

borings made and additional testing is in progress.

Groundwater quality at a distance of 1200 feet from the dump was found to be significantly poorer than the average water quality in the aquifer but still generally within recommended drinking water limits. The exception was manganese. Manganese is troublesome in Rhode Island groundwater and this was found to be an important source of high manganese water.

AN ELECTRIC ANALOG MODEL OF THE CHIPUXET GROUNDWATER AQUIFER, UPPER PAWCATUCK RIVER BASIN, RHODE ISLAND

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The aquifer being modeled is relatively small - approximately 4 miles long and 4000 feet wide. The Chipuxet River flows over the areas of highest transmissibility, the most favorable locations for high yield wells. Pumping adjacent to streams is expected to effect streamflow and it is necessary for planning purposes to be able to accurately quantify this effect.

A number of methods are available for evaluating the effects of pumping on streamflow but they all depend on an accurate description of the hydraulic connection between the aquifer and the stream over the area of interest.

As an aid in determining the relevant streambed properties an analog model was operated on the basis that the transmissivity from an initial transmissivity map and the aquifer boundary conditions were known, reasonable assumptions on the basis of data available, and the streambed properties were unknown. To match the watertable prior to development only resistors representing the streambed varied. This approach resulted in a good match of the observed watertable map. Some adjustment in the initial transmissivity would further improve the match. The streambed properties determined in this way are felt to be a good starting point for analysis of future pumping schemes. As an additional check the properties determined from the analog are being compared with values determined from analysis of pumping tests both by traditional techniques and by modeling the pumping tests using digital computer techniques.

TECTONIC ENVIRONMENT OF TORRIDONIAN-MOINE-DALRADIAN DEPOSITION

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The Eocambrian to Early Cambrian Moine and Dalradian metasedimentary assemblages of northern Britain outcrop over a larger area and are much thicker than equivalent sequences in the same structural position along strike of the Caledonian-Appalachian orogen. I suggest that initial rifting and a small amount (≈ 100 km) of sea-floor spreading occurred about 750 m.y. ago on two arms of a 3-rift triple junction sited in the area now occupied by the Scottish Moine-Dalradian assemblage. Sediment supply controlled by the southwestern arm and the now lost southeastern arm accounts for the anomalously large accumulation at the junction. About 600 m.y. ago, rifting recurred in this area, and started on the site of the Appalachians, leading to the opening of the Appalachian-Caledonian ocean (Iapetus). Evidence for two phases of rifting in Scotland includes: the rift vulcanism and

change of depositional environment at the base of the Upper Dalradian; the eastward cut-out of the Torridonian by the unconformably overlying Durness platform sequence; the facies change within the Torridonian from alluvial fans to a thick greywacke sequence; the absence of the Eocambrian glacial boulder bed from Appalachian stratigraphy; and the available dates for rifting in the northwestern Appalachians (≈ 600 m.y.) compared with those in the Caledonides (≈ 750 m.y.). The movements of Madagascar during the Mesozoic provide an appropriate analog with the situation discussed.

RELATION OF THE HYPSONOMETRIC INTEGRAL TO LOW STREAMFLOW DURATION FOR SOME PENNSYLVANIA WATERSHEDS

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Eight watersheds in Pennsylvania, draining areas of uniform climate and lithology, but different geologic structure, were studied for their geomorphic, geologic, and low streamflow characteristics for 25 summer months. From this investigation, a model has been developed which relates low streamflow duration (cfsm) to a single geomorphic parameter, the hypsometric integral (HI). With the model, the separate effects of geologic structure and lithology on local groundwater regimes can be evaluated quantitatively in the relatively undeformed Allegheny High Plateaus section and the folded and faulted Appalachian Mountain section in Pennsylvania.

In the two areas, the hypsometric integral is an index of the areal distribution of different rock types, and streamflow duration increases as the value of the integral increases. For the Plateau data, the relation between summer $Q(90)$, cfsm, and HI has a correlation coefficient of 0.960 at the 0.05 level of significance. For the Mountain data, $r = 0.950$ at the same level of significance.

The separation of the two curves shows that a predominantly shale-siltstone area in the deformed mountain terrane produces as much low-flow runoff per unit area as a sandstone area in the relatively undeformed plateau terrane. As these two lithologies should, in the same climatic setting, produce significantly different quantities of base-flow runoff, the effect fracturing due to deformation has on local groundwater regimes is quantified by the model.

