in Europe. Indeed, wherever we went we found that the number of Hollanders who now prefer to spend their lives in Java, and other islands of the Indies, has increased very much since the last war. This appeared to be due in part to the increased comfort afforded by electric refrigerators, fans, and radios — and also to a sense of security in living so far from the turmoil of Europe!

While we were at dinner, MARIAN's attention was riveted on the wall-covering of the dining room, and Dr. VAN MOOK seemed pleased to have it admired. "It's the 'Agel,' the material from which the sails of the Makassar praus are made," he said. "It comes from the leaves of the 'Gebanga' palm, *Corypha elata.*" This palm is the same species as that known in the Philippines as the "Buri." Thanks to Dr. VAN MOOK's kindness, large specimens of this beautiful material are on exhibition in the Museum of the Fairchild Garden. Along the coast of Celebes, we had admired the sailing canoes, but not until we arrived in Makassar did we appreciate what airy swiftness these craft can attain by using this Agel matting.

* * *

Two and a half hours of flying took us back to Soerabaya. The pilot indicated to us in a general way the location of the emergency landing fields, but there was no evidence of the slightest suspicion of an invasion. I felt the romance which I always feel in a plane and which comes perhaps from my memories of that very first public flight of a heavier-than-air flying machine, the flight of GLENN CURTISS in 1908, when he flew a measured mile over the vineyards of Hammondsport, N.Y., thirty feet above our heads, and the dusk shut his landing from our view.

From those days in Soerabaya, which were filled with all sorts of doings, including a visit to DAAN HUBRECHT'S sugar estate and final arrangements for getting off, two outstanding events remain in my memory. One was the day spent among the Lontar palms of Grisse with Dr. J. H. COERT, an amateur naturalist, during which I "made the acquaintance," so to say, of a real expert in the art of tapping these trees for their sweet sap. A man who has climbed, every other day for years, without climbing irons, to the top of a fifty-foot shaft, has straddled its giant leaves, and with a pair of wooden pincers has macerated its hard flower clusters to fit them for tapping, has a "story." It is a story which in my opinion is quite as fascinating as that of the line-men who hang on the poles and string the wires of our telephones. Our "expert" had one pair of pincers which he called "Gapit lakke," for mashing the male flower spikes, and another for the larger female flower spikes which was called the "Gapit prampoean." For the Lontar, like the date but unlike most other palms, bears its male and female flowers on separate trees. Botanists have sometimes disputed as to when sexuality in plants was discovered, and the suspicion is warranted that the date growers of Assyria must have suspected sexuality centuries before the scientific botanists. The sap collectors of the Lontars, I should judge, found out that their palms were of two kinds, and that only one bore fruits.

When I talked with this man, I found that there was much more to his trade than I had imagined, for when he climbed up into the crown of big leaves he not only pared down the sharp edges of the leaf stalks, which otherwise would cut his legs, for they are as sharp as razors, but he also gathered such of the leaves as were mature enough to be used in the making of baskets and hats, and so forth. Fermentation soon turned into toddy the sap he collected every day from the cut-off ends of the flower stalks he had mashed previously. Then, too, the sap he collected was often made into that delicious palm sugar called Jaggery, sweeter than barley sugar obtained from malted barley.

I found it fascinating to interview this expert, quite as fascinating as it had proved in my early days of travel to interview the brewmasters of Munich and Pilsen. But had I given this fellow a glass of beer, he would have spit his first mouthful out; and the Munich brewmaster would have thrown the toddy away. "*Chacun à son gout.*" . . .

FELIX ALEXANDER VENING MEINESZ EXPONENT OF INTERNATIONAL COÖPERATION THROUGH GEOSCIENCE

by

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No history of science and scientists in the Netherlands East Indies would be complete without an account of the explorations of VENING MEINESZ with the splendid coöperation of the Netherlands' Navy.

