"on" the membrane, suggesting that the knife action splits the membrane in half. Chloroplasts yield a number of different type faces with both large and small particles. Quantosomes were studied in even greater detail. In these studies the surfaces were examined before and after two kinds of enzyme treatment, looking for surface alterations as well as changes in physicochemical properties. Both lipase-galactosidase and pronase alter the photochemical activity of the system, but only pronase influences the absorption spectrum. Pronase alters the surface characteristics by reducing the size of the particles in the cleavage surface without altering the smooth surface areas. However, galactosidase-lipase roughens the smooth areas without markedly altering the size of particles present. These results were interpreted to mean that membranes are composed of subunits and that the number, arrangement, and chemical composition of these subunits vary in different membranes.

The meeting was held under informal circumstances, and no publication is planned. In addition to the staff of the City of Hope and the speakers, interested scientists from California Institute of Technology; University of California at Los Angeles, La Jolla, and Berkeley; and the University of Southern California attended the meeting.

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Marine Geotechnique

Description of the physical, chemical, and mechanical properties of the gas-fluid-solid system of the sea floor, together with an understanding of the response of the system to applied static and dynamic forces, falls within the broad province of marine geotechnologists. This relatively young field of research was the subject of the first International Research Conference on Marine Geotechnique, held 1–4 May 1966, at the University of Illinois' Allerton House conference center near Monticello. Twenty-eight scientists and engineers attended; seven were from foreign countries.

Areal studies of the mass physical and chemical properties of estuarine and marine sediments were emphasized. C. R. Kolb (Waterways Experiment Station, Vicksburg) and B. McClelland (McClelland Engineers, Houston) discussed the geotechnical properties of interdistributary, prodelta, and offshore clays of the Mississippi delta region. Kolb's x-ray radiography of clay specimens has revealed flowage, fractures, and other inhomogeneities in otherwise massive-appearing clays. McClelland at the same time showed that some of the clays exhibited excess pore-water pressures that probably have not dissipated in the 500 years that have elapsed since clay deposition. He also pointed out that values of the compression index (C_c) often increase with increasing values of the liquid limit and that void ratio generally correlates well with liquid limit.

Shear strength, bearing capacity, gas content, and general mass properties of Chesapeake Bay sediments were discussed by A. G. Altschaeffl (Purdue University), A. M. Richardson (University of Pittsburgh), and Wyman Harrison. The c/p ratio for silts with a high content of clay shows values that are quite different from those obtained from the usual correlation between c/p and plasticity index. At the same time, an average gas content of these sediments approximates 10 percent. Plate-load tests (similar to ASTM Test D 1196-57) on Chesapeake Bay sands revealed a decrease in the settlement of a plate under a given load as the diameter of the plate increased. Higher ultimate carrying capacities were obtained than would have been predicted by Terzaghi's equation for bearing capacity.

W. R. Bryant (Texas A & M University) performed consolidation testing of Gulf of Mexico cores in which the Anteus back pressure apparatus was used. Samples from the abyssal plains yield e-log p curves that show the foraminiferal oozes to be "underconsolidated." This fact contrasts with data from deep-sea clays and oozes presented by Richards and E. L. Hamilton for Atlantic, Pacific, and Mediterranean core samples. R. F. Scott (Caltech) and N. Morgenstern (Imperial College, London) questioned the meaning of values for the "preconsolidation" pressure P_c obtained from the upper few meters of recent marine sediments.

E. L. Hamilton and R. F. Dill (Naval Electronics Laboratory, San Diego) reviewed NEL's comprehensive program in marine geotechnique. Hamilton's group will continue studies of sound velocity in marine sediments, especially the determination of the shear wave in situ. Dill described the results of explosive loading of shallow sands off California and Jamaica and the use by SCUBA divers of a torque "screwdriver" to make shear vane tests of marine sands. Explosion of charges of black powder leads to densification of the sands. While the in situ vane shear test may give relative estimates of sand density from place to place, conference members engaged in soil mechanics research felt that information on the distribution of normal stress in the mass being sheared would be needed before such values could be used in slope stability analyses.

