



# THE MAINE GEOLOGIST

THE NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MAINE

MARCH 1978

VOL. 4 NO. 3

## Bedrock Groundwater

For the past five years, supported largely by State Planning Office funding, W. Bradford Caswell has been studying the occurrence and distribution of water contained within the bedrock of Maine, on which a significant portion of the population depends for its household uses. Now working as hydrogeologist for the Maine Geological Survey, Brad discussed Maine bedrock groundwater facts and problems at UM-Farmington on March 17th, as the Society's featured speaker for the Spring Meeting, and displayed slides and drawings which he and his colleague, Melanie Lanctot, have compiled to illustrate findings.

Maine is a water-rich state, well-endowed with lakes, ponds and streams. Annual precipitation is relatively high, averaging state-wide somewhere around 42 inches, and evaporation from the water bodies is fairly low at roughly 22 inches per year. The apparent surplus of water notwithstanding, however, the state is also characterized by a sizable population distributed in rural areas not adjacent to lake-fed pipelines. Brad has estimated that some 41% of the people depend on groundwater wells for their water.

Water-bearing sands and gravels supply some of these people, but serviceable gravel aquifers are few and far between, and people in 3/4 of the state's area are required to drill into the bedrock, or "ledge", to find their water supplies.

To study and to understand the groundwater environment in the bedrock is Brad's specialty. The essential goals of his work would seem to be two-fold: to assist the people in locating new sources of this vital commodity; and, ultimately, to save the resource from the contamination and destruction which can be assured by uncontrolled or uninformed human endeavours on the overlying ground surface.

### WATER SOURCES

Groundwater in Maine is derived entirely from rain and snow meltwater which percolates into the soils and along cracks in the bedrock. Its migration beneath the ground surface is downward toward some ultimate lower-elevation outlet, in a pond, stream or the ocean. Migration in soils is through the spaces between sediment grains. In coarse gravel deposits the permeability may be very high, sometimes permitting wells which yield 1000 gallons per minute (GPM) or more. In Maine blue clays, widespread throughout southern Maine, the sediment grains are too small and closely

packed together to permit any useful flow of the contained water into wells.

The situation in the great mass of the bedrock is even worse than in the clays, since the bedrock of Maine is largely tightly-compressed and internally-welded metamorphic rock or wellbonded crystalline granites, some of the worst aquifer environments in the world. The only source of water in the bedrock here is within the cracks - in the joints which cut across the fabric of the rock, or in the partings which lie parallel to the foliation or layering of the rock. Even though there may be numerous cracks in a bedrock mass, most are very tight and few contain recoverable water. Some detailed driller's records suggest that most wells intersect only one or two water-bearing seams.

After study of many thousands of driller's records for Maine, the highest-yield bedrock well Brad has found reported about 300 GPM. 70% of the wells yield less than 10 GPM. Happily, 86% of the wells do yield at least 2 GPM, which is ample for most private households.

Brad has also found a relationship between bedrock groundwater yield and the thickness and type of soils cover which overlies the ledge surface in the area of the well. For sand and gravel and glacial till soils, the thicker the soils column, the higher the well yield. An inverse relationship appears for bedrock underlying clay soils, with decreasing yields as the clay blanket thickens.

### GROUNDWATER MAPS

To analyze bedrock groundwater for the coastal counties, Brad and Melanie have compiled and interpreted their basic well data on maps of five types: bedrock well yield; bedrock well depth; overburden (soils) thickness; topography of the bedrock surface; and topography of the potentiometric surface.

The bedrock yield maps quickly reveal areas where the higher-yield wells are located, and in some instances appear to show a direct spatial correlation of "zones" of high-yield wells with fault zones mapped in the bedrock, or with prominent physiographic features such as long valleys or lake chains. Donald W. Newberg (Bowdoin College) has field-checked four of these high-yield locations, and in each case was able to identify a structural or physical feature in the bedrock nearby which may be of significance in creating an aquifer structure.

The well depth maps show that it may not always be simple good luck if you hit water at a shallow depth in bedrock. Some discrete areas in

the coastal counties appear to be blessed with relatively shallow water-bearing cracks, while in other areas bedrock water occurs at definitely deeper horizons. The overburden thickness maps are useful in appraising general potential for bedrock groundwater in an area, since the soils may assist in collecting precipitation, to permit it to start percolating downward into rock fractures. It may be possible, by analyzing soils thicknesses in relation to soils types, roughly to estimate the sort of well yield to be anticipated for a given area.

