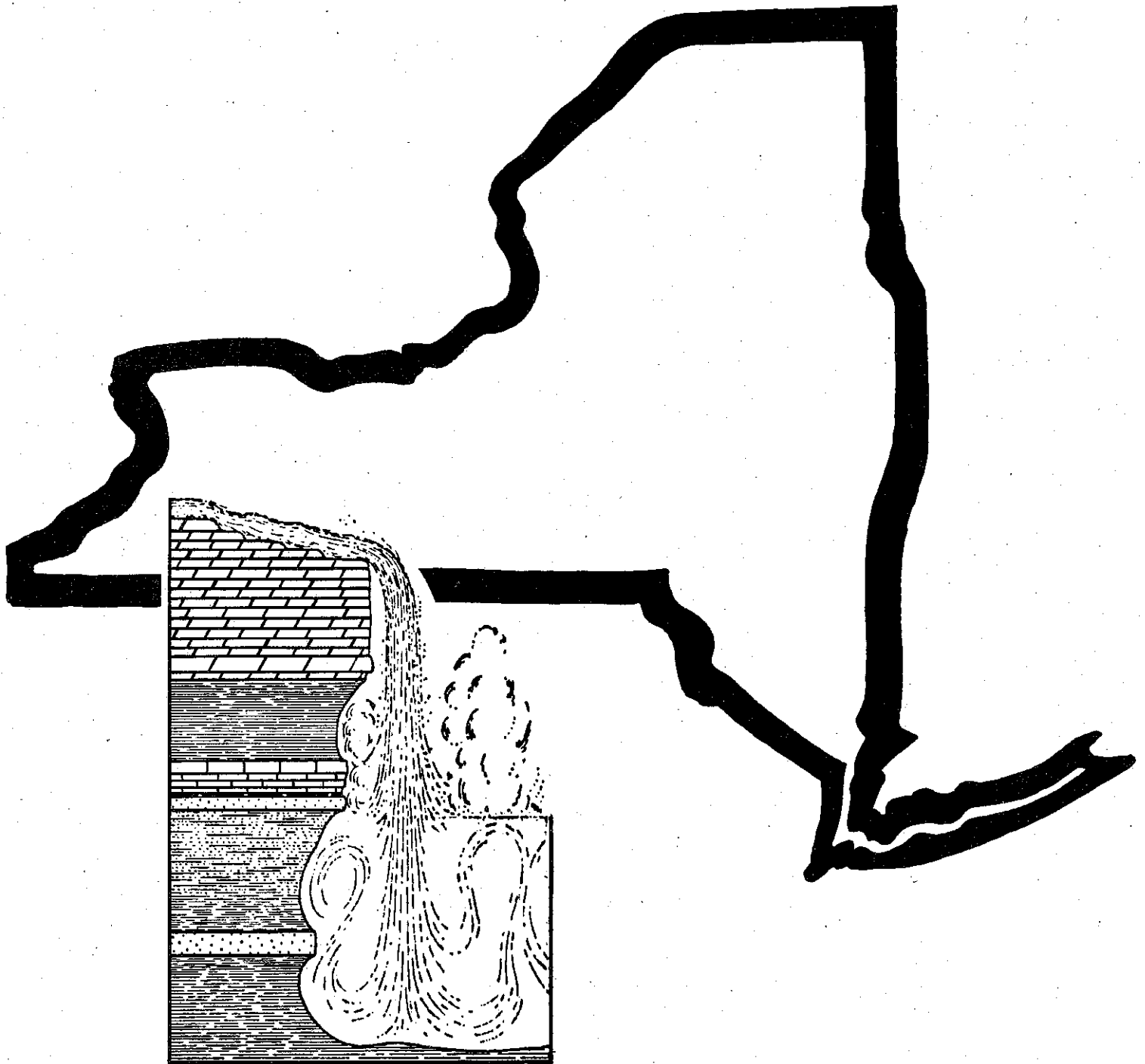


VOLUME 13, NUMBER 1 • MAY 1978

# NEW YORK GLACIOGRAM



**DEPARTMENT OF GEOLOGICAL SCIENCES**

State University of New York at Buffalo  
Buffalo, New York 14207

## EDITORIAL POLICY

The GLACIOGRAM is intended to be a collection of informal notes concentrated on Quaternary work relating to New York either directly or indirectly. It is not a formal publication and is not circulated to libraries nor to individuals not engaged in Quaternary research. The information included is often of a preliminary and tentative nature and as such should not be quoted and certainly not without communication with appropriate authors. One of the charter contributors (Muller, v. 6(1)) has suggested that reference to information in the GLACIOGRAM be identified merely as informal communication.

Parker E. Calkin

Peter J. Barnett - Ontario Geological Survey

As of April 1st, the former Ontario Division of Mines, Ministry of Natural Resources has changed its name to the Ontario Geological Survey, Ministry of Natural Resources.

An updated index map of Federal (GSC) and Provincial (OGS) government publications on Quaternary geology in Ontario is now available.

February 1978, saw the release of the Quaternary Geology of the Simcoe area, Southern Ontario (OGS GR162) which contains discussions on several glacial events which affected the Lake Erie Basin, and may be of interest to workers in New York State. Also I have finally submitted a paper on Lake Whittlesey proposing a different supporting ice front position in Ontario (Waterdown Moraines) which is probably the correlative of the Marilla Moraine. Based on the relationship to Lake Whittlesey this advance (depositing the Halton Till in Ontario) may be the Port Huron Moraine Equivalent in the eastern end of the Erie basin.

Last summer, field mapping commenced in the area around Renfrew, Ontario in the Upper Ottawa Valley. Of interest there is the Champlain Sea shoreline features. Several levels of the sea were indicated by the reconnaissance mapping project, but more detailed work is required to sort out these various levels. This coming summer mapping will be in the adjacent area to the west.

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Bern Feenstra - Ontario Geological Survey

An open file report on the Niagara Welland area is about to be released. The following is the abstract of this report which will be of interest to workers in New York State.

#### ABSTRACT

The Quaternary deposits of the Niagara-Welland area range in thickness from 0 to 400 feet (0-122m). They cover a dissected Ontario lowland - Niagara and Onondaga cuesta landscape (Eriean Valley?, St. Davids Gorge) underlain predominantly by gently south-dipping Paleozoic (Ordovician-Devonian) shales, dolostones, and limestones.

The oldest Quaternary deposits, dating back to the Middle - and possibly Early Wisconsinan Substages, have been recognized to date only as sedimentary fill in the buried St. Davids Gorge.

The Late Wisconsinan sequence comprises in ascending stratigraphic order: 1- buried lower till (Missouri-Port Bruce Stadial); 2- buried lower proglacial lake-bottom deposits (Mackinaw Interstadial-Port Huron Stadial); 3- surficial Halton Till (Port Huron Stadial); and, 4- surficial upper proglacial lake deposits (Port Huron Stadial - Two Creeks Interstadial); associated with the Lakes Warren - Iroquois stands. This sequence was well exposed along excavations for the relocated Welland Canal. It suggests basically two advances by the Ontario-Erie

lobe of the continental ice sheet across the area and inundation by lake waters accompanying glacial retreat.

Silty to clayey Halton Till is exposed in the Iroquois plain, along the Niagara Escarpment, and at the Vinemount Moraine and segments of the Fort Erie, Crystal Beach, Wainfleet, and Mohawk Bay Moraines in the Haldimand clay plain.

Upper proglacial lake deposits consist of bottom clay and silt (predominant on Haldimand plain), ice-contact deltaic material or Halton Till, and deltaic sand (west of Wainfleet, Twelve Mile - and St. Davids re-entrant valleys). The Lake Iroquois shorebluff forms the most prominent abandoned strandline feature. It is interrupted by a large baymouth bar in St. Catharines.

