QUARTERLY NEWSLETTER OF THE VERMONT GEOLOGICAL SOCIETY

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

SUMMER-FALL 2016	VOLUME 43	NUMBER 3 & 4

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PRESIDENT"S LETTER

Chris Koteas and Chris Eddy of Norwich University led the Vermont Geological Society fall field trip on Saturday October 22nd entitled "Structural variability along and across the Taconic-Acadian margin in central Vermont". The trip focused on the Acadian (Devonian) deformational events and structures that overprinted the Richardson Memorial Contact (RMC) and surrounding rocks. The RMC is the presumed unconformity between Pre-Silurian and Siluro-Devonian rocks that runs the length of Vermont. For the detailed trip description, see the following section. Chris Koteas and his students are doing detailed field mapping and intensive microstructural and petrological work to unravel the architecture of this complex lithotectonic zone. Twenty VGS members attended the trip on a cool drizzling fall day. We are currently looking for field trip leaders for next summer and fall.

Field trip introduction in Hardwick. Leaders Chris Koteas (red coat) and Chris Eddy (green coat and blue cap) in left-center.

Chris Koteas describes Acadian fold sets in thick sandy marbles of the Waits River Formation

S1 foliation plane with two intersection lineations.

Group photo at the end of the day. Chris Koteas (C1) and Chris Eddy (C2).

Undeformed granite body (lower right (G)) that intruded mylonitic rocks (M) near the RMC/ Dog River Fault Zone.

Marjie Gale (left) and Larry Becker (right), current and retired Vermont State Geologists.

Structural variability along and across the Taconic-Acadian margin in central Vermont

The Taconic-Acadian interface, often considered the Richardson Memorial Contact (RMC) has long been described as being defined as an unconformable surface (i.e. Richardson, 1919). However, this interface has also been described as preserving evidence for faulting and has been called the Dog River Fault Zone in Northfield, VT (Westerman, 1994) and Montpelier, VT (Walsh et al., 2010). Work north of Montpelier, between Woodbury and Craftsbury, has recognized an anastomosing set of upper-greenschist to lower-amphibolite grade shear zones. These zones are sub-parallel with the RMC, but appear to operate independently and are hypothetically a continuation of the Dog River Fault Zone along-strike to the south. Field studies as well as microstructural and microgeochemical work on high-strain rocks associated with these shear zones, suggest subtle localized rheological changes that manifest as marked changes in kinematic conditions. Integrating shear strain measurements from individual strands of this distributed high-strain zone suggests minimum displacement of 25.5 +/- 0.5 km. A broad set of high-strain zones suggests that significant shortening normal to the RMC, as well as extensive elongation of minerals parallel to this interface, occurred relatively late in Acadian orogenisis.
A geochemical comparison of plutonic rocks and their contact margins, from both the east and west sides of the RMC, show rather significant changes in terms of Rare Earth Element patterns as well as igneous microtextures. Outcrop-scale structural features suggest considerably different intrusive mechanisms across the RMC. However, the lack of strain present in igneous rocks indicates late syn- or post-tectonic Acadian emplacement. This suggests unique structural controls associated with the RMC influenced the magma mobility from east-to-west and the potential for rather different crustal levels

preserved across this margin. This work highlights the complexity of this enigmatic boundary in central Vermont and this trip will focus on a selection of reasonably accessible locations to illustrate strain variability in what is interpreted here as a distributed shear zone cross-cutting the Taconic-Acadian margin as well as the differences in intrusive styles of granitoids across the RMC.
Trip Date/ Time: Saturday October 22nd at 8:30am
Meeting Location: public parking area behind the Village Restaurant in Hardwick, VT at the junction of VT Rt. 14 and VT Rt. 15
Authors: Christopher Koteas, Christopher Eddy, Kirstin Lortie, Adele Del Avellano, and Christopher DeFelice

Respectfully submitted,
Jon Kim, President

TREASURER'S REPORT

Finances: Active members continue to support The Society with both dues and contributions to our Research Grant Program. Nearly all members have paid their 2016 dues, but a few stragglers will be granted another brief extension. Anticipated immediate expenses in the near future include costs associated with an upcoming Executive Committee meeting and another round of student research grants.

