, Middlebury, Vermont 05753

Chromite is known to occur in every type of geologic setting (intraplate, island arc and spreading center) and hence, a recognition and understanding of chemical trends could be extremely useful in the interpretation of chromites from unknown sources.

The purpose of this paper is to compare and to contrast the petrologic differences between chromites of known origins with samples collected at the Rochester Quarry in Rochester, Vermont. How and under what conditions the Rochester body was emplaced will be considered and synthesized into a regional geological model.

The nodular chromites in Rochester demonstrate significant similarities to alpine-type chromites. The Ti content of the Rochester chromites is low, ranging from .03 to .19 weight percent. The deposit shows distinctly reciprocal Cr-Al variation, and Cr_2O_3 increases with a decrease in MgO. This latter trend may be due to partial reequilibration of the chromites to later conditions of lower temperature during serpentinization of the peridotites.

As a result of the distinct petrologic similarities between known alpine-type chromite complexes and the Rochester body, it is reasonable to interpret the origin of the Rochester body as an alpine-type chromite complex. The body has undergone extensive serpentinization, as evidenced by entirely serpentinized olivine, chlorite and carbonates. This interpretation would support the existing model of this region of Vermont as lying within an area of plate margin activity.

Chemical variations between Cr_2O_3, Fe_2O_3, Al_2O_3 and MgO in the Rochester samples show a clear correlation with variations observed in ophiolites. By contrast, these variations are distinctly different than the variations observed in either island arc or intraplate chromites.

AN ANALYSIS OF THE STRUCTURAL HISTORY OF TIBBIT HILL VOLCANICS

Hedal, Joseph A., Department of Geology, Middlebury College, Middlebury, Vermont 05753

The Tibbit Hill Formation in the vicinity of Metcalf Pond is composed of interbedded metasediments and metabasalts. The metasediments consist of muscovite schists and quartz-albite massive rocks. The metabasalts are pillow lavas and chlorite-epidote massive basalts. All the rocks have been metamorphosed to the greenschist facies.

There is evidence for two deformations affecting this area; the later deformation was the more intense. The earlier deformation formed a schistosity which is preserved as a transposed fabric in thin section. The dominant schistosity was developed during the second deformation. Small scale folding and a crenulation cleavage were also formed as part of the later deformation. The folding and crenulation cleavage occurred at the same time, either during or soon after the development of the dominant schistosity. If there was a folding event associated with the earlier deformation, evidence for this was destroyed by the second deformation.

The dominant schistosity of the area strikes N 10° E to N 25° E and dips steeply to the east. The lithologies appear to be oriented the same as the dominant schistosity. Axial planes of the small folds strike about the same as the schistosity, but some of the axial planes dip steeply to the west while others dip to the east.

THE PLIO-PLEISTOCENE DEFORMATION OF THE CENTRAL RANGE, SOUTHERN TAIWAN

Hill, L. Bruce, Department of Geology, University of Vermont, Burlington, Vermont 05405

Taiwan is situated on the leading edge of the Eurasian plate where the east-dipping subduction zone of the Manila-Luzon arc system changes across a left-lateral transform fault to the northwest-dipping subduction zone of the Ryukyu system. Along the Manila trench, ocean floor rocks of the South China sea and slope-rise sediments seaward of the Asian mainland have been accreted to form much of central and western Taiwan. The Central Mountains with its central metamorphosed core and unmetamorphosed Eocene-flysch cover represents part of the emerged accretionary prism. The arc volcanic rocks and over-lying flysch of the Coastal Range to the east represents the western edge of the Luzon arc that has collided with central and western Taiwan during Pliocene-Pleistocene time.

A 60 km traverse across the southern part of the Central Mountains provided an excellent opportunity to compare the structural/metamorphic history of the older core rocks (Tananao Schist) with the unmetamorphosed Eocene(?) cover (Hsinkao Formation). Two unconformities were delineated in the process of lithic and structural analysis, one at the base of the Hsinkao Formation, which had been recognized previously, and the other at the base of the Chulai Formation. Both unconformities are characterized by sharp, unsheared contacts and systematically truncate units on a regional scale.

Six generations of folds are present throughout the Tananao Schist and the Chulai Formation (F_1-F_6), while only five are present in the overlying Eocene Hsinkao Formation.

Assuming an Eocene age for the Hsinkao Formation throughout its geographic extent, much of the observed deformation and metamorphism in the metamorphic core of the Central Mountains is Pliocene-Pleistocene and not older (Mesozoic) as suggested by other workers in the region. The older structural fabrics associated with accretion are largely destroyed by this younger deformation.

GRAVITY AND MAGNETICS NEAR HANCOCK, VERMONT

McCarthy, Jill, Department of Geology, Middlebury College, Middlebury, Vermont 05753

A six square mile gravity and magnetic survey was conducted in the Hancock region of central Vermont. The purpose of this study was to determine the subsurface structure of a massive albite-epidote-calcite-chlorite schist commonly known as green-stone. Sixty-five gravity and one hundred and fifteen magnetic stations, located along five east-west oriented traverses, were used to model this subsurface structure.

Two magnetic highs of approximately 2000 and 850 gammas have been located within this field area. Both anomalies are oriented north-south and both coincide with visible greenstone outcroppings. A magnetic profile across the center of this region tentatively indicates a sloping body which dips to the west at approximately 30 degrees.

Both gravity and magnetic data were analyzed with a high speed digital computer. Magnetic programs were designed to model the shape of the subsurface mass producing the observed anomalies. By dividing the mass into m laminae, each corresponding to a polygon of n sides, any shape could be generated, the effect of which could then be compared to the observed data. The shape which best conformed to the data was taken to be the model of the subsurface structure.

Gravity programs computed the Bouguer anomaly and performed two dimensional modeling similar to that described for the magnetics.

POST GLACIAL SEDIMENTS OF ADDISON COUNTY, VERMONT

Mooney, Kate P., Department of Geology, Middlebury College, Middlebury, Vermont 05753

Late Pleistocene glaciolacustrine and marine sediments exposed at fifteen localities throughout Addison County, Vermont were carefully examined, and measured sections were described and sampled. From comparison of composition and varve thicknesses at different localities, inferences can be drawn regarding source areas and rates of sediment accumulation. The sediments become finer and more thinly laminated with increasing distance from the Green Mountains.

Mineralogy of the sand fraction provided evidence for source areas in the Green and Adirondack Mountains.

GEOLOGY AND PETROGRAPHY OF THE OLIVE POND REGION, EASTMAN, QUEBEC

Nyman, Mark, Department of Geology, University of Vermont, Burlington, Vermont 05405

The Olive Pond region is located 28 km north of the U.S.-Canada border in Eastman, Quebec. It is bordered to the northeast by imbricated serpentinite-pyroxenite-diabase-volcanic complex (Baldface-Orford-Chagnon Ophiolite; B.O.C.), and to the west by polydeformed metasedimentary rocks of the Ottauquechee-Sweetsburg-Sutton Schist sequence. Within the study area, five rock types are differentiated by detailed 1:7800 mapping: 1) Black slates with olistostromal horizons; 2) metagreywackes; 3) sheared to massive serpentinite; 4) a variety of intrusive rocks; and, 5) massive to pillowed basic volcanic flows, felsic volcanic rocks, agglomerates and volcanic breccias.

Metasedimentary units, which correlate with the St. Daniel Formation east of the B.O.C. complex, are in fault contact with the Ottauquechee-Sweetsburg rocks west of the study area, and with serpentinite bodies and igneous rocks within the study area. No intrusive contacts between any of the igneous rocks and metasedimentary units are observed in the field.

The intrusive rocks range from fine-grained microgranite to a brecciated intrusive rock, containing clasts of felsic volcanics, trondhjemites, hornblende gabbros and syenites and rare metapyroxenite, in a chaotic, fine-grained K-feldspar poor matrix. All intrusives and intrusive breccias are soled by serpentinite-bearing faults and have been transported within serpentinite masses along thrusts imbricated with metasedimentary units.

The geology of the Olive Pond area suggests a complex history of chaotic deposition and fault imbrication. Some of the clasts within the intrusive rocks can be traced to similar rocks in the B.O.C. complex; other clasts and a variety of volcanic bodies have unknown local sources but may have affinities with dismembered island arc rocks (Ascot Weedon Formation at the Stoke Mountain belt). Regionally, this zone may provide evidence for continental margin-ophiolite-island arc collision in the Vermont-Quebec segment of the Appalachian orogen.

THE GEOCHEMISTRY AND CONSEQUENT TECTONIC IMPLICATIONS OF THE PINNEY HOLLOW METABASALTS, CENTRAL VERMONT

Poyner, Raymond, Department of Geology, Middlebury College, Middlebury, Vermont 05753

The Hancock Member of the Pinney Hollow Formation, exposed directly west of Hancock, Vermont, is a dark green albite-chlorite-epidote-calcite schist characterized by a high percentage of chlorite with albite (An_{03}) porphyroblasts. This fine to medium-grained metabasalt is well foliated, with quartz lenses running along the orientation of stress. A fine to medium-grained albite-muscovite-magnetite unit lies locally interbedded within the greenstone.

The metabasalts in this region are thought to represent late Precambrian rifting of the continent. Initial trace element chemistry may be consistent with this conclusion. An observed slight LREE/chondrite enriched-moderate HREE/chondrite depleted pattern describes a differentiated tholeite, which may erupt during the final stages of continental rifting. Also, high concentrations of Zr, varying from 70-230 ppm, as well as relatively low Y/Nb ratios with a mean of 2.2 are indicative of rifting volcanics.

STRUCTURAL AND METAMORPHIC HISTORY OF CHESHIRE-UNDERHILL CONTACT BALDWIN CREEK, WEST-CENTRAL VERMONT

Roeske, Sarah, Department of Geology, Middlebury College, Middlebury, Vermont 05753

The study area covers a two mile west to east cross-section from Route 116 to South Starksboro, Vermont, parallel to Route 17. The lithologies grade from quartz-rich sediments in the west to sericite schists in the east. The structures are consistent within the western mile and three-quarters, but the eastern one-quarter mile has experienced as more complex deformational history.

In the western section, arkosic argillaceous arenite with interbedded phyllitic slate has two strong deformational events. The earlier fabric is seen as a schistosity which is very faint at the western end, but increases steadily across the western sequence. The second fabric is the dominant fabric and is associated with extensive shearing, folding and crenulation.

The phyllite grades into a muscovite-chlorite schist mapped as the Fairfield Pond Member of the Underhill Formation. This unit has the deformational history of the western sequence until the eastern end of the study area. This eastern zone has experienced three deformations, with the second and third being analogous to the first and second seen to the west. The first event in the east is seen as isoclinal folding of compositional layers. The second event developed a dominant schistosity with numerous tight folds axial planar to it. The third event in the eastern zone is seen as a crenulation cleavage and minor folding of the two previous events.

Metamorphism plays a minor role relative to stress in the history of this area. Recrystallization increases west to east and lower greenschist facies assemblages appear one-half mile east of the western end of the area, increasing to greenschist facies within another mile. Muscovite-chlorite-calcite is the main assemblage with occasional incipient biotite. The grade increases slightly from west to east within the Underhill.

The overall deformational history in this area contains elements of both Middlebury synclinorium history and Green Mountain anticlinorium history. This region thus appears to include a tectonic contact between these two structurally different, but lithologically similar rock units.

A STRUCTURAL AND LITHOLOGIC STUDY OF THE PRECAMBRIAN AND LOWER CAMBRIAN ROCKS IN THE VICINITY OF LINCOLN, VERMONT

Senior, Lisa, Department of Geology, Middlebury College, Middlebury, Vermont 05753

A structural and lithologic study of the Precambrian and Lower Cambrian rocks in the vicinity of Lincoln, Vermont was conducted to examine in detain the transition from the Champlain lowlands into the Green Mountain massif.

A west to east traverse was made from Ackworth to South Lincoln, mostly observing rock exposed in the New Haven River. Cambrian metasediments of the Cheshire and Underhill formations outcrop from Ackworth to Lincoln. They exhibit progressively greater deformation to the east, recording one event in the west to three near Lincoln. Between Lincoln and South Lincoln there are discontinuous outcrops of the Precambrian Mount Holly Complex. Fabrics characteristic of the Precambrian basement are transposed along its western margin to orientations parallel with those of the metasediments to the west. In South Lincoln, schistose quartzites and sandstones of the Pinnacle (Hoosac) Formation are folded, warped and intensely sheared in places. Ten foot phacoids of amphibolite, probably igneous in origin, are also deformed and appear among these sheared Cambrian metasediments.

The Cheshire Quartzite and Underhill schists sit at the eastern edge of the Middlebury synclinorium, forming what seems to be west-verging folds interrupted by faults and zones of shear. The Precambrian unit appears to have been faulted and slid west over the younger shelf sediments, as evidenced by the transposition fabric of rocks near Lincoln, although the transport surface was not identified in the field. To the east of the Precambrian slice, rocks similar in age to the Cheshire, but likely deposited farther to the east in deeper water, record more intense deformation, suggesting that deformational stresses were stronger to the east. Metamorphism increases, in general, to the east, grading within the greenschist facies from the chlorite to biotite isograd in the Cheshire and Underhill.