Recent drainage courses (Niagara River, Twelve- and Twenty Mile Creeks and others) originated on the eastward expanding Niagara Peninsula soon after deglaciation and during further lowering of lake levels in the Erie and Ontario basins.

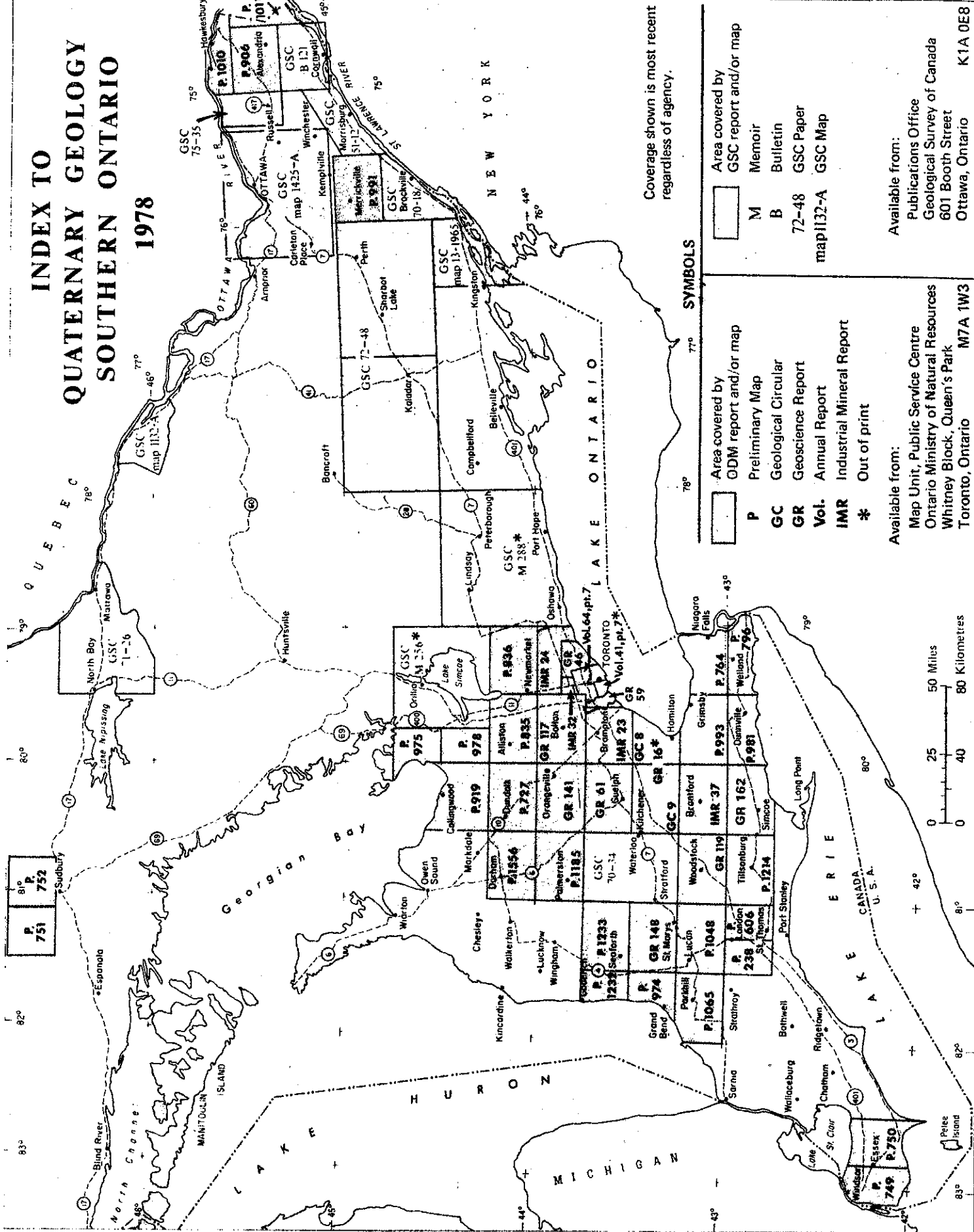
Fine grained sand on the large, open, ancestral Grand River-Lake Dunnville delta plain west of Wainfleet was blown by westerly winds into a field of small inland dunes.

The Welland Bog is the most extensive peat bog in the area and its origin and size may be related to overgrowth of an open pond at the Grandage Escarpment and bog-transgression.

Lake Erie shore material consists of bedrock exposed mainly at low, flat headlands or points, beach sand and gravel along bays inbetween, and a narrow strip of backshore dune sand. The Lake Ontario shoreline is characterized by low, eroding bluffs composed of Lake Iroquois sediments overlying Halton Till. These bluffs are interrupted by drowned stream valleys closed off from the lake by baymouth bars.

Sand and gravel aggregate potential on a commercial scale in the area is essentially limited to the ice-contact deltaic deposit at Fonthill. The only commercial source of peat is formed by the Welland Bog where peat moss is processed for use as soil conditioner. The large clay-resource has not been commercially worked for the manufacture of brick and drain tile since the 1920's.

# INDEX TO QUATERNARY GEOLOGY SOUTHERN ONTARIO 1978



Coverage shown is most recent regardless of agency.

SYMBOLS	
<span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span>	Area covered by ODM report and/or map
<span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span>	Area covered by GSC report and/or map
P	Preliminary Map
GC	Geological Circular
GR	Geoscience Report
Vol.	Annual Report
IMR	Industrial Mineral Report
*	Out of print
M	Memoir
B	Bulletin
72-48	GSC Paper
map1132-A	GSC Map

Available from:  
Map Unit, Public Service Centre  
Ontario Ministry of Natural Resources  
Whitney Block, Queen's Park  
Toronto, Ontario M7A 1W3

Available from:  
Publications Office  
Geological Survey of Canada  
601 Booth Street  
Ottawa, Ontario K1A 0E8

Bob Black - - - - Geology - - - - University of Connecticut

My note, written for "Geology", on the "Regional stagnation of ice in northeastern Connecticut: An alternative model of deglaciation for part of New England" appeared in the September, 1977, Bull. of GSA instead. I would have amplified many portions of the paper if I had known it would appear there. Hopefully the readers will see enough evidence to justify the conclusions reached. This summer I will be involved in the compilation of the glacial map of Connecticut. Then I will go to Wisconsin for some additional field checking on former research, and then to Canada for meetings in Edmonton and also to the Juneau Ice Field.

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Parker Calkin - - - - Geology - - - - SUNY at Buffalo

My students, Kim Fortune, Tom Drexhage, and Sandy Brennan, are still working on inlet closure, bluff recession, and bluff stability respectively of the New York Coast of Lake Ontario. Richar Geier is doing similar studies of the N.Y. Lake Erie coastline. Pierrette Turcotte-Roy is starting a comprehensive study of Lake Wisconsin glacial retreat in the Northeast as a Ph.D. project. My paper with Carlton Brett on the Ancestral Niagara Gorge will be coming out in the August Bulletin of GSA. Jim Ellis and I are getting ready to go to the Brooks Range Alaska this summer where we're looking at glaciation along the Trans-Alaska pipeline on the Continental Divide.

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Donald R. Coates - - - - Geology - - - - SUNY at Binghamton

My major research effort this summer and fall (while on sabbatical) will be completion of the manuscript for my textbook ENVIRONMENTAL GEOLOGY. I am also working on a variety of consulting projects that involve glacial geology: (1) sand and gravel cases for the NYS Attorney General, (2) geologic source reports for NYSDOT... four need doing at this time, (3) lawsuit involving the Broome County Sanitary Landfill, the leachate occurs in some glacial sediments, and (4) quantity of glacial borrow used in construction of parts of Route 17.

