Quaternary Geologist and Geomorphologist

NEWSLETTER OF THE QUATERNARY GEOLOGY AND GEOMORPHOLOGY DIVISION

February 1980

ELECTIONS

Division officers were elected on the annual ballot in October. Officers for 1980 will be:

Chairman ..... Stan Schumm
First Vice Chairwoman ..... Marie Morisawa
Second Vice Chairman ..... Troy Péwé
Secretary ..... Don J. Easterbrook

Three new panel members were also elected for two-year terms from a slate of six nominated by the Division-at-large:

Gail Ashley Dick Janda Dick Goldthwait

They will join the three holdover panelists finishing the second year of their term.

Jack Armstrong Pete Birkeland Ken Pierce

MACKIN GRANT

At the annual business meeting in San Diego, the Division voted to increase the Mackin Grant to $500, effective with the 1979 award. Applications are available upon request from the Division secretary, Department of Geology, Western Washington University, Bellingham, Washington 98225. **Deadline for receipt of applications is February 15th.**

Donna Marron, University of California at Berkeley, was awarded the 1979 Mackin Grant at the annual banquet and business meeting in San Diego, November 6, for her proposed research on slope processes in Redwood National Park. The following citation was made by Bill Bull, Chairman of the Division:

Donna Marron:

It is a distinct pleasure for the Quaternary Geology and Geomorphology Division of the Geological Society of America to award you the J. Hoover Mackin Research Grant for 1979 for your proposed studies on slope processes in the watersheds that have recently been added to Redwood National Park in northwestern California. Your work should provide some exceptional data and new concepts regarding rates of geomorphic processes and impacts of human activities.

The J. Hoover Mackin Research Grant is in honor of a truly outstanding geomorphologist. For more than three decades, Hoover Mackin stimulated and guided many students at two major universities. He was renowned as a teacher as well as being an outstanding field scientist, and his scientific contributions have greatly increased our understanding of a variety of important subjects. J. Hoover Mackin's memory can be honored in no better way than to provide a token of financial support to a student like yourself. His dedication to Quaternary geology and geomorphology and his careful work set a remarkable standard of quality for all of us.

Congratulations on your award-winning ideas on your Ph.D. research. The Society wishes you the best of luck.

W. B. Bull

KIRK BRYAN AWARD

Stan Schumm, Colorado State University, was presented the 1979 Kirk Bryan Award at the annual meeting in San Diego for his work "The Fluvial System." The citation, made by Division Chairman Bill Bull, will be published in the GSA *Bulletin*.

BRETZ WINS PENROSE MEDAL

J Harlen Bretz was awarded the Geological Society of America Penrose Medal for 1979 at the annual meeting in San Diego. Although he was unable to personally attend, his daughter and son were present to receive the award and read a statement written by him. The formal citation by M. King Hubbert and Bretz's response also will be published in the *Bulletin*. The nominating letter, prepared for the Division by Victor Baker, succinctly spells out Bretz's contributions to geology:

The Quaternary Geology and Geomorphology Division of GSA is honored to nominate one of the great geologists of our century for the 1979 Penrose Medal. Dr. J Harlen Bretz not only contributed an immense body of knowledge to American geology, but he also originated one of the most important genetic interpretations of a landform assemblage in the annals of science.

In a brilliant series of papers between 1923 and 1932, Bretz

shocked the geological community with his studies of an enormous plexus of proglacial channels eroded into the loess and basalt of the Columbia Plateau, eastern Washington. This region, which he named the "Channeled Scabland," contained erosional and depositional features that were unique among fluvial phenomena. With painstaking field work, before the advent of aerial photographs and modern topographic maps, Bretz documented the field relationships of the region. He argued that the landforms could only be explained as the product of a relatively brief, but enormous flood, which he called the "Spokane Flood."

When Bretz published his work on the Channeled Scabland, the ruling paradigm of Geology was uniformity. The Spokane Flood hypothesis appeared to contradict the uniformitarian tradition that made geology a science in the nineteenth century. It was the catastrophist idea of the Noachian debacle that Louis Agassiz had laid to rest with his glacial theory. Bretz's Spokane Flood hypothesis appeared as anathema to many of his contemporaries. Everett Olson, writing in the *Journal of Geology* (1969, v. 77, p. 59), summarized the reaction to Bretz's hypothesis: "During its not always calm history, the story of the development of the Channeled Scabland was thought by some to have brushed beyond the dividing line in flaunting catastrophe too vividly in the face of the uniformity that had lent scientific dignity to interpretation of the history of the earth."