LOWER ORDOVICIAN (CANADIAN) PERITIDAL CARBONATE SEDIMENTATION: A PALEOENVIRONMENTAL MODEL FOR THE FORT CASSIN FORMATION-PROVIDENCE ISLAND DOLOSTONE INTERVAL

Speyer, Stephen E., Department of Geology, University of Vermont, Burlington, Vermont 05405

Lower Ordovician (Canadian) carbonates in the northern Lake Champlain region consist of a series of limestone, dolostone and intraformational carbonate conglomerates which reflect shallow shelf peritidal depositional regimes. The upper Fort Cassin Formation and lower Providence Island Dolostone are exposed on the Providence Island shoreline perimeter. Analysis of sedimentary features indicate an alternation of five environmental settings:

1) Supralittoral Flats. Massive, featureless dolomite is interrupted by chert nodules and lenses.

2) Hypersaline Algal Mats. Laminated, stromatolitic dolostones are characterized by dessication features and general absence of fauna.

3) Littoral Flat. Rhythmically bedded limestone units (calcisiltite, calcilutite, calcirudite) associated with calcareous shale partings; calcirudite dominantly intraformational flat-pebble conglomerate; roundness dependent upon energy regime of deposition; trace fossils reflect proximity of low-tide level and environment severity; allochthonous trilobite and gastropod fragments abundant.

4a) Low-Littoral Algal Mats - Algal Banks. Dolomite-mottled limestone beds; bioturbation evident; fauna limited to gastropod and cephalopod.

4b) Peritidal Current Channels. Cross-bedded calcisiltite and calcarenite units with foreset pockets of well-rounded carbonate pebbles; fauna similar to 4a.

5) Sublittoral Algal Biohermal Shoal. Stromatolitic limestone mounds up to 1.5 meters in height; indigenous fauna of varied trilobite forms with a prominant gastropod and cephalopod component.

The Fort Cassin Formation (Cassinian Stage) is interpreted as representing continuous, vaguely transgressive, sedimentation on a stable cratonic shelf. The Valhallan Stage (Fortey, 1979) marks the onset of dramatic uplift and prolonged supratidal, hypersaline environmental conditions. This stage is represented in Vermont by the Providence Island Dolostone. The gastropod *Ceratopea* sp. confirms the latest Lower Ordovician age for this formation. The Valhallan dolostone units are conformably overlain by typical Chazyan stratigraphy, characterized by rapid marine transgression and reef-complex development.

COMPARISON OF FIELD RELATIONS BETWEEN CHAGNON MOUNTAIN, QUEBEC, AND SELECTED "ULTRAMAFIC" BODIES NEAR NORTH TROY, VERMONT

Winner, Phil, Department of Geology, University of Vermont, Burlington, Vermont 05405

Chagnon Mountain is located south of Lac Orford, at the southern termination of the ophiolite belt in southern Quebec. The area is underlain by an igneous complex, metamorphosed within the greenschist facies. The meta-igneous rocks include, from west to east, foliated gabbro, schistose serpentinite mélange, massive serpentinite, pyroxenite, gabbro, trondhjemite, diabase dikes and volcanics. Gradational contacts, presumably formed by fractional crystallization, are preserved between massive serpentinite and pyroxenite, pyroxenite and gabbro, and gabbro and trondhjemite. Tectonic contacts are observed between schistose serpentinite and massive serpentinite + pyroxenite + gabbro, thus forming the mélange unit. Structural contacts also occur between pyroxenite and gabbro + trondhjemite. In addition, numerous shear zones are found within the ultramafic and gabbroic rocks. All tectonic surfaces generally strike north-northeast, and dip moderately to steeply east. A sharp transition from plutonic to volcanic rocks, along with truncations in map pattern support the suggestion that volcanics are in structural contact with plutonics. Diabase dikes intrude pyroxenite, gabbro and trondhjemite, but are not found cutting adjacent metasedimentary rocks or the melange zone. The relationship between dikes and volcanics is not known.

Thirty-three kilometers to the south, two schistose serpentinite bodies crop out east of North Troy, Vermont. In addition, massive serpentinite, meta-pyroxenite, foliated gabbro and metagabbro outcrop in minor, but significant, amounts. Gabbro and pyroxenite are locally gradational; however, structural contacts are observed. In addition, a xenolith of diabase occurs within the metagabbro.

The similarity and association of lithologies, metamorphism, structural setting and style with all rocks from both areas is striking. If the Chagnon-Baldface-Orford complex is accepted as fragments of ancient oceanic lithosphere, a similar origin is suggested for related rocks near North Troy, Vermont.

A STRUCTURAL ANALYSIS OF THE SHELBURNE MARBLE BELT WITHIN THE EASTERN LIMB OF THE MIDDLEBURY SYNCLINORIUM

Wommack, Lynne E., Department of Geology, Middlebury College, Middlebury, Vermont 05753

Past studies on the east limb of the Middlebury synclinorium indicate that a high strain zone of distributed shear, faulting, and folding accommodated a westward displacement of the Green Mountain massif.

Results of field work on the Upper Cambrian and Lower Ordovician carbonates 3 1/2 miles northeast of Middlebury, illustrate a similar metamorphic history which is manifest in different structural styles, partly due to the unique properties of calcite marble.

On a macroscopic scale, the entire area has experienced uniform east-west strain, seen in the pervasive cleavage striking due north to N 20° E, dipping 40° to 50° E. The calcite is more ductile than the dolomite in response to stress, resulting in such varied structures as calcite flowage, dolomite boudins and quartz-filled shear zones.

On the microscopic scale, petrographic analysis shows that the calcite marbles have experienced inhomogeneous strain, seen in the varying degrees of recrystallization and shear within a 500 foot interval.

Geothermometry studies, using x-ray diffraction, indicate that both the calcite marble and Clarendon dolomite in the area were recrystallized at temperatures as low as 375-425° C, which corresponds to maximum formation depths of 13 km.

The cleavage and folded boudins indicate at least two periods of deformation in this area. The lack of two distinct cleavages, and absence of any bedding planes is probably due partly to the ductile characteristic of calcite, but may also suggest that the deformation was either continuous, or came in pulses, rather than occurring as two discrete orogenies, as has been the traditional view.

FROM THE EDITOR

Deadline for the summer issue of the Green Mountain Geologist will be early in July. It will include the report of the nominating committee and the tentative plans for the fall field trip and annual meeting.

VGS members will be interested to know that besides the list of members printed in this issue, our mailing list includes three institutional libraries which the executive committee designated as depositories for our publications awhile back. They are: USGS Library at Reston, Virginia, Bailey/Howe Library at the University of Vermont and the Vermont State Department of Libraries in Montpelier, Vermont.

JD

MEMBERSHIP LIST

Listed below are members in good standing for the calendar year 1980. Following the policy adopted by the executive committee, we will publish names of members whose dues are received after publication of this issue in a future issue.

Eric Allinson	Box 195, Montpelier, VT. 06502
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David P. Bucke	Dept. of Geology, University of Vermont, Burlington, VT. 05405
David Butterfield	RFD 1, Montpelier, VT. 05602
Wallace Cady	348 So. Moore St., Lakewood, CO 80226
Stewart Clark, Jr.	25 Marvin St., Montpelier, VT. 05602
Elizabeth Connor	Box 35, Waitsfield, VT. 05673
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James Dawson	Institute for Man and Environment, SUNY, Plattsburgh, NY 12901
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Ballard Ebbett	RFD 1, Lyndonville, VT. 05851
Sandria Ebbett	RFD 1, Lyndonville, VT. 05851
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J. Charles Fox	P.O. Box 64, 6 Eastern Avenue, Barre, VT. 05641
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Peter B. Harris	The White Mountain School Littleton, NH 03561
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Malcolm Heyburn	Meore Way, Mtn. View Estates, Washingtonville, NY 10992
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Winslow Ladue	102 Park St., Burlington, VT. 05401

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Fred Larsen	9 Slate Ave., Northfield, VT. 05663
John Malter	23 Hubbard St., Montpelier, VT. 05602
Winona Manning	Route 1, Williamstown, VT. 05679
Linda G. Marek	Water Resources Center, 601 Main St. Burlington, VT. 05405
J. Gregory McHone	Star Route, Pittsfield, VT. 05762
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Mary Ann Mento	RD#1, Arlington, VT. 05250
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Peter Northrop	3230 S. Gessner Apt. 716, Houston, TX. 77063
The Chaplin Library	Norwich University, Northfield, VT 0566
Duncan Ogden	Landgrove, Londonderry, VT. 05148
John P. Oski	9 Oak Hill Road, Greenfield, MA. 01301
Sanborn Partridge	62 Ormsbee Ave., Proctor, VT. 05765
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Roger B. Thompson	RFD#1, Woodstock, VT. 05091
Terry F. Thompson	RFD#1, Woodstock, VT. 05091
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Philip W. Wagner	48 Henderson Terrace, Burlington,Vt 054
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Christopher White	RFD 1 Box 240, Bristol, VT. 05443
Richard Willey	9602 Alda Drive, Baltimore, MD. 21234

ROCK OF THE QUARTER

Monkton Quartzite, a prominant rock type in the Champlain Valley, has been selected for our Spring feature. Quartzite is a hard, tough sedimentary rock composed mainly of quartz sand grains which have been so firmly cemented by silica(quartz) that when broken, it breaks through the grains rather than around them. The Monkton Quartzite is banded in colors from buff to pink, rose and red purple. Cut and polished, it looks like mahogany. The red color tones indicate the presence of iron impurities. Even if we knew nothing about the history of this rock, we would be suspicious that the source of the sediments forming it was the iron-rich Adirondack Mountains. These mountains were a cape extending out into a warm shallow sea over 500 million years ago when these sand deposits were formed. A visit to the Hoover Street quarry, just off Shelburne Road in Burlington, presents us with evidence that the sand deposits which became the Monkton Quartzite were laid down in shallow water. The quartz walls bear evidence of crossbedding; the floor of the quarry has evidence of ripple marks and raindrop pits. Among the rocks exposed at Red Rocks Park in South Burlington this writer has also found fossilized mud cracks. The extensive walking trails and overlooks in this lovely park on Lake Champlain just off Queen City Road, offer a pleasant means to view outcrops of the Monkton Quartzite which is a dominant feature of the park.

If we travel south on Route 7 from Burlington toward Mount Philo, we pass, on our left as we enter Shelburne, an Episcopal Church built of the Monkton Quartzite. This is a reminder of one of the uses of a tough, durable rock. University of Vermont's Red Stone Campus off Prospect Street has several buildings and a wall built of this rock. The bath house at Red Rocks Park beach was built of blocks of this material, salvaged from the burned-out Roman Catholic Cathedral in Burlington and brought to Red Rocks so the new building would harmonize with its surroundings. Another valuable use of this rock is "road metal". Many of the roads and driveways in the Champlain Valley have crushed Monkton Quartzite in them.

A visit to the main western overlook in the summit area of Mount Philo shows us another exposure of Monkton Quartzite. Here we find several hundred feet of this material lying above the younger black limey shale of the Stony Point Formation. It is an anomalous position. The presence of Monkton Quartzite here is a result of the Champlain overthrust which occurred during the formation of the Taconic Mountains some 450 million years ago. Modern plate tectonic theory indicates that this was the result of two continental plates moving toward each other, closing the proto-Atlantic Ocean and buckling the continental shelf to form the Taconic Mountains, Green Mountains and Appalachian Mountains, as well as causing the Champlain and Hinesburg thrust faults which run north south parallel to the lake.

Certainly this ordinary rock has a story to tell those who ask questions and it is utilitarian besides.

Submitted by: Ethel Schuele

WINTER MEETING REPORT

Forty-one hearty individuals celebrated the first substantial snowstorm of the winter in Vermont by attending the Vermont Geological Society's symposium about geology in the Champlain basin. Discussions following the talks were lively, and we look forward to publication of these papers in our first issue of Vermont Geology.

During the meeting of the executive committee, it was decided to combine our savings and checking accounts into a single, interest-bearing NOW account. The editorial board, appointed to oversee publication of the first issue of Vermont Geology will include: Charles Rattė, Jeanne Detenbeck, Fred Larsen and Rolfe Stanley.

NEW MEMBERS

We welcome the following new members, who were accepted for membership by the executive committee at the winter meeting

Sanborn Partridge	Proctor, Vermont
Winslow Ladue	Burlington, Vermont

VERMONT BIBLIOGRAPHY ANNOUNCEMEN

From the Office of the State Geologist we have the news that the bibliography will go to the printers around May 15 and should be ready for sale on the 1st of June. Cost for each copy will be $3.00 and orders accompanied by payment should be sent to:

Department of Libraries
Geologic Document Section
111 State Street
Montpelier, Vermont 05602

The bibliography contains approximately 2000 entries and has computer sorting capability by area and category.

FROM THE UNIVERSITIES AND COLLEGES

As of early May, Philip Wagner, a member of the faculty of the Department of Geology at University of Vermont, will be working full time in his newly incorporated consulting firm, Wagner, Heindel and Noyes, Inc. in Burlington, Vermont. The Society wishes him well in his new endeavor.