Expenses:

$93.49	GMG Expenses
$400.00	Spring VGS Meeting Expenses
$300.00	First Prize, Best Paper and Charles Doll Award Winner: William Burke, Middlebury College
$200.00	Second Prize, Best Paper, Jennifer Bower, UVM
$100.00	Third Prize, Best Paper, Stephan Koenigsberger, Middlebury College

Income:

$68.00	Dues for 4 new members

Balance: Our current balance as of October 31, 2016 is $10,741

New Members:

Jeffery A. Nelson, Director, Energy & Environmental Service, Vanesse Hangen Brustlin INC, So Burlington, VT
Ethan Thomas, AOT Geologist, VT Agency of Transportation, Berlin, VT
Cheyne L. Aiken, UVM Graduate Student, Burlington, VT
Edwin A. Romanowicz, Director, Center for Earth and Environmental Science, SUNY Plattsburgh, Plattsburgh, NY

Respectfully submitted,
David S. Westerman, Treasurer

ADVANCEMENT OF SCIENCE COMMITTEE REPORT

The following applications were submitted to the Vermont Geological Society Research Grant Program by the October deadline:

Name: Tucker Meredith
Status: Middlebury College undergraduate student
Title: Geochemical analysis and origin of uranium in groundwater wells in the Clarendon Springs Formation, Colchester, Vermont
Amount Requested: $1050.00

Name: Evan Tam
Status: University of Vermont Master's student
Title: Role of the Prospect Rock Fault in the Exhumation of High Pressure rocks in Northg-Central Vermont
Amount Requested: $676.00

Name: Cheyne Aiken
Status: University of Vermont Master's student
Title: Exhumation of the Tillotson Peak Complex in Northern Vermont
Amount Requested: $676.00

STATE GEOLOGIST'S REPORT

The key issues addressed this summer and fall by the Geological Survey were related to health and to chemical and physical hazards. Jon Kim is investigating the contamination of groundwater by perflorooctanoic acid (PFOA) in fractured bedrock in Bennington County. Jon assembled the expertise of the informal groundwater consortium (Middlebury, UVM, SUNY Plattsburgh) and expanded the group to include Tim Schroeder of Bennington College, Dave DeSimone of DeSimone Geoscience, USGS, Union College and EPA. The investigations being conducted by this group highlight the importance of geoscience and the full scope of expertise that geoscientists bring to issues and to public service. Jon has done an outstanding job coordinating the project with our external partners and internally with the Waste Management Division. The Survey would also like to acknowledge the following people who are contributing to the aquifer characterization work and building the knowledge base related to this chemical and its behavior in the environment:

- Dr. Pete Ryan of Middlebury College and Emmet Norris (student) are working with Jon on geochemical "fingerprinting" of groundwater and on descriptions and logging of cores which will aid in the 3D interpretation and groundwater flow;
- Dr. Ed Romanowitz of SUNY Plattsburgh is leading the effort for geophysical well logging;
- Will Buchanan, a Bennington College student, correlated GPS location data with well tag numbers in order to connect to the water well driller database and obtain sub-surface information;

- Dr. Laura McManus-Spencer of Union College (Schenectady, NY) whose research will address the fate and transport of PFOA in the subsurface;
- Connor Remington (UVM student) who is conducting a fracture analysis plus geophysical well logging to help identify groundwater flow paths and recharge domains;
- Dr. Dave DeSimone of DeSimone Geoscience Investigations who is under contract to complete surficial geologic maps of the ~40 square kilometer PFOA contamination area; and
- USGS scientists Jamie Shanley, Tom Mack and Joe Ayotte who sampled 8 water wells and are analyzing data from multiple age tracers in groundwater in order to understand groundwater flow systems and PFOA.

If you'd like to learn more about the project, listen to Jon's Sept. 13th VPR interview or watch his interview on Fox 23 News, Albany, NY. He discussed aquifer characterization associated with the Bennington project in general and also the specifics of the well logging. Ed Romanowicz from the State University of New York at Plattsburgh was there to operate his geophysical logging equipment. The three-minute feature ran on the 5:30 and 6:30 news on 10/12/2016:
http://news10.com/2016/10/12/vermont-dec-geologists-work-to-build-3d-map-for-pfoa-contamination/

New Geologist at the Survey

On October 31 we welcomed Colin Dowey to the VGS as a temporary employee through June. Colin earned a MS in Earth Science from the University of Maine and a BS from Bates College. He has experience in 10Be age dating, glacial geology, surficial mapping, GIS and Adobe products. He'll be doing a variety of tasks for us and can be reached at colin.dowey@vermont.gov.

Association of American State Geologists (AASG) 108th Annual Meeting.

