THE MAINE GEOLOGIST

THE NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MAINE

SEPTEMBER 1978

VOL. 5 NO. 1

NOTICE OF FALL MEETING

DATE - FRIDAY, NOVEMBER 10, 1978

PLACE - New Geology Dept. Quarters
Colby College, Waterville

SCHEDULE - 3:00 - 5:30: Business Meeting and Short Notes on geologic projects, thoughts, problems, findings, etc.

5:30 - 7:00: Evening meal at Colby

7:00 Onward: SPECIAL PRESENTATION:

RADON IN MAINE GROUNDWATER, by Prof. Stephen A. Norton, U-Maine, Orono.

ANNUAL MEETING 1978

In accordance with a notice published in the June Newsletter, the Annual Meeting of the Society was convened on the evening of July 28, 1978, in the lounge of Hastings Hall, University of Southern Maine, Gorham Campus, with about two dozen members in attendance.

It having been determined by Bill Rideout that a quorum was present, the following articles of business were dealt with:

1. By-Laws: The revised By-Laws, dated May 15, 1978, as transmitted to the Membership with the June Newsletter, were proposed for adoption by D. Koons, seconded by R. S. Jones, and adopted unani mously by a hand vote.

2. Atlantic Geoscience Society: In response to a letter dated April 6, 1978, from Howard V. Donohoe, Jr., relative to developing closer communication between geologists in Atlantic Canada and Maine (refer to June Newsletter), a committee consisting of W. A. Anderson, W. H. Forbes, A. M. Hussey II and D. S. Westerman was requested to coordinate with GSM Secretary A. M. Berry, Jr. to prepare a response to Dr. Donohoe's letter. In the matter of Dr. Donohoe's suggestion for a joint meeting of the Societies in 1980, the Committee indicated that such a meeting might fit in well with present (tentative) planning for a major conference in the Spring of 1980 in Bangor.

On closer routine communication between the two Societies, it was suggested that we might get started by exchanging Newsletters, and by trying to arrange it so that representatives of each Society might attend the other's meetings.

3. Treasurer's Report: J. R. Rand presented the details of Society receipts and expenditures for the Society year to July 28, 1978. The final financial results for the full 1977-78 fiscal year are published separately elsewhere in this edition of the Newsletter.

4. Meetings Committee: A Committee was appointed to arrange for the programs of the 1978-79 Fall, Winter and Mid-Summer Society meetings, comprised of Donaldson Koons, Bruce Bouley and Dave Westerman. Don Koons will handle the Fall meeting at the new Geology Department facilities at Colby. The Winter and Mid-Summer meetings remain to be organized.

5. BULLETIN Committee: Art Hussey reported that the up-coming First Edition of the Society's BULLETIN is still in the review process, delayed somewhat by the summer field season. There will be 9 technical papers, to make up a publication of about 80 pages. Outside review has been completed for some of the 9 papers, and should be finished for all after the start of the Fall academic term. The first BULLETIN may be ready, then, for release toward the end of 1978.

6. Election of Officers: Upon appropriate nominations and seconds, the following Officers and Director were elected for the 1978-79 GSM year:

President	David S. Westerman
Vice-President	Bruce A. Bouley
Secretary	Archie W. Berry, Jr.
Treasurer	John R. Rand
Director-1981	Robert G. Gerber

In addition, J. R. Rand was re-appointed as Editor of the Newsletter, and W. Bradford Caswell was appointed Assistant Editor.

TRIGOM REQUEST

We have received a request from Richard Harvey of The Research Institute of the Gulf of Maine (TRIGOM) to run the following notice:

NATURAL RESOURCES AND ENVIRONMENTAL INFORMATION

TRIGOM is currently identifying and describing data files held by Maine researchers, naturalists and others which bear on the natural environment (geology, soils, biological features, the atmosphere, water resources, et cetera). If you collect and hold such information, we would be interested in talking to you. If you already have been contacted by interviewers on our ENDEX Program from the Fall of 1975 on, your information is included. TRIGOM, 21 Vocational Drive, South Portland, Maine 04106; 207-799-6234.

Mineral Resources Association

The development of a mineral group in Maine (now called the Maine Mineral Resources Association) has continued after being initiated by Herb Babitzke in December, 1977. Preliminary bylaws have been drawn up to express the status of the group at present and to define the direction in which it is heading. The principal change from the initial thought has been to decide that for the present the group will not affiliate with the Society of Mining Engineers of AIMS, but will be an autonomous group.

The present officers are: John S. Cummings, Chairman; Bruce A. Bouley, Treasurer; and Terry C. Williamson, Secretary. There are also at present two committees: 1. Steering Committee, with John Cummings, Terry Williamson, Bruce Bouley, Larry Wing, Bob Holliday, Ed Lyden, Bob Doyle, Charles Heinonen, Tom Flannigan & Barkley Wyckoff; and 2. Program committee for the next meeting, with Bob Holliday, Terry Williamson & Bruce Bouley.

The Program Committee has been charged with arranging the next meeting, hopefully to include a field trip, dinner and business meeting. The agenda for the fall business meeting will include adoption of preliminary bylaws; signing up of members & collection of dues; and appointment of committees to further the development of the group.

