The Geological Society of America, Inc.

Volume 7
No. 3

ENGINEERING GEOLOGY DIVISION

September
1965

NEWSLETTER

Message from Laurence James, Acting Chairman

"As announced in an earlier issue of the Newsletter, our Division Chairman, George Ekblaw, was hospitalized early in the year by illness. George's health is improving, but slowly. In the interim, division business is continuing under the direction of the Management Board (incidentally, this is a new name for the group formerly designated the Executive Committee of DEG-GSA. The new title was adopted in the revised by-laws of the Division to avoid confusion with the Executive Committee for the Society as a whole).

"The Management Board appointed several committees during the year for various purposes. The Nominations Committee included John Melvin, Chairman, Tommy Thompson and Tom Fluhr. This group was commended by GSA Executive Secretary, R. C. Becker for its prompt submission of a slate of Division officers for 1965-66. Nominees were Laurence James for chairman, Robert Karpinski for Chairmen-elect, and Donald MacDonald for secretary. On unanimous recommendation of the Board, the ballot also contained an item relative to whether or not affiliates were willing to pay annual dues in the amount of two dollars to help defray costs of Division operation over and above those for which the Society provides funds.

"An Ad Hoc committee was established to review and edit a publication by Tom Fluhr and V. G. Terenzio which epitomizes extensive geologic work performed in the past by the New York Board of Water Supply. The publication should result in a substantial contribution to engineering geology literature. Members of the committee are Robert Laurence, chairman, Alice Allen and B. C. Moneymaker.

"The program chairman for the 1965 national meeting in Kansas City is Lloyd B. Underwood. With assistance of Gordon Prescott an abundance of stimulating papers have been assembled for presentation. Elmer Marliave has been appointed program chairman for the 1966 San Francisco meeting and some advanced planning for that event is being done.

"The American Society of Civil Engineers is sponsoring a symposium on the engineering properties of shales as part of its Water Resources Conference to convene in Denver in May 1966. The ASCE-GSA joint committee on engineering geology is responsible for the shale program. Shailer Philbrick, GSA delegate, has compiled a tentative program covering the properties of shales, the engineering problems they pose, and methods for engineering design construction of structures to be located on these materials. An array of excellent speakers is being assembled and a field trip to appropriate shale areas will be included. More information on this conference should be forthcoming in the near future.

"It had been suggested that a certificate or diploma be issued to affiliates of DEG-GSA which could be framed or otherwise displayed. An inquiry of GSA concerning the propriety of this proposal was answered by Robert Legget, Vice President. He informs us that consideration is already being given to an appropriate certificate by the Executive Secretary of GSA. Perhaps we will hear more about this at the annual meeting."

Rock Mechanics

Laurence James was the GSA representative at an Intersociety Coordinating Committee for Rock Mechanics meeting in Washington, D. C., May 25. He reports that increasing interest in the field of rock mechanics has led to a proliferation of meetings, symposia, and conferences devoted to this subject. Twelve separate rock mechanics meetings had been sponsored by several societies during a one-year period. The desirability of reducing the number of annual meetings and improving communication between the growing number of geologists and engineers interested in rock mechanics has been recognized by several of the professional and scientific societies. The Washington meeting was sponsored by the National Academy of Sciences Committee on Rock Mechanics (an outgrowth of the DEG-GSA technical committee on rock mechanics), to discuss the problem and consider whether an annual interdisciplinary meeting on rock mechanics should be instigated. The other societies represented were ASTM, SPE, AAPG, AIME, AEG, ASCE, HRB and SME.

It was noted that the annual "4 School-Society of Mining Engineers Symposium (Colorado School of Mines, University of Minnesota, University of Missouri at Rolla, Pennsylvania State University, and the Society of Mining Engineers) might be expanded to achieve an interdisciplinary meeting. By adding other universities, a sufficiently broad base might be obtained.

The committee favored reducing the number of meetings, if possible, and having an annual, truly interdisciplinary meeting to improve communication in all fields of rock mechanics - civil, geological, mining, and petroleum engineering; geophysics; and structural geology. A preferred way to accomplish this is to enlarge the sponsorship of the annual interdisciplinary meetings of the "Four Universities" and the Society of Mining Engineers. It was recommended that the professional and scientific societies appoint representatives to a new intersociety committee for rock mechanics. The NAS/NRC Division of Earth Sciences offered to provide the secretariat for communications and arrangements until formal establishment of an intersociety committee.