Among scientists VENING MEINESZ is classified as a geodesist. He was born at 's-Gravenhage (The Hague) on July 30, 1887, as the son of S. A. VENING MEINESZ, Burgomaster of Rotterdam, and later of Amsterdam. He attended the "Hoogere Burgerschool" and afterwards the Institute of Technology at Delft, from which he graduated in 1910 as a civil engineer. In 1915 he obtained the degree of Doctor of Science from the University of Utrecht, where in 1927 he was appointed Professor of Geodesy. In 1937 he became chairman of his Government's Committee for Geodesy. In 1933, he had been elected President of the Association of Geodesy of the International Union of Geodesy and Geophysics.

VENING MEINESZ' national and international

* *Original contribution, especially prepared for "Science and Scientists in the Netherlands Indies."*

honors need not be listed in this article, but his accomplishments should be briefed as an outstanding illustration of scientific imagination and method in the exploration of a fundamental physical phenomenon of the earth. The geographical counterparts of the Netherlands East Indies exist in such other archipelagoes as the West Indies and the Aleutian Islands. Due to VENING MEINESZ' geophysical and geological researches in the Netherlands East Indies we now know that their geographical and structural counterparts have probably reoccurred as great dynamic deformational rhythms of the lithosphere during the entire 1,500,000,000 or more years of our planet's geological history.

It has already been stated that VENING MEINESZ is by training and occupation a geodesist; a scientist who is primarily concerned with methods for determining the mass, weight, density, shape, and surface configuration of the earth — including such inequalities in relief as ocean basins, ocean deeps, continents and mountains. Primarily, however, a geodesist is an advanced type of surveyor or topographic engineer whose chief responsibility is to improve and perfect surveying instruments and methods. Had VENING MEINESZ confined his activities to the arts and practice of geodesy alone he would still be rated as one of the outstanding geoscientists of today. The story of how he so effectively transgressed the border lines of scientific departmentalism to the great benefit of geoscience is particularly significant as an illustration of his skill in national and international coöperative research and of his appreciation of the natural exploratory advantages of the sovereign territory of the Netherlands.

VENING MEINESZ' principal responsibility to his country was to determine local deflections of the vertical, or the deviation of the plumb-bob, in order to correct certain irregularities in the triangulation survey of Holland. A triangulation survey may be defined as the most precise method for the determination of geographic positions, or the location of first-order bench marks to which all local surveys are "tied in," or related.

VENING MEINESZ' great contribution to geoscience was his discovery of the linear belt or strip of negative gravity anomalies, that is deficiency of density, topographically expressed by the islands and oceanward troughs or foredeeps of the East Indian Archipelago. The outstanding characteristic of VENING MEINESZ, like that of all great scientists, is his interest in anomalies, or those observations which do not seem to fit a generally accepted classification of natural phenomena. Thus, instead of attempting to average out anomalies by purely mathematical mechanics he studies the anomalies as particularly interesting phenomena in themselves.

Some thirty years ago, while VENING MEINESZ was initiating the gravity survey of Holland he encountered serious difficulty in the instability of the waterlogged terrain. The standard pendulum machine which he was using to determine local gravity (the excess or deficiency of which will serve to indicate an excess or a deficiency of mass) in the outer portion or crust of the earth was so jarred by the movements in the ground that he was forced to design an apparatus which would enable gravity to be determined in spite of these disturbances. By swinging two pendulums, instead of one, in the same plane for each observation, he discovered that he could compensate for the vibrational errors of a single pendulum. VENING MEINESZ immediately appreciated the great significance of this new geophysical as well as geodetical instrument. Like his colleague and close friend the great American geodesist, WILLIAM BOWIE of the United States Coast and Geodetic Survey, VENING MEINESZ was fully familiar with the geological implications of isostasy as originally defined by C. E. DUTTON in 1889, for the theory of gravitational balance between relatively broad, contiguous areas of different average altitudes, or of topographic relief. According to this theory continents are assumed to "stand high" relative to the ocean basins, because they are composed of lighter and less dense material. The condition of compensation, or no strain, is assumed to exist at some 60 miles below the surface of the earth, as at this depth all material must be non-rigid and capable of "flow." Hence the definition of isostasy, or the suggestion that the rigid blocks of the crust of the earth "float" in a uniform sub-crustal medium. According to isostasy the ocean basins are relatively low because the sub-oceanic lithosphere is relatively heavier (more dense) than the continents which are high because they are relatively lighter (less dense). The English Geodesist PRATT had demonstrated in his pendulum survey of India that the Himalayas were high because they were deficient in mass; and the Americans, HAYFORD and BOWIE, had published monographs on the geological, as well as the geophysical significance, of isostasy. As early as 1875 attempts had been made to determine the density of the sub-oceanic lithosphere by means of a gravity barometer, and in 1911 L. A. BAUER urged the development of an apparatus which would measure gravity at sea with the same degree of accuracy as on the *terra firma* of the continents.