Briefly to summarize the goals of the new association, they are to develop communication among those interested in the exploration, extraction and processing of mineral resources; to provide information to the public from those who are closely asociated with exploration, extraction and processing of minerals; and to provide a forum for discussion and group expression concerning any matter related to mineral resources. In addition to providing communication among members and mutual assistance on technology, job opportunities, and personal growth, the association desires also to provide public educational information on the critical manner in which mineral resources affect everyone's daily life, and the manner in which Maine mineral resources specifically relate to the well-being of the people of Maine.

All those interested in the new group, for which annual dues are proposed at $5, should contact Terry Williamson directly, c/o J.S. Cummings, Inc., 51 Broadway, Bangor 04401. (JRR)

RADON ^{222}

To advise you generally as to the subject of Steve Norton's presentation scheduled for the Fall GSM meeting at Colby, and further to give you a suggestion as to the significance of his work, the following abstract is reprinted from Geological Society of America, Abstracts with Programs, Vol. 10, No. 2, p. 78, 1978:

GEOLOGIC CONTROLS ON NATURAL LEVELS OF Rn^{222} IN GROUNDWATER IN MAINE.

NORTON, Stephen A., Department of Geological Sciences, University of Maine, Orono, Maine 04473; BRUTSAERT, William F., Department of Civil Engineering, University of Maine, Orono, Maine 04473; HESS, Charles T., Physics Department, University of Maine, Orono, Maine 04473; and CASPARIUS, Robert E., Physics Department, University of Maine, Orono, Maine 04473.

Using inexpensive radon measurement techniques employing liquid scintillation counting (Pritchard and Gesell, 1977), we have measured radon (Rn222) levels in water from approximately 160 sites in York, Aroostook, Penobscot, Oxford, Cumberland, Waldo, Lincoln, and Hancock counties, Maine. Sites have been characterized according to bedrock lithology, type of surficial materials, depth of surficial materials, depth and type of wells, and chemistry of groundwater. Rn222 levels range from 100 to 150,000 pico-Curies per liter (pCi/1). Lithology of bedrock and type of well exert the strongest influence over Rn222 levels. For drilled wells in bedrock, metasedimentary rocks yield relatively low (500-5000 pCi/1) Rn222 levels whereas Devonian granites yield up to 150,000 pCi/1. No simple relationship exists between depth of drilled wells and Rn222 levels. A weak relationship suggests decreasing Rn222 levels with increasing well depth in the same geologic formation. Dug wells, springs, and surface waters have 1 to 2 orders of magnitude less Rn222 than drilled wells underlain by the same lithology. Residence time of ground water in granites as indicated by water chemistry suggests a direct relationship between Rn222 content and age of the groundwater. Essentially all samples from drilled and dug wells and from all lithologies had Rn222 levels in excess of recommended limits (500 pCi/1 Rn222; Environmental Protection Agency, 1974) for potable water.

THE PEOPLE'S CORNER

This is a public corner in the Newsletter to be devoted to observations, questions, answers and ideas. I would like members to contribute words, maps, sketches, important locations, cartoons or anything involving their current work, thoughts or hopes. An effort will be made to answer all questions, and there is no standard format to hold to.

My first 2¢ worth in this corner is to make some statements based on 5 weeks of field mapping conducted this past summer (1978) along the U.S.-Canadian border west of Jackman, Maine. This work was supported by the Maine Geological Survey and the U.S. Nuclear Regulatory Commission.

D. S. Westerman, Pres., GSM
University of Southern Maine

THE NORTHERN BOUNDARY FAULT

The Northern Boundary Fault of the Boundary Mountain Anticlinorium appears on the 1967 Preliminary Geologic Map of Maine as a northeasterly-trending solid line extending a distance of 20 miles and separating very early Paleozoic rocks from rocks of Devonian age. This contact extends to the WSW where it has been mapped by Canadian geologists. Many of the very early Paleozoic rocks are now thought to be of pre-Cambrian age (Naylor et al, 1973), as was previously proposed by Boucot (1961). The boundary between these 2 blocks of widely disparate ages has been suggested to be a SW-dipping thrust fault (Rodgers, 1970); a NW-dipping thrust fault (Albee & Boudette, 1972). St. Julien and Hubert (1975) indicate in cross-section the presence of 14 steeply dipping normal faults in the Eastern Townships NW of the Boundary Mountain Anticlinorium, presumedly trending parallel to that structure.

The map pattern of the 10-mile section which I mapped reveals straight-line segments of the contact between the very old rocks on the SE side and Devonian rocks to the NW. Angular changes in orientation of these segments appear to be produced by minor cross faulting, usually in conjugate pairs at steep angles to the main contact.

The boundary fault is characterized by 1), the absence of a wide fine-grained mylonitized zone in the straight segments of the contact; 2), an abundance of quartz-filled fractures roughly parallel to and on both sides of the main contact; 3), very well developed and closely-spaced fractures which dip steeply NW, with mineral lineations indicating normal down-dip movement in the older rocks; and 4), the presence of younger rocks on the NW side of the contact. These characteristics suggest the presence of a high-angle, post-Devonian normal fault on which thousands of feet of rock were downdropped to the NW. In places, elongate slivers, sometimes brecciated and containing Silurian limestone, Devonian slate, Ordovician granite and pre-Cambrian(?) gneiss, are located within the fault zone.