A number of graduate students are doing their dissertations and theses on glacial problems and include:

Robert Gillespie (Ph.D.) Character of glacial deposits and landforms in the Binghamton-Elmira region.

Richard Caprio (Ph.D.) Re-interpretation of the Olean-Binghamton Drift and glacial stratigraphy in central New York.

Amy Altman (M.A.) Quantitative analysis of the magnitude of glacial erosion in western New York.

Kevin Phelan (M.A.) Genesis of anomalous bedrock landforms in central New York.

Peter Michael (M.A.) New York umlaufbergs.

Carol Terrana (M.A.) Soft sediment deformation in glacial deposits.

For those who haven't seen LANDSLIDES (D.R. Coates, ed., Geol. Soc. Amer. Vol 3, Reviews in Engineering Geology, 1977) there are several chapters devoted to glacial geology aspects of the topic.

I hope to see many of you during the course of the next several months but please mark on your calendar the dates of October 20-21. This will be the time of the Geomorphology Symposium. The topic is Thresholds in Geomorphology. I am firmly convinced that thresholds will constitute one of the significant research areas in geomorphology in the next 10 to 15 years... The establishment of boundary conditions for change should be of vital concern to us all.

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Robert H. Fakundiny - - - - Environmental Geology - - - - NY Geo. Survey

The New York State Geological Survey is undergoing reorganization that will probably result in two sections, one to continue regional and typical studies and the other to undertake specific research programs directed to energy resource evaluation and environmental geology studies. Robert H. Fickies has joined our staff as a new member of the Energy/Environmental Geology section. Another change at the Survey is the resignation of James F. Davis as State Geologist. Jim is the new State Geologist of California and Director of the California Division of Mines and Geology. We wish Jim success in California. It will be difficult to find a replacement who will be able to support glacial studies to the extent that Jim did. His new address is:

Dr. James F. Davis  
California Division of Mines  
and Geology  
1416 Ninth Street  
Sacramento, California 95814

Our studies at the low-level nuclear waste burial site located at West Valley in northern Cattaraugus County continue with increased emphasis on erosion rates and landform modification processes. We hope to eventually put these findings into a computer program that would evaluate the time expected for radionuclides traveling by way of groundwater paths to reach

the surface environments. This requires not only an estimate of radionuclide migration rates along anticipated groundwater routes, but also the rate of land surface downcutting and backwasting toward the burial trenches.

Glacial geology mapping and compilation will continue this summer in the Finger Lakes Region with, we hope, the participation of glacial geologists and students from several universities within New York. The Quaternary Geology of New York State Niagara Sheet by Ernest H. Muller, Museum & Science Service, Map & Chart Series 28, is published and is proving to be a great success. A couple of potential uses of the map are aggregate resource location and assessment and land-use planning, because the units are designated not only by age and glacial deposit genesis but also material type. I will be presenting a discussion of this potential in the 14th Forum on the Geology of Industrial Minerals being held in Albany, New York this May 4-6. The New York State Geological Survey is a co-host of the proceedings along with N.Y.S. Geological Survey, Empire State Concrete & Aggregate Producers Association, Inc., State University of New York at Albany, N.Y.S. Department of Transportation, N.Y.S. Department of Environmental Conservation, Rensselaer Polytechnic Institute, and Dunn Geoscience Corporation.

Research will continue this summer in Lakes Erie and Ontario by a United States Geological Survey team based at Woods Hole. They have a new boat that is outfitted with a spectrum of geophysical equipment and sampling devices. Anyone with ideas for research projects that can "piggyback" on the planned research program should send me a note for collation into a work schedule. Structural targets, locations of unusual bedrock topography, bottom sediment sampling sites, and basement geophysical anomalies are among the types of features that would be interesting to investigate.

Another program that should be started is a regional investigation of the relationship between geomorphic features, especially those developed in post-glacial time, and neotectonics-earthquake hazard. I would be interested in any ideas that could lead to a Federally funded, team-study that might produce some estimates of regional erosion rates, earthquake recurrence rates, and aseismic crustal deformation rates.

The New York State Geological Survey intends to start a statewide assessment of landslide potential under the direction of Bob Dineen. Any suggestions for approaches to regional compilation, useful map scales, and effective presentation techniques will be gratefully accepted.

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Robert Dineen - - - - New York State Geological Survey

1. Colonie Channel Project, R. J. Dineen (NYSGS), R. Waller (USGS - Albany), E. Hanson (Albany County Environmental Management Council). The



illustrations and figures for this project are almost ready. The final text is being written by Roger Waller and me. Electric and gamma-ray logs from twenty-two test wells show seventeen gamma-ray units, several of which can be traced from Saratoga Lake to South Bethlehem, N.Y., a distance of forty-five kilometers. These units average three meters in thickness, are varved clays to silts, and are usually bounded by turbidities. They tend to fine upwards (with a few exceptions). The gamma-ray correlations and lithologic data indicate at least two readvances into Lake Albany; the later readvance occurred just before the end of Lake Albany. The gamma-ray units might be caused by either surges of the ice, rapid retreat of the local ice tongue, or by catastrophic floods from the Iroquois-Mohawk, or all of the above.

Roger Waller is preparing a report on the hydrology of the Colonie Channel.

2. Albany 15 Minute Quad, Surficial Geology, R. J. Dineen. I have completed mapping the Albany 15 minute quad at 1:24,000. I have started mapping the Coxsackie 15 minute quad. I am working on the final text for the Albany quad, which will include a section on engineering properties of the surficial deposits. Deltaic sequence, terraces, paleochannels, and subsurface data indicate the following glacial lake stages in the Albany area:

- +360 ft. Lake Schodack
- +335 ft. Lake Rensselaer, with several ice surges
- +310 ft. Lower Lake Rensselaer - readvance to Albany
- +335 ft. Lake Albany - Delmar readvance
- +310 ft. Lake Quaker Springs - initiation of Colonie Dune episode
- +250 ft. Lake Quaker Springs
- +210 ft. Lake Coveville
- +160 ft. Lake Coveville
- +110 to +60 ft. Fort Ann - Hudson River Stage

Locally, stagnant ice blocks survived until the end of the Fort Ann stage. The Colonie Dune episode continued, with decreasing intensity, until the time of the C1 (or Oak-Hemlock) Pollen Zone.

3. Holocene Studies

a. Pollen Studies, R. J. Dineen and Don Lewis, (NYS Biological Survey). These studies include examination of pollen cores for regional and local climatic data. Several pollen cores in the Albany area show a strong local influence of pine that persists into the regional oak zone. These cores are being compared with a core from Bear Swamp, in the Helderberg Mountains, that seems to better reflect regional pollen zonation. Carbon - 14 analysis from these cores are providing us with relatively solid dates for the pollen zones.

Bear Swamp shows a date of 11,590  $\pm$  295 yr. for the boundary of the A-B (Spruce - Pine) zones and 4000  $\pm$  100 yr. for the early part of the

C-2 (Oak - Beech) zone. Additional dates have been submitted to pin down the ages of the early A zone, the A-B boundary, and the C1-C2 boundary.

b. Archeological Studies: two floodplain sites containing Late Archaic Amerind remains have been mapped in the upper Hudson (Schuylerville) and upper Susquehanna (Street Site - east of Oneonta). A terrace colluvium site has been mapped in Beacon, on the lower Hudson. These studies are providing data on floodplain history and sedimentation, and are training archeologists to deal with the complications of interpretation caused by the floodplain geological environment. Eventually, I hope these sites will contribute to a better understanding of Holocene stratigraphy, climate, and environments. The studies are being conducted in co-operation with R. Funk, B. Wellman, and W. Starna (Oneonta - Street Site), C. Fisher, W. Bouchard, R. Norelli (Beacon Site), and H. Brumbach (Schuylerville Site).