Maps showing the topography of the bedrock surface are useful to determine directions and paths of near-surface water migration in the overburden above the bedrock. In some areas in Cumberland County, valleys on the bedrock surface have been found to lie more than 150 feet below sea level. In some of these cases, deep bedrock troughs coincide with elongate zones having numerous high yield bedrock wells; in some, the troughs coincide with mapped fault zones which may also may be significant groundwater aquifers.

The potentiometric surface maps show by means of contours the regional variations of elevation of the groundwater surface in bedrock wells. These maps, then, indicate the theoretical directions of groundwater flow within the bedrock. They must be used with care, however, since the water is constrained to follow the bedrock cracks as it seeks its base level, and may not always be permitted to roll, stone-like, straight down hill.

#### COASTAL PENINSULAS

There is, apparently, evidence in the coastal zone that most groundwater flows in partings which lie parallel to the layering or foliation in the metamorphic rocks, with relatively little flowing in the joints and fractures which cut transversely across the textural fabric. Much of the coast to the east of Cape Elizabeth is characterized by its narrow peninsulas and islands, having generally thin soils cover. Their areas for recharge from rainfall are small, the thin soils are limited collectors, and salt ocean waters lap constantly at their sides. But they do provide bedrock water on a continuing basis if treated with due respect.

First, they have bedrock groundwater because they are law-abiding and follow the Ghyben-Herzberg principle, which holds that because of specific gravity differences fresh water will "float" on salt water and, iceberg-like, will extend downward to a depth which is about 40 times its height above sea level. Beneath the coastal peninsulas then, the bedrock groundwater environment forms a long lens- or keel-like zone which interconnects with the groundwater environment inland.

Second, working with James K. Richard (now with SCS Engineers, Augusta), Brad found that draw-down of bedrock wells on High Head, Harpswell, has rarely resulted in salt water intrusion beneath that narrow peninsula. High Head has bedrock foliation trending north-south parallel to the peninsula, and steep cross-joints striking across the peninsula, occasionally from shore to shore. Draw-down of wells within the most prominent cross-joint zone has caused salt water intrusion there. In other areas, however, the conclusion seems to be

that recharge of wells is provided by groundwater migration along the peninsula in the foliation partings. It is not yet clear in what degree this recharge situation may be trifling with the Ghyben-Herzberg principle.

From a 3-year observation of wells on High Head, with gauges provided by the U.S. Geological Survey Water Resources Division in Augusta, Brad and Jim Richard have identified 3 types of bedrock wells there, all at an equal distance from the ocean:

1. Water Table Well: the character of the gauge record for this well indicates that its groundwater elevation remains constant on a short term basis, fluctuating markedly in response to pumping and rainfall;

2. Semi-Artesian Well: the water-level plot from this well shows minor fluctuations due to tidal changes, and responds gradually to rainfall on the area;

3. Artesian Well: the water level in this well not only fluctuates continually in response to changing ocean tide heights, but also reacts to atmospheric pressure changes, perceptibly varying in elevation as storm systems pass over the area.

#### GROUNDWATER CONTAMINATION

While all wells are subject to contamination by downward-percolating solutions, water table wells are notably vulnerable due to their direct interconnection with ground surface. Since they are recharged immediately by rainfall, they may also be rapidly contaminated by pollutants collected by that rainwater, such as sewer effluent, dump leachate, chemical spills and road salt. Brad cited 2 examples of high-yield wells in jeopardy of pollution from surface developments.

In Harpswell, 2 water table wells have been provided for a peninsula development. The wells are located down hill below another area set off for a number of houses, and down hill from a new highway. In Searsport, a zone of high-yield bedrock wells has been put in jeopardy of contamination by the establishment up-slope of a new landfill town dump, in an upland gravel pit.

#### LINEAMENT CONTROLS

It has long been practiced in the interior platform region of the U.S. to go to locations where topographic alignments intersect, to find groundwater in sedimentary rocks normally noted for their bulk dryness. Brad suggests that a comparable procedure may bear fruit in Maine, and displayed aerial photos of a prominent physiographic lineament in eastern Maine which could be seen in detail to have locations where transverse lineaments cut across it. Although these particular intersections are not yet tested, it does seem that we may do well to emulate our Midwestern brethren, in Maine areas where bedrock groundwater may otherwise be difficult to find, or where some larger volumes may be needed for farm irrigation or commercial uses. A quick glance at a satellite photo shows that Maine has no shortage of regional physiographic lineaments and transverse intersections, lying in wait for someone to give them a try. (JRR)

# Maine's Critical Areas Program

by Anne Pendergast  
Maine State Planning Office  
Augusta, Maine 04333

Relatively few people in Maine are aware of the State Planning Office's Critical Areas Program, which has been working since 1974 toward a comprehensive compilation of the state's significant natural features, including botanical, geological, and zoological, to be placed on the Register Of Critical Areas. The register is essentially an inventory of the state's unique areas; the data will then be available for future planning. 142 areas have been registered thus far, and more are on the way.