MEETINGS

Apr 24	Burlington Gem and Mineral Club - see below
Apr 26	VERMONT GEOLOGICAL SOCIETY'S spring meeting See cover of this issue for details
May 19-21	Annual meeting of the Geological Association of Canada and the Mineralogical Association of Canada at Dalhousie University in Halifax, Nova Scotia.
May 22	FOURTH ANNUAL VGS TEACHERS' WORKSHOP AND FIELD TRIP - see page 19 for information.
May 29	Burlington Gem and Mineral Club - see below
Jun 19-20	Summer meeting of the Vermont-New Hampshire Chapter of the Soil Conservation Society of America in Burlington, Vermont.
Jun 20	VERMONT GEOLOGICAL SOCIETY'S summer meeting See page 2 for information
Aug 2-3	Burlington Gem and Mineral Club's Gem, Mineral and Fossil Show in South Burlington, Vermont

The Burlington Gem and Mineral Club holds a monthly meeting until June on the last Thursday evening of each month at 8:00 P.M. in room 100 of Perkins Geology Hall on the campus of the University of Vermont. The April 24th meeting will have Chuck Ratté as an invited speaker. Fran Nelson is also bringing African Mineral Specimens that will be on sale during the meeting. The May 29th meeting will be our annual club auction. Field trips on weekends during the summer are being planned. Our club will be sponsoring a 2-day Gem, Mineral and Fossil Show at the South Burlington Community Library, Kennedy Drive and Dorset St., Saturday 10-6 August 2 and Sunday 10-5, August 3. There will be commercial dealers, lapidary demonstrations, exhibits of an educational nature, speakers, an auction, and door prizes. Admission will be $1.00 for adults and 50¢ for children.

From time to time, VGS receives mail from other organizations and institutions containing information of potential interest to our members. When space permits, the GMG will include appropriate exerpts from this mail.

The Laboratory for Applications of Remote Sensing of Purdue University presents a short course on Numerical Analysis of Remote Sensing Data monthly through June 1980. For further information contact:

Douglas B. Morrison
Purdue/LARS
1220 Potter Drive
West Lafayette, IN 47906

FOURTH ANNUAL VGS TEACHERS' WORKSHOP AND FIELD TRIP

The Vermont Geological Society Teachers' Workshop will again be held in the Northeast Kingdom. On Wednesday, May 22, 1980, there will be an all-day field workshop in the vicinity of Lake Willoughby. The contacts between granitic rock and the surrounding schists and marbles are spectacularly exposed on the 1000 foot walls of Willoughby Gap, a glacial trough. Glacial moraines and outwash are also well-exposed northwest and southeast of the lake. Unstable slopes that may be related to talus piles and highway construction are clearly visible near a battered sign that warns "Beware of Falling Rock".

Time: 9;30 A.M. Wednesday, May 22, 1980
(coffee and refreshments when you arrive)

Place: Lobby of Alexander Twilight Theater, Lyndon State College (Eight miles north of St. Johnsbury on U.S. Route 5, or I91 (exit 23) is Lyndonville. Follow signs from Lyndonville Post Office.

(Please bring a bag lunch.)

REGISTRATION

Fee: $2.00 each (checks payable to VGS)
NO FEE FOR MEMBERS

Mail to: Ballard and Sandria Ebbett
Lyndon State College
Lyndonville, VT. 05851

NAME ______________________________

ADDRESS ______________________________

GREEN MOUNTAIN GEOLOGIST
VERMONT GEOLOGICAL SOCIETY
BOX 304
MONTPELIER, VERMONT 05602

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BURLINGTON VT
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1980
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FIRST CLASS

CHARLES A. RATTE'
10 INDEPENDENCE GREEN
MONTPELIER, VT 05602

THE

GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

SUMMER 1980 VOLUME 7 NUMBER 2

CONTENTS PAGE

Quote from A Summary of Investigations Upon the Drinking Waters of Vermont:

"The results of this investigation may be anticipated so far as they are involved in the statement that no State in the Union is more abundantly supplied with pure water than is Vermont, in none is it more readily obtained for town supply, in none are the sources of water supply less likely to be contaminated and in none is there better provision for the analysis of the water used. Since the establishment of the State Laboratory we have not been left to conjecture as to the purity of our drinking water, we can have analyses and from them we may know with certainty that in general the water that is drunk in Vermont is of unusual purity. Whatever one's taste may incline him to drink, there is no possible excuse on the score of healthfulness for drinking anything but water in this State."

from Report of the State Geologist, G.H. Perkins, 1904

NOTE FROM THE PRESIDENT

There are several matters that I would like you all to think about or be aware of while you are occupied with summer activities. We are proposing changes to the bylaws that will reduce the number of yearly meetings from 4 to 3 and alter the manner in which the nominating committee makes its report. This is being done because of low attendance and lack of focus for the summer meetings for the last few years. Summer is the time when people are out in the field or preoccupied with other matters. The remaining meetings are well attended, and we have developed over the years such interesting topics as field trips, conferences and our always popular student research seminar in the spring. With the increasing cost of gas and the other interests of summer, I think we can do away with this meeting. Think about it.

There are several other matters that will interest you. First, the fall meeting will be a field conference on glacial geology headed by Fred Larsen, and will be held in the Northfield area. Fred has some fine geology to show us and I expect a full turn out. Second, we are already planning the winter meeting. Lance Meade and I are enlisting papers for a full day seminar on Applied Geology in Vermont and Regional Studies in Western New England and Adjacent Quebec. I have invited several people for my half day session and I am sure that Lance also has done so. If you would like to present work at the seminar, please contact Lance or me. As an added feature this year, we plan on having poster sessions. So there will be two ways to present material..a formal 20 minute talk or a poster session.

I hope you are all having a productive and enjoyable summer. See you at the fall meeting.

Peter Gourley
President

NOMINATIONS

The following slate of officers was presented at the summer meeting on June 20, 1980:

President	Charles Ratté
Vice President	Fred Larsen
Secretary	Lance Meade
Treasurer	Stewart Clark
Board of Directors (2 year term-1982)	Stanley Corneille

Submitted by the Nomination Committee: Rolfe Stanley, Ethel Schuele and John Malter.

Voting will take place at the annual meeting in the fall, the tentative date for which will be found elsewhere in this issue.

PROPOSED BYLAW REVISIONS

The following changes to the bylaws are proposed:

Article VIII.A. Regular meetings shall be held three times a year. Normally these will be held during the academic year. [This article now calls for four regular meetings. The change is proposed because of the very low attendance at summer meetings the last few years. This proposed change does not preclude additional meetings during the year. Special meetings are provided for in Article VIII.B.]

Article V: Committee on Nominations

B.2. Report to the Executive Committee one month after the spring meeting the names of nominees, at which time additional nominations will be accepted from members submitted by prior mail addressed to the secretary.

[Note from the editor: The last updated copy of VGS's Constitution and Bylaws was made in October 1977 and there are a few copies left which I will mail to any members who request them. After the above revisions have been voted upon at the fall annual meeting, it seems appropriate that a new copy of this document should be compiled. Look for it in the Winter 1981 GMG.]

NEW MEMBERS

Welcome to the following new members whose applications were accepted by the executive committee at the summer meeting:

Peter M. Garrity	E. Calais, Vermont
Thomas G. Olivio	Hinesburg, Vermont
Philip Winner	Burlington, Vermont

STATE GEOLOGIST'S REPORT

Recent legislation passed by the 1980 Vermont General Assembly included the Uranium bill which will require an Act 250 permit for exploration for fissionable materials that exceeds reconnaissance level work. This would involve core drilling, excavation for sampling, and other land disturbing techniques of exploration.

Applications for mining or milling of fissionable materials must have legislative approval followed by an Act 250 permit before such activities can be conducted in the state.

***

Nineteen eighty summer field mapping projects involve a continuation of the detailed mineral resource assessment and geologic mapping of the Mt. Holly Complex at Okemo State Forest, and the initiation of a detailed mapping project at Lincoln, Vermont.

Dr. Rattè, Alan McBean and Eric Lapp are working in the Okemo area, and Peter Tauvers, a University of Vermont graduate student, is working under the guidance of Dr. Rolfe Stanley in the Lincoln area.

***

The U.S. Bureau of Mines "Analysis of the Vermont Slate Industry" has been completed by the contractor, Arthur D. Little, Inc. A summary of the results is available from the State Geologist's Office.

***

The "Bibliography of Vermont Geology" is now available at the Vermont Department of Libraries, Geological Documents Section, 111 State Street, Montpelier, Vermont 05602. Price per copy is $4.00 which should accompany each order.

***

The COCORP (Consortium for Continental Reflection Profiling) Project is currently working in Vermont. The proposed line is from W. Pawlet to Danby, from Wallingford to Tyson, and then to Felchville and Ascutney and into Claremont, N.H. Some variations may be required if road conditions, etc. do not meet the requirements of the heavy equipment being used. If anyone is interested in visiting the operation, he may contact the State Geologist's Office to learn of the current location of the seismic crew.

Submitted by: Charles Rattè, State Geologist, 802-828-3357

MINERAL OF THE QUARTER

Gold Au

Crystal Form: Cubic; usually found in octahedral crystals; dendrites, wires or thin plates are also common.
Hardness: 2 1/2 to 3; very malleable and ductile.
Specific Gravity: 19.3 when pure; less when alloyed.
Color: Golden yellow when pure; lighter if alloyed with silver.
Streak: Golden yellow   Luster: Metallic.

Only a few elements can be found in nature in their uncombined state. Gold, which is not attacked by corrosives in the air and water, is one of those few. It often occurs alloyed with silver, copper, lead or other metals (60-98% being gold). Gold occurs in small amounts in hydrothermally deposited veins in rock and is often associated with quartz. It is commonly found in metal sulphide ore deposits. The rich nickel sulphide ores found near Sudbury, Ontario are hand-sorted for pieces containing quartz "windows" because of their high gold content. Because gold is inert and very heavy, gold grains and nuggets from weathered gold-bearing rock tend to concentrate in the magnetite and garnet sands in stream beds wherever the flow is slowed or obstructed. Since gold is so soft, a nugget will be more rounded, the further it is found from its source.

Streams flowing down from the Green Mountains' rocky spine carry gold in their sediment load. Before the value of gold was allowed to rise from the legal limit set in 1934, it was possible to recover about 50 cents worth of gold flecks for an energetic day's work in Gold Brook in the Stowe area or Broad Brook in the Plymouth area. At the current price of about $500 per ounce, gold panning should prove to be a more profitable pastime.

According to an old "Report of the State Geologist", Plymouth, Vermont had its own "gold rush" in the mid 1800's after the discovery of placer gold in Broad Brook. The residents, for a time, gave up farming and turned to working the placer deposits. When the profits were calculated and divided, it became obvious that they were not earning that much more and the wise Yankees returned to farming. Thus ended the gold rush in Vermont.

If you want to spend a hot summer weekend panning for gold with your feet in a cool Vermont stream, here is a list of those places where gold-bearing magnetite and garnet sands are reported. Look for spots where the flow of water is slowed, as these areas will concentrate the heavy materials. The magnetite can be removed with a magnet. The garnet residue should be checked carefully for small gold particles. Brown mica flakes, which look like gold can be broken with a needle point - while gold will bend!

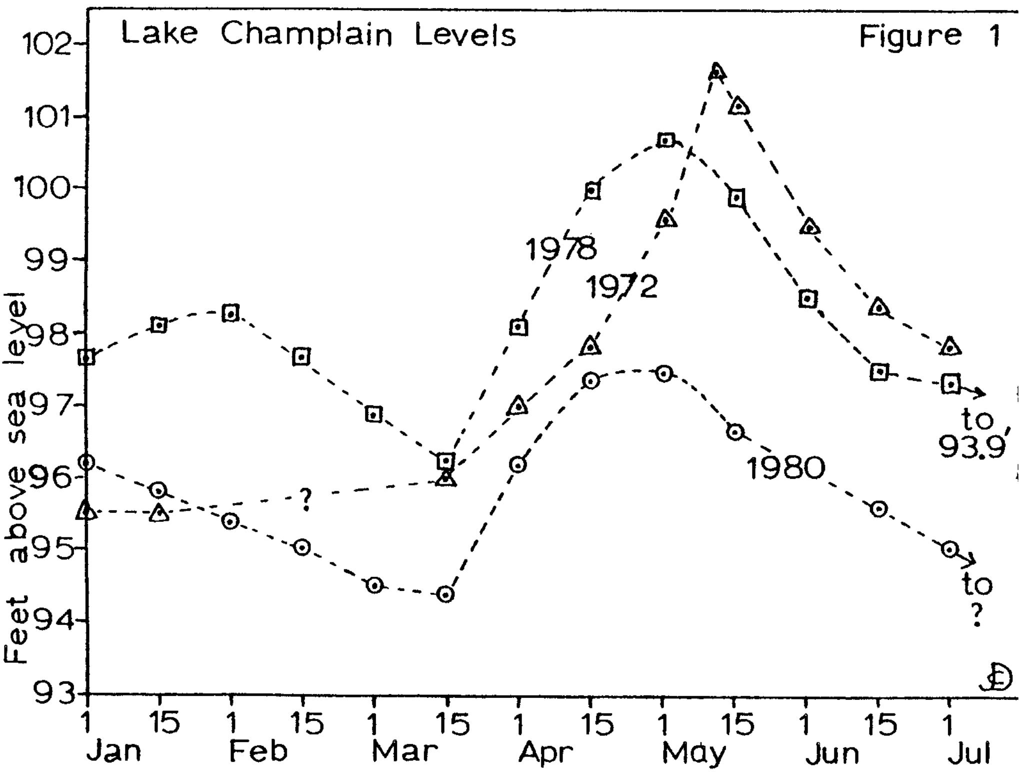
Additional gold panning sites:

- Rock River in Newfane and Dover
- Williams River in Ludlow
- Ottaquechee River in Bridgewater
- White River in Stockbridge and Rochester
- Third Branch of the White River in Braintree
- Mad River in Warren, Waitsfield and Moretown
- Shady Rill Brook in Wrightsville
- Little River in Stowe and Waterbury
- Lamoille River in Johnson
- Gihon River in Eden
- Missisquoi River in Lowell and Troy