If the boundary fault is a normal fault, this would imply that it formed as a result of tension, either due to lateral spreading (SE-NW), or perhaps more likely, due to isostatic adjustment in the earth's crust. The Boundary Mountain Anticlinorium may be a thick sliver of continental crust which has risen because its basement is less dense than the basement underlying Paleozoic cover on both sides of the structure. Determining the true nature of the Northern Boundary Fault is critical in the task of generating and evaluating models of New England geology, which has direct importance to the Maine mineral industry sector in their efforts to locate economically valuable ore deposits.

The details and maps of this work will be on open file at the Maine Geological Survey, Augusta, and anyone interested in investigating this problem is welcome to those data. (DSW)

Albee, A.L. and Boudette, E.L. (1972), Geology of the Attean Quadrangle, Somerset County, Maine: U.S. Geological Survey Bulletin 1297, 110 p.

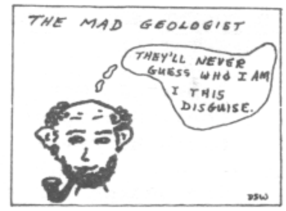
Boone, G.M., Boudette, E.L. and Moench, R.H. (1970), Bedrock Geology of the Rangely LakesDead River Basin Region, Western Maine, p.1-24: in Boone, G.M.,ed., Guidebook for Field Trips in Western Maine: 62nd N.E.I.G.C., p. C1-C21.

Boucot, A.J. (1961), Stratigraphy of the Moose River Synclinorium, Maine: U.S. Geolological Survey Bulletin 1111-E, p. 153-188.

Naylor, R.S., Boone, G.M., Boudette, E.L., Ashendon, D.D. and Robinson, P. (1973), Pre-Ordovician Rocks in the Bronson Hill and Boundary Mountain Anticlinoria, New England, U.S.A.: Trans. Amer. Geophys. Union, Vo1.50 (4), 495.

Rodgers, J. (1970), The Tectonics of the Appalachians: Wiley Interscience, New York, 271 p.

Editor's Note: We had space problems here. Please see PAGE 5 for a view of Westy's Northern Boundary Fault map.



LEWISTON-PITTSFIELD FAULT(?) ZONE

(Your Editor's 2¢, worth)

It might be useful to those who like not only to contemplate regional tectonic history but also to go to the field to gather facts, to suggest that an apparent major fault zone in central Maine deserves a closer look. The zone trends NE between Lewiston and Pittsfield, and may continue for substantial distances in the region SW and NE.

Although specific faults do not seem to have been mapped in the zone, several lines of evidence point to its presence and regional importance. SE-trending metamorphic isograds (Warner et al, 1967) are sharply turned to the SW between Ripley and Winthrop. Isograd anomalies SW of the Sebago pluton suggest the continuation of the zone from Windham past Springvale into New Hampshire. Bouguer gravity patterns (Kane & Bromery, 1966) show a "ramp" along the zone, and further suggest its continuation NE from Corinna past Lincoln. At the GSM Annual Meeting in 1975, Kane suggested that this anomaly might reflect a contact of basement rocks in a zone of early Atlantic closing (MAINE GEOLOGIST, Vol. 2, No. 1).

Last spring, Dallmeyer and VanBreeman (1978) reported deformed radiometric "chrontour" lines across the zone between Lewiston-Pittsfield, and interpreted this anomaly to reflect a record of Late Paleozoic or Early Mesozoic strain along the zone. Isolated exposures of NE-trending diabase dikes occur along what may be the NE projection of the zone in Dexter, Atkinson and from Macwahoc to S. Bancroft; and on across New Brunswick to the Shippigan Peninsula where the dike is dated at 167 and 180 m.y., and interpreted to reflect tensile forces related to initial rifting of the last Atlantic (Burke et al, 1973). Historical Earthquake activity, including 2 Intensity VI(MM) events, is closely associated with the zone in central Maine, between New Gloucester and Fairfield (THE MAINE GEOLOGIST, Vo1.3, No.3, 1977).

An intriguing suggestion is offered by Aleinikoff & Zartman (1978) that "Silurian-Devonian" rocks of the Merrimack Group in New Hampshire (SE of the zone's SW geometric projection) "are probably no younger than Ordovician and possibly are Precambrian". Merrimack Group rocks in Maine include the Berwick and Vassalboro Formations, to the SE of this apparent major crustal break. (JRR)

Aleinikoff, J.N. and R.E. Zartman (1978) GSA, *Abstracts with Programs*, V.10, No.7, p.357-358.
Burke, K.B.S., J.B. Hamilton and V.K. Gupta (1973) Can. J. Earth Sci., V.10, p.1760-1768.
Dallmeyer, D.R. and O. VanBreeman (1978) GSA, *Abstracts with Programs*, V.10, No.2, p.38.

Kane, M.F. and R.W. Bromery (1966) USGS Map GP-580

Warner, J., R.G. Doyle and A.M. Hussey II (1967) Prelim.Geol.Map of Maine, Me. Geological Survey.