A variety of significant geological features throughout the state are currently in various stages of investigation. Topics are selected by the program staff in consultation with the Maine Geological Survey. Some areas are being identified, inventoried, and documented by professional geologists, who write planning reports on a particular aspect of Maine's geology and describe specific areas. Other features are "in registration", i.e. the landowners are notified of the existence and importance of the potential critical area, the program staff evaluates the area on the basis of their field check and the information contained in the planning report, and the area is reviewed by the eleven member citizen's Critical Areas Advisory Board, which eventually votes to decide whether the area merits placement on the register. The program is non-regulatory, however, so the burden of proper management resides in the landowner.

Five planning reports on geological topics have already been completed for the program. Dr. Woodrow Thompson's two reports, Maine Tourmaline Localities and Rose Quartz Crystal Localities in Maine, recommend the registration of important tourmaline and rose quartz crystal localities. The Significant Bedrock Outcrops of the Casco Bay Group, by Dr. Arthur Hussey, discusses the general geology of the Casco Bay region, focusing on twenty outstanding outcrops. Dr. William Forbes has written the report, Significant Bedrock Fossil Localities in Maine, summarizing important fossils and their occurrences including many of their paleoecological contexts. Dr. Harold Borns has written the report, Emerged Glaciomarine Deltas in Maine, which discusses three significant deltas in the state.

Several reports are in various stages of completion and a number of topics are being considered for investigation in the future. An extensive report on undeveloped sandy beaches is being prepared by Dr. Ken Fink and Bruce Nelson, recommending the registration of 27 beaches. Dr. Hussey's report on the significant bedrock outcrops in York County is nearing completion. In addition, Dr. Forbes is working on marl ponds, Dr. Tom Brewer is working on three reports covering waterfalls, gorges, and whitewater rapids, and Dr. Borns is working on an esker report. Cobble beaches will be covered in the near future.

Twenty-six recommended geological sites have been registered already, including three tourmaline

quarries, fifteen localities in the Casco Bay Region, and eight fossil localities. In the case of geological sites, there has been some confusion over what constitutes proper management and conservation. The botanist thinks in terms of leaving rare plants untouched in their natural state, for example, but geological sites must be viewed from a different perspective since specimen removal is often an important part of their scientific, educational, and economic value. The landowner is responsible for the management of areas; since the program is non-regulatory the Critical Areas Program staff can only make suggestions as to proper conservation. Ideally a long term management plan can be worked out which is compatible with the aims of both the landowner and the program and which ensures that the areas will be available for further scientific study.

Publicity of critical areas poses a potential problem not only because of the possibility of destruction of more vulnerable areas but also because of many landowners' wishes to keep publicity to a minimum. Therefore, because the success of the program depends entirely on the cooperation of the landowner, it is the policy of the State Planning Office to make every attempt to respect the landowners' wishes for anonymity. Few requests for information on specific sites are actually received.

While the identity of individual sites must generally be protected, increased knowledge of the program itself should result in greater public awareness of the need for preservation of the state's outstanding natural features. The goals of the program should be viewed in the light in which they are intended, in which the program makes a positive contribution to the identification and preservation of these unique areas for future scientific study.

For more information on the program or to obtain copies of the planning reports please contact the Critical Areas Program, State Planning office, 184 State Street, Augusta, Maine 04333, (207) 289-3155.

**GSM, Inc.**



The following 2 pages display the papers of incorporation of GSM, organized as a non-profit Maine corporation on December 2, 1977, followed by the By-Laws, adopted at the Annual Meeting on August 1, 1975. On the non-profit business, to be official it is necessary to obtain a ruling from the Internal Revenue Service, and steps have been taken to achieve that goal. On February 28, 1978, an IRS Employer Identification Number was obtained (No. 01-0353848); on that same day, an 11-page "Form 1023" was mailed to the IRS, along with supporting papers of incorporation, by-laws, and a typical Newsletter. Form 1023 is the Application for Recognition of Exemption from Federal tax under Section 501(c)(3) of the Revenue Code. When we receive our Certificate of Recognition, then we can go for special postal rates, for a no-minimum, interest-paying bank account, AND for some tax-deductible contributions.