Submitted by Ethel Schuele

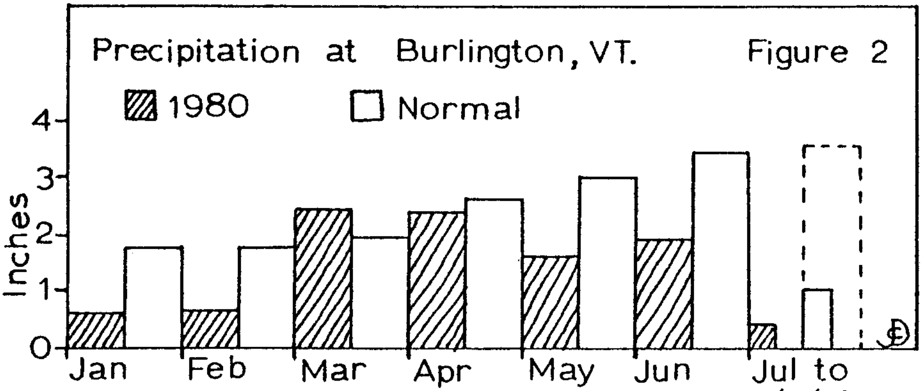
WATER RESOURCES REPORT

"The lake is going down and the rivers are dry; we have had no soaking rain and are approaching extreme conditions." This was the reaction of Monty Fischer of the New England River Basins Commission and a student of Lake Champlain to a question about the condition of water resources in Vermont this summer of 1980. Admittedly, Vermont is not suffering under the type of drying conditions currently prevailing in the Southwest and Plains states, but the general lack of precipitation within the last year, which nearly left Vermont with a snowless winter, is causing record low ground water levels and a noticeably low level of Lake Champlain. A rough idea of how low the lake is this year was gleaned from the lake level records kept by the Lake Champlain Transportation Company at the King Street dock in Burlington since 1970. The graph in Figure 1 shows water levels during the first half of 1980 and for comparison, the years 1978 and 1972. The record low water level for the decade was recorded on December 4, 1978 at 93.9 feet above sea level. So far this year, lake levels have been about two feet lower than the corresponding months of 1978, and the level is still falling toward the 1980 low. Levels for 1972 were chosen for comparison because in that year the near record high (101.60 feet on May 10) occurred at about the same date as this year's high. Record high for the decade was 101.65 feet on April 4,



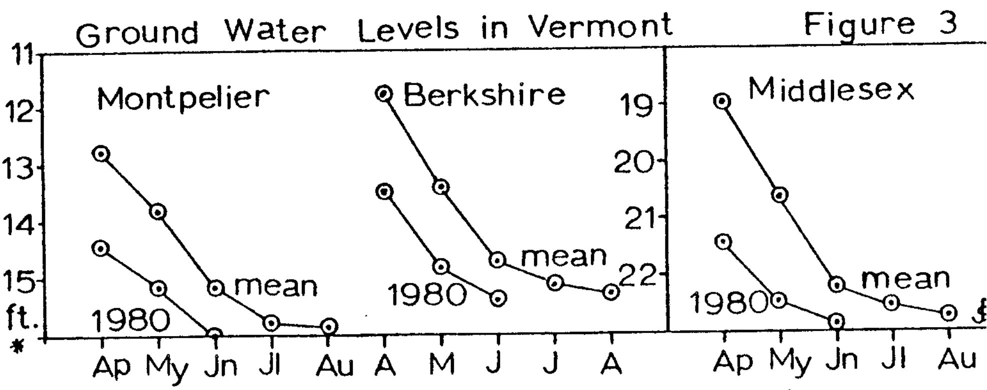
1976 and the all time recorded high was 101.8 feet in 1903. High levels in the spring are usually around 100 feet and lows in the fall and winter about 95 feet.

Precipitation, the most immediate source of recharge water for the lake, presages the low lake level. Monthly amounts for the first six months of 1980, with one exception, consistently fall below normal (Figure 2).



Source: National Weather Service

Water coming from ground water sources to recharge the lake doesn't show much promise either. Records of ground water level measured in wells located in water sheds draining into Lake Champlain also show low levels. Wells in Berkshire, Middlesex and Montpelier (Figure 3) already this year are at levels below the mean for August. A more detailed account of this year's depressed ground water levels is presented in the following article which was printed in The Vermont Well Driller's Newsletter, published by the Vermont Department of Water Resources and provided by James Ashley.



*Measured as depth below ground level.
Source: Vermont Department of Water Resources

IS THERE GOING TO BE A DROUGHT?

A number of headlines throughout the winter and spring proclaimed that we were going to have a drought in Vermont. Of course, it is important to know whether we are talking about lack of adequate water for reservoirs, or for growing crops, or to maintain our ground water aquifers. A number of drillers have already been busy finding additional water for water users with marginal supplies. There are indications from monthly readings taken by this department in cooperation with the United States Geological Survey that we are generally experiencing lower than normal ground water conditions for this time of year.

Of the 15 observation wells measured at the end of June, four set new monthly lows, and all but three were more than 30% lower than normal. Only the observation well in Pittsford showed a reading slightly higher than the normal for that well.

A review of precipitation records for January to May of this year compared to the same period during the drought in the 60's for a recording station at Rutland shows that this year is 38% below normal. In 1965, during the drought, the precipitation at this station was 52% below normal.

Other locations during 1965 also showed low precipitation levels (Bellows Falls - 51% below normal, Cavandish - 47% below normal, Vernon - 27% below normal). This year, in addition to Rutland, a number of other locations have recorded precipitation deficiencies. These are shown on the accompanying map [Figure 4]. The lowest January to May precipitation is Morrisville which is 51% below normal.

It therefore appears that there are areas in Vermont which are experiencing precipitation and ground water conditions approaching those experienced during previous "drought" conditions. Marginal water supplies which are dependent on "normal" ground water levels or "normal" recharge are probably experiencing drought conditions, and unless we receive good wetting rains in some critical areas, ground water supply problems may become more severe. Because of the use of water by vegetation, which normally helps depress the water table during the summer, it should be anticipated that the water table will continue to drop. Related problems of low stream flow and low lake levels may also become more apparent.

The locations which are shown on the maps [Figure 4] are for the ground water level monitoring network and for the precipitation recording stations. The ground water levels are expressed as the percentage that the June reading deviates from the monthly average for that station toward either the high or low extreme. Where a new extreme has been set, the percentage is 100. The precipitation levels shown on the second map are the percent this year's precipitation is below the normal precipitation recorded for that station.

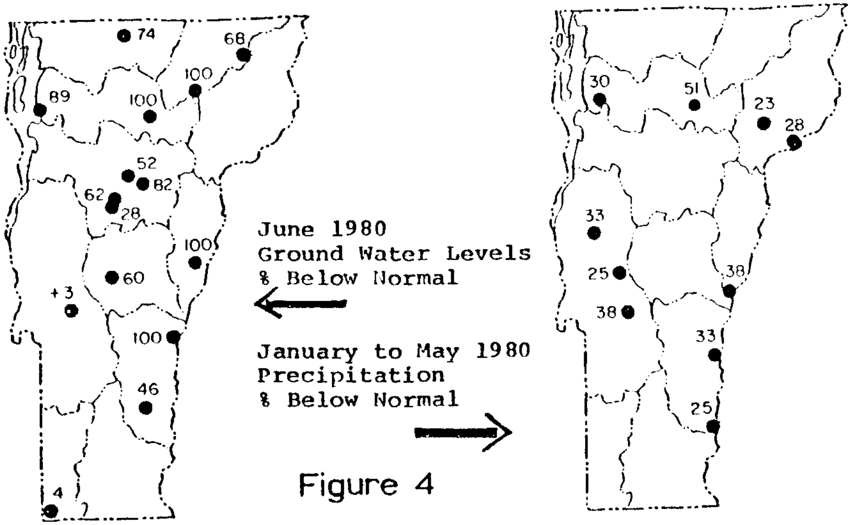


Figure 4

[If these conditions persist throughout the fall, this subject will be pursued in the Winter Issue of GMG.]

Compiled by Jeanne C. Detenbeck

SPRING MEETING REPORT

While a pleasant spring day beckoned, an audience of 45 gathered in Angell Lecture Hall at UVM to attend the presentation of 15 research papers by students from Middlebury College and University of Vermont. Each year, it seems, the students as a whole have made greater progress in their research than the last, and this year's presentations provided a problem for the judges. When the scores were tallied, two undergraduates were deadlocked for first place. The executive committee was consulted and they decided in an unprecedented action to award two first prizes to the deserving students, Bruce Hill and Mark Nyman, both from UVM. The prize for the best graduate student paper went to Phil Winner also from UVM. Each prize is a check for $25. Judges for this year were Charles Doll (with Lance Meade substituting for him in the afternoon session), John Malter, Allen Hunt and Fred Larsen. Presiding over the sessions were Dave Bucke and Stewart Clark. Dave Bucke was in charge of arrangements for the meeting. Many thanks to all those who participated!

SUMMER MEETING REPORT

This is almost the tale of a meeting that was called and nobody came. But in spite of a late afternoon downpour, a few members did cook hamburgers over a charcoal fire, and we all ate our picnic suppers inside Perkins Hall. The business meeting was short and the report of the nominating committee was duly made. All the business that was transacted is reported throughout this issue of the GMG.

Those who were absent missed the excellent presentation in colored slides of his trip to Taiwan that Rolfe Stanley has put together. It is a blend of oriental culture, mountain scenery, structural geology and the visible effects of plate tectonics in action. One only needs to add from imagination the senses of smell and sound to feel transported halfway around the world!

VERMONT GEOLOGY – PROGRESS REPORT

The first issue of Vermont Geology will most probably see the light of day this fall, hopefully before the date of the fall meeting. The editorial committee, at its most recent meeting, accepted five papers for publication. With firm commitment from two other authors, whose papers still require some revision, Vermont Geology should contain seven papers, a good start for an organization of our size.

It would be a delusion to say that all has gone smoothly, but we have learned some things about producing a publication and can say "this is how we will do it next time"! Financial reality has caused some compromise in the quality of materials we wanted to use for this issue, but the offset printing of computer text-edited copy which we plan to use should look no less professional than typeset print on glossy paper. We have examined a number of fledgling publications such as ours, recently, and have even received advice from several of the editors. The appearance of Vermont Geology as a source of information of current research being undertaken in our state will be a satisfying experience for us all.

MEMBERSHIP LIST-ADDITIONS

The following additions and changes to the membership list were received too late for inclusion in the Spring issue of the Green Mountain Geologist:

Mary Crandall	17 North Street, Rutland, VT. 05701
Robert Cushman	20 Court Street, Middlebury, VT. 05753
John Drake	Dept. of Geology, University of Vermont, Burlington, VT. 05405
Charles Duzinski	8 Prospect St., Brattleboro, VT. 05301
Richard Eliot	45 Skyline Drive, Lyndonville, VT. 05851
Peter Garrity	R.D. Box 117, E. Calais, VT. 05650
J. Gregory McHone	Dept. of Geology, Purdue University, Indianapolis, INDIANA 46205
Peter Northrop	10901 Meadowglen #10, Houston, TX. 77042
Thomas Olivio	Box 84 Baldwin Rd., Hinesburg, VT. 05461
James Stewart	Terrace Heights RD 1, Middlebury, VT. 05753
Philip Winner	Perkins Geology Hall, University of Vermont Burlington, VT. 05405

MEETINGS

Jul 18-20 Annual meeting of the Geological Society of Maine, in Presque Isle. Field trip to Dickey-Lincoln area near Allagash. (William Forbes, University of Maine at Presque Isle)

Aug 2-3 Champlain Valley Gem and Mineral Show at South Burlington High School, Dorset Street and Kennedy Drive, Saturday 10-6 and Sunday 10-5. This will be the biggest show yet sponsored by the Burlington Gem and Mineral Club. There will be 10 commercial mineral and lapidary hobby supply dealers, a gold panning demonstration, a swapping area, lectures on Vermont geology, pictures of Mt. St. Helens - before and after, mineral and fossil displays, lapidary craft demonstrations, door prize drawings, and refreshments. The Granby Dinosaur Museum will be bringing dinosaur footprints, and their 9x16 foot fiberglass dinosaur will be in attendance. Come and bring the family.

Aug 18-20 American Quaternary Association biennial meeting at University of Maine at Orono with field trips before and after. (Harold W. Borns, Department of Geological Sciences, UMO, Orono, ME. 04469)

Oct 2-4 Binghamton Geomorphology Symposium on Applied Geomorphology at Kent State University in Ohio. (Jesse L. Craft, Dept. of Geology, Kent State University, Kent, Ohio 44242)

Oct 4 VERMONT GEOLOGICAL SOCIETY - FALL FIELD TRIP AND ANNUAL MEETING. Fred Larsen will lead the trip to glacial geologic sites in the Northfield-Randolph area. Details of the meeting place and dinner arrangements will be mailed in the fall.