The Spokane Flood controversy is perhaps the finest example in our science demonstrating the value of an outrageous hypothesis. Scientists are frequently inept at distinguishing absurdity from outrage. A foolish idea is always self evident, but not so with the rare, creative insight that happens to pass all reasonable bounds in the consensus of knowledge. The remarks of a former president of our society: "How narrowly limited is the special field, either in subject or locality, upon which a member of the Geological Society of America now ventures to address his colleagues. I wonder sometimes if younger men do not find our meeting rather demure, not to say a trifle dull; and whether they would not enjoy a return to the livelier manners of earlier times . . . (Their) feeling of discouragement must often be shared by the chairman of a meeting when, after his encouraging inviation, 'This interesting paper is now open for discussion,' only silence follows. We shall be indeed fortunate if geology is so marvelously enlarged in the next 30 years as physics has been in the last 30. But to make such progress, violence must be done to many of our accepted principles."

After speaking these words in 1926, William Morris Davis made the case for value of outrageous geological hypothesis, even suggesting that geologists seriously consider "the Wegener outrage of wandering continents." He concluded by saying that the valuable outrage was that which encouraged the contemplation of other possible behaviors. Such outrages deserve contemplation followed not, he states, "by an off-hand verdict of 'impossible' or 'absurd,' but a contemplation deliberate enough to seek out just what conditions would make the outrage seem permissible and reasonable."

Needless to say, W. M. Davis was one of the first to accept Bretz's interpretaiton in the 1920s. It is a commentary on those years that others were not so tolerant. "During all those years, I was fighting for my professional career" (quotation of Dr. Bretz by the Seattle Times, July 11, 1971). Bretz himself explored the consequences of his "outrage." His 1956 paper resoundingly confirmed the catastrophic flood theory by answering in meticulous detail all the previous objections to his grand hypothesis. It took over 30 years and the coming of a new generation of geologists for his theory to gain general acceptance.

J Harlen Bretz was born on September 2, 1882. His Ph.D. dissertation (Univ. Chicago, 1913) was the first definitive monograph on the Quaternary geology of the Puget Sound region of Washington. As a faculty member at the University of Chicago for over 30 years, he wrote 20 major articles and monographs on the Channeled Scabland. In the 1930s his research turned to physiographic studies in Greenland and the geology of the Chicago region. His two monographs on Chicago contain an ingenious analysis of the draining of Glacial Lake Chicago (a predecessor of modern Lake Michigan). From 1938–1961 Bretz established one of the most important American schools of thought on the origin of limestone caverns. His studies of caves in 17 states, Mexico, and Bermuda placed speleology on a firm scientific base. His insights and energy are a major reason for the modern resurgence of karst geomorphic and hydrologic studies in the United States.

Dr. Bretz officially retired from the University of Chicago in 1947. However, the attached professional bibliography shows that his years as Professor Emeritus were nearly as productive scientifically as those on the active faculty. With Leland Horberg he published the first modern geological analysis of petrocalcic soil formation (caliche). Perhaps the most extensive survey of caves in one state was his book *Caves of Missouri* (1956). In the 1960s Bretz's monumental analysis of geomorphic history of the Ozarks of Missouri had him questioning the new geomorphic paradigm of "dynamic equilibrium." Today, at age 97, Dr. Bretz still maintains a vigorous correspondence with former students and colleagues from his home at 2114 Cedar Road, Homewood, Illinois 60430.

As the Viking spacecraft were orbiting Mars in the summer of 1976, the cameras were trained on the great Martian channel systems. They revealed uplands streamlined by fluid flow, eroded scabland on the channel floor, and many other features that we now know to be diagnostic of bedrock erosion by catastrophic flooding. Fifty years after J Harlen Bretz's theory of scabland erosion on the Columbia Plateau was being denounced at an infamous meeting of the Washington Academy of Science, Viking scientists were using Bretz's well-documented studies of the Channeled Scabland as the major Earth-analog to Martian channel erosion. Few geological concepts, born amid bitter controversy over a half century ago, have continued to have such relevance to our science.

A SELECTED BIBLIOGRAPHY OF J HARLEN BRETZ

(in chronologic order)

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ARCTIC SYMPOSIUM REPORT

A 1-day symposium "Important Frontiers of Research in the Paleoceanography of the Arctic Seas," was held on April 17, 1979, at the Quaternary Research Center, University of Washington in Seattle. The participants represented a broad spectrum of disciplines, including physical and chemical oceanography, sea-ice dynamics, marine geochemistry, micropaleontology, glaciology, geomorphology, and magnetic stratigraphy. The purpose of the conference was to examine the present status of knowledge and to point out the most pertinent areas of future research.