AASG held its 108th annual meeting in June in Girdwood, Alaska. The meeting was attended by State Geologists from 35 states plus representatives from the NOAA, National Park Service, US Ocean Energy Management (BOEM), American Geoscience Institute (AGI), IRIS, National Academies of Science, Engineering and Medicine (BESR), and other agencies. Formal sessions included resource development, environment-related hazards, ground collapse, energy, mapping, remote sensing, water, and geoscience in government plus spectacular field trips through Turnagain Arm and down the Kenai Peninsula to Homer.

Hazards

This fall we released a landslide hazard susceptibility map for the Town of Highgate and all of Addison County (see publications below). The county map is based on an analysis of Lidar plus some on the ground reconnaissance work. We plan to complete maps in areas where Lidar is available and work our way through the State by county. We also continued to monitor the landslide in Jeffersonville through a contract with Johnson State College.

John Lens of the UVM School of Engineering, in partnership with us, launched a service learning project to conduct a detailed seismic hazard review and recommend mitigation for the Health Department building on Cherry St. in Burlington.

The Drought Task Force has been reviewing information and data related to drought conditions in Vermont. The Agency of Natural Resources recently posted the drought reporter web site where homeowners can report water well issues: https://anrmaps.vermont.gov/websites/droughtreporter/

STATEMAP

The annual STATEMAP Advisory Committee (SMAC) meeting was held in September at ANR with 18 SMAC members in attendance. The SMAC recommended that we apply to USGS for STATEMAP funds for surficial mapping in Bolton, Barre East, and Proctor and to transfer and edit existing surficial maps on a Lidar base map and begin compilation of surficial data.

In 2016, maps were completed for the Cabot quadrangle and the Town of Monkton. Mapping in Cabot was conducted by George Springston (Norwich University), with volunteer assistance and in-kind match from Devlin Rutherford, Gary Gulka and Peter Gale. Mapping in Monkton was conducted by John Van Hoesen and students (Green Mountain College) with assistance and in-kind match provided by Steve Pilcher and WendySue Harper of Monkton. The maps and databases provided information that was subsequently applied to issues of water supply, radioactivity in groundwater, and earth resources. Mapping is in-progress by George Springston in the Joes Pond Quadrangle and Stephen Wright in the town of Weathersfield.

New Publications

Our Norwich University and Green Mountain College partners made considerable contributions to the geologic knowledge of Vermont. Links to recently published surficial maps, groundwater resource maps, and landslide hazard maps are on our web site in the "What's New" section at http://dec.vermont.gov/geological-survey/news and are listed below:

Springston, G., Kim, J., Gale. M. and Thomas, E., 2016, Geology and hydrogeology of the Town of Calais, Vermont: VGS Open File report VG2016-1, 8 color plates, scale 1:24,000.

Springston, George, 2016, Surficial geology and hydrogeology of the Cabot 7 1/2 minute quadrangle, Vermont: Vermont Geological Survey Open File Report VG2016-3, text plus 9 plates and GIS data.

Springston, G., 2016, Final report on a landslide inventory of the Town of Highgate, Vermont: Vermont Geological Survey Open File Report VG2016-4, text plus 6 plates, scale 24,000.

Van Hoesen and others, 2016, Final Report summarizing the efficacy of GIS-based modeling of landslide susceptibility, Addison County, Vermont: Vermont Geological Survey Technical Report VGTR2016-1.

VanHoesen, John, 2016, Surficial geology and hydrogeology of Monkton, Vermont: Vermont Geological Survey Open File Report VG2016-2, text plus 11 plates and GIS data.

Respectfully Submitted,
Marjorie Gale, State Geologist

CALENDAR

Dinosaur Revolution at the Montshire Museum
Dates: Sept 24, 2016 - Jan 2, 2017
Information: Special exhibition/maze at the museum in Norwich, VT

2017 Northeast and North-Central Sections Geological Society of America Annual Meeting
Date: March 19-21, 2017
Location: Pittsburgh, PA

2017 GSA Annual Meeting
Date: 22–25 October
Location: Seattle, Washington, USA

2018 Northeast Geological Society of America Annual Meeting
Date: March 18-20, 2018
Location: Burlington, VT

2018 Resources for Future Generations - Energy, Minerals, Water, Earth
Date: June 17-21, 2018
Location: Vancouver, Canada
Host: International Union of Geological Sciences, Geological Association of Canada, Mineralogical Assoc. of Canada, Canadian Institute of Mining, Metallurgy and Petroleum, and Canadian Federation of Earth Sciences

The **Vermont Geological Society** is a non-profit educational corporation.
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Please send it to the Treasurer at the above address