THE GROUND WATER REGIME OF MAINE'S FINE-GRAINED LODGMENT TILLS

By Robert G. Gerber
Cons. Geologist & Civil Engineer
South Harpswell, Maine 04079

The search for sanitary landfill sites in Maine has often concentrated in areas where glacial tills are found. Gravel pits containing sand and gravel ice contact deposits were found to have rapid permeabilities and little adsorption capacity, thus allowing landfill leachates to pass too freely through the soil in the gravel pits, endangering ground water quality. The tills, on the other hand, contain silt and clay which provide adsorption media and create much lower permeability rates. There are differences among the tills, however, that should be recognized.

The percentage of fines (that portion of the soil fraction that is in the silt- and clay-size range) is usually a function of the parent rock material from which the till was created. Granitic rocks produce relatively coarse-grained tills; schists, pelites and volcanics produce relatively fine-grained tills. The tills of small glacial readvances may also be fine-grained if they are partly composed of overridden glaciomarine or lacustrine sediments.

Extensive testing was conducted on tills over a 1000-acre land parcel in the Searsport area. The bedrock that predominantly influenced the till composition was the Penobscot Formation, a chlorite-grade phyllite of presumed Ordovician age. The primary till - interpreted to be the main lodgment till of Late Wisconsinan Laurentide glaciation - became saturated within 0 to 10 feet of ground surface, has a water content of 8 to 12%, void ratio of 0.25 to 0.30, dry unit weight of 130 to 135 pounds per cubic foot, Liquid Limit of 25%, Plasticity Index of 10%, and percentage passing #200 sieve (silt and clay) of 45 to 55%.

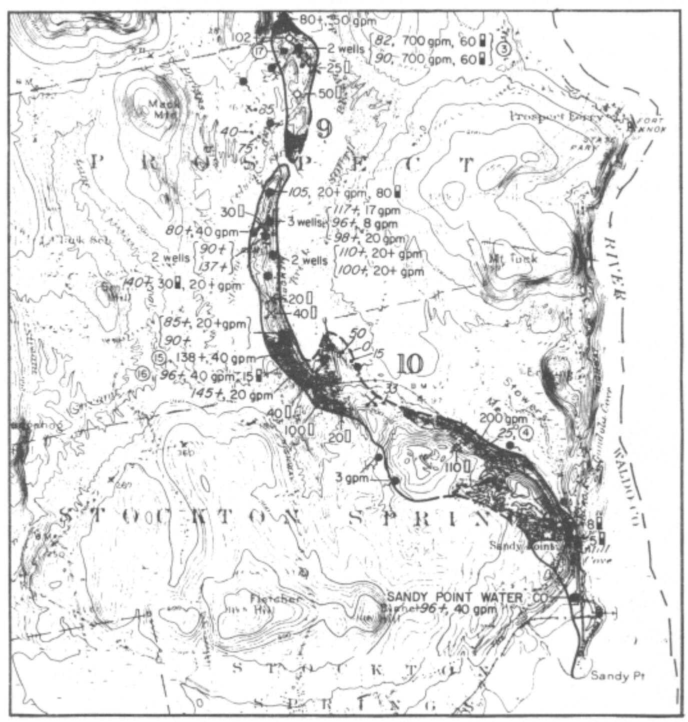
The hydraulic conductivity was estimated from field permeability tests and other data to be 10-2 to 10^{-4} feet per day. In a soil of this type, capillary action is effective for 10 to 15 feet above the potentiometric level. In fine-grained tills of this type, the potentiometric level is within several feet of the ground surface in the spring, even on top of what look like well-drained hills. By fall, the potentiometric level is usually 7 to 10 feet lower than its spring high. Obviously, the reason for such seasonally high water tables in these tills is the very slow rate at which the soil is able to drain itself, which, in turn, is a function of the denseness and high percentage of fines in the till.

These fine-grained tills present problems for the location of sanitary landfills. The Solid Waste Management Regulations of the Department of Environmental Protection (which govern landfill location in Maine) require that the soil under a landfill has from 15 to 40'~ fines, and that the water table be at least 5 feet below the bottom of the landfill. The range of allowable fines is intended to be an optimum compromise between acceptance of landfill leachate and adsorption of deleterious matter in the leachate. The fine-grained tills have too high a percentage of fines and thus a very low infiltration capacity. Leachate would tend to mound under the landfill or pass through the sides of the landfill. Obtaining the 5-foot separation to the seasonally high water table must usually be accomplished by placing fill on top of the fine-grained till, because to drain a soil with such a low permeability is for all practical purposes impossible. With so much of Maine covered by fine-grained lodgment tills, the amount of suitable land for sanitary landfills is greatly reduced, since ice contact deposits, outwash, and glaciomarine and lacustrine silts and clays have also been termed unsuitable. Since landfills seem to be the only feasible short-term solution for most of Maine's towns, many landfills will be built on far less than ideal geologic materials or terrane.

Gravel Aquifer Maps

The Maine Department of Environmental Protection is funding a 3-year project by the Maine Geological Survey to map gravel aquifers in the populated part of the state not yet covered by U.S. Geological Survey ground-water favorability maps. This work is being conducted in 2 phases: the first is reconnaissance surficial geologic mapping; and the second is gravel aquifer mapping combined with inventorying all available well, spring and test-hole data. Final products of this project will include not only maps and companion reports of gravel aquifers, but also reconnaissance surficial geology maps of much of the state not now mapped.

