THE GREEN MOUNTAIN GEOLOGIST

QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

VGS Website: http://www.uvm.org/vtgeologicalsociety/

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The Vermont Geological Society's
Summer Field Trip

Bedrock Control of Surficial Deposits and Groundwater Issues in Part of the Knox Mountain Granite Pluton, Northeastern Vermont

July 31, 2010

TABLE OF CONTENTS

SUMMER FIELD TRIP DESCRIPTION

Saturday, July 31, 2010

TITLE: Bedrock Control of Surficial Deposits and Groundwater Issues in Part of the Knox Mountain Granite Pluton, Northeastern Vermont

LEADERS: Jon Kim and George Springston

TIME AND MEETING PLACE: 9:30 AM, Marshfield Public Offices, 122 School Street, Marshfield, Vermont

DIRECTIONS: From US Route 2 East, make a right onto School Street before Rainbow Sweets bakery, cross over the Winooski River on a small bridge, and make a right into the Marshfield Town Offices parking lot (AKA the Old Schoolhouse Commons). Lunch supplies can be obtained prior to the start of the trip in Plainfield village or here in Marshfield village. We will not be near any stores at noon.

NOTE ABOUT CARS: Please make every effort to carpool once you reach the assembly point as parking is tight at a couple of the sites. If you're driving, be aware that we'll be travelling for several miles on an old rail bed that has some ruts and jutting rocks. Although you do not need a big truck to get through, do not try to drive a really low-clearance car on this route.

ITINERARY: See the 2009 NEGSA abstract that follows this itinerary for an overview of this trip.

Stop 1. Marshfield public water supply well at southeast end of Folsom Road. Discussion of uranium in groundwater issue.

Stop 2. Marshfield Inn & Motel, Route 2.

> *Part A*. Surficial geology overview. From the parking lot we can overlook the Upper Winooski River valley. We'll point out the shoreline elevation of glacial Lake Winooski, fan-terrace deposits marking the former lake bottom elevation, and the meandering course of the parking lot.
>
> *Part B*. Bedrock geology overview and outcrops of biotite–garnet–staurolite phyllites and quartzites of the Gile Mountain Formation. At outcrops in the fields above the Inn.

Stop 3. View of Marshfield Mountain from Bailey Pond Road. Discussion of bedrock structures and their effect on the geometry of surficial deposits. The topography of the Marshfield Pond basin is the result of extensive glacial scour, followed by the deposition of a complex of ribbed moraines composed of sandy till.

Stop 4. Owl's Head Overlook (lunch stop). Discussion of orientations and cross-cutting relationships of aplites and pegmatites, relationship of NW-trending pegmatites to trend of Lake Groton basin. We'll hike about 0.2 miles to the top of the mountain (bring your lunch).

Stop 5. Kettle Pond parking area on west side of Vermont Route 232. This will be a somewhat rugged 0.5-mile hike over rough terrain.

Part A. Ribbed moraine near parking area, on west and east sides of Route 232. This is the most accessible of the complex of moraines in the Stillwater Brook valley. The boulder-studded moraine is composed of sandy till (exposed in an overgrown sand pit on the east side). The overall pattern of moraines and outwash channels in the vicinity suggests that active glacial ice occupied the Kettle Pond basin and the Marshfield Pond basin to the north and that meltwater flowed southeastward down the Stillwater Brook valley toward the Lake Groton basin.

Part B. Lag deposit of granite boulders in a meltwater channel in the bottom of the Stillwater Brook valley. The modern Stillwater Brook flows among moss-covered boulders spread out on a broad, flat-bottomed valley floor. The boulders are interpreted to be a lag deposit left behind after glacial meltwaters winnowed away finer material. The present-day brook is incapable of shaping the terrain it flows through, and thus is left to pick its way around and under the boulders.

Part C. "Leggo" blocks of granite bedrock along Stillwater Brook. The pattern is formed by the intersection of shallowly dipping exfoliation fractures with two vertical fracture sets (commonly NW- and NE-trending). We'll discuss the implications of these outcrop-scale "Leggo" blocks for the origin of map-scale topographic patterns.

Stop 6. Naismith Brook swimming hole along Naismith Brook Road.

Part A. Beginning of contact zone for Knox Mountain granite pluton. Granite dikes that intruded phyllites and quartzites of the Gile Mountain Formation.

Part B. Thick surficial deposits along the granite contact zone. Water well records indicate thick surficial deposits in the Naismith Brook valley, with several exceeding 80 meters. Some of the well records report stratified sand and gravel deposits under thick, sandy till. We may be able to take a look at the till at a stream bank that is a couple hundred feet downstream from Part A.

2009 NEGSA Abstract, Portland, Maine

Kim, J., Springston, G., and Charnock, R., 2009, Bedrock control on surficial deposits and groundwater issues in part of the Knox Mountain Granite Pluton: NE Vermont: Geological Society of America Abstracts with Programs, vol. 41, no. 3.