State of Maine

THE GEOLOGICAL SOCIETY OF MAINE

Certificate of Organization of a Corporation, under Title 13, Chapter 81 of the Revised Statutes, and Amendments thereto.

BY-LAWS

(Adopted August 1, 1975)

The undersigned, incorporators of a corporation duly organized at 55 Main Street in the town of Farmington State of Maine on the second day of December A.D. 1977 hereby certify as follows The name of said corporation is THE GEOLOGICAL SOCIETY OF MAINE, INC.

ARTICLE I

Name

Section 1. The name of the association shall be "The Geological Society of Maine" (GSM).

Section 2. The name of the society may not be used, nor any reference to it made in any advertising, promotion, solicitation, or the like, without prior written permission of the society.

ARTICLE II

Purpose

Section 1. To further the public awareness and understanding of the geology of the State of Maine, and of the modern geologic processes which affect the Maine landscape and the human environment;

Section 2. To develop and encourage continuing social contact and dialogue among geologists working in Maine;

Section 3. To advance the professional improvement of its members;

Section 4. To inform members and other interested persons of current and planned geologic programs in Maine.

Section 5. To provide a financial base to publish and distribute a periodic Newsletter, to cover matters of technical and general interest, and to announce future society meetings.

Section 6. To receive and administer gifts, bequests, and devises from person, firm, or corporation to the GSM.

Section 7. To perform acts instrumental in the furtherance of the foregoing purposes, including the owning, leasing, or otherwise dealing in real estate in order to further said purposes.

ARTICLE III

Non-Profit

Section 1. This society shall be non-profit. All assets shall belong to the GSM and shall not inure to the benefit of any member or group of members of the society.

ARTICLE IV

Membership

Section 1. A member shall be defined as any person who is interested in furthering the goals of the society and who fulfills the requirements of section 1a, 1b, or 1c.

1.a. Those persons who hold a Bachelors degree in geology and have engaged in the practice of geology for at least one year, or who have a Masters degree in geology, in lieu of the one year requirement, or who have demonstrated by trade a degree of geological professionalism, regardless of academic training, shall be designated as "Regular Members".

1.b. Those persons who demonstrate an interest in the geological sciences and who are desirous of association with the society, but do not meet the requirements of sections 1a or 1c, shall be designated as "Associate Members".

1.c. Those persons currently enrolled as a student in any college or school of higher learning who are interested in the field of geology and are desirous of association with the society, shall be designated as "Student Members".

Section 2. There will be no Maine residency requirement for any of the three categories of membership.

The purpose of said corporation are exclusive for charitable, religions, educational and scientific purpose, including, for such purpose, the making of distributions to organizations that qualify as exempt organizations under section 501(c)(3) of the Internal Revenue Code of 1954 as amended.

No part of the net earnings, of the corporation shall inure to the benefit of, or be distributable to, its members, trustees, officers, or other private persons, except that the corporation shall be authorized and empowered to pay reasonable compensation for services rendered and to make payments and distributions in furtherance of the purposes set forth in the paragraph above. No substantial part of the activities of the corporation shall be the carrying on of propaganda, or otherwise attempting to influence legislation, and the corporation shall not participate in, or intervene in (including the publishing or distribution of statements) any political campaign on behalf of any candidate for public office. Notwithstanding any other provision herein, the corporation shall not carry on any activities prohibited under section 501(c)(3) and section 170(c)(2) of the Internal Revenue Code of 1954 as amended.

Upon the dissolution of the corporation, the officers shall, after paying or making provision for paying all liabilities of the corporation, dispose of all the assets of the corporation exclusively for the advancement of charitable, educational, religious, or scientific purposes as shall at the time qualify as exempt under section 501(c)(3) as cited herein. Any such assets not so disposed of shall be disposed of in the District or Superior Court where the principal office of the corporation is then located for the purposes enumerated herein.