Gravel aquifer maps covering York County and the region from Brunswick to Pittsfield will be available from the Maine Survey by June, 1979, at 1:50,000 scale. The first map of this series covers eastern Waldo County, and is available now from the Survey (as sampled below). (WBC)



Sample from "Gravel Aquifers of Eastern Waldo County", by W. B. Caswell and others, Maine Geological Survey, 1978. Shading indicates extensive marine clay cover overlying sand and gravel.

GROUND WATER HANDBOOK

Maine people confronted by ever more complex questions concerning our valuable ground water supplies now have a source of general and current information in the GROUND WATER HANDBOOK FOR THE STATE OF MAINE, written by W. Bradford Caswell, Hydrogeologist for the Maine Geological Survey. Although this handbook is a hefty 145 pages long, it is profusely illustrated with figures such as that shown below, which help a non-technical reader through the "equipotentials" and over the "flow divides". Principles of ground water hydrogeology are of necessity introduced, but where possible the technical discussion focuses on ground water as it is found in Maine.

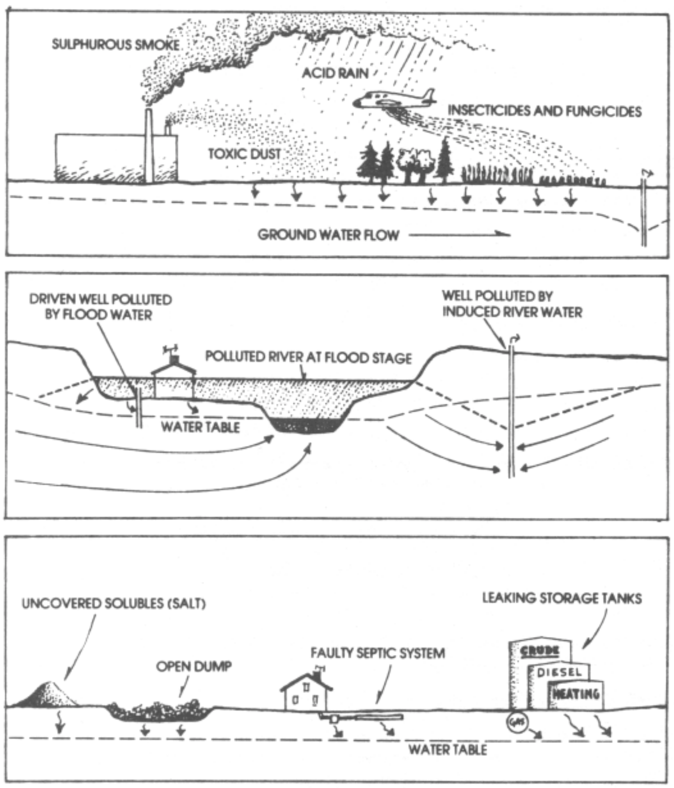


FIG. 45 Mechanisms of ground-water contamination from air, water and land sources.[10]

Numerous examples of ground water problems are discussed and illustrated. Case studies include the all too typical pollution of ground water by petroleum products, such as occurred in Deer Isle, to the more bizarre pollution of ground water by rotten potatoes in Aroostook County. Dry wells, caving wells, high-yield wells, piles of road salt, dumps and other situations relating to ground water quantity and quality are described.

Hydrogeologic information available from our local state and federal sources is discussed and referenced. Many suggestions are given as to how the available technical reports and maps can be applied to both finding sufficient quantities of ground water, and to protecting available supplies from contamination.

This handbook is not intended to solve all of our present and future ground water problems, but in the author's opinion, "To make thoughtful decisions,... people must be able to ask thoughtful questions that emanate from a basic knowledge of ground water principles and a more particular knowledge of Maine's ground water situation".

The GROUND WATER HANDBOOK is one of a series of technical publications being sponsored by the Maine State Planning Office. It is available free of charge by calling or writing to the State Planning Office, 189 State Street, Augusta 04330; Phone 207 289-3155. (WBC)