A strong, significant correlation between summer flow-duration curves and total flow-duration curves for two streams in each area illustrates the value of short-term gaging for hydrogeologic analysis.

UPTAKE OF MERCURY BY MUSKRATS RESULTING FROM INDUSTRIAL POLLUTION IN ONONDAGA LAKE, CENTRAL NEW YORK

Kozuchowski, Jack, Biology Department, Syracuse University, Syracuse, New York 13210

Onondaga Lake, a polluted eutrophic lake in central New York State, has received mercury loadings as high as 22 pounds per day through the discharge of local soda ash manufacturing. A muskrat population around Onondaga Lake has been compared to a rural control muskrat population with respect to mercury concentration in liver and kidney tissues. The kidney tissue average of 6 Onondaga Lake muskrats shows a mercury concentration of 211.68 micrograms/gram, as compared to 145.44 micrograms/gram in 6 kidneys from a control popu-

PLEISTOCENE GEOLOGY II: NEW YORK, NEW ENGLAND, AND ATLANTIC PROVINCES

Persian Room, 1400 hours

Parker Calkin and Jean-Claude Dionne, Presiding

1. *Robert G. LaFleur*: Sequence of Events in the Eastern Mohawk Lowland Prior to Waning of Lake Albany 1400
2. *George C. Kelley*: Deglaciation of the Housatonic Region in Northwestern Connecticut 1420
3. *Stephen P. Averill*: Multiple Wisconsin Glaciation of the Hudson and Hackensack Valleys 1440
4. *Leslie A. Sirkin*,* *Robert Stuckenrath*: The Mid-Wisconsinan (Farmdalian) Interstadial in the Northern Atlantic Coastal Plain 1500
5. *Walter S. Newman*,* *Thomas J. Pike*: Late Quaternary Geology of Northern Queens County, Long Island, New York 1520
6. *Marvin Saines*: Geomorphology of Dry Brook Hill, Connecticut Valley, Massachusetts 1540
7. *Frederick D. Larsen*: Movement of Late Wisconsinan Ice in Central Vermont as shown by the Barre Granite Indicator Fan 1600
8. *Raymond W. Tekverk*,* *C. Wroe Wolfe*: Stratigraphy of Glacial Clays in Norridgewock, Maine 1620
9. *R. P. Lynde*,* *M. J. Hewett*, *B. Wiley*, *D. W. Folger*: Distribution of Lacustrine and Marine Sediments in Southern Lake Champlain 1640
10. *D. R. Grant*,* *V. K. Prest*: The Contrasting Styles of Late-Wisconsinan Laurentide and Appalachian Glaciation: New England and the Atlantic Provinces . . 1700

SYMPOSIUM V: HOT SPOTS AND AULACOGENS OF THE MARGINS OF IAPETUS (THE PALEOZOIC ATLANTIC)

Empire Room, 1400 hours

J. Tuzo Wilson, Presiding

1. *John F. Dewey*: The Wilson Cycle 1400
2. *John M. Bird*: Late Precambrian Graben Facies of the Northern Appalachians 1415
3. *Marshall Kay*: Ottawa-Bonnechere Graben: Tectonic Significance of an Aulacogen 1430
4. *Thomas Thompson*: Abstract not available 1445
5. *Harold Williams*,* *J. G. Payne*: Metamorphic Complexes within the Proto-Atlantic Ocean 1500
6. *John Rodgers*: Appalachian Salients and Recesses 1515
7. *W.S.F. Kidd*: Tectonic Environment of Torridonian-Moine-Dalradian Deposition 1530
8. *Kevin Burke*: Hot Spots and Aulacogens of the European Margin: Leicester/Shropshire; Oslo/Fen; Alno 1545
9. *W. D. Brückner*, *C. J. Hughes*, *J. Malpas*: Facies Comparison of Late Proterozoic-Early Paleozoic Rock Units in Southeast Newfoundland and Southwest Morocco 1600
10. *Robert S. Fleming, Jr.*,* *John R. Sumner*: Interpretation of Geophysical Anomalies over the Arcuate Appalachians 1615

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VOLUME 7 · NUMBER 1 · JANUARY 1975 · BOULDER, COLORADO
GAAPBC 7 (1) 1-140 (1975)
US ISSN 0016-7592

Northeastern Section 10th Annual Meeting

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