session was given over to the value of the soybean in supplementing deficient diets; one to the avitaminoses and alcoholism and metabolism; and one to fortification of foods with vitamins and hypervitaminoses. A further session dealt with nutrition as a factor in the geographical distribution of dental caries and paradentosis; and a final session was given over to a discussion of defective nutrition and public health.

Health Education: Dr. Ira V. Hiscock and Dr. W. P. Shepard, in charge. The sessions on health education were all joint sessions arranged by the Western Branch of the American Public Health Association. The sessions were opened by a symposium on health education at which addresses and reports upon various aspects of health education were presented. Following this session the program was divided into five sessions meeting simultaneously; three dealing with school health education (health instruction in the classroom, health service in schools and physical education and recreation), and two with health education of the public. The sessions continued with a résumé of the discussions on school health education and with further sessions on health education of the public. The sessions concluded with a general symposium on health education at which Dr. Walter H. Brown summarized the discussion on school health education, Dr. W. Ford Higby that on health education of the public, and Dr. Ira V. Hiscock discussed health education in the U. S. A.

Soil Resources: C. F. Shaw, S. W. Cosby, M. H. Lapham, R. E. Storie and W. W. Weir, in charge. This section, under the leadership of the late C. F. Shaw, was somewhat differently organized from the other sections. The main emphasis was laid on informal discussion of topics rather than upon formal presentation of papers. Included in the program were two two-day field trips; one to Placerville and way stations and one to Watsonville and Santa Cruz and way stations to inspect projects dealing with land use and methods of conservation and to serve as a basis for discussions at following sessions. Sessions were devoted to natural factors determining land use; soil, climate, water supply and topography, and to methods of study and mapping of the natural factors determining land use. A series of sessions were devoted to soil conditions and land use in various localities; in the foothills and interior valleys of California, in Oregon, in Washington, in the western Canadian provinces, in Central America, in Mexico, in China, in the tropical Pacific, in Australia and New Zealand, and in the Pacific coastal regions. The sessions closed with a general discussion of soil problems of Pacific lands.

THE STRUCTURE OF THE PACIFIC BASIN AS INDICATED BY EARTHQUAKES[1]

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OUR earth originated about 2,000 million years ago. Great changes must have occurred in its early history, but even yet both gradual and sudden changes show us that it has not gained complete equilibrium. The sudden movements, which we call earthquakes, give us important information about the constitution of the earth.

The main features of earthquakes are fractures and displacements which occur usually at some depth, the focus of the earthquake, but which occasionally may extend to the surface and be visible there in the form of cracks, displaced roads or fences, etc. Such displacements frequently recur for long intervals in time and space in the same direction. A well-known example is the fault system in California, especially the San Andreas fault. The movements there occur in such a way that the eastern (continental) side moves southeastward relative to the western (Pacific) side. The same fact is proved by geologic measurements in Japan.[2] As mentioned already, movements occur gradually as well as during earthquakes. If in a certain region a block along one side of the fault moves gradually in one direction relative to the block on the other side, strains will be set up along the fault which finally lead to an earthquake at the time when the strain exceeds the breaking strength of the material and a break occurs. At this moment the material on one side of the fault "snaps" towards the unstrained position in one direction, that on the other side of the fault in the opposite direction. On both sides there is a compression in the direction in which the "snapping"

[1] Abstract of a public address at the Sixth Pacific Congress, Berkeley, Calif., August 1, 1939.

[2] During the meeting of the Pacific Science Congress Professor Ch. Tsuboi stated that in Japan, along all faults without exception, the continental (western) side is moving southward relative to the Pacific side; and, according to a statement by Dr. Bailey Willis, movements along the major fault in the Philippines occur in the same way, the continental side moves southward relative to the Pacific side. These results suggest the possibility of a general movement of Eastern Asia and Western North America to the south relative to the Pacific Basin. However, many more observations are needed before this can be considered a fact.

occurs and a dilatation in the opposite direction so that in such a simple case we should expect two quadrants about the source in which compressional waves are observed and two with dilatational waves. It is of interest that such patterns of compressions and dilatations are actually observed in earthquakes. More complicated patterns occur when the shock occurs at some depth and along a fault plane which is not vertical. The fact that thus far definite patterns have been observed in all earthquakes (no data exist for those produced by volcanic eruptions) regardless of their focal depth indicates that in all shocks the processes producing the waves are of the same type of "faulting" (shearing) and can not be due to a pure explosion or collapse in the interior of the earth.