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Aleksis Dreimanis - - - - Geology - - - - University of Western Ontario

It took several months last winter to catch up with the work that had piled up during the extensive travels last summer and last fall: couple of trips to British Columbia, two INQUA field trips - one along, on and under the glaciers of southern Iceland, another - in Ireland, the INQUA X Congress in U.K., lecturing and field discussions with Swedish and Danish Quaternary geologists and geomorphologists in southern Sweden, a few days in southern Germany, the ALPQUA excursion through eastern and southern Switzerland, and finally the GSA annual meeting at Seattle, Wash. The field trips were particularly valuable for differentiating facts from hypotheses, for discussing different views, for learning about Quaternary geology and geomorphology and the way of life in other countries, and, finally, for widening my own views.

Among my last year's publications the following one is in part related to northern New York: "Correlations of Wisconsin glacial events between the Eastern Great Lakes and the St. Lawrence Lowlands", in vol. 31, Nos. 1-2 of Geographie Physique at Quaternarie. In Pleistocene stratigraphy we are so short of absolute dating methods that it is worth investigating the so-called "semi-absolute" dating methods. Therefore, after having watched the thermoluminescence dating with considerable scepticism for several years, I and A. Raukas (Tallin, Estonia), supported by two physicists, G. Hutt and P.W. Whippey, have written a review on the present status of TL dating of terrestrial Pleistocene deposits, with main purpose to stir more interest in developing this method. It is in press in "Geoscience Canada". According to the claims of some Ukrainian and Russian stratigraphers, the TL age determinations, presently well accepted in archaeology, may range up to 1.2 million years B.P., but the method still has numerous weaknesses.

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Edward Evenson - - - - Geology - - - - Lehigh University

Ed Evenson, Jim Cotter (Lehigh U.), Les Sirkin (Adelphi U), and Bill Sevon (Pa. Geol. Survey) will begin a project this Fall designed to determine the absolute age, provenance, and geometry of deglaciation of northeastern Pennsylvania and adjacent New York and New Jersey. Included in the study will be the mapping of ice marginal deposits north of the "Terminal Moraine" and provenance studies of tills. In addition, paly-nological investigations will be utilized to select material for radio-metric dating. By identifying the Herb pollen zone in sediments from cores of lakes and bogs related to moraine complexes, we hope to obtain organic material deposited during the initial stages of deglaciation. In this way we hope to obtain accurate deglaciation dates rather than "minimum dates".

In a related investigation, two graduate students at Lehigh University, Joanne Meglio and Jack Ridge, are engaged in mapping the glacial deposits and sequential deglaciation of the Great Valley Province. Areas between the "Culver's Gap Moraine" in Northern New Jersey to south of the "Terminal Moraine" in Northern New Jersey to south of the "Terminal Moraine" in Pennsylvania will be mapped (scale 1:24,000). Relative ages of the drift sheets will be determined using clay mineralogy and pedology. Provenance will be determined using heavy minerals and pebble counts.

Both projects are aimed at reconstructing the geometry and timing (absolute and relative) of the Woodfordian deglaciation of Pennsylvania and New Jersey - areas which hold the key to accurate correlation between the eastern and central U.S. glacial sequences.

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Rhodes Fairbridge - - - - Geology - - - - Columbia University

Lately I have been following up the Hudson Bay beach-ridge work begun with C. Hillaire-Marcel (4th Aug. 1977, Nature; and Jan. 1978 Geology). We are hoping that a useful Holocene chronology will emerge that will relate planetary orbital cycles, geomagnetics, radiocarbon, & climate (March 1978 EOS).

See further contribution from Rhodes Fairbridge at the end of GLACIOGRAM.

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Jane L. Forsyth - - - - Geology - - - - Bowling Green St. University

Jane reports (October 31) that, after a quick trip to Colorado's Big Thompson Canyon, to see the effects of the catastrophic 1976 flood (area

has been recovered very well, but anyone knowing what the canyon used to look like can see impressive changes), she headed to England for INQUA this last summer. The pre-congress trip taken was the "Northern Highlands of Scotland", a magnificent cross-country demonstration of gorgeous scenery with excellent interpretations by Dr. Chalmers Clapperton of the University of Aberdeen Geography Department--very fine, very-well-run trip, aided by six days of beautiful sunshine in those mountains. The meetings, which lasted for 10 days, were fun, as most of you probably know, since I saw a number of you there. The post-congress trip I went on was the Yorkshire area, run by Dr. John Catt, of the Rothamsted (soil) Experiment Station in Hertfordshire, and friends. This trip, too, was very well run. It concentrated on a smaller area, within, on the border of, and just outside the region of Devensien (latest, - Wisconsin) glacial deposits. Although Dr. Catt is at a soil experiment station, glacial workers there do not use soils in their mapping, which shocked me, so that I was constantly suggesting how soils might help, to the point that I was called on, in many sites, for "what would soils information tell us here?". Though all of this took many dollars, it was well worth it, which I hope other of you agree with.

Not much research was done at home, but I am still looking at the history of the western end of Lake Erie basin and also at the relationship between plant distribution and geologic substrates and history. In regard to the former, I am still trying to see where our extensively occurring sand-bar deposits at 705' fit into the glacial-lakes record. In terms of elevation, they correlate best with Galcial Lake Arkona, but they do not appear to show evidence of having been submerged after formation. Parker raised some of the same questions about some beaches in a similar relative position in his 1970 paper on the beaches of the western New York area. Any contributions to this problem will be most welcome.

In regard to the plant-distribution studies, on-going work in the Bowling Green region suggests that much of what has been called the "Prairie Peninsula", the spots of originally treeless areas here that have been interpreted as having been vegetated by western species moving eastward, were actually areas too wet for trees. Most of the original vegetation in this Wood County area was swamp forest trees, but spots of treeless land, called "prairie", seem to lie consistently in the areas of very slight depression in this very flat ("laid down by a ruler") land. Interesting! and it raises a question about how much of the famous "Prairie Peninsula" was really vegetated by western species. Work continues.

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MORE FROM JANE L. FORSYTH

My summer of 1977 was dominated by INQUA, which was exciting and satisfying. I was particularly interested, in the post-Congress Yorkshire field trip, to see landscape and stratigraphy much like the midwest, but to learn that soils are never used to help in Quaternary mapping! Hopefully, I managed to "brainwash" a few of the workers there!

Summer 1978 field work will mainly deal with geologic substrates for local pre-settlement prairies, in the easternmost tip of the Prairie Peninsula (looks like these "prairies" were on wetter sites!?) and distributions of brief pre-maumee, ice-marginal lakes near Lima, Ohio, but will be limited as I try to complete manuscript preparation for earlier studies.

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Chauncy Holmes - - - - Tulley, New York

Some young researcher might become interested in a diatom-rich part in the basal few feet of a section around the margin of Jam Pond, which is near the north border of the Smithfield Flats (N.Y.) 7 1/2 min. quadrangle, about 4 miles west of McDonough. It seems similar to a diatomaceous deposit near Devils Lake, Wisconsin. The Jam Pond section is about 30 ft. thick.