During the 2008 field season, bedrock and surficial geologic maps were constructed of parts of the towns of Marshfield and Peacham to serve as a basic framework for understanding elevated U levels in groundwater from bedrock wells in this area. The SE 75% of this region is underlain by the M. Devonian Knox Mt. granite pluton that intruded the Late Silurian-Early Devonian metasedimentary rocks of the Gile Mt and Waits River fms. in the NW 25%. The dominant surficial deposits are tills, ranging from dense, fine-sandy silt matrix till in the NW to a variety of looser, sand-matrix tills in the granite portions. During the course of this project, it was apparent

that bedrock structures exerted strong control on the thickness and distribution of surficial deposits. These thick surficial deposits may form localized areas of higher well yields.

We focused on the following associations between bedrock structure and surficial deposit distribution and/or thickness: 1) The paleochannel of Naismith Brook, currently buried by >80 meters of sediments (sandy till at surface with stratified sand and gravel at depth), follows the western intrusive contact of the Knox Mt. granite. 2) Thick (>30m) surficial deposits in the Winooski River valley bottom from Plainfield to Marshfield villages roughly follow the granite contact. 3) Complexes of moraine ridges are found in glacially scoured rock basins down ice (south of) granite hills whose shapes are controlled by major fracture sets. 4) Major E-W trending valleys in the granite parallel to an E-W fracture set. 5) The granite hills deflected ice-flow from about 165° in the metasediments in the NW of the field area to 170-200° in the bottom of the Winooski valley and in the granite.

The bedrock-surficial associations have implications for groundwater quantity and quality issues. The thick surficial deposits in the granite contact zone near Naismith Brook are potential zones of higher well yields due to buried stratified sand and gravel aquifers. With respect to groundwater quality, there are numerous public and domestic bedrock wells with elevated abundances of U in the Knox Mt granite. A collaborative study by Gleason (2007) with the Vt Geological Survey tested 19 additional bedrock wells in the field area and found that 2 of 19 wells had elevated gross alpha (>15 pci/l) and that 3 of 19 had elevated U (>20 ppb).

PRESIDENT'S LETTER

[Unavailable at publication time]

SPRING MEETING MINUTES

The meeting of the Executive Committee followed fourteen student presentations during the Spring Meeting held in Middlebury, Vermont, on April 24, 2010. President George Springston called the meeting to order and a total of six people were in attendance. Before addressing a number of agenda items, long-time VGS Treasurer and Membership Committee Chair Steve Howe announced that he would be stepping down from these posts at the end of the year. The Executive Committee acknowledged and thanked Steve for his long service to the Society (12 years on the Executive Committee). The Committee also discussed the significant workload Steve has assumed for the VGS over the years and the importance of finding a committed person(s) to fill the roles of Treasurer and Membership Committee Chair. The identification of suitable candidates for these positions before the Fall Meeting was agreed to be a top priority.

Treasurer Steve Howe indicated that the financial condition of the Society is sound (see the Treasurer's Report below for details). In his capacity as Membership Committee Chair, Steve indicated we currently have 104 members in the Society (98 individuals and 6 institutions). Steve also indicated that publishing the *Green Mountain Geologist* continues to go well and that printing and postage costs have been greatly reduced by the electronic delivery option adopted by most members.

The major topic of discussion at the meeting centered on whether to impose an annual maximum limit on the amount of funds that are allocated to Student Research Grants. It was emphasized that while the financial condition of the Society is sound, it is not sustainable to allocate more money to Student Research Grants than is taken in through dues and contributions – the Society's primary income sources. The importance of allocating as much money as possible to student research was emphasized and discussions shifted to ways to increase revenue. The Committee discussed and eventually approved an increase in the annual dues to $20/year for individuals and institutions (up from $15), and $25/year for families (up from $20). It was agreed that dues for students would remain the same ($8/year). Additional ideas aimed at increasing revenue (e.g., soliciting corporate/industry donations, producing and selling calendars, etc.) were discussed and several Committee members agreed to explore these various options before the Summer Meeting.

It was noted that the electronic balloting option employed during last year's election was highly successful (over 30 votes were cast, as opposed to the typical fewer than five votes cast in previous "all paper elections"). The Committee agreed to continue with this form of balloting. It was announced that Stephen Wright agreed to continue is his role as the VGS Lecturer for 2010. It was confirmed that Jon Kim and George Springston will be leading this year's Summer Field Trip to the Knox Mountain pluton on one of the last two weekends in July (see the details of this field trip elsewhere in this issue). There was a brief discussion of running a combined Fall Field Trip with the New Hampshire Geological Society and this is currently being explored. Finally, the Committee briefly discussed the possibility of establishing an award for "Outstanding Lifetime Contributions to Vermont Geology." It was agreed that if such an award were established, the award would come in the form of a plaque produced from some prominent "Vermont stone" (e.g., Barre Granite). The meeting was adjourned.