Oct 10-12 New York State Geological Association annual meeting at Rutgers University, Newark, New Jersey. Symposium: Rift basins on trailing Atlantic margins on Friday and field trips Saturday and Sunday. (Warren Manspeizer, NYS Geological Assn., Dept. of Geological Sciences, Rutgers University, Newark, New Jersey 07102)

Oct 11-13 New England Intercollegiate Geological Conference at Presque Isle, Maine. (David C. Roy, Dept. of Geology and Geophysics, Boston College, Chestnut Hill, Massachusetts 02167)

GREEN MOUNTAIN GEOLOGIST
VERMONT GEOLOGICAL SOCIETY
BOX 304
MONTPELIER, VERMONT 05602

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

FIRST CLASS

..arles A. Ratte'
10 Independence Green
Montpelier, VT 05602

THE GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

FALL 1980 VOLUME 7 NUMBER 3

COME TO THE FALL FIELD TRIP
AND ANNUAL MEETING OF

THE VERMONT GEOLOGICAL SOCIETY

4 OCTOBER, 1980, 9 A.M.

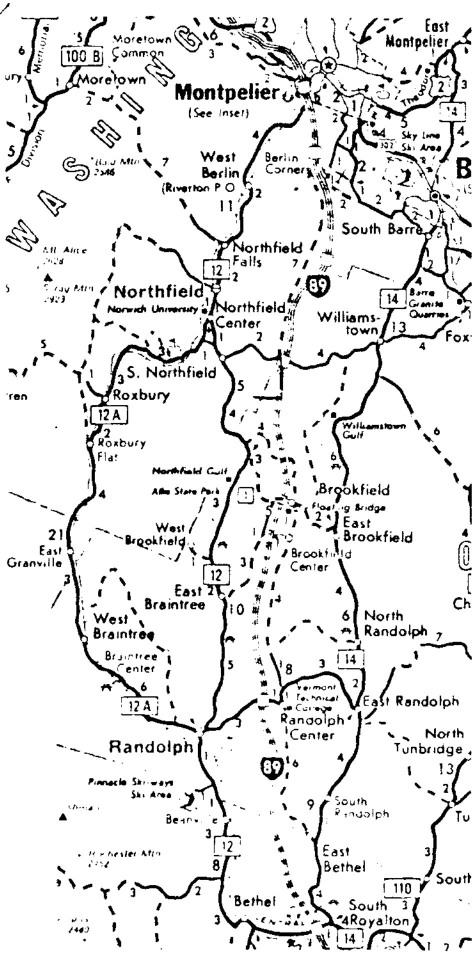
Meet at the Cabot Science Annex
Norwich University
Northfield, Vermont

"GLACIAL HISTORY
IN CENTRAL VERMONT"

Join us for dinner at
Norwich University's
VIP Dining Room

Pick up your copy of
VERMONT GEOLOGY

Details on page 3



CONTENTS PAGE

NOTE FROM THE PRESIDENT

As the present elected officers approach the end of their term, we look back at our accomplishments and gracefully forget our failures. Today I dwell on our successes.

Perhaps our principal success is the publication of Vermont Geology. The papers in this issue were given last February at the symposium on the Geology of the Lake Champlain Basin and cover diverse subjects ranging from a historical and environmental overview by Monty Fischer, through recent tectonism (Barnett and Isachsen), late Cenozoic sedimentation (Hunt), Mesozoic igneous activity (McHone and Corneille), to environmental geology (Heindel). Each of the papers was reviewed critically by several outside readers and the editorial board: Charles Ratté, Fred Larsen and Jeanne Detenbeck. I know you will join me in a hearty applause to all these people for a job well done. The society has something it can be proud of.

We have had three very good meetings, beginning with a fine field trip with Brewster Baldwin and Andrew Raiford in the Taconic region. The winter meeting was topically oriented and its success has encouraged us to follow a similar format for February of 1981. The spring meeting was excellent with fine papers from students at the undergraduate and graduate level. It is only appropriate that the current officers turn the helm over to a new group promising strong leadership in the future. We close our term with an exciting field trip in the Northfield area with Fred Larsen. I look forward to seeing many of you there because Fred has an interesting Pleistocene story to unfold.

A word about the February synposium in Burlington. As you see in this issue and as I mentioned in the last, the symposium is divided into two parts. I will chair the morning session of bedrock geology and Lance Meade will chair the afternoon meeting on applied geology. Already I have several speakers for the bedrock session. We hope to formalize the program in the near future. Again we plan on publishing the papers in the second issue of Vermont Geology.

In closing, I would like to take this opportunity to thank the membership for their support and participation during the past year. I look forward to an increase in activity during the years to come.

VGS FALL FIELD TRIP AND ANNUAL MEETING

TOPIC: GLACIAL HISTORY OF CENTRAL VERMONT

LEADER: Fred Larsen of Norwich University

DATE: Saturday, October 4, 1980

PLACE: Cabot Science Annex
Room 148
Norwich University
Northfield, Vermont

Cabot Science Annex is the southernmost brick building at Norwich University. The building is on the west side of Route 12, 0.7 miles south of the Northfield post office. Park adjacent to the building or in the student parking lot to the south. Look for the VGS signs and enter the south entrance.

SCHEDULE: 9:00 A.M. Briefing
9:30 A.M. Depart. Trip will proceed south from Norwich University on Route 12A with stops in Roxbury, Braintree, Randolph, Bethel and Brookfield. The field trip stops will be within the area covered by the Barre and Randolph 15 minute quadrangle maps. Take time to read Fred's article, starting on the following page, about the morpho-sequence concept used in mapping glacial deposits. Fred has an especially good field example to show us.

LUNCH: Participants are responsible for their own lunches. We will have lunch at one of the stops.

5 P.M.: Cocktail hour at Pat's Pioneer Restaurant, 1/4 mile south of South Northfield on Route 12.

6 P.M.: Dinner at Norwich University in the VIP dining room (located in Harmon Hall, the big dining hall due north of Cabot Science Annex, above the snack bar).

MENU: Steak, baked potato
salad, vegetable
dessert, coffee
COST: $6.00 per person

RESERVATIONS: Fill out the form in the center of this issue and mail it to Fred Larsen with your check (payable to "Vermont Geological Society") before October 3.

7:30 P.M. Annual meeting and election of officers.

VERMONT GEOLOGY (hot off the press) will be available for members. Come get yours and save us some postage!

QUATERNARY GEOLOGY

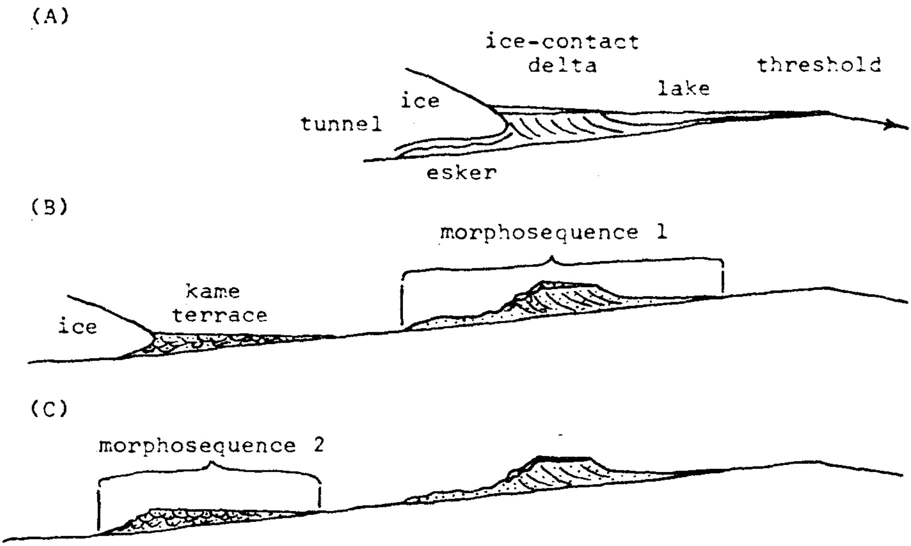
MORPHOSEQUENCES

Picture a small, shallow depositional basin formed by a glacier blocking the lower end of a valley. Melt water from the glacier forms a lake and escapes over a temporary threshold. Sediment carried by the melt water is deposited in the lake formed between the ice margin and the threshold. Coarse gravel deposits form near the ice margin while fine gravel and sand is carried further from the ice. Silt and clay are transported even further and if the melt water discharge is great enough may even be removed from the basin by passing over the threshold.

Sediment is delivered to the basin by streams flowing in ice-margin channels and subglacial tunnels. Where streams enter the lake ice-contact deltas form and with time grow larger partially filling the depositional basin. If the ice margin is stationary for a long period of time sediment may fill the basin and eventually be transported from the basin by the outlet stream.

Let the ice margin retreat a few kilometers to a second position and permit melt water streams to seek a lower outlet, and the whole process can be repeated. Sediments formed in the original depositional basin are left high and dry (?) and are often associated with distinctive landforms (morphs) such as ice-contact deltas, kame terraces, outwash plains, etc. All the deposits formed in the original depositional basin (defined by the first ice-margin position and outlet) are considered to be part of one morphological sequence. All the deposits formed in the second basin (defined by the second ice-margin position and outlet) would be assigned to a second morphological sequence.

The term morphological sequence, now contracted to morphosequence, was defined as a group of landforms that formed under, adjacent to, and far from the ice margin. An example would be an esker, ice-contact delta and distal outwash fan. The choice of the word sequence as applied to a group of landforms was incorrect in that sequence usually has a time connotation when used in geology. The AGI Glossary of Geology defines sequence as "a succession of geologic events, processes, or rocks, arranged in chronologic order to show their relative position and age..." As described above the two sets of landforms (first morphosequence, second morphosequence) constitute a time sequence, the first is older and the second is younger, but either set by itself has no time significance.



Hypothetical model illustrating the formation of two morphosequences. In A melt water drainage from the ice passes to the right. The line between topset and foreset beds in the ice-contact delta approximates the level of the lake which in turn is controlled by the threshold. In B the ice margin has retreated to a new position and melt water flows parallel to the ice margin either toward or away from the observer. In C the ice margin has retreated to the left out of the field of view leaving two morphosequences graded to two different levels.

more →

The morphosequence concept originated in Europe but it was first defined and utilized to any extent by Richard Jahns (1953) who applied the concept to mapping surficial deposits in the Ayers quadrangle, Massachusetts. With the advent in the 1940's of 7 1/2-minute topographic maps with 10-ft. contour intervals, geologists of the U.S. Geological Survey embarked on a program of mapping the surficial deposits in southern New England using the morphosequence concept. Surficial geologic maps of Massachusetts, Connecticut, and Rhode Island are currently in preparation and will be the first state maps to use the morphosequence concept to such a high degree. The concept was not used on the 1970 Surficial Geologic Map of Vermont because that map was based on reconnaissance mapping on 15-minute topographic maps with 20- and 40-ft. contour intervals. The concept eventually will be applied to many lowland areas in Vermont such as the Champlain and Connecticut Valleys, however this work will be hindered by the lack of maps with 10-ft. contour intervals.

Reference: Jahns, R. H., 1953, Surficial geologic map of the Ayer Quadrangle, Massachusetts: U.S. Geol. Survey Geologic Quadrangle Map GQ-21.

Note: The morphosequence concept has been reviewed and expanded upon by Carl Koteff in Coates, D. R., 1974, Glacial Geomorphology, Proc. of 5th Ann. Geomorphology Symposium, Binghamton, N.Y. p. 121-144.

F. D. Larsen

ROCK OF THE QUARTER

Clay Concretions

Many people have seen the "buttons" found along the shore of Lake Champlain from which Button Bay acquired its name. These are clay concretions (formed from very fine clay cemented with calcium carbonate) which are being washed from the Pleistocene clay beds exposed along the lake shore there. Because glacial deposits are so extensive in Vermont, there are a number of less well known occurrences of these geological oddities in this state.

The glacial clays in which concretions occur show horizontal banding known as varves. Each varve consists of a thicker band of coarser sediments (deposited during the summer when more material is being brought from the glacier), over which a thinner band of finer grained material (representing the winter layer of colloidal clay particles) is deposited. The sediments which formed these varves came from the melt waters of the continental ice sheet which intermittently covered northeastern North America over a period of 150,000 years. Many glacial varved clay deposits represent deltas formed when rock debris, ground up by the movement of the ice sheet, was carried by melt water into lakes impounded by glacial moraines. Besides these sediments, the glacial meltwaters carried dissolved minerals. During the summer, the fine clay and dissolved minerals remained suspended in the water. In winter, as the water grew colder, the colloid-sized clay particles began to settle to the lake bottom at the same time that the dissolved minerals such as calcium carbonate became less soluble and sank as a gelatinous mass. This jelly-like material attracted clay particles as it dropped and eventually settled around reeds, around rocks or as globs on the lake bottom. A simple concretion is usually shaped like a round dome-topped disc, slightly flattened at the base where it lay on the clay bottom. During the winter, more and more of the mineral load dropped and as clay was collected, more concretions were added to the lake bottom, some building onto earlier ones, forming complex aggregates. When the next warm season arrived, the deposition of coarse material resumed, covering the winter's crop of concretions.

Two Vermont collecting locations for clay concretions are in Manchester and in Barre. The Manchester clay banks containing concretions are found behind the Center Lanes bowling alley in the Manchester Shopping Center. The easiest places to find the concretions are in the erosion channels on the hillside. These are aggregate concretions and have very complex shapes. The Barre collecting location is in the field to the far left (as you see it from the road) of the Ames Shopping Center. Park at the far end of the parking lot and walk through the field to the clay hills. Many of the concretions in these hills are simple balls and disc shapes.