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Paul Karrow - - - - Geology - - - - Waterloo University

Sabbatical leave in 1976-77 was spent at Scripps in La Jolla learning the laboratory preparations for amino acid dating in Jeff Bada's lab. Besides samples from raised California marine terraces and Alberta vertebrates, some time was spent on samples from the Toronto interglacial beds. Analyses are not yet complete so no new information can be reported.

Summer of 1977 was spent driving back from California and attending INQUA in England.

Over the winter 1977-78 I am trying to advance several projects: investigation of a Middle Wisconsinan interstadial peat and paleosol at Guelph, Ontario; revision of Geol. Rept. 16 on the Hamilton-Galt area (out of print for several years) for the Ontario Geological Survey; and oxygen and carbon isotope studies on two postglacial kettle fillings near Waterloo. A manuscript with Barry Miller and Len Kalas on glacial lake molluscan assemblages (Algonquin-Nipissing) has been submitted and a manuscript on Toronto interglacial ostracods is nearly completed with Silvana Poplawski. An attempt to date tills by thermoluminescence is being explored with Dave Huntley at Simon Frazer University; Russian literature has been reporting such dates for several years. A compilation of Canadian sub-till organic sites is in progress for IGCP.

Summer plans for 1978 include: surveying valley terraces to illuminate glacial lake history east of Lake Huron; compiling well data and geophysical surveying for bedrock topography in the Guelph and Cambridge (Galt) areas; attending AMQUA in Alberta.

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Walter Newman - - - - Geology - - - - Queens College, CUNY

We are continuing our research in several areas. Our immediate interest concerns the Ramapo Fault Zone in the vicinity of the Hudson Estuary. We are attempting to discern whether or not there has been movement along the fault zone during late glacial and Holocene time. One approach is to assume that the many ponds, lakes, and bogs along the fault zone are "sag ponds". If the later assumption be correct, if the "sag ponds" were mid-Holocene in age, the peat and pollen accumulating within the basin would be of this age and still younger. Sheldon Nelson, an M.A. candidate, finds that the bog on the Ramapo Fault just northeast of Ladentown presents a normal and expectable postglacial pollen profile so that the depression does not appear to be a Holocene "sag pond".

With Richard Pardi and Leonard Cinquemani, we are continuing to construct radiocarbon dated sea levels from basal peats along the Hudson Estuary. We find that the transgression rates for the past 6000 years decrease appreciably from south to north. This tilting represents upwarping towards the north or downwarping towards the south or some combination of both. The data is based on six stations; three north and three south of the Ramapo Fault Zone. A seventh station within the fault zone shows an anomalously high transgression rate which seems to suggest that this tidal marsh is within a graben which has sunk during the last 6000 years.

We are also working up a paper for the forthcoming Symposium on "The Extent of Late Wisconsin Ice in Northern and Eastern Canada and Eastern United States". An abstract of this paper appears below. This summer we will be working along the South Atlantic Coast attempting to secure basal peat samples from the extensive tidal marshes there so that we might compare our results with existing data further to the north and east.

#### WISCONSINAN GLACIER LIMITS IN NEW ENGLAND AND EASTERN NEW YORK

Newman, Walter S., Craig, Howard, and Sassos, Michael P., Department of Earth and Environmental Sciences; Pardi, Richard R., Radiocarbon Laboratory; and Sperling, Jon A., Department of Biology; Queens College of the City University of New York, Flushing, New York 11367

At least some portions of the subject area were covered by Laurentide Ice during the interval from the close of the St. Pierre Interstade until the incursion of the Champlain Sea west of Montreal. Although the middle St. Lawrence Valley was apparently largely ice-covered during this entire interval, there is compelling evidence for one or more mid-Wisconsin interstades in southern New England and New York. The Montauk Till in eastern Long Island is clearly earlier Wisconsinan in age while tills of similar aspect and stratigraphic position on western Long Island and Martha's Vineyard are probably also early Wisconsinan in age. It thus appears that both major Wisconsinan stades achieved approximately similar maximal stands in the subject sector.

There is no evidence that Laurentide Ice began to evacuate this sector much before 15,000 YBP (Years Before Present). Indeed, much of southern New England and New York appear to have been covered by glacial ice of the

Port Huron Stade as recently as 13,200 YBP. However, both the timing and incremental areal stages of the waning Woodfordian Stage are in controversy. Persuasive evidence indicates that the single most important event involving the southeastern sector of the Laurentide Glacier during this stage was the partitioning caused by the St. Lawrence calving ice bay. Evidence within the lower Hudson Valley clearly suggests that Great Lakes drainage ceased using the Hudson sluiceway earlier than 12,500 YBP. This observation favors Harington's (1977) hypothesis that those five fossil marine mammal finds from the Huron side of Michigan must have arrived between 12,000 and 13,000 YBP through a hitherto unrecognized arm of the Champlain Sea. For perhaps as much as one millennium after partition, local ice existed south of the St. Lawrence Valley as local remnant glaciers whose specific locations are still largely uncharted.

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Carolyn Olson - - - - Geology - - - - Indiana University

Carolyn sent the announcement for the MIDWEST FRIENDS OF THE PLEISTOCENE's 25th Meeting to be held in Southwest Indiana on May 19-21, 1978. The subject is as follows. The loess stratigraphy (Peoria, Farndale, and Loveland) and associated paleosols and ground soils will be examined in the thick loess belts bordering the confluent Wabash and Ohio Valley source areas. The effects of complexities of confluent sources upon the loess-dispersion model will be studied. The fit of southwest Indiana within the regional system of the Midwest will be presented.

Ed. - - If this gets to you before the conference and/or you wish a guidebook, write or phone Bob Ruhe at the Department of Geology, Indiana University, Bloomington.

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Jaan Terasmae - - - - Geology - - - - Brock University

Last year, geological studies supported by palynology and radiocarbon dating were carried out in the Tillsonburg area, southern Ontario, by J. Terasmae, C.E. Winn (graduate student), and P. Barnett (Ontario Geological Survey). These studies related in part to glacial lakes (such as Lake Whittlesey) and radiocarbon dates in the range of 12,000 yrs BP were obtained. A report (dealing with deglaciation of this part of Ontario) has been submitted for publication.

A study of radiocarbon dating of different kinds of samples (peat, wood, marl) from the same stratigraphic unit (Lake Nipissing sediments) has been completed in the southern Georgian Bay area and a report is ready for publication.

A report on the geology, palynology, and radiocarbon dating in the Belleville - Kingston - Ottawa area (Ontario) has been prepared. It deals with the correlation problems related to Lake Algonquin, Lake Iroquois, and the Champlain Sea.

In 1978, geological and palynological studies (supported by radiocarbon dating) will be continued in southern Ontario for the purpose of improving the currently available deglaciation scenarios for this part of the Great Lakes region.

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Fred VanAlystne - - - - NYS Dept. of Environmental Conservation

Not much to report from this part of the Department of Environmental Conservation. I am still involved with evaluation of groundwater resources throughout the State. Last winter was spent in the snows of the Pulaski area drilling at the Salmon R. Hatchery site, more work there in the Fall. Drilling this summer, I hope, at Saranac Inn, Bath and DeBruce (fish hatcheries). The rest of the time its environmentally oriented projects such as contamination, landfills, etc. Also getting my fill of the administrative aspects of ongoing studies like 208's.

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George W. White - - - - Geology - - - - University of Illinois

George W. White has now completed a map on the scale of 4 miles to the inch of the Allegheny Plateau in northeastern Ohio. It has been compiled from the 15 county maps already published or in press by the Ohio Geological Survey. The preparation of the text is proceeding.