The "shallow" earthquakes (less than 30 miles deep) show one belt of high activity around the Pacific Ocean, and another through southern Asia and the Mediterranean. The "great" earthquakes are more common around the Pacific. A still larger percentage of the "intermediate" shocks (depth 30 to 200 miles) and all very deep shocks which have been found thus far (maximum depth about 450 miles) originate in the circum-Pacific area. The boundary of the true Pacific Basin is outlined by the earthquake epicenters. On the west side it follows the "Andesite line," which separates regions of different petrologic and chemical composition, and runs east of Japan, the Marianne Islands, the Palau Islands, thence north of New Guinea and the New Hebrides towards the islands of Samoa which are on the Pacific side, and then turns southward, leaving the Kermadec Islands and New Zealand on the "continental" side. On the American side, the boundary is close to the coast. The fact that the foci of all earthquakes originating deeper than 200 miles have been found close to and on the continental side of this boundary indicates that the Pacific Basin has a unique structure.

The waves produced by an earthquake spread in all directions. There are different types, which are characterized by different modes of vibrations and different speeds. The fastest waves are of the "push-pull" (longitudinal) type and travel through the interior of the earth. They are followed by vibrations in which the particles vibrate sidewise back and forth. The last group are various types of surface waves, traveling exclusively along the surface of the earth. The speed of the first waves has been determined in various regions. The results indicate that certain granitic and basaltic layers exist in the continental regions down to a discontinuity at depths between 20 and 35 miles, depending on the locality. The data for the Pacific Basin are scant and agree with the assumption that the continental surface layers are missing there. On the other hand, in Japan and New Zealand, which we have considered already as belonging to the "continental" area, these continental surface layers clearly exist, though their thickness is relatively small; this is true also for the California coastal region.

The waves traveling along the surface lead to similar conclusions. They show, in addition, that the surface structures of the Atlantic and Indian Oceans are similar to those under the continents, but much thinner. Surface waves crossing the boundaries of the Pacific Basin lose a noticeable fraction of their energy, which indicates this boundary is a marked discontinuity between different structures. The fact that very long waves are not appreciably affected leads to the conclusion that the difference between these structures ends at a depth of noticeably less than 100 miles.

Finally, waves which are reflected at the surface of the earth can be used to deduce conclusions as to the conditions at the point of reflection. If the distance between the source of the shock and the recording stations exceeds a few thousand kilometers, the energy of the "echo" is stronger if the reflection has taken place within the continental surface layer than if this was absent at the point of reflection. Discussion of these observations has confirmed results from other sources and added some details as to the exact location of the boundary of the "Pacific Basin." It has added evidence in favor of a limited area with continental structure in the southeastern part of the Pacific and of Pacific type of structure in a part of the Arctic basin.

All evidence available agrees with the conclusion that the layers which form the uppermost crust in the continents are lacking in the Pacific Basin as defined above. The belt surrounding the Pacific Basin is characterized by faults in great number. Earthquakes originating at depths from close to the surface down to several hundred miles and the existence of relatively large gravity anomalies in many of the areas involved leave no doubt that this belt is the most active region of the world and that changes are going on in it extending from the surface to a depth of a few hundred miles at least. These processes, on which local changes are superimposed, seem to persist in their directional characteristics over long-time intervals and over large distances, at least notable fractions of the Pacific boundary. The source of the energy which produces these movements and the mechanism involved are not known exactly. It seems very likely that subcrustal currents, perhaps due to thermal processes, and the difference in structure between the Pacific basin and the surrounding regions play an important role.

However, another conclusion is unavoidable: There is no reason why the earthquakes around the Pacific belt should cease. While we can not predict the exact time or location of coming shocks, there is no doubt that there will be great earthquakes somewhere around the Pacific Basin during each coming year. As a

matter of fact there is no day without small shocks in this narrow belt. However, there need not be any excessive damage connected with these shocks, even the greatest, as the science of engineering has made such progress during recent years that earthquake resistant structures can be built at a cost not exceeding much the cost of ordinary buildings. Just as large parts of California have been made "drought-proof," so that even in the driest years no lack of water is to be feared, all works of construction in the circum-Pacific belt should be made "earthquake proof," thus providing another triumph of science.