Deficiency or excess in mass in any portion of the earth's crust is manifested as a gravity anomaly, and if the theoretical value for gravity, at any position, has been corrected for the topography and for isostatic compensation of the topographic features and compared with the measured value, the difference or anomaly is called an isostatic anomaly. Thus isostatic anomalies signify instrumentally determined deficiency, or excess, of mass of the crust of the earth in the immediate neighborhood of the gravity measuring machine.

VENING MEINESZ' first experiment with his multiple-pendulum apparatus was made on a small steamer on the North Sea Canal near Amsterdam. This and subsequent experiments on larger ocean-going vessels suggested that his machine could measure gravity at sea provided certain improvements were made in the mechanism such as photographic recording, gimbal-mounts and such gadgets as would tend to reduce the effect of the motion of the ship. However, he eventually discovered that the mechanical vibrations of a steam-driven vessel seriously interfered with the accuracy of his instrument. It was then that he conceived the idea of using a submarine, not only because of the possibility of obtaining greater stability beneath the surface but primarily because submarines, when operating below the surface, are driven by electric motors with a minimum, if not complete absence, of mechanical vibration. VENING MEINESZ therefore consulted the Netherlands Admiralty, and especially those officers who were particularly skilled in the operations of submarines. The purely scientific char-

acter of the problem so appealed to these naval officers that they gave full coöperation and thus helped to set a standard of naval coöperation in marine geophysics which was later followed by the American, British, French, Italian, Russian and Japanese navies.

In preparing for his first extensive submarine gravity-measuring expedition VENING MEINESZ wisely selected the outer arc of the East Indies as affording the greatest difference in altitudes (exclusive of sea level) between the tops of the mountainous islands and the contiguous foredeeps or troughs on the oceanward side of the archipelago, since these troughs were already known to be much deeper than the general level of the ocean bottom. By selecting such a geographical area for the first test of his machine he was reasonably sure that any slight inaccuracy in its operation would probably be more than compensated by the maximum difference in topography (relief) of his gravity-measuring traverse. In this respect he was entirely correct, but the gravity anomalies which he obtained were certainly not what he had expected!

The first expedition was on the Netherlands Submarine *K II* in 1923. The second expedition, on the Netherlands Submarine *K XI* in 1925. The third expedition on the Netherlands Submarine *K XIII* in 1926. The fourth expedition, on the same submarine in 1927. In the first expedition VENING MEINESZ used the same Stückrath apparatus, of four bronze pendulums swinging in two planes, that he had used in his preliminary experiments on the North Sea Canal. During the three later expeditions he used a three-pendulum apparatus, and perfected such improvements as photographic recording of each pendulum separately, multiple-chronometer readings in the timing of the pendulums, better gimbal-suspension, better pendulum bearings to decrease friction, and other details in design which not only increased the accuracy of the entire apparatus but also its ease of operation. Between 1923 and 1927 after much hard labor, and with the full coöperation of the Netherlands Navy, VENING MEINESZ had definitely proved the accuracy of what we may now designate the Vening Meinesz Marine Gravimeter; but, this assurance of the dependability of his apparatus made the gravity anomalies which he had obtained all the more astounding. He discovered greater gravity anomalies, regardless of sign, than had hitherto been found for any part of the earth's crust, or lithosphere. More astonishing still this relatively narrow line of anomalies, closely following the foredeeps or troughs on the oceanward side of the great sinuous island archipelago, proved to be a well-defined strip of negative anomalies! As VENING MEINESZ had expected, the general gravity field of the sub-oceanic lithosphere was slightly plus, intimating a greater density than that of the continents. Why, therefore, did these great foredeeps which occurred as major depressions in the sub-oceanic lithosphere register a greater deficiency in density than the highest mountains on the continents? Could it be that this astounding negative anomaly strip which we now refer to as the Vening Meinesz Strip, was a direct refutation, in such oceanic regions, of the great principal of isostasy? Thus by 1927 VENING MEÍNESZ had discovered one of the apparently greatest anomalies in the whole of geoscience, but an extremely dynamic anomaly which, like geomagnetism, makes no direct and measurable impression on our senses, but is as fully important in geoscience as earthquakes and volcanoes whose superficial phenomena we now suspect may be closely related, in origin, with his discovery of the negative anomaly strip in the Netherlands East Indies.