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Michael Wilson - - - - Geography - - - - Univ. of North Carolina

Michael plans to return to Genesee Valley for more field work. Till sampling study related to eastern extension of Batavia Moraine. Will spend at least a small amount of time with Brad Higgins who will be initiating an SCS mapping project in Livingston County. I'm certainly interested in communicating with anyone who has an interest in this region.

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CONTRIBUTIONS

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REPORT: The Tenth INQUA Congress

(Birmingham, England, 1977)

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The International Union for Quaternary Research (INQUA) meets every four years by invitation of a "host" country on the recommendation of the national committee of that country. Scientists do not belong to INQUA as such, but enroll individually for each meeting. Interested nations subscribe to continuing memberships in the INQUA organization, which is itself organized through the ICSU (International Council of Scientific Unions), that in turn is supported through UNESCO (Paris). Its continuing scientific activity is maintained through a small secretariat and a series of research commissions (e.g. Quaternary Stratigraphy, Lithology, Shorelines, Loess, Tephrochronology, Paleopedology, Neotectonics, Holocene, Quaternary Maps, Paleoecology of Man), and inter-congress committees (Paleoclimatology, Environmental Organization, Chronometry).

Previous congresses in recent decades have been: Rome/Pisa (1953), Barcelona/Madrid (1957), Warsaw (1961), Denver (1965), Paris (1969), Christchurch, New Zealand (1973). Meetings usually last about 7-10 days with pre- and post-congress field trips which are generally up to a week in length. Around 1000 delegates attended the Paris and Birmingham meetings. Of these, perhaps 25% are essentially geomorphologists; other specialists include palynologists, pedologists, marine geologists, archeologists, and others interested specifically in the dating, processes, climates and organic life of the last one or two million years.

Besides the international organization, it should not be forgotten that there are numerous regional or national groups, enjoying rather similar acronyms-- AMQUA (America), AQQUA (Quebec), ASSQUA (West Africa), DEUQUA (Central Europe), NORDQUA (Nordic, i.e. Scandinavian area), SASQUA (South Africa); there is also the French group AFEQ (Assoc. Fr. pour l'Etude du Quaternaire) and the less wordy British one with the QRA (Quaternary Research Association). Certainly there are other Quaternary groups and committees around the world, signifying the almost universal concern with this area of interdisciplinary studies.

Geomorphologists may find their interests catered to by two other international unions--the International Union of Geological Sciences (IUGS) and the International Geographical Union, and Quaternarists have committees or sections within the international unions dealing with Botany, Zoology, Pre-history, Anthropology and Archeology. Nevertheless, more and more in recent years the geomorphologists have found themselves reduced to an extreme minority status in various major unions of organizations. In contrast, at INQUA this reporter counted no less than 224 personal acquaintances out of slightly less than 1000 registrants in the Birmingham member list, many of them primarily geomorphologists. This illustrates the fact that in modern geomorphology the

time element is coming to be critical; it is now quantitatively studied in a sophisticated and skilled manner, usually as a result of interdisciplinary teamwork. And further, study of long-term landform processes must recognize climatologic geomorphology. INQUA is above all a forum for time and paleo-climate studies. So it is the right place for geomorphologists to be.

This assertion is not to ignore a number of other areas where INQUA does or could play a key role. It is, above all, an interdisciplinary group. It brings together botanists and limnologists, paleontologists and geophysicists, dedicated to the common goal of understanding the processes, climates and paleogeography of the youngest period of geologic time, the Quaternary. If geologists believe in paying more than just lip service to the Principle of Actualism, it is essential that they learn something more about contemporary processes, especially of erosion, transport and sedimentation, and the variability of those processes in the recent past. Unquestionably, the record of that variability is best preserved and most completely observable in the Quaternary.

#### PREDICTION OF FUTURE TRENDS

There is a growing interest today in predictability. This is a factor of particular human interest and may well emerge as a major item in national economies. For instance, there are strong implications of predictability in the modern studies of shorelines and the behaviour of sea level. Not surprisingly therefore, we noted the presence at INQUA of the directors or senior officers of the geological surveys of several countries threatened by the sea, such as the Netherlands, Belgium, Germany, Denmark and the U.K. The activity of the INQUA Shorelines Commission will be reported below.

Then there is the work of the Neotectonics Commission (also to be discussed in more detail below). Neotectonic studies, of course, especially concern the earthquake-prone regions such as the western United States, USSR, Japan, and New Zealand, and naturally the corresponding experts were at the meeting.

Natural hazards are in general becoming matters of high economic significance in many parts of the world, most especially in regions of high population density. Mineral deposits such as the coastal "black sands" or alluvial tin and alluvial diamonds can now be located with the aid of the information generated by the INQUA shoreline specialists. Paleosols associated with former land surfaces under specific paleoclimates are now known to carry major deposits of bauxite (aluminum ore), nickel and other metals. Sessions at the meeting were devoted to Pedology and to Paleopedology.

Long-term climatic prediction has long been one of the fruitless dreams of meteorologists. But meteorologists are not trained in geomorphology or the chronometric techniques of the Quaternarists. Perhaps the most promising breakthrough in climate prediction will emerge from the recent geological discoveries correlating geomagnetics and climatically related geomorphic features.

### CLIMATE AND THE MAGNETIC FIELD

At INQUA a Japanese delegate, Prof. Naoto Kawai of Osaka, displayed a 200,000 year record from Lake Biwa, showing the terrestrial magnetic field intensity and declination. Apparently they are independent of the Milankovitch planetary radiation cycles, but there is clearly a succession of fluctuations in the earth's field intensity at up to 30,000 year intervals that correlate with climatic events. In this way, now and again, the field strength drops to zero to periods of up to several thousand years. Some of the fluctuations are accompanied by total field reversals but others are not. But in any case, they are found to coincide with brief catastrophic drops in mean world temperature, as indicated by such things as sea level records, glacial readvances, Oxygen-18 isotopes, palynological or marine planktonic indicators. The writer (Fairbridge, 1977) recently proposed this in the case of the last brief geomagnetic excursion, the Gothenburg Event (i.e. around 13,000 yrs B.P.), which only lasted a few hundred years. Nevertheless there was a glacial readvance of more than 500 km, causing a sea level drop of about 12m. According to H. Flohn (Quat. Res., v. 4, 1974, p. 385) the distinguished meteorologist from Bonn, also present at the meeting, and equally supported by the Arctic specialists, Ives, Andrews and Berry (Naturwissenschaften, vol. 62, 1974, p. 118), the climate reactions set up by a brief but intense cooling institute a runaway feedback process that can cause "little ice ages" of catastrophic nature.

The magnetic-climate correlation, though anticipated by several studies, can now be regarded as proven, although cause and effect relations have yet to emerge. It is the special concern of an I.G.C.P. Working Group on Quaternary Paleomagnetism led by George Kukla. In a paper presented at the congress, Kukla (with F. Brown and R. Shuey) reported a paleomagnetic study of the Burmester core in the Great Salt Lake Basin, Utah. The Bruhnes-Matuyama boundary was found at 99m depth where it is immediately followed by a dry-climate interglacial soil and then the Bishop Ash. It is interesting that both the Gothenburg and Bruhnes magnetic events (of different magnitude), occurred at the end of major glacial intervals, and perhaps could therefore be related causally to the change in global axis and rotation due to deglacial load transfer. In themselves, however, brief falls in global temperature during magnetic reversals may be a meteorologic result of the cosmic radiation effect. As was pointed out at the meeting by Derek Schove, the minor oscillations of the magnetic field appear to have no climate correlation. The close sampling by Dr. Kawai (every 4mm) gives evidence for significant magnetic "events" at intervals over the last 200,000 yr, with an average period of 30,000 yr, but it is not by any means a regular cycle. Of interest to the magneticists is the evidence from France that puts the long-discussed Laschamp Event around 45,000-47,000 B.P. (also in the Grant Pile, see below).