SCIENTIFIC EVENTS

THE CITY AND RURAL HEALTH CONSERVATION CONTEST

THE Chamber of Commerce of the United States in cooperation with the American Public Health Association has announced awards for the 1938 City Health Conservation Contest and the 1938 Rural Health Conservation Contest. These contests are said to be the most effective means of stimulating adequate health protection and health promotion services yet devised in this country.

Awards are made not necessarily to the healthiest communities, but rather on the effectiveness with which a community is meeting its health problems. Each city or county is appraised by a grading committee consisting of a group of carefully selected health experts from all parts of the country. Each community is appraised on what measures it takes: (1) to provide and safeguard its water supply; (2) to furnish adequate and safe sewerage disposal; (3) to reduce infant and maternal deaths; (4) to combat tuberculosis and syphilis; (5) to protect its citizens against other communicable diseases; (6) to insure healthy children; (7) to protect and safeguard its milk and other foods; (8) to promote effective cooperation with its physicians and dentists in furnishing necessary services to all those who need them; and (9) to enlarge and improve its lay-understanding of ways and means of preventing sickness and death and of maintaining good health.

The City Health Contest is financed by a group of life insurance companies. The Rural Health Contest is financed by the W. K. Kellogg Foundation of Battle Creek, Michigan. The contest in Canada is sponsored jointly by the Canadian Public Health Association and the American Public Health Association.

Two special contests, one on tuberculosis and one on syphilis, are carried on in conjunction with the City Health Contest. Awards are made to those competing cities which appear to have the most comprehensive and effective programs for combatting tuberculosis and syphilis as follows:

In Group I (cities over 500,000 population) Cleveland, Ohio, wins the first award. Awards of merit in this population group go to Buffalo, N. Y., and Pittsburgh, Pa.

In Group II (cities of 250,000 to 500,000 population) Providence, R. I., is the winner. Awards of merit in this group go to Memphis, Tenn.; Louisville, Ky.; Dallas, Texas, and Cincinnati, Ohio.

In Group III (cities of 100,000 to 250,000 population) the winner is Grand Rapids, Mich. Awards of merit go to Reading, Pa.; Yonkers, N. Y., and Erie, Pa.

In Group IV (cities of 50,000 to 100,000 population) the winner is Newton, Mass. Awards of merit go to Madison, Wis., Greensboro, N. C., and Evansville, Ill., tied.

In Group V (cities of from 20,000 to 50,000 population) the winner is Plainfield, N. J. Awards of merit go to Winona, Minn.; Orange, N. J., and Stamford, Conn.

In Group VI (cities of less than 20,000 population) the winner is Englewood, N. J. Awards of merit go to Hibbing, Minn., and Virginia, Minn.

In the 1938 Special Contest for Tuberculosis Control Hartford, Conn., and Newton, Mass., tied for first place. In addition a certificate of merit was awarded to New Haven, Conn. In the 1938 Special Contest for Syphilis Control the winner was Louisville, Ky.

THE EXPEDITION TO HUDSON BAY OF THE UNIVERSITY OF MINNESOTA

THE University of Minnesota Expedition to Hudson Bay returned to Minneapolis on September 18. It left Senneterre, P. Q., by plane on June 25, arriving at its objective, Richmond Gulf, on June 26.

Richmond Gulf is a large, triangular body of salt water in Lat. 56° 15′ N. and Long. 76° 30′ W. It is surrounded by hills rising 800 to 1,500 feet above sea level, making this region relatively rugged for the east coast of Hudson Bay. The thoroughly glaciated hills are composed of sedimentaries of various kinds overlaid or penetrated by diabase trap, and also are composed in some cases of Archaean granites.

Botanically, the area is significant not only because it has needed thorough botanical exploration, but also because it has a great diversity of habitats and lies at the transition from coniferous forest to the barren grounds.

The members of the expedition collected flowering plants, ferns and some mosses, lichens and hepatics in the Richmond Gulf area until August 13. At this time the party left by canoe for Great Whale River. Collections were made in the vicinity of Great Whale River and along Manitounuck Sound until the arrival of the Hudson's Bay Company's vessel on August 22. The opportunity was taken to accompany the vessel on its annual visit to the Belcher Islands, where further collections were made. The return trip on the vessel was completed on September 11 upon arrival at the