Submitted by Ethel Schuele

STATE GEOLOGIST'S REPORT

This report summarizes the long-range plans for topographic mapping in Vermont. The project is conducted by the U.S. Geological Survey - Eastern Mapping Center through a cooperative program with the Vermont State Geologist.

The new topographic mapping format adopted by the U.S.G.S. for nationwide mapping will be 7.5 minutes of latitude by 15 minutes of longitude at a scale of 1:25,000, with metric contours. The Vermont Mapping Advisory Committee has agreed to this format for Vermont.

Topographic mapping of Vermont, however, will progress as follows:

1. The cross-hatched area (Figure 1) will be published at 1:24,000 scale with foot contours and in the 7.5 minute format. Maps for this area are currently in various stages of completion under the old 7.5 minute format.

2. All quadrangles covered with the X pattern will be completed in the new 7.5 x 15 minute, 1:25,000, metric contour format.

3. The remaining area which is now covered by 7.5 minute, 1:24,000 scale mapping with foot contours will be scale converted and printed at 1:25,000 scale with foot contours and 7.5 minute format.

   Items 1, 2 and 3 are expected to be completed by the late 1980]s, giving complete coverage of the state at 1:25,000,scale.

4. As funds permit, progress will be made toward complete metric revision and conversion to the new 7.5 x 15 minute format.

Estimated dates of completion for individual quadrangles:

Oct 1980	Barre, Port Henry, Willsboro
Jan 1981	Randolph, Strafford, Mt. Cube
Jul 1982	East Barre
Oct 1983	St. Johnsbury
Dec 1983	Jay Peak, Plainfield, Hardwick, Lyndonville, Bellows Falls, Saxons River, Brattleboro
Jul 1984	Wallingford, Londonderry, Wilmington

Submitted by Charles Ratté

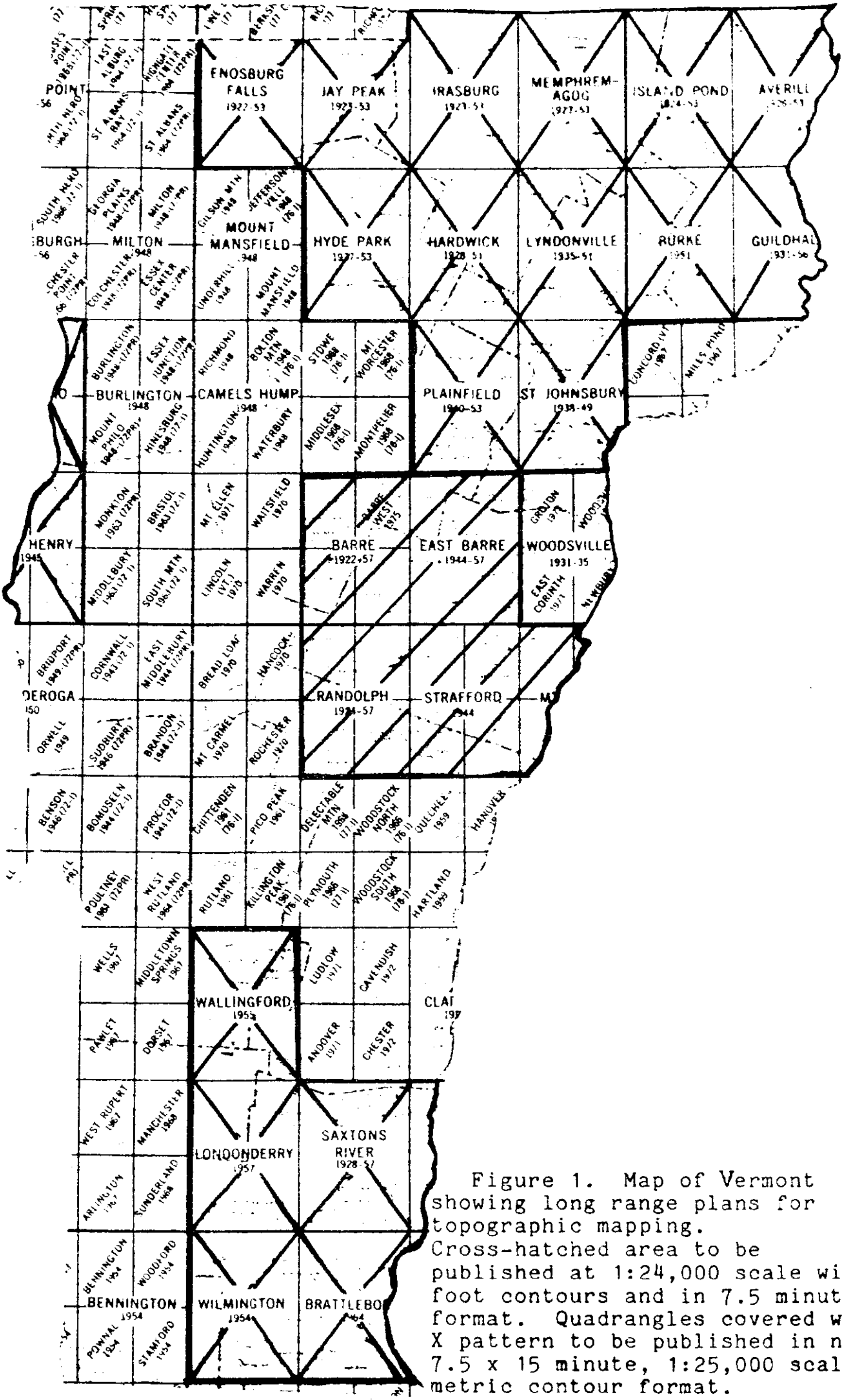


Figure 1. Map of Vermont showing long range plans for topographic mapping. Cross-hatched area to be published at 1:24,000 scale with foot contours and in 7.5 minute format. Quadrangles covered with X pattern to be published in new 7.5 x 15 minute, 1:25,000 scale, metric contour format.

VERMONT GEOLOGY ANNOUNCED

At last, the dream has become reality! On September 17, the layout copy for the first issue of Vermont Geology was delivered to the printer. The final copies are promised in time for the annual meeting. All members who are in good standing (dues paid up for 1980) at this time will receive one free copy. If you come to the fall field trip and/or the annual meeting, you will be able to obtain your copy (and in doing so save the Society some postage!). This first printing is 500 copies, and additional copies may be purchased for $4.00 postpaid. The volume contains 6 papers and consists of 36 pages plus a cover. Later this fall, we will place a small advertisement in Geotimes (probably the December issue). In the meantime, we will have advertising brochures available, and will send them out to a limited mailing list selected from an extensive one kindly provided us by Jack Rand of the Geological Society of Maine. Members are more than welcome to take some of the brochures for non-member friends. Proceeds from the sale of Vermont Geology will bolster our depleted treasury, giving us funds to start work on the second issue.

Jeanne C. Detenbeck

ABSENTEE VOTING

At the annual meeting in 1976, the bylaws were amended to provide for absentee ballots for members unable to attend the annual meeting. In order to encourage participation in the activities of the society, you will find an absentee ballot stapled in the center of this issue. If you absolutely cannot attend the meeting, you are encouraged to return the ballot as directed thereon.

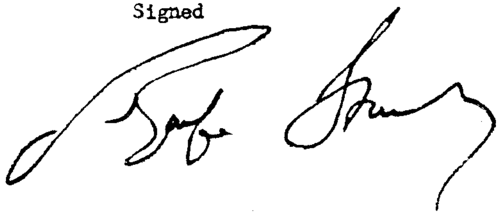
CALL FOR PAPERS

One last formal call for papers for our winter meeting to be held early in February 1981 in Burlington, Vermont. Contact Rolfe Stanley, Geology Department, University of Vermont, if you have a paper to give pertaining to regional geology in western New England and adjacent Quebec, or Lance Meade, PO Box 133, Pittsford, Vermont 05763, if you have a paper on applied geology in Vermont. These papers will be published in the second volume of Vermont Geology.

A SPECIAL NOTE

On behalf of the Society, I would like to take this opportunity to thank Jeanne Detenbeck for a superb job as editor of Vermont Geology. She has worked long and hard putting the first edition together and the results speak for themselves. It goes without saying that her effort has been the difference between success and failure. She has put together a thoughtful, attractive first edition which I am sure we will all take pride in. Let us hope that we will again have her expertise next year. If she agrees to assume these responsibilities, we will have to support her efforts more than we did this year. I do not think that any of us (except Dr. Doll) realized what was involved when we decided to publish our own journal. So from all of us to you, Jeanne, many thanks for a job well done.

Signed



MEETINGS

Oct 4 — VERMONT GEOLOGICAL SOCIETY - FALL FIELD TRIP AND ANNUAL MEETING. See page 3, this issue, for details.

Details of the following meetings were published in the summer issue of the GMG.

Oct 2-4 — Binghamton Geomorphology Symposium on Applied Geomoprhology at Kent State University, Ohio.

Oct 10-12 — New York State Geological Association annual meeting at Rutgers University, Newark, New Jersey.

Oct 11-13 — New England Intercollegiate Geological Conference at Presque Isle, Maine.

REMINDER: Deadline for the Winter 1981 issue of the Green Mountain Geologist is January 19, 1981!

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FIRST CLASS

THE GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

WINTER 1980 VOLUME 6 NUMBERS 3&4

COME TO THE THIRD ANNUAL WINTER MEETING OF

THE VERMONT GEOLOGICAL SOCIETY

16 FEBRUARY, 1980 9:00 A.M.

THE GEOLOGY OF THE LAKE CHAMPLAIN BASIN AND VICINITY

A SYMPOSIUM

CABOT SCIENCE ANNEX

NORWICH UNIVERSITY

COFFEE AND CONVERSATION AT 8:30 A.M.

CONTENTS PAGE

NOTE FROM THE PRESIDENT

This year marks the seventh year of the Society and as such I believe it is appropriate to make a major effort to launch a scholarly publication for the Society. We have talked about this in the past but have not had the collective motivation or appropriate opportunity to publish the first edition. Chuck Ratté has provided the focus - a symposium on the geology of the Lake Champlain basin planned for the Winter meeting of the Society. The papers presented at this meeting will be published by the Society as its first issue of "Contributions to Vermont Geology". With the activity that is going on in the state, we hope that similar issues will be appearing yearly. Whether or not we will maintain the thematic approach in the future will depend on the wishes of the Society. Stewart Clark is helping with the meeting, and if the past experience is any guide, Norwich University will do an outstanding job.

The Executive Committee has been relatively dormant during the fall primarily due to my reluctance to call monthly meetings. The members have still been active and look forward to the winter meeting for a thorough coverage of Society activities. So, if you as a member wish to present something to the Society, please feel free to write me at Perkins Hall, University of Vermont, so that the matter can be discussed in February. We look forward to seeing you there also.

Research activities appear to be increasing in pace, with the Vermont Geological Survey's mapping in the Precambrian, crustal seismic work across southern Vermont by a group out of Cornell University and various industrial activities that I keep hearing about from time to time. Our work at the University continues in Quebec and north central Vermont, and Lake Champlain where Allen Hunt is coming up with some very interesting information on recent faulting. Victor Rahmanian, recently appointed sedimentary petrologist at the University of Vermont, is beginning paleoenvironmental work in western Vermont. The activity at Middlebury College and Norwich University continues at a high pace as do research projects from other schools and universities outside of Vermont. With the publications of the new state maps for Massachusetts and Connecticut in the near future, coupled with active research to our north in Quebec, more and more people are turning to Vermont as a potential area for detailed examination of scientific problems stemming from current plate tectonic interpretations of the northern Appalachians. Perhaps in years to come, we, too, can begin considering a revised edition to the Geological Map of Vermont. It still stands as one of the outstanding state maps in the country.

I look forward to seeing you all at the winter and spring meetings.

Rolfe Stanley

President

V.G.S. WINTER MEETING

DATE: Saturday, February 16, 1980

TIME: 8:30 A.M. Registration and coffee

PLACE: Cabot Science Annex, Norwich University, Northfield, Vt.

Cabot Science Annex is the southernmost brick building at Norwich University. The building is on the west side of Route 12, 0.7 miles south of the Northfield post office. Park adjacent to the building or in the student parking lot to the south. Look for VGS signs and enter the south entrance.

It is recommended that you bring a bag lunch if possible. Coffee and soft drinks will be available. The Norwich University snack bar will be open in the basement of Harmon Hall.

INFORMATION FOR SPEAKERS: One Kodak Carousel projector and one overhead projector will be available for use in Room 45.