Turning to areal studies in European waters, A. Jerbo (State Railways Board, Stockholm) summarized the geotechnical properties of nearly 3000 samples from the Gulf of Bothnia and the Baltic. He noted the relatively high content of natural gas in the fine-grained sediments and stressed the fact that the shearing resistance of clayey sediments stored in cores is markedly affected by the addition of gas produced by microbes. Richards reviewed his work with the Norwegian Geotechnical Institute (NGI) on the geotechnical properties of sediments from the Oslofjord. The NGI gas-operated sampler was used for incremental sampling of the bottom and subbottom; high-resolution, echo sounding techniques were employed to determine the sediment levels actually sampled. This method of investigation, directed toward other areas of the sea floor, is being continued at Illinois.

F. C. Kögler (University at Kiel, Germany) is concerned mainly with the effects of diagenesis on sediment strength and consolidation. Cohesion of Baltic and Persian Gulf sediments—as measured with the Swedish fall-cone penetrometer—were described. Gerhard Einsele (University at Tubingen, Germany) discussed his shear strength measurements on cores from the Nile Delta, where anomalous profiles of cohesion versus sample depth can be used to determine approximate amounts of erosion of overlying sediments. G. Almagor (Geological Survey of Israel, Jerusalem) reported on the cohesion and consolidation of shelf sediments off Israel.

Laboratory work on the consolidation mechanics of artificially sedimented clays was reported by Altschaeffl, Einsele, and Scott. Altschaeffl's laboratory clays indicate they could be sedimented so as to duplicate the c/p values found in natural clays of similar

composition. One of Scott's students has developed a nonlinear theory of compressibility, based upon analysis of laboratory-sedimented clays. Richardson's laboratory work on the behavior of artificial marine sediments is directed toward the development of a theory for the mechanics of sinking of solid objects through the upper few meters of marine clays. Laboratory data of E. C. Robertson's (U.S. Geological Survey, Silver Spring, Maryland) show that at relatively low stress levels aragonitic muds from the Bahamas do not have a component of compression resulting from the crushing of aragonite needles (as postulated by Ruth Terzaghi in 1940).

Morgenstern reviewed his work on submarine slump mechanics, pointing out that slumping can take place on low slopes (1 degree to 28 degrees), that Terzaghi's theory of liquefaction may underestimate the time it takes for excess pore pressures to dissipate, that slumping can be expected when the uniformity coefficient is less than five, and that submarine slumps may not be initiated by low-to-moderate-magnitude earthquakes because the dynamic stresses may in fact be small. A. Andresen (NGI, Oslo) presented an historical resumé of Norwegian submarine flowslides.

The response of sediments of St. Andrew Bay, Florida, to artificial loading by concrete blocks of various shapes was described by G. H. Keller (U.S. Naval Oceanographic Office). Keller also described a nuclear sediment density probe that uses backscattering techniques to measure in situ density at water depths down to 6500 meters.

The extensive program in sea floor engineering at the Naval Civil Engineering Laboratory (Port Hueneme, California) was reviewed by R. Smith. Few data were presented, however, because of their classified nature. Smith emphasized that the strength of deep sea sediments is dependent upon their age as well as their composition. He also discussed the application of soil mechanics to problems related to the recovery of the hydrogen bomb off Spain. McClelland outlined problems of sea floor engineering of particular interest to his commercial firm. Among these problems were (i) the friction capacity of piles, (ii) estimation of lateral load-bearing capacity, and (iii) problems related to pipeline construction and stability on the sea floor. J. Heacock (ONR, Washington) summarized his interpretation of the Navy's requirements for marine geotechnical information.

Laboratory investigations at the University College of North Wales on the relation between acoustic and mass properties of North Atlantic deep-sea cores were reviewed by D. T. Smith. Hamilton reviewed NEL's program in this field of research and gave a graphical presentation of the speed of sound versus porosity of core samples. He showed that Pacific sediments plot in groups that reflect their environment of deposition; he recommended that pulse techniques be used to measure the speed of sound. J. J. Gallagher (Naval Underwater Sound Laboratory, New London, Connecticut) explained that his program followed NEL's guidelines, but cores are analyzed at the University of Rhode Island for their physical-acoustical properties. C. T. Fray (Lamont Geological Observatory) is studying acoustic reflecting layers in deep ocean sediments. Recent work suggests that the "Layer-A" reflector found throughout much of the North Atlantic may be the uppermost surface of sediment of Cretaceous age.