Membership Changes

The Division welcomes the following geologists who affiliated with us during the past year:

John D. Fett
Aubrey D. Henley
John C. Kolesar
Ruth A. M. Schmidt
Ok Joon Kim
Lloyd B. Underwood
Clifford C. Payton

The Division announces with sadness the loss of the following affiliates who died during the year:

Joseph L. Gillson
Harold M. Hawkins
Carl E. Thorsen
James W. Wilson
Mark S. Lyons
V. C. Perini, Jr.
Hugh M. Roberts
H. N. Coryell

Meetings of Interest to Engineering Geologists

ASCE Hydraulics Division Conference in Tucson, August 25-27.--The sessions featured Water Resources Planning, Hydromechanics, Flood Control, Tidal Hydraulics, Surface Water Hydrology, Hydraulic Structures, Hydrometeorology, Ground Water Hydrology, and Sedimentation. According to Elmer Marliave, the papers

most interesting to members of our Division were: "Approaches to Solution of Tidal Hydraulic Problems by Analog Model, Sacramento-San Joaquin Delta area" by J. A. Nelson; "By-Passing Obstacles to Littoral Sand Movements" by W. J. Herron; "A Hydraulic Model Solves Problems in the San Francisco Bay" by E. A. Schultz; "Factors Affecting Yields of Several Aquifers in Illinois" by W. C. Watton; and "The influence of Density differences on the Rate of Removal of Saline Water by Drains" by R. E. Glover.

Association of Engineering Geologists in Denver, October 21-24.--This year's annual meeting will feature tunnels, and our Division's technical committee on Tunnels is cooperating in sponsoring a symposium on Oct. 23. David J. Varnes has arranged a program of invited speakers to present in depth modern concepts of tunnel planning and design, instrumentation, and new driving techniques. Two of the six field trips (the first a pre-convention trip) will visit tunnel projects: the Bureau of Reclamation Navajo Project tunnels in Tertiary shaly sandstone at Farmington, New Mexico (and the adjacent earth-and rock-fill Navajo Dam); and the Colorado Highway Department pilot bore through Precambrian rocks beneath the Continental Divide near Loveland, in which geologic studies made prior to construction are correlated with results.

Other subjects of engineering geologic interest will be presented, and field trips will visit:

The Morrow Point Project of the Bureau of Reclamation at Montrose, Colorado, featured by a subterranean room 125 feet high and 2-5 feet long cut in Precambrian rocks for the power plant, and the first large double-curvature thin-arch dam in the U. S.

The Cabin Creek Pumped-Storage Project of the Colorado Public Service Co. at Georgetown, where two earth-and rock-fill dams on glacial sediments will be connected by a pressure tunnel through Precambrian rocks.

A research area at Limon, Colorado where the Department of Highways and the University of Colorado are studying new techniques for determining swell potential in clay shale.

An engineering geology trip in the Denver area to observe the varied geology and its applications to engineering problems of urban development being studied by the U. S. Geological Survey.

Are you interested in Airphoto Interpretation?

As the Division liaison representative to the American Society of Photogrammetry, Jack Van Lopik would like to hear from the Division members who use photo interpretation and photogrammetric techniques in their work, with an indication of the extent and significance of this utilization. In addition to the interpretation of conventional aerial photography, are there needs or areas where improvements in existing remote sensing techniques (infrared, millimeter wave and radar imagery) would be of particular value in engineering geology?

Please address letters to Dr. J. R. Van Lopik, Technical Director of Space and Environmental Sciences, Texas Instruments, Inc., P.O. Box 5621, Dallas, Texas

Regional News

NEWS FROM THE NORTHEAST: Reporter, Albert J. Depman.--Because of the prolonged drought in the Northeastern States, concerted efforts are being made to up-date constructing of several dams in the Delaware River Basin. These potential water supply reservoirs will act to relieve the critical water shortages in the metropolitan New York and northern New Jersey areas, also to augment fresh water flows into the Delaware River to prevent further salt-water advance into the tidal estuary. At present the salt-water wedge endangers the Philadelphia water supply - the intake of which is about 95 miles from the sea and 15 miles downstream of the "fall zone" at Trenton, N.J.

