signal that would be only marginally observable, even if it appeared instantaneously. [Hao et al., op. cit.]

Hao et al. took an approach of normal elasticity analysis employing the usual conventions of sign. The essential feature, they state, is the avoidance in their analysis of the effects of stress singularities. A related problem is in the piezomagnetic moment as it is plotted across a fault. They note that stress and the piezomagnetically induced magnetization are continuous across a fault, and thus the calculations do not yield artifacts caused by the infinite field that would be required by a discontinuity, which would be physically impossible. Thus they imposed artificial limits on the calculated stress in their 'smeared dislocation' model.

The result of the calculations seems to be consistent with the observations that pre-earthquake magnetic phenomena are hard to pin down. The authors end on an optimistic note, however, 'Nevertheless, a seismomagnetic effect must exist. . . . The particular advantages of sensitivity to stress rather than strain and integration of effects down to ca. 20 km, remain. Seismomagnetic observations are more difficult than we thought, but we believe that they are feasible.'

The results indicate that the magnetic anomalies are extremely weak, the peak magnetic flux density reaching 5 nT in only one model, and in all models considered the anomaly fields that exceeded 1 nT are very restricted. Thus identification of seismomagnetic anomalies will require very sensitive and favorably located instruments.—*PMB*

New Apollo Asteroid Discovered

PAGE 609

A new asteroid that periodically crosses the earth's orbit was recently discovered when two components of a rare split comet were photographed. The asteroid has been made a possible candidate for an asteroid rendezvous mission under study at Jet Propulsion Laboratory. The newly discovered body, 1982 DB, is a member of a group of earth-orbit-crossing objects called Apollo asteroids. They are maverick asteroids in unique orbits outside the main asteroid belt between Mars and Jupiter.

1982 DB, one of 34 known Apollo asteroids, made its closest approach to the earth in January, when it passed within 4.6 million k (2.9 million miles). The asteroid also is especially accessible from the earth since it is nearly in the plane of the ecliptic—the approximate plane of the solar system in which the planets orbit the sun.

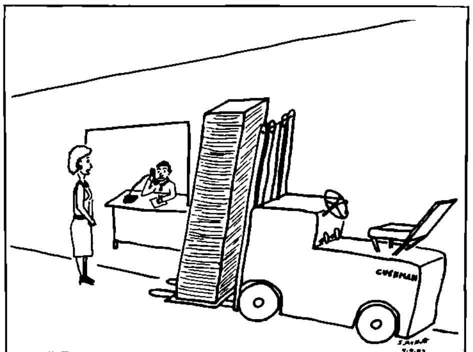
Eleanor Helin and Eugene Shoemaker have conducted a systematic search for asteroids and comets at Palomar Observatory for 10 years. They discovered the new asteroid while obtaining a follow-up observation of Comet du Toit-Hartley, which was observed 45 years ago as a single body and which had split since its earlier apparition. Both components of the comet were recorded about 1° apart on a single photographic plate with the 1.2-m Schmidt telescope at Palomar. In between the two cometary bodies, Helin found the characteristic streak of the 'new' asteroid—1982 DB.

'To obtain an observation of a split comet and this object in that position in the sky is quite extraordinary,' Helin said of the discovery. When the asteroid was found, it displayed retrograde motion in relation to the earth. Observations from the Kitt Peak Observatory in Arizona and the Mauna Kea Observatory in Hawaii are underway to determine the possible composition and size of the asteroid, in addition to its rotation rate. Its size could range from less than a mile to several miles in diameter.

Helin initiated a systematic search for Apollo-type asteroids in the early 1970's in collaboration with Shoemaker. The search, conducted with the Schmidt telescopes at Mt. Palomar, has yielded many discoveries, including the Apollo asteroid Aten, the first asteroid found to have an orbit smaller than the earth's and a period of revolution about the sun of less than a year. Other discoveries include unusual asteroids crossing Venus, Earth, and Mars orbits and numerous main-belt asteroids. She discovered Comet Helin in the spring of 1977.

The asteroid was determined to be an accessible target for an asteroid rendezvous mission, replacing the asteroid Anteros as a prime candidate for a possible mission to explore and sample an asteroid. Asteroids may contain a geologic record of the early solar system and could provide clues to the formation of planets and satellites.

According to mission designers at the Jet Propulsion Laboratory, 1982 DB could be reached by spacecraft with relatively little energy. The Mariner Mark 2 spacecraft, under study at JPL for low-cost space exploration missions, could be used for such an asteroid rendezvous mission. [Source: JPL]—*PMB*



"I HAVE THE AUGUST JGR. WHERE DO YOU WANT ME TO PUT IT?"