Said corporation is located in the town of Farmington county of Franklin State of Maine

The number of officers is seven and their names are as follow: President William W. Rideout Vice President Walter A. Anderson Secretary or Clerk Archie W. Berry, Jr. Treasurer Join R. Rand Directors of Trustees James W. Skehan (Councilors) Raynold R. Holmes Robert G. Doyle

(SS C.5.55 Rev.77)

Handwritten signatures of Archie W. Berry, Jr., Ruth Pullen, and Peter Mills, with a stamp that says 'Incorporators'.

STATE OF MAINE

Franklin As. December 2, A.D. 1977 Then personally appeared the within named

Archie W. Derry, Jr. ; Ruth Pullen; Peter Mills

and severally made oath to the foregoing certificate by the signed, that the name is true.

Notary Public signature and stamp for Justice John D. Dwyer, Notary Public.

my commission expires November 10, 1984

STATE OF MAINE

SECRETARY OF STATE'S OFFICE December 7, A.D. 1977

I hereby certify that I have examined the foregoing certificate, and the same is properly drawn and signed, and is conformable to the constitution and laws of the State.

Signature of Deputy Secretary of State and the text 'DEPUTY SECRETARY OF STATE'.

(This Certificate must be filed in the Office of the Secretary of State within 60 days of approval)

ARTICLE V

Dues & Fees

- Section 1. There will be an initial application fee of \$2.00 for all new members; said fee will help to defray Newsletter publication costs.
- Section 2. Annual dues will be assessed all members as follows:
- |                   |             |
|-------------------|-------------|
| Regular Members   | \$5.00/year |
| Associate Members | \$4.00/year |
| Student Members   | \$2.00/year |

ARTICLE VI

Annual Meeting

- Section 1. An annual meeting of the members of the society shall be held during the summer, between June and September, of each year, for the purpose of electing councilors, receiving financial reports, and for the conduct of such old business as may come before the meeting. The date and time of the meeting shall be determined by the Executive Council. The Secretary of the society shall be responsible for providing sufficient notification of the meeting to all members.
- Section 2. Other meetings may be called by the President or Executive Council when deemed necessary.
- 2.a. Several periodic meetings will be scheduled each year; time and place of said meetings to be designated by the President of Executive Council.
- Section 3. At each annual meeting the membership shall elect four officers to a one-year term, and one councilor to a three-year term or office (Article VII, Sections 1-6 and Article VIII). A slate of officers and councilors shall be recommended to the membership by a nominating committee prior to the annual meeting.

ARTICLE VII

Officers

- Section 1. The officers of the association shall be as follows:
- President
  - Vice-President
  - Secretary
  - Treasurer
- Section 2. The officers shall be elected by the membership at the annual meeting to serve one year terms of office.
- Section 3. President - The president shall be responsible for conducting the affairs of the society and for executing the policies established by the Executive Council. He shall appoint the chairman of the committees as provided in Article VIII and shall serve ex officio as a member of each committee, including the nominating committee.
- Section 4. Vice-President - In the event of the absence or disability of the President, the Vice-President shall perform the duties of the President, and when so acting, shall have all the powers of that office.
- The Vice-President shall perform such other duties as assigned to him by the Executive Council or by the President.
- Section 5. Secretary - The Secretary shall be responsible for recording the activities of the Society; recording names of officers, councilors, and committee members; giving notice of all meetings of the Society, the executive council, and committees; keeping the minutes of the meetings of the members and the Executive Council, and cause them to be recorded in a book kept for that purpose; and conducting such correspondence as may be required.
- Section 6. Treasurer - The Treasurer shall have custody of the society funds, shall keep full and accurate accounts of receipts and disbursements and shall deposit all funds and other valuable effects in the name and to the credit of the Society in such depositories as may be designated by the Executive Council. Under the direction of the President, he shall prepare an annual report accounting for all transactions and describing the financial condition of the Society. He shall

On disbursements of funds over three hundred dollars (\$300.00) the President shall countersign the checks. Otherwise the Treasurer shall be the sole signator of checks for disbursement of Society funds.