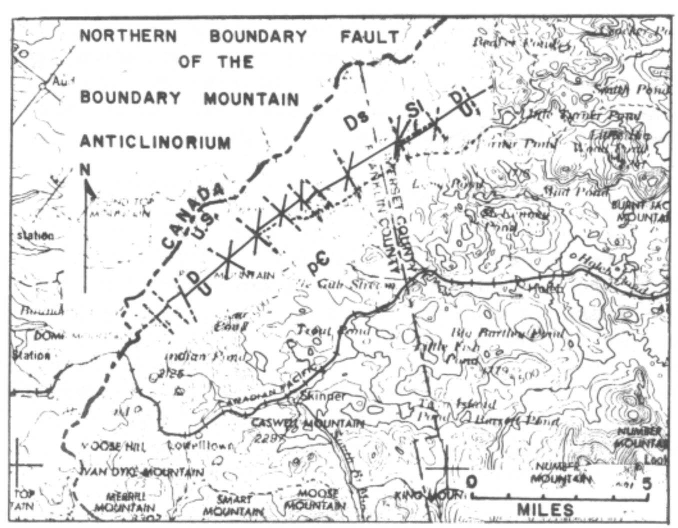
Summer Field Trips

Following the Annual Meeting at USM-Gorham, Art Hussey led a group of 18 members on July 29th through the section of the Casco Bay Group of presumed Cambro-Ordovician formations from Scottow Hill, Scarboro, to Willard Beach, South Portland, to Ram Island Farm, Cape Elizabeth, with several intermediate stops. And on Sunday, July 30th, Kost Pankiwskyj led a 16-member group through the Casco Bay Group terrane between Coopers Mills and Liberty, 60-70 miles on strike to the northeast of Cape Elizabeth. In addition to Casco Bay Group exposures, Kost's trip examined one exposure of an unusual diopside-tremolite-plagioclase mass which was defined as a meta-ultramafic; an exposure of Lincoln Sill ("prowerose"/metashonkinite) in contact with (Acadian?) foliated quartz monzonite; 3 exposures of Silurian Vassalboro Formation; and a finestkind exposure of the Dearborn Brook fault, about 4000' west of Palermo village on Route 3, north side of highway (STOP 13).

A copy of the Guidebook for these field trips is included with this Newsletter. The trips were very interesting and informative, and we who were there thank Art and Kost very kindly indeed for their work and time expended for our benefit.

Editorial License

(We regret not having been able to place Dave Westerman's diagram of the Northern Boundary Fault with his article on Pages 2-3. This Newsletter was too far pasted up for printing when the map arrived. As a hoped-for consolation, we have overprinted Dave's line drawing on a copy of the area from the Sherbrooke 20 sheet, to aid in locating the study area in NW Franklin County.)



PROTECTING SHORES

By Robert G. Gerber
Cons. Geologist & Civil Engineer
South Harpswell, Maine 04079

Many of Maine's shorefront property owners have spent time and money building walls at the shore's edge in hopes of holding back storm waves of the future. Most of these barriers will fall within a few years. The force of waves breaking on a shore is far greater than most people would imagine.

Work by Iribarren and Hudson at the U.S. Army Coastal Engineering Research Center resulted in the following formula that can be used to estimate the weight of a block of stone that should be used in building a rubble mound seawall for a given set of conditions:

$$W = \frac{W_r H^3}{K_D (S_r - 1)^3 \cot\theta},$$

where

- W = weight in pounds of an individual armor unit in the face of the wall
- W_r = unit weight of armor unit in pounds/cu.ft.
- H = design wave height at the wall in feet
- S_r = specific gravity of armor unit (2.7 for most rock)
- θ = angle of structure slope measured from the horizontal in degrees
- K_D = stability coefficient varying with armor unit shape, roughness, and degree of interlocking with other units

This formula is particularly instructive in illustrating that the average weight of stone used in a wall is proportional to the cube of the wave height. The formula also states that the weight of stone needed varies inversely with the cotangent of the slope angle - the flatter the slope, the smaller the stone.

Substitution of a few typical numbers for the variables in the formula shows why that 150-pound rock you thought would be the mainstay of your wall is ineffective. On the open coast of Maine, a wave height of 4 feet at the shore could occur at least once a year. If rough, angular quarrystone were used in a two-layer wall with a 450 slope (unit weight = 173 pounds/cu.ft.), the stability coefficient, K_D, would be about 2.5. From the formula, the weight of the stone required would be 900 lbs. If the wall is designed to withstand an 8-foot wave (which could be expected once every 10 or 20 years), each stone should weight 7200 pounds. Last winter's storms brought 3-to 4-foot waves up relatively sheltered bays, so if you can carry those rocks you are building your wall with, the rocks are plainly not heavy enough.

One way to make small rocks more effective is to bind them together into a larger mass. This can be done with concrete, or by placing the rocks into wire cages, called "gabions". These wire cages are filled with rocks larger than the wire mesh openings and the cages are, in turn, wired together along the shore. If the gabions are built up a natural slope in a step-wise fashion, they can be fairly effective if placed on a proper drainage blanket and extended higher than the design runup (wave runup, however, could extend 10 to 20 feet vertically above Mean High Water).

No wall will be effective, however, unless it is on a solid foundation. Waves breaking against the shore will create a scour trough at the foot of the wall that is approximately as deep as the design wave is high. If a rubble mound wall is constructed on sand (as, for example, beginning at the Mean High Water level at Popham Beach), storm waves can easily undermine it. Thus, a seawall should be founded on bedrock or extended below grade at least to a depth equal to the expected wave height at the structure. Obviously, if the wall is not secured into bedrock at each end, severe erosion will occur there. If the wall is capable of stopping shoreward erosion, then waves will begin removing material in front of the wall, in the present regime of rising sealevel. Thus, the land might be saved but the beach would be lost.