Geophysicists

PAGE 609

Benjamin A. Morgan has been appointed chief of the Office of Geochemistry and Geophysics at the U.S. Geological Survey in Reston, Va. He succeeds ***Robert I. Tilling,*** who had been chief since May 1977. Tilling will resume his research within the USGS Geologic Division in Reston.

Francis G. Stehli, dean of graduate studies and research at the University of Florida, has been appointed dean of the University of Oklahoma's new College of Geosciences. Before becoming dean at the University of Florida in 1980, Stehli spent 20 years at Case Western Reserve University as a professor of earth sciences and in various administrative positions, including dean of science and engineering.

Books

Some Perspectives of the Major Biogeochemical Cycles

PAGES 609, 610

G. E. Likens (Ed.), SCOPE 17, John Wiley, New York, xiii + 175 pp., 1981.

Reviewed by James C. G. Walker

It was little more than a decade ago that the first attempts were made to compile comprehensive budgets for the trace constituents of the atmosphere. The realization that material flows through the atmosphere—that atmospheric gases have sources and sinks—was still strange, exciting, and new. The budgets were grossly in error, of course, because the photochemical activity of the troposphere, associated with the hydroxyl radical, was not appreciated. The biogeochemical cycle has become a household name in the world of science in a very short period of time.

We study biogeochemical cycles to understand what processes control the composition of the environment, to learn how this composition may have varied in the past, and to predict how it may vary in the future. Concerns about pollution have been the major stimulus to this study. Indeed, the volume under review is a publication of the Scientific Committee on Problems of the Environment (SCOPE) of the International Council of Scientific Unions (ICSU). As up-to-date as any work available, this volume shows how much we have learned about biogeochemical cycles and how little we know.

There are at least three phases in the study of biogeochemical cycles, all of them illustrated in this book. The first phase is the budget: an attempt to describe and quantify the flows of material that constitute the cycle. Section I is entitled 'Biogeochemical Cycles of Carbon, Nitrogen, and Sulphur' and contains excellent budget papers by T. Rosswall for nitrogen and M. V. Ivanov for sulphur. There is also a disappointing article on theories of climate change by E. T. Degens, H. K. Wong, and S. Kempe. This article is uncritical and unbalanced in its survey of ideas in this field.

The second phase is the attempt to understand how a biogeochemical cycle works: What are the controls and feedbacks that determine the sizes of the fluxes. There is little of this kind of work in this volume, because the major focus is phase three: interactions between biogeochemical cycles. Interactions are just beginning to receive attention; this is probably the first book devoted to them. The impact is uneven. On the one hand, it becomes clear that more than 10 years of intense effort have taught us very little about the real workings of nature. On the other hand, there clearly are important and interesting interactions for us to explore. D. H. Ehhalt, in a straightforward and uncontroversial paper, considers the photochemical coupling of nitrogen, sulphur, and carbon cycles in the atmosphere that results from their common dependence on hydroxyl. G. E. Likens, F. H. Bormann, and N. M. Johnson use a largely anecdotal approach to describe interactions in terrestrial ecosystems. A fine paper by D. W. Schindler shows how phosphorus in fresh water ecosystems controls the cycles of nitrogen, carbon, and sulphur. The companion paper by R. Wollast on marine ecosystems is really a budget paper masquerading as a paper about interactions.

The last two chapters deal with socioeconomic impacts. G. Persson estimates the costs of controlling or curing the effects of acid rain in Europe. K. M. Meyer-Abich considers possible political responses to increasing atmospheric carbon dioxide: prevention, compensation, and adaptation. He argues that the appropriate response, and indeed the only realistic one, is adaptation. In other words, the environmental effects of increasing carbon dioxide, as presently understood, do not call for any mitigating political action. I recommend this provocative paper highly. It effectively challenges some of our fondest illusions.

James C. G. Walker is with the Space Physics Research Laboratory at the University of Michigan, Ann Arbor.

A Geology of Ireland

PAGE 610

C. H. Holland (Ed.), John Wiley, New York, x + 335 pp., 1981, $49.95.

Reviewed by Kevin Burke

Regional geologists are among the unsung heroes of the earth sciences. They make maps in the field and draw stratigraphic and structural cross sections that they control by laboratory faunal, stratigraphic, and petrographic studies. Our knowledge of how the world worked in the past depends on the accumulation of many years of this kind of unglamorous data acquisition. In Ireland, field work has often been difficult: it rains a great deal, much of the solid geology is buried beneath Quaternary cover, and political and economic considerations at times in the past have not always encouraged geologic research.