ARTICLE VIII

Executive Council

- Section 1. The Executive Council shall be composed of the four elected officers plus three additional councilors elected from the membership of the Society. At the first annual meeting one councilor will be elected to serve until the second annual meeting, one shall be elected to serve until the third annual meeting, and one shall be elected to serve until the fourth annual meeting. At each annual meeting after first, one councilor shall be elected by the membership to a three-year term of office.
- Section 2. The Executive Council shall provide the general direction and control the affairs of the association. In addition to the duties customarily performed by the Council it shall:
1. Transact all business necessary and proper for the efficient management of the Society.
  2. Establish dues and fees, payment schedules, and any reimbursements deemed appropriate.
  3. Confirm membership and terminate members who resign from the Society or who, given good cause, are voted out of the Society by a two-thirds vote of the Executive Council.
  4. Fill vacancies on the Executive Council.
  5. Appoint a By-laws Committee from the Executive council and membership at large to make recommendations for changes to these By-laws for consideration by the members at the annual meeting or a special meeting for said purpose.
  6. Appoint a nominating committee from the Executive Council and membership at large to make recommendations for officers and councilor to be nominated at the annual meeting.
  7. Appoint committees from the Executive Council and/or membership at large to address specific areas of concern to the Society, including but not limited to the following:
    - a. Program Committee
    - b. Public Relations Committee
    - c. Fund Raising Committee
    - d. Publications Committee

The Executive Council may from time to time establish other permanent or temporary committees to carry out particular activities as they may deem necessary.

ARTICLE IX

By-Laws

- Section 1. The By-Laws of the Society may be altered or repealed by affirmative vote of two-thirds of the Society membership present at any scheduled meeting of the Society. Any question as to the proper interpretation of the provisions of these By-Laws shall be resolved by majority vote of the Executive Council.

ARTICLE X

Liability and Grievances

- Section 1. No Officer, Council member, Committee member, or other member working in the name of the Society shall be held liable as a result of Society activities.
- Section 2. Grievances concerning any aspect of Society activities shall be referred to the Executive Council for consideration.

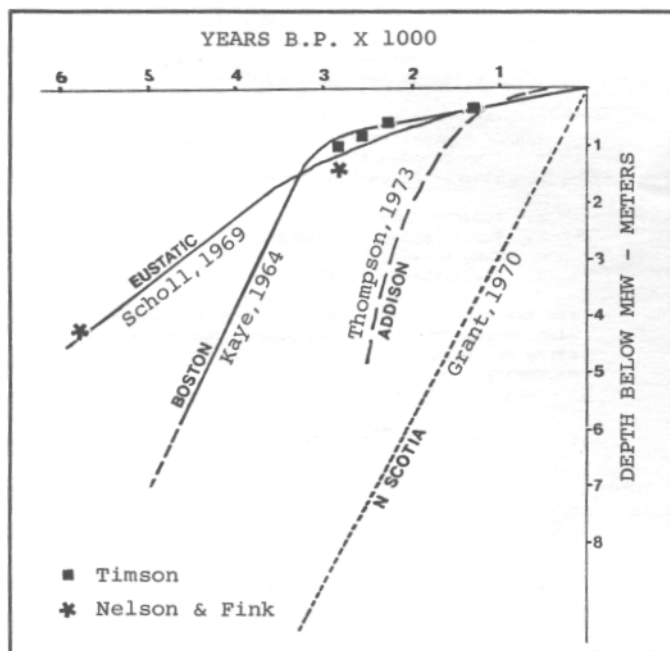
## SPRING MEETING

The Spring Meeting of GSM, hosted by Prof. Archie W. Berry, Jr., was convened by Bill Rideout at 3:20 PM on March 17th in 22 Ricker Hall, Dept. of Geology, University of Maine at Farmington, with about 38 members and guests attending. For the afternoon session, various business matters were discussed, and progress or information reports presented. Following supper at the UM-F diningroom (including various Kelly-green-shaded victuals), the evening session featured Brad Caswell's paper on groundwater planning in the Maine coastal zone, with some 4 dozen in attendance. Immediately preceding Brad's talk, Prof. Thomas E. Eastler performed an oratorical marvel in which, among other complex treatises, he exhorted the GSM to work toward the total eradication of run-off, to eliminate forever the troublesome cause of downstream pollution. The Membership deferred appointing a Run-Off Study Committee to an undetermined later date.

We wish to thank all members of the Geology Department very kindly for their many hospitalities in making the spring Meeting an informative, comfortable (and humorous) affair.

## New Carbon<sup>14</sup> Dates

We have just received, simultaneously, from Barry Timson (Consulting Geologist, Augusta) and Bruce Nelson (UM-Darling Center, Walpole), some new radiocarbon dates on saltmarsh peat samples, as shown on the following diagram from Barry.