As indicated by Dr. V. Šibrava in his Presidential Address, the eight warm cycles identified in central European loess profiles above the Brunhes-Matuyama boundary correlate nicely with those of the deep sea cores (shown by carbonate production, paleontology and oxygen isotopes). Thus we have a firm framework now for dating the last 700,000 years or so. In this period, the first "traditional" glacial stage, the Alpine Günz, correlates well with the "A" Glacial of the Dutch Crommerian (of Zagwijn), so that the classical four Alpine glacials formerly thought to be subdivided by interstadials, should now be reassessed in terms of eight glacials and interglacials. Nomenclatural problems are clearly looming.

At first sight we seem to have a "neat package": the classic Alpine glaciations are spread nicely throughout the Brunhes positive geomagnetic interval. Alas, it is not suitable for export. The bearer of the bad news to North America was John Boellstorff (Lincoln, Nebraska), who reported on fission track dating of volcanic ash shards. The Ogallala Group (formerly considered Pliocene) now appears to be older than 6.5 m yr and thus Miocene. The Upper Ogallala is the Kimball Formation. The Mio/Pliocene boundary is now generally put at 5 m yr. The Early Pleistocene (pre-Kansan) is here recognized as being within the Matuyama reversed epoch (pre 700,000 yr) and includes the classical Nebraskan, which rests on an ash dated 2.2 m yr and the latter in turn lies on an older till, the Elk Creek Till of Reed and Dreeszen (1965), which overlies a 2.5. m yr ash. According to marine geologists, these dates would place the Nebraskan, etc., in the Pliocene.

Thus the standard four tills in the Alps can in no way match the standard four tills of North America, Nebraskan being more than twice as old as Günz. Only the Würm-Weichselian-Wisconsinan correlation rests on reasonably firm ground, and even here many details have to be worked out.

The deduction that must be made from this and other evidence, is that the Tertiary cooling that began with the Oligocene glaciation, was progressive (though oscillatory). Clearly, the continental interior of North America was affected long before the extensive "classic" glaciations of the Alps, though earlier glaciations there ("Donau", etc.) have long been recognized.

The subdivision of the last c. 100,000 yr glacial cycle has now made "a great leap forward". The modest heroine of the story is Genevieve Woillard-Roucoux (Louvain, Belgium), who, under the direction of Frans Gullentops, studied the pollen in a long continuous lacustrine sequence from La Grande Pile, a site in the southern Vosges (Alsace) that dates from 9000 back to 140,000 B.P. It is a glacially controlled depression situated between the moraines of the last glaciation (Würm) and the previous one (Riss); it was not overridden by the Würm, so it faithfully records the vegetational history right up to the early Holocene. The cores have been studied also for diatoms, heavy minerals and volcanic ash and dated by radiocarbon and paleomagnetism. With great resourcefulness, Nils-Axel Mörner transported a Swedish foil piston

corer to the site, obtaining multiple, oriented, undisturbed cores for geomagnetic analysis. The critical evidence is that the warmest stage of the last interglacial, the Eemian, corresponds to the Blake magnetic event, as recorded also in the deep sea cores of the last interglacial. Following this there were two cool phases (Melisey I and II, counting up) and two quite warm oscillations (St. Germain I and II) before the more typical cold floras of the classic Würmian came in. The three warm phases seem to correlate with the famous Barbados reefs, I, II, III, (counting downwards), the three last glacial high sea levels dated about 110,000, 95,000 and 75,000 B.P. According to Mörner (and particularly according to Kawai) the key magnetic events of the last interglacial/glacial cycle are thus: Blake 110,000; Salmon Spring 65,000; Laschamp (c. 45,000); Lake Mungo (27/29,000); Gothenburg (12,350-13,750). Thus it now became possible to obtain significant marker horizons to bracket the "grey areas" that are just too old for radiocarbon dating.

#### BOUNDARY PROBLEMS

According to the newly published recommendations of the IUGS Sub-Commission on Stratigraphic Nomenclature (Hedberg, 1976: Jour. Geol. Education, 1977: review, v. 25, p. ), the best way to set about establishing standard definitions of strata is to identify in the field recognized sequences, set apart by boundary stratotypes, agreed to by the regional specialists. From this edifice of solid down-to-earth data, paleontologic, paleomagnetic, paleoclimatic correlations can be proposed that enable the synthesisers to propose regional or global chronostratigraphic divisions. At the meeting, Academician V.V. Menner (USSR) proposed an interesting and valuable conceptualization of total geologic chronology, pointing out, for example the logical absurdity of the Holocene as an epoch in terms of uniform time divisions. This was a body-blow near the heart for all Holocene specialists, who reacted in various degrees of indignation. Menner was right in a way, but we should also remind ourselves that classifications are set up by man for man's convenience: not by any laws of nature. It is, of course, desirable that we mortals should attempt to frame our classifications as concordantly as possible within the natural patterns. The short duration of Holocene time is certainly admitted, but the usefulness of identifying an important geologic time division for the "Recent" interglacial cycle is widely recognized.

#### The Pleistocene/Holocene Boundary.

In the discussion of Menner's paper, the present writer spoke rather strongly in favor of the lithostratigraphic bases of the Subcommission's recommendations, although it was also the same person (R.W.F.) who at Paris INQUA (1969) suggested going back from a recognized time concept to search for a lithic basis, i.e. the reverse method, when he proposed a motion that the lithostratigraphic boundary type section, for the Holocene, should be sought in the vicinity of 10,000+/- 300 B.P. (in radiocarbon years), inasmuch as this

time horizon reflected an approximate mid-point in the climatic warm up after the last glacial, as well as something close to a mid-point in the eustatic (melt) curve between the last glacial maximum (c. 18,000 B.P.) and the post-glacial high point (c. 6000 B.P.). These two parameters do not coincide, for there is a retardation of the melt process, a delay with respect to the atmospheric and ocean warming. So the suggestion was a compromise at best.

After the Paris meeting, on the basis of the global studies (by more than 100 specialists, see discussion below) of the INQUA shorelines Commission, the writer proposed that the best place to look for a Holocene boundary stratotype would be in S.W. Sweden, although some other areas could be considered (e.g. Scotland, Quebec, N.W. Washington, Japan, New Zealand). What was needed was an accessible site, in preferably marine facies, above sea-level today, and well studied. Intensive investigations and coring in the S.W. Swedish region showed that this was a good choice (Mörner, 1976: *Boreas*, v. 6, no.4). The first site proposal, the Botanical Gardens of Gothenburg, was almost perfect, but there was a narrow "grey area" between the horizon with distinctly cold water foraminifera and the following bed with warm water types, and so the search continues.

Quite independently at the meeting a paper by V. Vasari (of Oulu, Finland) demonstrated from palynological data that the late glacial/postglacial thermal boundary was situated at about 10,140 B.P. in Scotland, as again 10,100 B.P. in Southern Scandinavia. The difference in radiocarbon years is without significance, and the climate changes are thus really synchronous. Vasari concludes that this synchronicity is due to the sudden replacement of continental by oceanic conditions, and this in turn can be directly related to the rise in sea-level which at that time had just flooded the North Sea shelf and reached the Swedish west coast. In as much as the rise in sea-level ("Flandrian") is a world-wide phenomenon and is related to global warming, the selected Holocene boundary stratotype seems to be most convenient. Convenience must be stressed. In some high latitude, mountainous areas the thermal boundary tends to come later, while in the low latitudes the post-glacial warming with its increased precipitation comes as early as 13,000 B.P. (Fairbridge, 1972, *Quat. Res.*, v. 2, p. 283; also 1977, *Quat. Res.* v. 6, p. 529). The environmentally-controlled lithostratigraphically recorded change is then diachronous, whereas chronostratigraphy requires a truly synchronous time plane. That plane is not necessarily recorded in any local section except at the stratotype. Elsewhere it can only be approximated by relating it to paleontologic, lithic or magnetic markers. In connection with the Holocene boundary it is particularly convenient that Mörner (1977, *Quat. Res.* v. 7, p. 413) has now established that the Gothenburg Excursion (13, 750-12, 350 B.P.) is widely, perhaps univiersally present, and can be measured wherever appropriate sediments or igneous rocks are to be found.