Seen against such a background, the comprehensive summaries embodied in this book represent triumphant results of hard-won struggles. Most of the nine authors are faculty members at Trinity College, Dublin, and they have divided the book into 15 chapters arranged in stratigraphic order from 'Pre-Caledonian Basement' to 'The Littletonian Warm Stage-Post 10,000 BP.' In addition, there is an introduction by the editor; a brief chapter on geophysics, with maps of regional gravity and magnetic anomalies; a chapter on economic geology, including some information on the Irish continental shelf; and a chapter on the history of Irish geology.

There are 191 figures which are the meat of the book. About one third are well-chosen oblique aerial photographs, satellite images, and ground photographs, and two thirds are geologic maps, stratigraphic sections, and structure sections. There is an excellent index and a bibliography usually of between 10 and 20 references at the end of every chapter. The book, apart from its obvious role in the British Isles, should find a place as a basic reference in any library with a claim to regional comprehension.

I found the chapters on the Quaternary, the Carboniferous, and the lower Paleozoic especially interesting. The Irish Quaternary is deservedly famous, and Frank Mitchell summarizes its history in two authoritative and entertaining chapters revealing (in a tone of regret) that as he grows older the duration of deposition of the Irish Quaternary appears to grow shorter. Irish Carboniferous rocks are extensively exposed, and although economically significant coals are absent, major sulfide bodies have been found within them during the last 25 years. The structural and sedimentary environments of Carboniferous deposition in Ireland are varied and complex and have much to teach students of basin evolution.

During the older Paleozoic, the northern and southern parts of Ireland lay on either side of the *Iapetus* ocean, and the suturing of the two halves of the island has left a geologic record of extreme complexity. The chapters detailing the history of these events occupy nearly half the book. If the picture they leave is somewhat confusing it is p.obably as much because the processes involved destroy most of the record as because the authors have severely limited their comments (presumably from considerations of space) on what was going on at the same time along-strike in North America and Great Britain. Charles Holland notes in his preface that it is 17 years since Charlesworth's *Historical Geology of Ireland* appeared. In that time, geology has experienced more than one revolution, and those of us with Irish roots can be proud that Ireland's geologists have not only acquired much new data but have also proved capable of interpretation in terms of the new understanding of how the earth works.

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AGU

Arthur Weissman: Congressional Fellow

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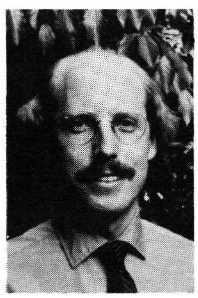

Arthur B. Weissman has been selected as the 1982–83 AGU Congressional Fellow. On September 1, he will commence his 1-year term on Capitol Hill as AGU's sixth Congressional Fellow.

Weissman received his Ph.D. earlier this year from the Department of Geography and Environmental Engineering at the Johns Hopkins University. His dissertation focused on the aesthetics and geomorphology of environmental changes.

He said, as a Congressional Fellow he would like to get involved more directly in environmental issues where scientific considerations must be related to other, often competing, viewpoints. 'I relish this mix of disciplinary perspectives and value systems and the challenge of sorting out different policy objectives,' Weissman said. 'The congressional issues in which I am particularly interested involve land use, environmental impacts, and water and air quality.' He also is interested in the way environmental impacts are defined, evaluated, and approached.

In 1975, he received an M.F.S. degree in natural resource management from Yale University's School of Forestry and Environmental Studies. Weissman received his A.B. degree in 1970 from Harvard College, where he majored in English literature and took premedical courses.

His professional employment includes a 2-year stint as assistant director of Connecticut's chapter of The Nature Conservancy, where he was responsible for management of nature preserves and for the summer student internship program. Weissman also has held summer or part-time research positions with the U.S. Geological Survey and the National Oceanic and Atmospheric Administration. In addition, he was a full-time member of the faculty at Leysin American School in Switzerland from 1971–1973.

The AGU Congressional Science Fellow program is one of about 20 professional society programs that make up the American Association for the Advancement of Science Congressional Science and Engineering Fellows Program. This program involves scientists and engineers in making public policy within Congress by working either on the staff of members of Congress, for a congressional committee, or in some other area of Congress.—*BTR*