WILLIAM BOWIE had followed the discoveries of VENING MEINESZ with increasing interest. Although the leading authority of the geophysical implications of isostasy he was neither disturbed nor dismayed at what, at first, appeared to be a serious blow to isostasy. Anxious as always to expand gravity surveys, both on land and at sea, BOWIE urged the collaboration of the United States Navy with VENING MEINESZ for the geophysical exploration of the Gulf of Mexico and those portions of the Caribbean Sea which were internationally open waters. BOWIE aroused the interest of Captain C. S. FREEMAN, Superintendant of the United States Naval Observatory, and eventually VENING MEINESZ was invited to continue his explorations in the Gulf-Caribbean Region with the further encouragement and coöperation of the National Academy of Sciences and the Carnegie Institution of Washington. This expedition was made during the fall of 1928 with the United States Submarine *S–21*. VENING MEINESZ was accompanied by F. E. WRIGHT of the Carnegie Institution of Washington, and E. B. COLLINS of the Hydrographic Office of the United States Navy. This expedition produced some noteworthy results, such as: (1) The suggestion that the Mississippi Delta is in isostatic equilibrium; (2) deficiency in gravity parallels the submerged margin of the continental shelf. However, the plan of the expedition seems to have been rather to test certain suboceanic areas as to the theory of isostasy rather than to determine whether or not the West Indian Archipelago was geophysically as well as geographically a counterpart of the East Indian Archipelago. In both the American and the previous Netherlands expeditions VENING MEINESZ had the advantage of the recently perfected sonic-sounding method for determining suboceanic topography, although full use of this rapid and accurate technique, so essential in the computation of gravity anomalies, was not fully developed until 1932. In 1929 VENING MEINESZ made another gravity measuring cruise to the East Indies in the Netherlands Submarine *K XIII*, and marine gravimetry had now become a "fashionable" adjunct to oceanographic exploration.

The Russian Navy made a gravity survey of the Black Sea in 1930 and the Italian Navy a gravity survey of the Mediterranean in 1931. Also, in 1931, gravity determinations were made with the Vening Meinesz apparatus in the Arctic Ocean during the *Nautilus* Expedition. It was not until 1932, however, that any serious attempt was made to prove the full geological as well as the geophysical significance of the strip of negative gravity anomalies associated with the East Indies archipelago. It had naturally taken several years for the leading structural geologists of the world to begin to appreciate the possible significance of VENING MEINESZ' geophysical discovery as directly related to tectonophysics, or the application of geophysical methods and techniques to exploration and study of mountain building and the accompanying phenomena of volcanoes and earthquakes. During his explorations in the Bahamas (1927) R. M. FIELD had discussed with WILLIAM BOWIE the use of a gravity