PROGRAM

Registration (no fee) Room 48
Coffee and donuts (Compliments of Vermont Marble) 8:30

MORNING SESSION Room 45 Charles Rattê presiding

1. R.M. Fischer: Introduction to the environmental geology of Lake Champlain and shoreland areas 9:00

STRATIGRAPHIC AND TECTONIC GEOLOGY

2. J.G. McHone and E.S. Corneille: Alkalic dikes of the Lake Champlain Valley 9:30
3. R.S. Stanley: Mesozoic and younger faults in western Vermont 10:00
4. S.G Barnett and Y. Isachsen: The application of Lake Champlain water level studies to the investigation of crustal movements 10:30
5. A.S. Hunt: The stratigraphy of unconsolidated sediments of Lake Champlain. 11:00
6. J.W. Ashley: Investigation of several deep buried basins, Milton-Colchester, Vermont 11:30

Panel discussion and questions 12:00

Lunch break: Brown bag lunch in Room 148 . . . . 12:30
(Executive Committee meets)

AFTERNOON SESSION Room 45 Stewart Clark, Jr. presiding

ENVIRONMENTAL AND GLACIAL GEOLOGY

7. C. Heindel: Estimating recharge to the bedrock groundwater environment in a small watershed in the Lake Champlain drainage basin 1:30
8. W.P. Wagner: New techniques for ground water exploration. 2:00
9. F.D. Larsen: Late-glacial and postglacial history of the Randolph, Vermont area. 2:30

Panel discussion and questions 3:00

Business Meeting 3:30

ABSTRACTS

INVESTIGATION OF SEVERAL DEEP BURIED BASINS, MILTON-COLCHESTER, VERMONT

Ashley, James W., Department of Water Resources, Montpelier, Vermont 05602

Pleistocene and recent sediments frequently obscure important bedrock features. Recently drilled water wells are beginning to delineate several buried basins in the West Milton to Mallett's Bay area of Milton and Colchester, Vermont. The largest of these buried basins occupies approximately three square miles while a second smaller connected basin occupies approximately one-half square mile. A substantial portion of the larger basin lies between 200 and 400 feet below sea level, which is 100 or more feet below the current base level controlled by Lake Champlain. The full depth of the larger basin is not known.

A smaller buried basin in Colchester runs from Niquette's Cove on Mallett's Bay north to U.S. Route 2. Depths to bedrock in this basin are near and below sea level.

Well driller's records indicate that 240' thick layer of blue clay separates an upper and a lower aquifer. The water producing zone beneath the clay layer consists principally of interlayered sands and gravels. Above the clay there is approximately 100 feet of medium grained brown sand. It appears that the lower sands and gravels were deposited by the earliest post-glacial melting event while the thick clay and upper sand sequences were deposited into the glacial lake (Lake Vermont).

While it has not been possible to establish with certainty the origin of these over deepend basins, it is possible that they were gouged out by the northwest to southeast movement of the Bennington-Burlington glacial advance. However, topographically high western and northwestern rock rims bordering both basins reduce the likelihood that glacer movement could be responsible for these features. A lineament study and the evidence for fault block displacements generally found in the area (see Stanley, Mesozoic Faults, this conference) suggest that the basin may be due in part to faulting that has continued into the Pleistocene and recent times. It appears unlikely that these basins are a result of normal pre-glacial stream erosion.

THE APPLICATION OF LAKE CHAMPLAIN WATER LEVEL STUDIES TO THE INVESTIGATION OF CRUSTAL MOVEMENTS

Barnett, Stockton, G., Department of Earth Sciences, State University of New York, Plattsburgh, New York 12901 and
Isachsen, Yngvar, New York State Geological Survey, Albany, New York 12230

A releveled line along the eastern flank of the Adirondack Mountains, and another across the central part of the dome suggests that the region is undergoing contemporary uplift, and that the northern end of Lake Champlain is sinking at a rate of 4.0 mm/yr with respect to the southern end (Isachsen, 1975, 1976). Lake Champlain, which lies along the northern three-quarters of the eastern Adirondack line and has long standing lake-level gauges at both ends, provides a perfect "natural level" to further refine interpretations of the region's neotectonics.

This study utilizes mean water levels at two demonstrably stable gauging stations at the southern and northern ends of the 160 km long lake. Apparent vertical movement between these stations (Whitehall, N.Y. at the south, and Rouses Point, N.Y., at the north), was determined by linear regression of the differences between mean lake levels over the 8-month period (April-November) for the time interval 1940-1978. The linear regression slope indicated that the northern end of the lake is rising 0.7 mm/yr with respect to the southern. This movement is opposite to that suggested by the releveling survey.

The apparent disparity between results of the two methods may be reconciled if, recognizing that the releveling profile indicates only relative movement, one uses the lake level data to "calibrate" the releveling profile. Thus, the water level gauging profile may be superimposed on the releveling profile by drawing a line between Whitehall and Rouses Point, with an upward slope of 0.7 mm/yr to the north. The result suggests that in the 18-year interval 1955-1973, the segment from Willsboro northward to Rouses Point remained essentially stationary, whereas that between Whitehall and Willsboro underwent an arching of 2 mm/yr. This uparched area corresponds closely with the breached, more elevated portion of the dome, suggesting that the present doming of the Adirondacks is the continuation of a more prolonged period of neotectonic activity.

INTRODUCTION TO THE ENVIRONMENTAL GEOLOGY OF LAKE CHAMPLAIN AND SHORELAND AREAS

Fischer, R. Montgomery, Lake Champlain Basin Program, New England River Basins Commission, Burlington, Vermont 05401

Lake Champlain, the dominant physical feature of an 8,234 square mile (21,325 square kilometer) drainage basin, lies at the bottom of the broad, open valley between the adirondacks in New York and the Green Mountains in Vermont. The Lake forms the boundary between the two states for 100 miles, and its total length is 120 miles from its southern end near Whitehall (New York) to its outlet near Ash Island (Quebec) where it discharges into the Richelieu River. The area of the Lake is approximately 434 square miles. Tributaries which drain the basin account for 90 percent of the water entering Lake Champlain.

In 1975 it was estimated that 459,000 persons lived in the ten counties which generally correspond to the boundary of the basin. About one half of the total basin population lives in the communities bordering the Lake. The waters of the Lake support many of the needs of these communities. It is used primarily for water supply, wastewater disposal, swimming, boating, and fishing.

Flooding along the shores of the Lake is an international problem. Increased eutrophication, growth of nuisance aquatic plants, runoff from agricultural land, and presence of toxic substances threaten the future water quality of the Lake.

The challenge facing basin residents is to maintain or improve the current quality of the basin environment and at the same time accommodate the demands for continued economic growth within the basin.

ESTIMATING RECHARGE TO THE BEDROCK GROUNDWATER ENVIRONMENT IN A SMALL WATERSHED IN THE LAKE CHAMPLAIN DRAINAGE BASIN

Heindel, Craig, Shelburne, Vermont 05482

Recharge to bedrock groundwater is estimated for a small area by the use of existing soils and surficial geology information and by the application of Darcy's Law. The area studied consists of two adjacent watersheds (35 square miles) in northwestern Vermont (Williston area). The amount of recharge to bedrock groundwater from running or standing surface waters, and from sources outside the watersheds, is determined to be relatively insignificant. The evaluation of bedrock groundwater recharge by percolation through soils is subdivided into a three-step process. Step one assesses the recharge potential of the soil types in the area, using surficial deposits information gathered in the field, and soils information available from the detailed county soil survey (U.S. Soil Conservation Service). Step two determines the areal extent of soils of similar recharge potential by straightforward map measurements. Step three calculates the relative contributions to bedrock groundwater recharge from various portions of the area by the use of Darcy's Law. According to this method thin permeable tills and ice-contact deposits contribute approximately three-quarters of the recharge to bedrock groundwater even though these soils occupy only one-third of the total surface area. The remaining one-quarter of the total recharge is assumed to come primarily from slow percolation through the less permeable soils occupying two-thirds of the area.

THE STRATIGRAPHY OF UNCONSOLIDATED SEDIMENTS OF LAKE CHAMPLAIN

Hunt, Allen S., Geology Department, University of Vermont, Burlington, Vermont 05405

It has long been known that Lake Champlain passed through three stages during its post-glacial history - Lake Vermont, Champlain Sea and Lake Champlain. Recognition and subdivision of these three stages in Lake Champlain sediments has been accomplished using biostratigraphic techniques. The Lake Champlain unit has been found to contain fresh water diatoms and pollen. Five foraminiferal and two ostracod assemblage zones have been recognized in the Champlain Sea unit. The Lake Vermont unit contains a fresh water ostracod assemblage zone at the top (Candona) with scattered evergreen pollen and plant debris lower in the section. The ability to subdivide lake sediments provides a basis for studies of the sedimentological history of the basin including sedimentation rates and lake pollution.

LATE-GLACIAL AND POSTGLACIAL HISTORY OF THE RANDOLPH, VERMONT, AREA

Larsen, Frederick D., Department of Earth Science, Norwich University Northfield, Vermont 05663

In late-glacial time, immediately after retreat of the last continental ice sheet, an elongate, Y-shaped lake occupied the valleys of Ayers Brook and the Third Branch of the White River in the vicinity of Randolph, Vermont. Outwash deltas and ice-contact deltas were built into this lake which had an approximate elevation of 715 feet (217m) at the latitude of Randolph. Lake-bottom deposits are characterized by thin clay layers and thick layers of fine sand with ripple-drift crosslamination that indicates a nearly constant transport direction to the south-southeast. In a 46-foot (14m) vertical exposure of lake-bottom sediments there are 13 varves, the lower eight of which have an average thickness of 4.1 feet (1.25m). It is not clear whether the lake in the Randolph area was an arm of glacial Lake Hitchcock that extended up the White River valley or whether it was a separate lake controlled by a till-protected threshold southeast of Bethel.

When the glacial lake drained the Third Branch cut down through about 50 feet (15.2m) of lake-bottom sediments. Downcutting ceased and the Third Branch began to cut laterally to provide a single floodplain up to 0.6 of a mile (1.0km) wide. That the floodplain was produced by lateral migration of meandering stream is well documented by point-bar deposits exposed at the Randolph sanitary landfill. A second downcutting took place and the Third Branch again eroded down through 50 feet (15.2m) of unconsolidated sediments leaving the former floodplain as a stream terrace. The Third Branch has since cut laterally to produce a modern floodplain 0.25 of a mile (0.4mk) wide. The cause of the two separate episodes of downcutting by the Third Branch probably can be determined by investigation of the lower White River valley but lies beyond the scope of the present study.

ALKALIC DIKES OF THE LAKE CHAMPLAIN VALLEY

McHone, J.G., Star Route, Pittsfield, Vermont 05762
Corneille, E.S., 4 Terrace Street, Randolph, Vermont 05060

Over 300 Early Cretaceous lamprophyre and trachyte dikes have been mapped in the central Lake Champlain Valley of Vermont and New York. Two regional subdivisions are recognized. They are, (1) a smaller swarm of about 60 lamprophyre (mostly monchiquite) dikes in the Plattsburgh - South Hero - Milton area, and (2) a larger swarm of over 200 monchiquite, camptonite, and trachyte (mostly bostonite) dikes in the Willsboro - Shelburne - Charlotte area. The lamprophyre dikes have basanitic compositions and mineralogies which include augite, olivine, kaersutite, phlogopite, andesine, and analcime. The trachyte dikes are composed mainly of anorthoclase, with minor quartz, biotite, and microcline. Most of the dikes trend roughly east-west, but more diverse orientations occur near the syenitic Barber Hill Stock of Charlotte, Vermont.

A new Rb-Sr age for seven trachyte dikes of 125 $\pm$ 5 m.y. enhances a cogenetic model for all the dikes. The Champlain magmas are part of the Monteregian - White Mountain igneous province, and may represent a mafic-felsic pair formed by an immiscible liquid mechanism from mantle-derived basalts.

MESOZOIC AND YOUNGER FAULTS IN WESTERN VERMONT

Stanley, Rolfe, Department of Geology, University of Vermont
Burlington, Vermont 05405

A system of north-trending, linear normal faults 50 kilometers in length, cuts the folded lower Paleozoic sequence of the Champlain plate into horsts and grabens. Displacement is small to moderate. Similar structures may well control the basement configuration of the Lake Champlain region.

The St. George fault, the longest fault in the system, extends through the kaolin mines and goethite-manganite deposits several kilometers south of East Monkton. This fault offsets major folds by as much as 1 kilometer in the eastern part of the Hinesburg synclorinorium, and cuts the western edge of the Hinesburg thrust near St. George and Colchester Pond. Measurements of minor faults associated with the St. George fault slickensides and right lateral offset of stratigraphic units indicate down-to-the-east displacement of 500 meters.

East of Colchester Pond, the Indian Brook fault is also downthrown to the east and may well extend 30 kilometers southward through Essex Junction, Lake Iroquois and to Starksboro.

Four kilometers north of Monkton Ridge, the St. George fault branches to the southwest forming the west-dipping Monkton fault which was originally interpreted by Cady (1945) as a low-angle thrust. Measurements of stratigraphic offset, fracture fabrics, and slickensides on the exposed fault surface indicate 850 meters of displacement. Numerous small cross faults of normal movement and possible strike-slip movement of less than 100 meters cut the north-trending system and probably inhibited subsequent movement.

This regional system of high angle faults developed during early Mesozoic extension since they cut compressional structures of western Vermont and are transected in several places by lamprophyre dikes of presumed Early Cretaceous age. Post-dike faults and fracture systems are well documented in the Burlington area.

NEW TECHNIQUES FOR GROUND WATER EXPLORATION

Wagner, W. Philip, Department of Geology, University of Vermont
Burlington, Vermont 05401

The purpose of this study is to evaluate the use of, first, a proton precession magnetometer for locating fractures in bedrock having a potential for high yield water wells, and second, geophysical bore hole logging (caliper, electric, and gamma ray) of wells to assess their profile characteristics and the possibility for guiding modifications intended to produce higher yields. Approximately three and one-half months of field testing of more than 21 different sites with the magnetometer and 23 individual wells provided extensive data from different geologic, hydrologic, and man-made conditions.