Respectfully submitted,
Dave West, Secretary

TREASURER'S REPORT

The financial condition of the Society continues to be very strong. As of July 11, 2010, the Society's checking account balance was $6,158.60. To my knowledge, there are no outstanding bills, but one student from Middlebury College who received a cash award of $75.00 at the VGS Spring Meeting in April still has not cashed or deposited his check. The Treasurer will continue to attempt to contact this student.

The following members have been approved for membership in the Society since the last report: Kerry Bowen, Brandon, Vermont; Kerrie Garvey, Burlington, Vermont; Leslie Morrissey, Burlington, Vermont; and Chris Stone, Montpelier, Vermont.

The Treasurer gratefully acknowledges the contributions to the Society's Research Grant Program by the following members: Peter Adams, Rick and Gretchen Dunn, David Gross, Peter Ryan, and John Van Hoesen.

Respectfully submitted,
Stephen S. Howe, Treasurer

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

The Vermont Geological Society funded one research grant proposal during the spring of 2010.

Rebecca Derr, an M.S. candidate in the Department of Geology at the University of Vermont, received an award of $622.50 for her proposal entitled "Measuring the Isostatically Tilted Surface of Glacial Lake Winooski, North-Central Vermont."

Respectfully submitted,
Stephen S. Howe *for* Jon Kim, Chair

VERMONT STATE GEOLOGIST'S REPORT

National Science Foundation (NSF) supported Vermont cooperative project presented to the AASG

As Chair of the Association of American State Geologists (AASG) education committee, the Vermont State Geologist led a planning session at the annual AASG meeting in New Brunswick, New Jersey, on June 28, 2010. The AASG plans to rekindle a previously supported NSF intern/mentor program. Several new concepts for an intern program were presented to stimulate the discussion. A University of Vermont–Norwich University–Vermont Geological Survey cooperation formed the core of one of the concepts. UVM and Norwich were successful in obtaining a NSF geophysical equipment grant for classroom instruction and senior projects. Helping the success of the application was the involvement of the Vermont Survey. Class and senior projects will focus on applied problems connected to Vermont Survey projects. The intern option was presented as "Geophysics Support for Survey Projects – a Survey/University Collaboration." The focus for students is work on real-world geology and environmental problems that are inquiry-based while including experiment design, deployment, data collection, and software analysis. The metrics to assess success include: field project reports, pre- and post-project knowledge surveys, and presentations before professionals.

Respectfully submitted,
Laurence R. Becker, State Geologist

ANNOUNCEMENTS

VERMONT GEOLOGICAL SOCIETY LECTURER PROGRAM

The goal of the Vermont Geological Society Lecturer Program is to offer local colleges, universities, and high schools the opportunity to invite a member of the VGS to speak at their institution on timely topics within the broad realm of earth and environmental sciences. The program is primarily intended to reach those departments which either do not hold a regularly scheduled seminar series or whose finances do not permit them to invite external speakers to present talks on a regular basis. Any costs associated with the Lecturer's travel, lodging, and meals are borne entirely by the Vermont Geological Society.

Stephen Wright, Ph.D., Department of Geology, University of Vermont, is our 2010 Lecturer. Stephen is offering the following lecture topic: "Glacial Geology of Northern Vermont: Ice Flow, Water Flow, and Glacial Lake History." For scheduling information, see the Society's website at http://www.uvm.org/vtgeologicalsociety/lecturer_program.html

STUDENT RESEARCH GRANT APPLICATIONS

Students and secondary school teachers are encouraged to apply to the VGS Research Grant Program by October 1, 2010. Downloadable Research Grant Program applications are available from the Society's website at http://www.uvm.org/vtgeologicalsociety/. For those without Internet access, forms may be obtained by writing to Jon Kim at the Vermont Geological Survey, 103 South Main Street, Logue Cottage, Waterbury, VT 05671 or by calling (802) 241-3469.

VERMONT GEOLOGICAL SOCIETY CALENDAR

7/31/10	VGS Summer Field Trip, Knox Mountain Pluton area, Vermont
8/1-6/10	National Speleological Society 2010 Annual Convention, Essex Junction, Vermont
9/24-26/10	NYSGA 82nd Annual Meeting, New Paltz, New York
10/1/10	Student Research Grant Program applications due
10/1-3/10	NEIGC 102nd Annual Meeting, Orono, Maine
10/10-16/10	Earth Science Week, various locations in Vermont
10/31-11/3/10	GSA Annual Meeting and Exposition, Denver, Colorado

Vermont Geological Society
P.O. Box 1224
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ADDRESS CHANGE?
Please send it to the Treasurer at the above address

Vermont Geological Society
Summer Field Trip
July 31, 2010, 9:30 AM

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