survey of the islands to determine whether or not the coral reefs and associated carbonate sediments were underlain by volcanic rocks of greater density. With the cooperation of the United States Coast and Geodetic Survey a gravity survey was made in the Bahama Region. This survey definitely proved that the Bahama Islands were not extinct volcanoes capped with coral reefs and that their geomorphology could not be explained in that way. It was further proved that the whole Bahama Region was structurally in no way related to the West Indian Archipelago, and it remained to be discovered as to what part Cuba played in the geological history of the Gulf-Caribbean Region. BOWIE then urged a marine gravity survey in the deep waters between the islands, and VENING MEINESZ consented to make such a survey provided it could be organized with the essential cooperation of either the Netherlands, British or American Navies. In December 1932 VENING MEINESZ attended the annual meeting of the Geological Society of America held in Tulsa, Oklahoma. It was at this meeting that he first thoroughly aroused the interest of the leading structural geologists in the United States and, in particular, conferred with B. WILLIS, A. C. LAWSON, W. H. BUCHER, W. T. THOM, and several petroleum geologists who were international pioneers in the development of geophysical-geological techniques. With the cooperation of the British Government, the United States Navy, the United States Coast and Geodetic Survey, the Geological Society of America, the American Geophysical Union, and the Department of Geology, Princeton University, the United States Navy-Princeton Expedition to the West Indies had already been organized. On this expedition VENING MEINESZ had the use of the United States Submarine *S-48* and the Submarine Tender *Chewink* which made the bathymetric soundings with the most modern equipment, so essential to the suboceanic gravity surveys. While VENING MEINESZ was determining the suboceanic gravity anomalies, the gravity survey on the islands was continued with the cooperation of the United States Coast and Geodetic Survey and several private agencies. VENING MEINESZ was assisted by T. C. BROWN of the United States Naval Research Laboratories and a young geologist from Princeton, H. H. HESS, who has since become one of the leading authorities on the tectonophysics of island arcs.

Later in the same year VENING MEINESZ made a gravity survey of the Mid-Atlantic Ridge near the Azores, in the Netherlands Submarine *K XIII*. M. MATUYAMA made a gravity survey of the Nippon foredeep with a Vening Meinesz apparatus on board the Imperial Japanese Submarine *RO-57*, and P. MARTINI made a gravity survey of the northeast Mediterranean with a Vening Meinesz apparatus on board the Italian Submarine *Fresnel*. In 1934 VENING MEINESZ made a gravity survey in the Netherlands Submarine *K XVIII* from Holland to Brazil to Capetown to Australia to Java; MATUYAMA made a gravity survey of the Japan Deep; and G. CASSINIS in 1935 further explored the Mediterranean, in the Italian Submarine *Des Geneys*.

In 1936, as Chairman of the Committee on the Geophysical and Geological Study of Ocean Basins of the American Geophysical Union, R. M. FIELD organized the United States Navy-American Geophysical Union Expedition to the West Indies, with the coöperation of the United States Navy, the United States Coast and Geodetic Survey, the Geological Society of America, the American Bell Telephone Laboratories, the Woods Hole Oceanographic Institution, and the American Philosophical Society. HESS was on this expedition as geological expert and M. EWING of Lehigh University was in charge of the gravimetric survey, assisted by R. J. HOSKINSON of the United States Coast and Geodetic Survey. The gravity cruise was made in the United States Navy Submarine *Barracuda*. EWING had succeeded in making some further improvements in the Vening Meinesz apparatus — notably in the mechanical timing of the pendulums. It was this expedition that definitely proved that the West Indian Arc was tectonophysically similar to the East Indian Arc, and that the Vening Meinesz strip of negative gravity anomalies was one of the greatest phenomena in the deformation of the lithosphere. The theory of isostasy had not been disproved — in fact it had been somewhat strengthened — but a new mechanism had been discovered in mountain building which had introduced an entirely new concept in structural geology. At present the Vening Meinesz negative gravity-anomaly strip as peculiarly associated with island arcs is interpreted by VENING MEINESZ and P. H. KUENEN (Netherlands), H. H. HESS, W. H. HOBBS, B. WILLIS, W. H. BUCHER, R. A. DALY and R. M. FIELD (U.S.A.), E. B. BAILEY and O. T. JONES (England), L. W. COLLET (Switzerland), and others in the following manner:

(1) A strongly negative gravity-anomaly belt, or strip, coincides with the outer, convex side of island arcs such as the Netherlands East Indies and the West Indies. The width of the negative gravity-anomaly strip is approximately less than 50 km wide. In the East Indies the strip is 5,000 miles long, and in the West Indies it is well defined along the entire arc from the eastern end of Cuba to the Coast of South America. The order of magnitude of the gravity anomalies within the area of the negative strip is from −150 to − 200 milligals, and there can be no doubt that the area of the negative gravity-anomaly strip signifies an abnormal, local deficiency in density for the entire thickness of the lithosphere for that area — certainly a local, but exceedingly important departure from isostatic equilibrium.