The deep-sea specialists will have none of this. They pin their faith on the tried and true methods of marine paleontology, which serves to calibrate the paleomagnetic and climatic records. In numerous long, continuous cores from the different pelagic sections of the world oceans, the accepted boundary is indicated by the extinction of Discoasters and first appearances of several foraminifera, diatoms, and other planktonic organisms. This boundary is associated with the top of the Olduvai magnetic interval and is traceable to Le Castella, where there is a specific sandy horizon ("The Golden Spike") chosen to be the boundary marker bed. The age seems to be close to 1.6 m yr (Haq, Berggren and Van Couvering, 1977), a very different story from the 2.5 m yr date reported above. Whichever way it is taken this conclusion will not disturb the newer datings for the Alpine glaciations, but if we choose the younger age for the Pleistocene, in North America the Nebraskan (and other early tills) will have to be called Pliocene.

While it has been customary in Mediterranean Europe to accept the lowest subdivision of the Pleistocene as the Calabrian (of Gignoux), it has now been shown that in the stratotype area at Santa Maria di Catanzaro, it is actually included within the Sicilian, as defined in 1872 from the Palermo Basin by Doederlein. Traditionally the "Calabrian" has been regarded as the oldest Pleistocene stage (marked by first appearance of *A. islandica*), followed by "Emilian" (ushered in by *A. balthica*) and followed by "Sicilian" (with first appearance of *Globorotalia truncatulinoides*) (see Bol. Soc. Geol. Ital., v. 94, 1975, p. 889). However, further work showed the "Calabrian" to lie completely within the Sicilian, and a new lowest Pleistocene term "Santernian" is proposed *ibid.*, v. 94, 1975, p. 1613). In this southern Italian region, there was an important post-Sicilian tectogenesis that is probably to be recognized also in other parts of the world. The three preceding stages are now lumped into a super-stage, Selinuntian (Ruggieri & Sprovieri, *ibid.*, 1977). The well-known "staircase" of descending Quaternary shorelines, formerly thought to begin with Calabrian, is in fact post-Sicilian; the earlier shorelines are so disturbed that no value can be attached to the early altitudinal "correlation".

The question of subdivisions within the Quaternary geologic marine sequence was analysed in detail by a large group of marine geologists, headed (alphabetically) by W.A. Berggren and read (last on the list) by N.J. Shackleton. They recognized consistent, world-wide "FADs" and "LADs" (First and Last Appearance paleontological planes); in general it seems that the FADs may appear in different parts of the world successively, whereas the LADs are apocalyptic. This says something for the theory that paleomagnetic events play a key role in extinctions. But is the extinction due to the abrupt climatic change or is it the genetic damage? As yet it is hard to say, for the dramatic decay in the magnetic field, the drastic cooling, the extreme fall of sea-level, and the consequent salinity change all go hand-in-hand. But it must be noted that in an essentially non-glacial time like the Cretaceous (see Cooper: *Pal. Pal. Pal.*, vol. 22, 1977, p. 41) extinctions go equally well along with magnetic reversals and falls of sea-level.

While Neotectonics is a subject that is becoming more and more interesting to the "general public" of our science, because of its significance in connection with geologic hazards (seismicity, volcanicity, subsidence, landslides, etc.), longer term responsibilities involve environmental impact statements and regional planning. Marine geologists are particularly interested in the locally very thick accumulations of rather unstable Quaternary sediments inasmuch as they offer sites where very extended time scales can be investigated for paleomagnetic, paleontologic and chronologic studies as well as oxygen isotope analyses for climatic purposes. The problem, however, is that the thicker the accumulation, the greater the danger of tectonic disturbance: here is a case where the neotectonic specialists may help their stratigrapher colleagues. Quite commonly in the world, the Quaternary is limited to a 1-2m thick veneer, but in certain regions it is over 1000m thick. We can think of 5000m in southern Alaska, 3000m in the Napier region of New Zealand, nearly 2000m in the Mississippi Delta, 1200m in the Great Hungarian Plain, and more than 1000m in the offshore oil wells of Nova Scotia and in the central North Sea. From this selection, the facies evidently range from marine (pelagic and turbidite-rich), to deltaic, to glaciomarine, fluvioglacial, lacustrine and other continental sediment types. Neotectonically, they range from active subduction sites, to trailing edge situations, and incipient aulacogens, to intracratonic basins.

Membership in the Neotectonics Commission could not be finalized at the meeting, but the following names have been noted for consideration by the executive:

F. CARRARO (Turin, Italy)  
J.A. CLARK (Ithaca, U.S.)  
R. GUIRAUD (Dakar, Senegal)  
C. HILLAIRES-MARCEL (Montreal, Canada)  
I.P. KARTASHOV (Moscow, USSR)  
J.A. KATILI (Jakarta, Indonesia)  
V. KLEIN (Zagreb, Yugoslavia)  
G.J. LENSEN (New Zealand)  
N.I. NIKOLAEV (Moscow, USSR)  
Y. OTA (Yokohama, Japan)  
R.P. PASKOFF (Tunisia and France)  
A. SUGIMURA (Kobe, Japan)  
R.E. WALLACE (Menlo Park, U.S.)

### OTHER TOPICS

Discussion of the many other interesting topics introduced at INQUA must be set aside for the moment except for three quite separate items that attracted attention.

Firstly, the dating of the East African Pleistocene lakes: this was treated by several speakers--Gasse, Butzer and others, while Maley spoke on Lake Chad. It is now becoming very generally accepted that the equatorial "pluvials" are interglacial in time; thus the present cooling of the Northern Hemisphere correlates, on geological timescales, with the Saharan desertification (although certainly Man and his overgrazing animals have contributed). In contrast to the equatorial aridity during the glacials, Mediterranean lands had at last some episodes of heavier-than-now precipitation: just when is not yet clear.

Secondly, analyses of Mediterranean deep-sea cores (DSDP) disclose multiple horizons of black sapropel muds which are to be followed as extensive time markers and accordingly have been numbered consecutively, for ease of classification. These zones represent times of stagnation which could either be due to extreme thermal stratification, or to a sudden outflow of fresh water, effectively inhibiting any dynamic overturn; it is thought that such times occurred when sea level was eustatically rising, so that fresh or brackish Black Sea water was able to rise above the Bosphorus threshold (-27m) and flood into the normally extra-saline Mediterranean, which would have stood well below this level during the pleniglacial episodes.

Thirdly, the late Quaternary coastal evolution of the humid equatorial belt was extremely well presented by Tastet (at the conference). Inasmuch as these coasts have mainly the stable Precambrian, cratonic hinterlands, the Flandrian (post glacial) eustatic rise is uncomplicated with glacial isostasy and marginal bulge effects (almost universally felt in North America and N.W. Europe). Tastet's model for the Ivory Coast can thus serve as an excellent "standard" for judging the different theories of barrier island development.