The 4 Timson samples were cored behind the Wells barrier beach, with the following dates and depths (meters) below Mean High Water level: 1290 years before present (-0.23); 2340 (-0.58); 2630 (-0.83); and 2860 (-1.07). The 2 obtained by Bruce and Ken Fink are from Atkins Bay, Phippsburg, at 5920  $\pm$ 100 (-3.96); and from Popham village, Phippsburg, at 2740  $\pm$ 70 (-1.49). The Nelson & Fink dates are corrected for an assumed C13/C12 value of -12%; Barry's dates are not so corrected. The correction may add roughly 9-13% to the apparent age.

Barry notes that these dates fit a eustatic sea-level curve, rather than the Addison Marsh (Maine), Boston, or Nova Scotia curves. Bruce comments further "If we can believe these dates, they drastically change the picture of Holocene sea level rise in the mid-coast area. They also force a rethinking of rates of barrier maintenance processes, rates of barrier retreat, and age of features on barrier dune fields or at the marsh/dune field boundary."

## Miscellaneous

(We have many more items, and too little room left to discuss them in any depth)

**A. THE MAINE SURVEY:** Has a 3-month job from Dave Wones (USGS) to look for post-glacial movement on the Norumbega fault, Orrington to New Brunswick; 2. Will be issuing 1:250,000 Bedrock & Surficial geologic maps for many 2-degree sheets by June; 3. Has the Kingsbury (Ludman), and Skowhegan & Kingfield (Pankiwskyj) 15' bedrock maps in the mill or underway, for release this year.

**B. USGS WATER RESOURCES:** The USGS has released Glenn Prescott's newest -Groundwater Favorability and Surficial Geology of the Windham-Freeport Area, Maine; Atlas HA-564 (\$1.75 from the USGS).

**C. SANDY RIVER, FARMINGTON:** Not receptive to Tom Eastler's demonstrated recommendation to open a 7-mile ice jam by controlled dynamiting, the State air-dropped 28 tons of crushed black rock along the frozen river on March 15-16, at a cost of about \$2000. If exposed to the sun, the aggregate will absorb heat and melt the ice. Tom's plan was simply to open the jam at the downstream end, where ice had run aground in a shoal area near the Town's sewage treatment plant (a floodplain site).

## IMPORTANT CONFERENCE

Prof. Irwin Novak announced at the Spring Meeting of GSM that University of Maine-Portland--Gorham and the Maine Survey are sponsoring a conference for town planners and other officials, water-supply people, laymen and specialists, on Future of Groundwater Resources in Maine. The conference, to be held at Science Hall at UM-PG on Friday, May 19, 1978, will include about 2/3 formal presentations and 1/3 work-shop sessions. Registration (the fee includes lunch) will be at 8 AM; the program will start at 9 AM. This is an important conference. Watch for further announcements in your newspaper and mail box.

## MEMBERSHIP

The Membership year runs from August 1st to July 31. Annual dues are \$5 for Regular members; \$4 for Associate members; and \$2 for Student members. There is also a one-time \$2 Application Fee charged to new members.

To conform with our normal practice, we have color-coded the address labels on this Newsletter to designate your membership standing. If your address label is lily white, you are paid up through July 31, 1978. If your label is colored Yellow, you still owe for 1977-78. If your label shows garrish PINK, you still owe dues for both 1976-77 plus 1977-78. We'd like to hear from you

# MAINE MINING - 1977

The following Annual Preliminary report is (reprinted from the U.S. Bureau of Mines "MINERAL INDUSTRY SURVEYS". Dated January 17, 1978, the material was prepared by H. R. Babitzke in the State Liaison Program Office, under a cooperative agreement between the Bureau of Mines, U. S. Department of the Interior and the Bureau of Geology of Maine, for collecting information on all minerals except fuels. For further information, please call Herbert R. Babitzke, 207-622-6171, Extension 292.

## THE MINERAL INDUSTRY OF MAINE IN 1977

The value of mineral production in Maine was \$42.1 million in 1977, an increase of one percent over that of 1976, according to the Bureau of Mines, U. S. Department of the Interior. Major commodities produced in the State by value were sand and gravel, cement, zinc, stone and copper.

After five years of mining, Kerramerican, Inc., has suspended mining operations at its zinc-copper mine at Blue Hill. Decision to close the 1,000 ton-per-day operation was attributed to steadily decreasing prices for copper and zinc. Kerramerican, Inc., was a joint venture of Kerr Addison Mines, Ltd., and Black Hawk Mining, Ltd.

One of the most concentrated veins of garnet ever found in the United States is being developed for mining by Industrial Garnet Extractives. Production is scheduled to begin in 1978. Mt. Zion

Mining Company is developing its feldspar property near Buckfield. Oxford Feldspar Corp. at West Paris will continue to process and market the feldspar.