VENING MEINESZ and his countryman, KUENEN, were the first to recognize the great geological significance of this discovery and, together with HESS, suggested not only the cause of the phenomena in terms of structural geology, but also the consequent relation of volcanic activity and the origin of igneous rocks, including the very significant and concomitant belts of serpentinized peridotite intrusions. Others, notably N. H. HECK, have discussed the significant relation of VENING MEINESZ' discoveries to the phenomena and origin of earthquakes.

The outer crust of the earth, or lithosphere, is known to have a specific gravity, or density, of approximately 2.7. This lithosphere has been shown by the seismologists to have a thickness of 25–35 km with an underlayer of the same thickness having a specific gravity or density of approximately 3.0. Beneath the layer of density 3.0 occurs a third layer of density 3.3. The outer layer of density 2.7 therefore characterizes the lithosphere to the depth of isostatic compensation. This is frequently, though incorrectly, spoken of as the granitic layer because the mean

average chemical composition and density of all types of rocks which compose the lithosphere is approximately that of the chemical composition and density of the igneous rock granite. The immediately underlying couch or stratum of denser material, because of high temperature and pressure, has no rigidity and exists as a magma which, when it finds its way into the lithosphere, cools and solidifies as an igneous rock called basalt. The subbasaltic layer or couch is composed of an even denser magma (sp. gr. 3.3) which when injected into the lithosphere solidifies to form the ultra-basic igneous rock known as peridotite. It should be particularly noted that the increase in difference in density downward from the granitic to the basaltic to the peridotitic layer is 0.3. VENING MEINESZ and KUENEN, realizing that the thickness of the granitic and the basaltic layers was approximately the same, suggested that within the area of the pronounced negative gravity-anomaly strip the granitic layer had entirely displaced the basaltic layer, thereby becoming 50–70 km thick, or twice the normal thickness of the lithosphere; and that island arcs, such as the East Indies and the West Indies, are long narrow structural belts where the lithosphere is close to, if not in direct contact, with the peridotitic layer. VENING MEINESZ further suggests that the peculiarly localized displacement of the basaltic layer by the lithosphere is due to a great compressional downfold of the lithosphere; and KUENEN further strengthens this theory by laboratory experiments in which he was careful to adapt the strength of the materials to the scale of his model. Thus was born the concept of the Tectogene, or downfold of the entire lithosphere, which since 1933 has played, and will continue to play, an important part in all observations and theories regarding the structure and origin of mountains.

One hundred and two years ago the ROGERS brothers described the structure of the Appalachian Mountains of Pennsylvania as a relatively narrow but thick belt (20,000 feet) of marine and estuarine sedimentary rocks which had been folded, faulted, uplifted, and eroded so as to produce the mountains which we see today.

In 1873 J. D. DANA suggested that the thick accumulation of sediments filled a long, narrow trough as it was being formed by lateral compression of the lithosphere. He also suggested that, after the trough had been filled with thousands of feet of sediments, its further compression squeezed the sedimentary filling into the great series of folds whose uplifted and eroded remnants form the present ridges and valleys of Pennsylvania. Such great compressional troughs he called geosynclines, and the folded filling of the troughs, synclinoria. The geosynclinal theory, originating from the study of the Appalachian Mountains, has been found to be applicable to the North West Highlands of Scotland, to the Swiss Alps, and to other regions where the stratigraphy and structure of the deformed rocks had been sufficiently studied. The geophysical studies in the Netherlands East Indies and the consequent leadership of VENING MEINESZ in the geophysical study of the West Indies suggests that the foredeeps in front of these great island arcs represent geosynclines in the making, but these geosynclines were not filled with sediments because of the lack of source material from the narrow bordering strip of islands (geanticline). Thus, the great curved linear geosynclinal belt, or anticlinoria of the Carpathians, Alps and Apennines is remarkably similar in origin to the embryonic development of the present-day island arcs. VENING MEINESZ and KUENEN have suggested the Tectogene, as the father of geosynclines, and their accompanying thick belts of deformed eroded sedimentary rocks and igneous intrusions.