THE GEOLOGICAL SOCIETY OF MAINE

TREASURER'S REPORT

FOR THE YEAR ENDED JULY 31, 1978

The paid-up Membership at July 31st included 196 members:

Regular	137
Associate	40
Student	19

YEAR-END BALANCE SHEET

RECEIPTS -	Balance over from July 31, 1977	$ 503.10
	Dues and Application Fees	1180.05
	Rooms-Food Receipts, UM-Gorham	79.50
	Total Receipts	$1762.65
EXPENSES -	Printing: 4 Newsletters & Guidebook	$ 656.01
	Attorneys Fees: Incorporation, ByLaws	200.00
	Postage: Newsletters, Notices	160.88
	Telephone: Dickey-Lincoln Meeting	27.63
	Address Labels, Xerox	19.09
	Overpayment Refunds to Members	4.05
	Total Expenses	$1067.66

BANK BALANCE, Canal Bank @ July 31, 1978 $694.99

RECORD OF DISBURSEMENTS

09/16/77	Check #47	J. R. Rand, Postage	$20.50
09/24/77	#48	J.H. French, 150 Newsletters	55.02
10/20/77	#49	J.R. Rand, Postage	21.00
10/20/77	#50	J.R. Rand, Xerox Address Labels	3.47
10/31/77	#51	J.H. French, Meeting Notices	32.62
11/08/77	#52	J.R. Rand, Postage	7.72
12/05/77	#53	Northeast Direct Mail, Xerox	8.82
12/05/77	#54	J.R. Rand, Postage	3.37
12/05/77	#55	J.H. French, Dickey-Lincoln Agenda	27.51
12/12/77	#56	J.H. French, 50 Letterheads	2.37
12/15/77	#57	J.R. Rand, Postage	21.45
12/18/77	#58	J.H. French, 175 Newsletters	72.83
12/30/77	#59	J.R. Rand, Telephone(Dickey-Lincoln)	27.63
01/16/78	#60	Mills & Mills, Incorporation Fee	150.00
01/23/78	#61	James M. Pierce, Overpayment Refund	1.05
01/23/78	#62	NE Direct Mail, Address Labels Xerox	6.80
01/23/78	#63	Color-Ad, Freeport, Reduce Bylaws	17.06
02/24/78	#64	J.R. Rand, Notice Postage	18.00
03/07/78	#65	J.H. French, 250 Notice Cards	9.19
03/20/78	#66	Color-Ad, Freeport, Photo Films	16.54
03/23/78	#67	J.R. Rand, Postage, Address Labels	32.84
04/03/78	#68	J.H. French, 260 Newsletters	92.51
06/01/78	#69	Mills & Mills, ByLaws Up-date	50.00
06/12/78	#70	Katy S. Robinson, Overpay't Refund	3.00
06/19/78	#71	Color-Ad, Freeport, Photo Films	17.06
06/30/78	#72	J.R. Rand, Postage	36.00
07/05/78	#73	J.H. French, 300 Newsletters, By laws	113.30
07/31/78	#74	J.H. French, 300 Fieldtrip Guides	200.00
		TOTAL DISBURSEMENTS:	$1067.66

August 1, 1978 John R. Rand, Treasurer

Geologic Activities '78

by W. A. Anderson
Maine Geological Survey

Bedrock mapping and research in the State of Maine for 1978 was carried out by the Maine Geological Survey, the U. S. Geological Survey, Virginia Polytechnical Institute, Queens College and Syracuse University. The Maine Survey put 8 principle bedrock investigators in the field this season, supported by Maine general fund appropriations and by the U. S. Nuclear Regulatory Commission.

Art Hussey, Kost Pankiwskyj and Don Newberg continued bedrock and brittle fracture investigations in the Lewiston 20 sheet. Gary Boone followed up on last year's structural and stratigraphic mapping in the Sherbrook 20 sheet. Dave Westerman divided his time chasing down faults in the northern part of the Sherbrook 20 sheet and continuing his mapping in the Wesley quadrangle in Washington County. Allan Ludman and several Masters candidates at Queens College continued mapping in the Fredericton quadrangle. Brad Hall carried out 4 weeks of intensive mapping in the Lake Munsungun area and the Presque Isle 20 sheet. Gene Boudette and Bob Moench of USGS were mapping this summer in western Maine and New Hampshire, and Norman Hatch, newly arrived this season, began mapping in the Lewiston 20 sheet, in New Hampshire and western Maine. Phil Osberg continues to unravel the complexities of the Bangor 20 sheet. Bob Neuman spent 4 weeks in the Shin PondTraveler Mountain area chasing down stratigraphic units. Fitzhugh Lee of the USGS Engineering Branch in Denver has acquired additional data and information in an on-going crustal-stress program in mid-coastal Maine. Fitz's Open File Report No. 78-862 (Reconnaissance Geotechnical Study of the Lucerne Granite, Maine) is now available from the USGS upon request.

Dave Wones, VPI-USGS, worked on the Norumbega fault zone from the Penobscot River to the St. Croix. Cleaves Rogers, working the seismo-tectonic program for Pat Barosh at Weston Observatory, is mapping in the Verona Island area and northern Penobscot Bay.

Prof. William Newell of Syracuse University is finishing up his mapping in the Bingham quadrangle this season. Bill Forbes, UM-Presque Isle, and Andy Casper continued their paleontological investigations and stratigraphic correlations in northern Maine.

Surficial mapping projects were especially active this season, supported by the general fund, the EPA (through the Maine Department of Environmental Protection) and the USGS. Nick Genes and Bill Newman mapped in Aroostook County; Geoffrey Smith in Androscoggin County; and D.W. Caldwell and Tom Brewer in York County. Gaylen Knoyer of UM-Orono will be mapping surficial geology in the Lincoln, Millinocket and Passadumkeag 15' quads this fall. A USGS grant to the Maine Survey supported Woody Thompson's mapping and Quaternary-movement analysis along the Norumbega fault from the Penobscot River to the Canadian border. The Maine Survey Quaternary Crustal-Warping Program is well underway with Hal Borns and his helpers completing the search and survey of 2 coastal salt marshes in the mid-coast this summer. Cores will be taken for radio-carbon dating this fall by Hal and Bob Struckenrath. Also, Hal and other investigators of the Quaternary Institute at Orono will begin tide-gauge leveling for archaeological and historical analysis of the Maine coast this winter.