Sobin Chemical Co., at Orrington, a subsidiary of IMC Chemical Group, Inc., has announced a \$15 million expansion to be completed by September 1978. Sodium chlorate and hydrochloric acid will be additional end products and the expansion will double the size of the operation.

Louisiana Land and Exploration Company (LL&E) and The Superior Oil Company reported discovery of significant deposits of zinc and copper and small amounts of silver and gold on Great Northern Nekoosa Paper Co. land northwest of Ashland. It was reported that the LL&E and Superior venture is also sinking additional deep drill holes in its massive sulfide show in Parmachenee Township in northern Oxford County.

Phelps Dodge recently opened a new office in Bangor and is looking at the massive sulfide deposits in the Northern and Coastal volcanic belts. Standard Metals, Inc., continued its search for base metals in the Lake Umbagog area of Oxford County. Aquitaine is reportedly doing geophysical work on its holdings in Bowmantown Township in northern Oxford County.

The processing industry is of considerable importance to the State of Maine. Estimated value of manufactured metal and nonmetallic products was \$890 million in 1977. Value of electrical energy produced during the year was \$200 million.

Table 1. -- Mineral Production in Maine <sup>1/</sup>

Mineral	1976		1977		p/
	Quantity	Value	Quantity	Value	
		(thousands)		(thousands)	
Clays-----thousand short tons--	134	\$216	121	\$ 150	
Copper (recoverable content of ores, etc.) ---short tons--	1,766	2,459	1,338	1,785	
Gem stones-----	NA	1,105	NA	1,600	
Lead-----short tons--	216	100	178	109	
Peat-----thousand short tons--	5	173	4	169	
Sand and gravel 2/-----do-----	10,312	13,950	10,900	16,300	
Stone-----do-----	1,443	4,609	1,229	3,776	
Zinc (recoverable content of ores, etc.) -----short tons--	7,810	5,779	7,423	5,107	
Value of items that cannot be disclosed: Cement, feldspar, industrial sand and gravel, and silver-----	XX	11,973	XX	13,091	
Total	XX	40,364	xX	42,087	

p/ Preliminary. NA Not available. XX Not applicable.

<sup>1/</sup> Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

<sup>2/</sup> Excludes industrial sand and gravel.

H. R. Babitzke recently sent the latest 1976 Bureau of Mines publications list. Selected publications on energy & fuels and mining in Maine are listed below. Order directly from Supt. of Documents, Gov't Printing Office, Washington, 20402, payable to Superintendent of Documents.

INFORMATION CIRCULAR IC 8722 - Fuels and Energy Data: Unites States by States and Census Divisions, 1973, by L. H. Crump. 1976. 112 pp. GPO Stock No. 024-004-01892-5. \$1.85

INFORMATION CIRCULAR IC 8704 - Historical Fuels and Energy Consumption Data, 1960-72, U. S. by States and Census Districts East of the Mississippi, by L. H. Crump. 1976. 456 pp. GPO Cat. No. 128.27:8704. Stock No. 024-004-01833-0. \$6.80

SPECIAL PUBLICATION SP 10-76 - Mining and Mineral Operations in the New England and Mid-Atlantic States. A Visitor Guide. by Bureau of Mines States Liaison officers. 1976. 72 pp. GPO Stock No. 024-004-01889-5. \$2.30





The Geological Society of Maine c/o  
 John R. Rand, Cundy's Harbor  
 RD 2 - 210A, Brunswick, Maine 04011

THE MAINE GEOLOGIST is published four times a year, in September, late Fall, late Winter and maybe June or July, for Members of the Geological Society of Maine, Inc., a non-profit educational Maine corporation interested in all aspects of the geology of the State of Maine.

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No, Virginia, this is not the GSM's candidate for the TRUE plot of post-glacial sea level rise, even though it doesn't look too bad as a first approximation. In case you have ever wondered what the month-to-month business of GSM looked like, here it is, attractively graphed, from the date of beginning in Art Hussey's Barn on July 28, 1974. Since the Society year starts on August 1st, Membership is arbitrarily taken to zero each year on that day, while money in the treasury carries over. The curves run to March 2, 1978, on which day we had \$944.93 in the pot, and we had 167 paid-up Members eagerly awaiting the Spring Meeting and/or the next Newsletter. We've had the Meeting; here's the Newsletter.