The wells supplying the water for Camden, N. J., and other southern N. J. towns are also threatened by the saline encroachment. Emergency plans are being formulated to move the Philadelphia intake upstream about 3 miles to assure a salt-free diet to the city's water supply.

The Department of the Interior is presently drilling six test wells into the Pleistocene sediments of ancient Lake Passaic in Morris and Essex Counties, N. J., to investigate this area as a source of potable water for the Northern New Jersey metropolitan area.

All available sources of water supply are being investigated by geologists of various Federal and State agencies. These potential sources include old limestone quarries, flooded mines, gravel pits, abandoned private, municipal and industrial wells, ponds and lakes -- all to be considered for use either as direct sources of water supply, or to augment stream flow to inhibit saline advance into the estuaries.

The upper reservoir of the Yards Creek Pumped Storage project at Blairstown, N. J., has been initially filled and only very minor seepage has been noted. The low losses attest to the relative impermeability of Shawangunk quartzite conglomerate and to the effectiveness of the cement grouting program in the fractured upper zone of the Shawangunk Formation. The dike material consists primarily of glacial drift materials armored with the aforementioned quartzitic conglomerate.

The new Northeastern Section of GSA holds its first meeting in Philadelphia, February 10-12, 1966. Papers on geologic studies in northeastern North America are welcome. Abstract forms may be obtained from Mrs. Alice Brokars, Departmental Secretary, Department of Geology, Univ. of Pennsylvania, Philadelphia, Pa., 19104. The deadline for abstracts is October 1, 1965.

NEWS FROM THE WEST: Reporter, Raymond C. Richter.--

Advance Notice - 1966 California Conference on Slope Stability

The American Society of Civil Engineers, Soil Mechanics and Foundations Division, will hold a speciality conference on slopes on the campus of the University of California during the week of August 29, 1966. The conference will emphasize the state-of-the-art in the field of slopes. Problems of stability, performance, instrumentation, stabilization, and earthquakes as they relate to embankments and natural slopes will be treated in a series of six half-day sessions. Field trips to the San Luis and Oroville projects are being planned for the two days immediately following the conference.

California Registration Bill for Geologists Dies in 1965 Legislative Session

The California Registration Bill for geologists died in the last days of the 1965 legislative session. This bill, if passed, would have registered all geologists in California and would have provided for specific registration of such specialities as engineering geology. Many geologic groups actively supported the bill until several undesirable administrative amendments were tacked on during the closing days of the 1965 legislative session.

Seattle Earthquake of April 29

At 08:29, April 29, 1965, a moderately strong earthquake, Richter magnitude 6.5 to 6.75, struck the Seattle-Tacoma-Olympia area. The epicenter was near Dabob Bay west of Seattle. Depth of focus was quite deep, on the order of 60 km. After-shocks were felt, and maximum recorded acceleration was 0.204 g. Minor damage was widespread and consisted mostly of broken chimneys, cracked mortar, fallen fluorescent light fixtures, and loosened brick facing. The great depth of focus is probably the key factor in the widespread but minor damage pattern. Damage to hydraulic

structures was slight. Longitudinal cracking was reported at two earth-fill dams and several pipelines were severed.

July 21, 1965, Doomsday in California

On July 21, 1965, Santa Barbara went back in time to the days of the sorcerer, the dowser, and the clairvoyant. It was on this day that earthquakes and tidal waves were predicted for Southern California by a prophet. Many county officials ignored the warning; however, Santa Barbara County alerted its citizens, to the distress and consternation of many. As usual, no doomsday appeared. Apparently some individuals find it easier to believe in the crystal ball than to face up to the cold hard facts of scientific knowledge.

Sea-Water Intrusion in California

Intrusion of sea water into coastal segments of California ground water basins is a major problem with respect to the management of these basins. Initial studies to evaluate the magnitude of the problem and to determine the feasibility of control utilizing injection wells were undertaken in 1951 by a joint effort between the California Department of Water Resources and the Los Angeles County Flood Control District. The results of this field investigation were released in 1958 by the Department of Water Resources in Bulletin No. 63, "Sea-Water Intrusion in California".

The initial studies indicated the feasibility of an injection well mound. The Los Angeles County Flood Control District has therefore forged ahead with a $3,500,000 injection well program to control sea-water intrusion in the coastal plain of Los Angeles County. For further information on details of injection well programs of determining transmissibility of aquifers and well spacing, please contact Mr. Edward J. Zielbauer, Chief Engineering Geologist, Los Angeles County Flood Control District, Los Angeles, California.