Magnetic surveys in many but not all cases revealed the presence of bedrock fractures by a linear positive magnetic anomaly. These anomalies in some cases correspond with fracture (?)-trace linears on aerial photographs. Commonly, however, the magnetic surveys reveal more linears than are evident on air photos; less commonly some photo linears are not associated with magnetic anomalies. Positive linear magnetic anomalies also were related to dikes, faults, and man-made features, with less certain but possibly important influences by metamorphic foliation. Anomalies were noted in quartzite, schist, gneiss, granite, and other common bedrock terrains, but not in limestone or dolomite areas. The cause or causes of anomalies over fracture (?)-traces is not known. A definite correlation between magnetic anomalies and ground water is found. Different methods for locating water wells by magnetic surveys are evaluated. In general, these methods show definite promise.

The use of bore hole logging surveys appears to have definite potential insofar as caliper and resistivity logs show significant relationships to water bearing fractures; gamma ray logs show no such relationships. However, this study shows that both high and low yield wells may penetrate rock which is heavily fractured. This may indicate that not all fractures are important for conveying and producing ground water. The potential for using logs to characterize the degree of fracturing is good, but not for distinguishing water bearing versus non-water bearing features.

CALL FOR PAPERS-SPRING MEETING

Saturday, April 26, 1980 will be the date for our seventh annual Spring Meeting to be held in Perkins Geology Hall at University of Vermont in Burlington. By tradition, this meeting is devoted to the presentation of student research papers related to Vermont geology. Students (both graduate and undergraduate) who wish to participate should submit abstracts no later than April 7 to:

Dr. Rolfe Stanley
Perkins Geology Hall
University of Vermont
Burlington, Vermont 05405

Abstracts should be limited to 300 words. Fifteen minutes will be allotted for each talk which will be followed by a five minute question period. The Society awards a prize to each of the best undergraduate and graduate student papers.

FOR THE TEACHER

Preliminary plans call for the Fourth Annual Teacher's Workshop to be held late in May in the Northeast Kingdom. Look for more information in the Spring issue of the Green Mountain Geologist.

Copies of the Third Spring Field Trip Guide from the 1979 teacher's workshop (Lake Willoughby and Miller Run valley) are still available. Write to: Ballard or Sandria Ebbett, Lyndon State College, Lyndon, Vt. 05851 and enclose $1.00 to cover copying costs.

Copies of the Second Spring Field Trip Guide (the Champlain thrust , 1978) can be obtained on request from: Second Spring Field Trip Guide, Vermont Geological Society, Box 304, Montpelier, Vt. 05602. There is no charge for members but non-menbers should enclose $1.00 to cover the cost.

FROM THE EDITOR

As chairman of the Communications Committee for five years, James Ashley has faithfully edited and mailed out the Green Mountain Geologist. This quarterly publication has taken on its present form under Jim's guidance, evolving through the years in order to keep members informed about the activities of the V.G.S. and its members. With this issue, the GMG takes on a new editor, but I don't expect that Jim will become less active as a member because he has shown great interest in the Society since it was formed.

The careful reader will have noticed from the masthead that we have missed publishing an issue in the transition between editors. I apologize, and hope that in "trying harder" with the next few issues, all will be forgiven. I will repeat the perennial request of editors. Please be encouraged to submit short articles or suggestions of topics for articles that would keep us all better informed about Vermont geology. The deadline for the Spring issue is April 7, so please send your correspondence to:

Jeanne Detenbeck
Perkins Geology Hall
University of Vermont
Burlington, Vermont 05405

The Spring issue which should be in the mail about April 12, will contain: abstracts of the 1980 student papers, the membership list for 1980 and -- who knows -- maybe your article!

TREASURER'S REPORT

The Vermont Geological Society had a total membership of 85 for 1979. During 1979 we added seven new members. Two membership applications are currently under consideration.

Requests for membership should be directed to:

Stewart Clark
25 Marvin Street
Montpelier, Vt. 05602

or

Membership
Vermont Geological Society
P.O. Box 304
Montpelier, Vt. 05602

The following is the financial condition of the Vermont Geological Society January 1. 1979 through December 31, 1979. A new fiscal calendar was adopted at the fall annual meeting. This report, which covers "new fiscal" 1979, in part overlaps the report given in the Summer 1979 Green Mountain Geologist.

Cash on hand January 1, 1979.		$755.03
Checking	$405.88	
Savings	349.15	
Total	755.03	
Income		800.78
Dues	736.00	
Interest	40.78	
Teacher's workshop	24.00	
Total	800.78	
Expenditures		528.49
Printing	202.79	
Postal service	164.56	
Typing	20.00	
Awards	50.00	
Burlington Gem and Mineral Club	50.00	
Stationery and office	29.34	
Bank charge	11.80	
Total	528.49	
Balance for 1979		+272.29
Income	800.78	
Expenditures	-528.49	
Balance	272.29	
Cash on hand January 31, 1979		1027.32
Checking	659.54	
Savings	367.78	
Total	1027.32	

Submitted by:

Stewart P. Clark, Jr. 1/26/80
TREASURER

MINERAL OF THE QUARTER

GARNIERITE $(Ni,Mg)SiO_3 \cdot nH_2O$

Hardness: 2-3; Specific Gravity: 2.5;
Crystal System: Monoclinic?; Streak: White to pale green;
Fracture: Concoidal to earthy; Luster: Earthy

Garnierite occurs in earthy masses as bright to pale green encrustations, or in glazed pebble-like masses. It is probably formed as a secondary alteration product of nickel-bearing rocks. It occurs in serpentine rocks along with chromite, talc and chlorite. It is often considered a nickel-rich serpentine. Its composition varies widely but it generally contains 4-8% nickel and is therefore a nickel ore where it occurs in economic quantities. Like serpentine, crystals of this mineral are unknown. The green color, massive habit and mineral associations are characteristic of this mineral.

An old nickel prospect in Windham County near Newfane is listed as a source of garnierite in Vermont. The location is reached from Route 30 south of Newfane, turning left onto the road to South Newfane and East Dover. About 8 miles from Route 30 a long outcrop of rocks is visible where this road crosses Adams Brook. Collecting is possible in the road cut and north along the brook. The nickel prospect can be reached by driving 1/2 mile north on a road running parallel to Adams Brook, turning left, driving 1/2 mile further to a gravel pit. By climbing down the steep bank of Adams Brook here, it is possible to reach the ledge that has been worked and a small dump.

The garnierite occurs as apple-green coatings in cracks in the rock. Several varieties of serpentine are also present. Agate, chalcedony and carnelian can also be found here, as well as drusy coatings of quartz crystals over a green base rock which are quite attractive.

Submitted by: Ethel Schuele

FROM THE UNIVERSITIES AND COLLEGES

VICTOR RAHMANIAN joined the faculty at University of Vermont this fall as a visiting assistant professor. Recent recipient of a PhD from Penn State, he brings his experience in sedimentary petrology to the department, teaching new courses in clastics and petroleum geology. He has begun a regional study in the Lower Cambrian Monkton Quartzite of the depositional history and paleodepositional environment and will make a provenance evaluation. This will be accomplished by detailed field studies of outcrops and quantitative study of the petrography of selected samples. Victor is also involved in a regional study of the Upper Devonian in eastern Pennsylvania and western New York State.

During his sabbatical in the fall 1979 semester, DAVE BUCKE initiated a paleoenvironmental analysis of the Dunham Dolomite Formation ("everything you always wanted to know about the Dunham, etc."). He expects to show that the Dunham was deposited in shallow water between supratidal and subtidal environments. Road cuts on Route 2, exposed during construction of the new Lamoille River Bridge in Colchester and Milton, have been the main subject of his outcrop studies but he plans to look at the Dunham regionally and consider time equivalent rocks laterally. This study will complement Victor's work in the adjacent Monkton Quartzite.

Some of ALLEN HUNT's continuing studies of Lake Champlain include determination of sedimentation rates by dating recent sediments from their pollens, examination of suspected faults in the lake and compilation of a map showing bedrock configuration and sediment thickness.

Lake Champlain (in lieu of any lake with better trout fishing) is also the location of JACK DRAKE's aquatic geochemistry studies. He is sampling interstitial waters in lake sediments in order to determine the reaction between sediments and water and identify the geochemical cycles and fluxes.

BARRY DOOLAN is continuing his field work in the northern Vermont-southern Quebec region and is presently supervising three graduate students in studies of bedrock, stratigraphy and structure of the Cambro-Ordovician section. PHIL WINNER has been working on the field relations and chemistry of the ophiolite complex of Chagnon Mountain and JERRY SMITH is beginning a study of the sedimentary and structural history of a series of graywackes west of the serpentine complex at Orford, Quebec.

ROLFE STANLEY spent the spring semester of his 1978-79 sabbatical mapping in the central mountains of Taiwan. This work resulted in three papers being presented before the Geological Society of China, and a written paper can be expected in the future. Rolfe looks forward to returning there next January. Mapping in northern Vermont at 1:10,000 is continuing at a slow but sure pace. The tectonic stratigraphy from previous work appears to characterize much of the section from the Hazen's Notch to the Mooretown.

BREWSTER BALDWIN, on leave from Middlebury College, is spending the spring semester at University of North Carolina at Chapel Hill where he is studying depositional environments and sedimentary structures.

Another member on sabbatical, FRED LARSEN from Norwich University, has been mapping in the Connecticut Valley in Massachusetts and the terrain to the east for the U.S.G.S. and is now helping to compile the surficial map of Massachusetts.

At Lyndon State College, BALLARD EBBETT and his students are studying sedimentary environments in melt water deposits, and mapping surficial deposits in some of the more rugged terrains in great detail. In Simpson Brook, they have picked up two till fabrics which may have resulted from debris flows.

NEWS OF MEMBERS

We missed having DICK WILLEY preside as outgoing president at our Fall Meeting because he had left Vermont in August to follow his job with the U.S.G.S. We hear that he is doing well at the new location in Towson, Maryland.

The big news at the Summer Meeting was the new addition to TERRY and ROGER THOMPSON's family. The new father calmly hosted our picnic even though mother and child were still in the hospital. Peter is thriving and Terry is now back teaching.

CHARLES FOX has retired from his position with the State Highway Department but he is still active as a Director of V.G.S. Charlie is the one who so beautifully letters the names on the membership certificates, and until a year ago he kept a careful eye on our treasury.

VERMONT BIBLIOGRAPHY

From the State Geologist's Office, Diane Vanecek reports that corrections from the reviewers have been made to the Vermont Bibliography. The final typing should be completed by mid-March. Information concerning the availability of copies will be carried in the Spring issue of the Green Mountain Geologist.

In its present form, the bibliography has sheets containing the entries by catagory. The bibliography entries are prepared, however, so that they can be sorted according to subject by computer should extensive use of the publication warrant it.

STATE GEOLOGIST'S REPORT

The first three months of 1979 were devoted almost entirely to the question of Vermont's potential for uranium exploration and eventual mining. Concerns for citizen opposition to uranium exploration on state land and uncertainties regarding the potentially serious environmental, health and safety problems associated with mining and milling of uranium in Vermont were sufficient to convince Governor Snelling to deny private industry the right to explore for uranium in the Okemo State Forest lands. The governor did direct the State Geologist to conduct detailed geologic, mineral and water resources assessments of all state lands so as to allow for future planned management of all resources known to be present on state lands. Legislation is being considered to deal specifically with uranium exploration, mining and milling.

A grant of $80,000.00 has been awarded to Arthur D. Little, Inc. to conduct a comprehensive institutional, economic, and technological analysis of the Vermont slate industry. This project is sponsored by the United States Bureau of Mines under the U.S.B.M.- Vermont Cooperative Program administered through the office of the State Geologist.

The first Water Well Driller's Workshop was organized and sponsored by the State Geologist and the Ground Water Section of the Water Resources Department. This workshop held in February was very successful and is expected to become an annual event. The intent is to provide technical and scientific information to well drillers on Vermont's hydrogeologic environment and to encourage more accurate and complete reporting from the well drillers.

Detailed geologic mapping and mineral resource assessment began in the summer of 1979 at Okemo State Forest in Ludlow, Vermont. Several stratigraphic units have been recognized in the Pre-Cambrian Mt. Holly Complex. Uranium occurrences are spotty. It is associated with graphitic schist interbeds in massive quartzite beds in tourmaline-quartz pegmatite-migmatite.

The office continues to function as a primary source for geologic information providing advice and consultation to government, industry and the private citizen.

The Barre West, Vermont 7 1/2 minute topographic quadrangle was published in April 1979. Other 15 minute quadrangles approved for revision mapping under the U.S.G.S.- Vermont Cooperative program are: Jay Peak, Hyde Park and Memphremagog. No publication dates have been announced.

Submitted by: Charles A. Ratté
State Geologist
Agency of Environmental Conservation
Montpelier, Vermont 05602

MEETINGS

FEB 16 VERMONT GEOLOGICAL SOCIETY Winter Meeting- see the program in this issue.

FEB 23 Water Well Driller's Workshop. This is a second annual event sponsored by the State Geologist's Office and the Ground Water Section of the Department of Water Resources. It will be conducted at Vermont Technical College in Randolph and the public is invited. For additional information contact Charles Rattė at 828-3357.

MAR 13-15 Annual meeting of the Northeastern Section of the Geological Society of America in Philadelphia, Pennsylvania.

MAR 28 Spring meeting of the Geological Society of Maine at Bates College in Lewiston, Maine. They, too, provide a forum for student papers in an afternoon session, and a talk by David W. Folger on Georges Bank follows dinner.

MAY 19-21 Annual meeting of the Geological Association of Canada and the Mineralogical Association of Canada at Dalhousie University in Halifax, Nova Scotia.

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