Knut Aagaard and Nobert Untersteiner (University of Washington), reviewed data on present oceanographic conditions in the Arctic, emphasizing that the strong density stratification of the upper 100 to 200 m of the Arctic Ocean is critical in the maintenance of permanent ice cover. Above about 500 m, the stability is solely salinity-controlled. Not only is the temperature contribution to density small, but it is also destabilizing. The salinity structure represents a dynamic equilibrium between the subsurface addition of salt from the Atlantic water and the addition of fresh water from runoff. In addition to salt, the Atlantic water also supplies large quantities of sensible heat. The role of various mechanisms is not completely clear, but gravitational convection during winter is probably of major importance. Several separate lines of inquiry have recently suggested that vertical mixing and cycling of salt and fresh water in the Arctic Ocean are more effective than had been thought.

A key question is therefore the temporal stability of the salinity stratification. At present very little is known about it, not even whether the most important feedback mechanisms are positive or negative. Annual variations in discharge from the major rivers can be nearly 50% of the long-term mean, and inflow of Atlantic water can vary by this much. The consequences for the ice cover of these variations is not known.

What happened in the past is also speculative, but during glacial periods, when the atmospheric circulation must have been more strongly zonal, little if any Atlantic water may have entered the Arctic Ocean, perhaps resulting in more stratification than at present. The same might also have been the case for the Norwegian Sea.

George Kukla, Lamont-Doherty Geological Observatory, discussed paleomagnetic stratigraphy of Arctic deep-sea cores collected by LDGO over the past two decades, and pointed out several problems inherent to oceanic sediments in low sedimentation areas, such as the flank and crest provinces of the Alpha Cordillera. Reasons perhaps include homogenization of sediments by bioturbation which makes the definition of magnetic boundaries imprecise and attenuates the signals of climatic fluctuations.

The oceanic paleoclimates interpreted from the fossil record of planktonic foraminifers and oxygen isotope measurements were summarized by Yvonne Herman, Washington State University: Three major climatic regimes are recognized in Arctic sediments deposited in the past ≃4.5 to 5 m.y. During the earliest, (≃4.5 to 2.5 m.y. B.P.), red clays containing manganese micronodules, ice rafted debris, and solution-resistant, cold-water planktonic foraminifera were deposited. The sediments representing the second climatic regime, deposited in the Matuyama epoch, contain abundant coarse, ice-rafted debris and sub-Artic solution-susceptible planktonic foraminifera. During the Matuyama epoch, (~2.5 to 0.7 m.y. B.P.), global temperatures were lower than in the preceding 2 million years, and the paradoxal dominance of "warmer" planktonics in this epoch may be due to the dissolution of these warmer solution-susceptible elements in the red clays. The sediments of the youngest climatic regime, deposited during the Brunhes epoch, contain about seven foram-rich/foram-poor cycles. The latter are believed by some investigators to represent low productivity periods, while other attribute the near absence of fossils to post-depositional solution due to prolonged exposure to corrosive cold bottom water in areas of very low sedimentation or to a very thick ice cover which would have inhibited productivity.

Minze Stuiver, University of Washington, reviewed interpretations of oxygen isotope analysis of planktonic and benthonic foraminifera in deep-sea cores, emphasizing the value of this technique for elucidating paleoclimates. He pointed out that interpretation of the isotopic record of foraminiferal shells is complicated by the simultaneous changes in the isotopic composition and temperatures of the oceans, the former primarily controlled by the waxing and waning of continental ice sheets.

Principal Conclusions and Recommendations

The consensus among participants was that an interdisciplinary long-term program would be highly desirable and very timely; such programs should include:

1. Comprehensive observational records in the fields of physical, chemical, and biological oceanography. Furthermore, the sediment-coring program should be extended to the little known Eurasian Basin, in particular to regions of relatively high sedimentation about the CCD and to sectors near the present sea-ice limits. The latter areas may be the most sensitive to climatic changes. Dating of sediments radiochemically and by magnetic stratigraphy needs to be undertaken concurrently with paleontological and oxygen isotope determinations.

2. Investigation of the effect of Arctic ice cover on global climate.

Yvonne Herman, Wash. State Univ.

NOMINATIONS FOR QG & G PANEL

Each year the Division-at-large nominates six member-candidates for the three upcoming vacancies on the QG & G Panel. The names will then appear on the annual ballot. Three of the six nominees will be elected to serve a two-year term on the Panel.

All voting affiliates of the Division are eligible to nominate three persons. Nominees must be listed in the QG & G membership directory found in the "Affiliates of the Society" section of the GSA *Membership Directory*. Send nominations to Don J. Easterbrook, Secretary, Dept. of Geology, Western Washington University, Bellingham, Washington 98225.

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Don J. Easterbrook, Secretary
Quaternary Geology and Geomorphology Division