NEWS FROM GHANA: Reporter, Anna Jespersen.--

Activity at Ghana's Volta River Dam

The world is well aware of Ghana's Akosombo Dam on the Volta River. The Volta Lake forming behind the dam is now expanding its coverage toward its ultimate 3,275 square miles, when it will impound 115,000 acre-feet of water. As of early August it stood at 32,000 acre-feet.

Testing is in progress and according to the Volta River Authority the electricity generated at the rock-fill Akosombo Dam by the first unit is expected to be ready for distribution commercially to the Accra-Tema area soon after September 1 and to the remainder of the southern Ghana transmission network a few weeks later. The second unit is planned to follow the first by about 2 months, with units 3 and 4 coming into production at 3-month intervals. Provision has been made for two more generating units, but they will not be developed until the demand warrants it, possibly 1970-1971.

An aluminum smelter, which will use the entire output of two generating units, is being constructed at Tema and is expected to begin drawing power in 1967. It will process imported alumina initially, until mining is developed on the large domestic bauxite deposits recently discovered at nearby Kibi and much earlier discovered at Mpraeso and Aya-Yenahin in southwestern Ghana. This smelter is one of the essentials in making the Volta River Project economically feasible.

A related but less vaunted engineering project is the relocation of some 80,000 people from 600 villages, whose homes have been or are being inundated by Volta Lake. These villagers are being regrouped in 52 communities around the lake, where each family is given a concrete-block aluminum-roofed house, one room of which is enclosed, but with plans for expansion by the occupant,

who is furnished with the necessary materials by the Volta River Authority. Each of the 52 townships is provided with schools, water and sanitation facilities, and markets. A large land-clearing program by the Volta River Authority will continue for several years, until the Ministry of Agriculture is satisfied that the needs of the relocated people in this respect have been adequately met. The policy in resettlement has been that no individual is to suffer from the move; the aim is to upgrade and improve living conditions wherever possible. The cleared land will be adaptable for mechanized farming.

Road building has been another closely related geological engineering project. Access had to be provided to the sites of the planned communities, not only for the new inhabitants but for transporting building materials. About 215 miles of new roads have been built, an equal mileage of trails have been upgraded, and some 100 miles of existing roads have had major repair.

The Geological Survey has had its full share in this tremendous undertaking from the very beginning. Sir Arthur Kitson, first Director of the Geological Survey, recognized the possibilities half a century ago of a hydroelectric plant in the Volta River Gorge as a means of providing power for converting the large newly discovered bauxite reserves into an aluminum industry. Mr. J. E. Cudjoe, the present Director of the Survey, is continuing to lend full support. Providing maps, evaluating the known bauxite and other economic mineral deposits and searching for new deposits the development of which will expand the demand for power output, and the siting of wells for the water supplies of the 52 new communities are only a part of his contribution.

NEWS FROM COSTA RICA: Reporter, Howard H. Waldron.-- Floods of water, mud, and debris from the slopes of Irazu Volcano are still plaguing parts of central Costa Rica and seriously threatening Cartago, the second largest city in Costa Rica. The flows of mud and debris are the result of the deposition of ash on the upper slopes of the volcano, which began erupting in March 1963 and kept spewing out great quantities of ash almost continuously until this past February, when it became quiescent.

The blanket of ash over the summit region profoundly upset the hydrologic regime of the streams and rivers that originate on the volcano so that even moderate rainfall caused flash floods. The accelerated runoff also greatly increased erosion, and each flash flood then severely scoured and undercut valley walls, producing torrents of mud and rock debris, reactivating several old large landslides, and initiating many new ones.

The capacity of these mudflows to destroy property and lives is very great. The December 1963 flow killed more than 20 persons and destroyed more than 500 houses in and near Cartago. In 1964 more than 90 flash floods occurred, 19 of which were serious. Not only have these floods of mud and debris destroyed many homes, but also, they have destroyed numerous bridges, wiped out sections of highways, devastated hundreds of acres of farm and residential land, and seriously threatened the water supply for San Jose, the capital and largest city of Costa Rica.