Several papers on instrumentation under development reflected both the sampling and the in situ testing needs of marine geotechnologists. Kögler explained the operation of the Kiel group's box corer. The corer is now being outfitted with a vibrohead for taking relatively undisturbed cores in sands. (Kögler, who is conversant with the Russian literature, said that vibrodrilling and coring is an advanced art in the Soviet Union.) A. Rosfelder (Scripps) displayed drawings of several corers that are to be built for taking large, "undisturbed," and oriented samples from the sea floor. Andresen presented drawings of an in situ pore pressure gage, accurate to pressure differences of 2 kg/cm^2. The gage was developed to measure pore pressures in fjord sediments where artesian pressure may be significant. This gage will be tested ultimately in the deep sea by Richards. Working with Richards at Illinois are R. Olson (Civil Engineering) and K. Preiss (Civil and Nuclear Engineering). Olson is fabricating an in situ shear-vane tester for deep-sea clays that will measure to 3 meters of sediment depth. Preiss has developed a gamma ray transmission device for the nondestructive laboratory determination of bulk density of sediment within its core barrel; an in situ probe has been designed for deep-sea investigations.

The conference was jointly sponsored by the Departments of Geology and Civil Engineering of the University of Illinois and the Institute for Oceanography, Environmental Science Services Administration. Many of the papers presented at the conference, together with others relating to marine soil mechanics and foundation engineering, will be published early in 1967 by the University of Illinois Press as a volume entitled *Marine Geotechnique*.

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Forthcoming Events

August

15–19. American **Statistical** Assoc., Los Angeles, Calif. (D. C. Riley, ASA, 810 18th St., NW, Washington, D.C. 20006)

16. International Assoc. for the **Prevention of Blindness**, general assembly, Munich, West Germany. (J. P. Baillart, 47, rue de Bellechasse, Paris 7, France)

16–17. Central Nervous System Effects of **Analgesic Drugs**, symp., Santiago, Chile. (J. Mardones, Inst. of Pharmacology, Univ. of Chile, Casilla 12967, Santiago)

16–19. International Assoc. of **Milk, Food, and Environmental Sanitarians**, Minneapolis, Minn. (H. L. Thomasson, P.O. Box 437, Shelbyville, Ind. 46176)

16–26. **Mathematicians**, intern. congr., Moscow, U.S.S.R. (V. G. Karamanov, Acad. of Sciences of the U.S.S.R., Lenin Prospekt, Moscow)

17–19. Joint **Automatic Control** Conf., 7th annual, Univ. of Washington, Seattle. (G. Kovatch, NASA, Electronics Research Center, 575 Technology Sq., Cambridge, Mass. 02139)

19–26. Applied **Geography**, symp., Intern. Geographical Union Commission on Applied Geography, West Greenwich, R.I. (P. H. Nash, Graduate School, Univ. of Rhode Island, Kingston 02881)

19–28. **Geology**, 23rd intern. congr., Prague, Czechoslovakia. (Organizing Committee, Ústredni ústav geologicky, Malostranské náměstí 19, Prague 1)

20–24. American **Phytopathological** Soc., Denver, Colo. (C. J. R. Shay, Dept. of Botany and Plant Pathology, Purdue Univ., Lafayette, Ind. 47907)

20–25. **Diseases of the Chest**, 9th intern. congr., Copenhagen, Denmark. (M. Kornfeld, American College of Chest Physicians, 112 E. Chestnut St., Chicago, Ill. 60611)

21–24. **Free Radicals in Solution**, intern. symp. Ann Arbor, Mich. (R. C. Elderfield, Dept. of Chemistry, Univ. of Michigan, Ann Arbor 48104)

21–25. American Soc. of **Agronomy**, Oklahoma State Univ., Stillwater. (M. Stelly, The Society, 677 S. Segoe Rd., Madison, Wis. 53711)

21–25. **Electron Microscopy** Soc. of