George Denton and Hal Borns are overseeing 2 Masters programs in Acadia National Park. The purpose is to determine ice stream flow and ice thickness at the coast of Maine during the Late Wisconsinan. Cornelia Cameron, USGS, in cooperation with the Maine Survey and the State Energy office, continued the peat bog inventory for Maine. Cornelia mapped peat bogs in coastal Hancock and southern Penobscot Counties. Geoffrey Smith of Ohio University is overseeing 2 Masters programs on the moraine in the Waldoboro area.

Ed Chiburis at Weston Observatory brought on line 3 additional seismograph stations at Jackman, Hinckley and Bucksport this past spring, making a total of 8 operating stations now in Maine. Ed is now busy installing a seismic array in the Passamaquoddy area. Based on second-hand information, we have learned that a team from Lamont Observatory (gravity) worked in eastern Washington County.

There has been a marked increase in visits to the Maine Geological Survey office by mining company geologists and representatives this summer. Claim staking on state-owned lands has also increased. The Maine Mining Bureau and its administration was included by the Legislature as one of the programs of the Maine Survey. The MGS will submit a bill to the next Legislature to make changes and improvements in the mining law for state-owned lands.

Industial Garnet Extractives is continuing to develop its garnet locality east of Rangeley off of Route 16. It has just purchased the Oxford feldspar mill in West Paris, and has completed pilot-plant operations. Marketing and production studies are now under way. The following companies are active in Maine this year: Phelps Dodge, J.S. Cummings, Inc., Superior Oil, Lehman Associates, James Dunn Associates, Getty Oil, Houston Oil & Minerals, Minatom Corporation, Bendix Field and Engineering Corp., DuPont and sub-contractors, and Larry Wing. International Paper has announced through its subsidiary General Crude Corporation, that it will open an office in Maine in the near future, and will conduct exploration on its own and neighboring lands. The Kerramerican mine in Blue Hill is on stand-by and is maintaining their various lease holdings.

GUIDEBOOK CORRECTIONS: Your Editor goofed in at least two instances in the preparation of the Guidebook: Page 3, Upper Right near STOP G - the "Portland Fault" should read "South Portland Fault"; Page 8, STOP 11, CUSHING FORMATION (5), should read "from 102 to 112 paces, gray biotitic marble" (not 142 paces). Also, on the map on Page 9, it should be noted that the Wilson Cove Member of the Cushing Formation (shown as a continuous dotted pattern along the SE edge of the Cushing Fm. area) has been seen in outcrop in only about one-half dozen locations in this area, and may not be a continuous unit throughout the map area.

The Geological Society of Maine c/o
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Correspondence about this Newsletter, or about membership in the Society may be addressed to John R. Rand, Cundy's Harbor, RD2-Box 210A, Brunswick 04011.

HYDROLOGIC IMPACTS-DEVELOPMENTS

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In December 1977, a consultant's report, "Cumulative Impact of Incremental Development on the Maine Coast", was presented to the Maine Department of Environmental Protection as background information for the Governor':: Committee on Coastal Development and Conservation. Although some of the report's findings and recommendations received publicity, most of the technical analyses on the physical effects of land development received no attention. One of the major discoveries of the study was that urbanization was creating significant hydrologic impacts.

Land development changes the amount of precipitation runoff and water quality of the runoff. The result of creating additional impervious area is an increase in the percentage of runoff and a decrease in the time required to concentrate watershed runoff, which both serve to increase the rate of peak runoff. Almost without exception, Maine coastal towns react to runoff problems as they occur, installing catch basins and storm water piping systems which only serve to increase peak runoff rates farther down in the watershed. Several studies of Maine coastal watersheds have been done that show that peak flow rates will double as the land use goes from rural to fully-developed residential. This increased flow causes streams to adjust their courses and gradients, producing substantial new streambank erosion. There are methods available to mitigate the effects of creating impervious cover that goes with development. These methods basically require storing runoff and letting it infiltrate into the ground, or letting it pass downstream at a rate controlled to be no greater than the rate that would have occurred before the watershed was developed.

The quality of the water in the runoff always seems to deteriorate as a watershed is developed. Several studies have been done on Maine's coast that compare coliform bacteria concentrations between undeveloped and urban areas. Coliform counts increase 10 to 100 times or more in water runoff from urban watersheds as compared with rural watersheds. In watersheds that are urbanized in the lower reaches and rural in the upper reaches, the effect on water quality is dramatic. The literature contains the results of studies in other parts of the U.S. that show that urbanization causes great increases in BOD in stream runoff, increases in heavy metals, nutrients, and stream temperature. Many of these water quality effects can also be mitigated through onsite storage and control of runoff within developments.

In summary, runoff problems are occurring in the Maine coastal area as development occurs. The traditional catch basin and storm sewer are not the proper solution to these problems - in fact, they aggravate the problems. More education of the public to alternative methods of onsite runoff control is clearly needed.