NEWS FROM SOUTH AFRICA: Reporter, David D. Smith.--In South Africa the field of engineering geology is just beginning to be recognized and practiced. The Geological Survey of South Africa has a three to four-man engineering geology unit concentrating principally on dam site investigations. Within the Council of Scientific and Industrial Research organization in Pretoria, two or three engineers are working in fields bordering closely on

engineering geology. In addition, several of the soils engineering firms in the Republic employ geologists, as do a few construction companies, but in the latter case the men generally do more routine engineering work than true engineering geology.

A course in engineering geology is given in only one University (Witwatersrand, in Johannesburg) and this in close association with the soils course in the Department of Civil Engineering. Nevertheless, prospects for greater utilization of engineering geologists in South Africa are good even though there is a considerable degree of "sales resistance" to be overcome in the contracting and engineering companies. Progress is being made slowly.

On a more personal basis our own company (Ocean Science and Engineering South Africa) in addition to extensive offshore geophysical and drilling work related to diamond prospecting, has carried out a series of harbour site investigation projects for various South African governmental agencies and private organizations. This work has centered around sub-bottom acoustic profiling and offshore vibratory coring of unconsolidated sediments -- the special equipment for both types of work were specially developed by our geophysical and engineering staff. In one harbour site project in the Cape Town area, a few days of geophysical and confirmatory vibratory coring work located a submerged, sediment-filled channel in the harbour floor which proved to be the key feature in selection of the precise site for the proposed harbour. A previous extensive (and expensive) drilling program onshore had failed to locate the channel.

Recent Publications

State of California, The Resources Agency, /1965/, Earthquake and geologic hazards conference, Dec. 7-8, 1964 (Proceedings): available from California Division of Mines and Geology, Ferry Bldg., San Francisco, Calif. 94111, or from Dept. of Water Resources in Sacramento, P.O. Box 388, zip 95802; cost, $1.00 (plus 4 cents sales tax for Californians). This is an unusual volume. It is a nearly verbatim record of what was said during the 2-day conference on current research activities in all aspects of the field of earthquake investigations. This was the first of several conferences convened and planned by the Administrator of the State Resources Agency to discuss geologic hazards. The speakers - outstanding geologists, seismologists, engineers and officials of City, County, State and Federal agencies - were asked to take part in informal discussions rather than to prepare formal papers. The proceedings volume makes good reading, and contains information on some of the most up-to-date techniques of studying earthquakes.

MINERAL INFORMATION SERVICE, the popular monthly publication of the California Division of Mines and Geology, has published an increasing proportion of articles on engineering geology recently. The July issue features a reprint (with some revision) of George Kiersch's prize-winning account of the Vaiont Reservoir disaster, and includes several other items of interest to engineering geologists. A map, prepared originally by Clarence Allen to illustrate his remarks at the Geologic Hazards Conference, shows the pattern of epicenters of the 1960 Chilean earthquakes during the first 6 months of activity, superimposed on an outline of California at the same scale. The pattern covers the State fairly well. The point is made that widely spread aftershocks may cause more local damage than the main shock itself. In the same issue is a brief report on the Seattle Earthquake of April 29, and a summary of the 2d Geologic Hazards Conference - this one on landslides and subsidence - convened in Los Angeles in May by the State Resources Agency.

Bauman, R. D., 1965, FOUNDATION CHARACTERISTICS OF SEDIMENTS, SALT LAKE METROPOLITAN AREA: Utah Geol. and Mineralogical Survey, Special Studies 10, 40 p. Price, $2.00. This report discusses the engineering properties of the highly varied sedimentary deposits that underlie the city, and the seismicity of the area. The article includes an aerial photograph of the area, 2 isometric diagrams and an Appendix of logs of nearly 200 boreholes

Hodgson, J. H., 1965, THERE ARE EARTHQUAKE RISKS IN CANADA: Canadian Consulting Engineer, v. 7, no. 7, p. 42-51. Reprints are available for 25 cents from the Dominion Observatory, Department of Mines and Technical Surveys, Ottawa and from the National Research Council, Division of Building Research, Ottawa.

The same combination of authoritative background and ability to write interestingly for the layman that was displayed in the paperback "EARTH AND EARTH STRUCTURE" (published last year by Prentice-Hall) characterizes this short paper, which deals with earthquake probabilities in Canada, and describes current work on seismic regionalization maps.

Alice S. Allen, Editor