Such has been the scientific contribution of Holland, through VENING MEINESZ and the Netherlands East Indies, to the whole of geoscience.

In their introduction to "The Contribution of Holland to the Sciences" (1943), A. J. BARNOUW and B. LANDHEER make the following observations: "The history of his own special field of knowledge is a field to which few scientists pay attention . . . In times like ours it is of significance to see how the combined efforts of many people have led to the discoveries or innovations which we so easily ascribe to one person. . . . That the Netherlands has always pursued a policy of tolerance has been an essential factor in the development of its scientific achievements." We have tried to emphasize the effect which VENING MEINESZ, the Netherlander, has had on geoscience. What has been the effect of geoscience on VENING MEINESZ, the Netherlander?

The last time that VENING MEINESZ was able to mix freely with his international colleagues was in September, 1939, during the Seventh General Assembly of the International Union of Geodesy and Geophysics in Washington, D.C. For several weeks, previous to this Assembly, events in Western Europe had rapidly become more disturbing. Delegates from most of the adhering countries, then thirty-two in number and including all of the present belligerents, arrived in fair numbers, but there was some discussion as to the advisability of cancelling the Assembly. Finally, just previous to the meeting, Germany invaded Poland, and there was a hurried meeting of the Bureau of the Union which determined to carry on. In this discussion the Bureau was greatly encouraged by the United States Department of State, whose Secretary, CORDELL HULL, opened the Assembly with these words: "It is my fervent hope, which the people of this country share, that the day may soon come when the statesmen of the world will take a leaf from the book of the scientists and solve international political problems in the same dignified and friendly spirit."

During the succeeding week of the Assembly VENING MEINESZ was a tower of strength. No one foresaw more clearly than he the consequence of Germany's invasion of Poland, yet his tolerance during this international gathering of scientists in Washington was largely responsible for the calm and friendly spirit of its deliberations. As President of the International Association of Geodesy, his were the primary interests of a great specialist whose scientific inclinations were to emphasize the international importance of geodesy. However, his researches in the Netherlands East Indies, extending to all the oceans and continents of the earth, had taught him the importance of cooperation not only of different specialists, but also of all manner of men. Above all, he had made the most of the full social opportunities of fundamental geoscience, in contradistinction to the somewhat asocial implications of mathematics and astronomy or the economic implications of physics and chemistry. He, particularly, was trusted by every one — Poles, Germans, Italians, Japanese, and British alike. Ac-

cording to last accounts VENING MEINESZ is still in Holland. We are not informed as to his present physical or mental condition, but we sincerely hope, that in the interests of post-war planning he will be able to help us. Any scientist who has accomplished so much in international cooperation without the destructive stimulus of war will be particularly needed during the post-war period of reconstruction. VENING MEINESZ is such a scientist; to his more intimate colleagues he is still a typical Hollander and a famous explorer of the structure and origin of the Netherlands East Indies. His hypothesis of the Tectogene will undoubtedly be modified, and may even be replaced, but his discovery of the negative gravity-anomaly strip will remain as the greatest advance in the application of gravitational physics to geology since the discovery of the deflection of the vertical, and the consequent geophysical-geological concept of isostasy.

A few of the most significant branches of geoscience which are particularly affected by the first discovery of the negative anomaly strip in the East Indian Archipelago are:

(1) Theory and origin of geosynclines
(2) Location and origin of earthquakes
(3) Origin of volcanoes
(4) Origin of ultra-basic eruptives and serpentines
(5) Direction and rate of migration of geographic coordinates
(6) Depth of isostatic compensation
(7) Permanency of ocean basins
(8) Numerous problems in stratigraphy and structural geology
(9) Origin and distribution of geomagnetism.

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THROUGH BANTAM AND THE PREANGER REGENCIES IN THE EIGHTIES

by

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late Director, University Museums, Liverpool.

On the road — The Sundanese language — Every man a naturalist — Bird-life at Genteng — Weaver-birds' nests — A native rural bazaar — Forest devastation — Geological structure of the district — A wonderful case of mimicry in a spider.

On my return to Java from the Keeling Islands, I had the good fortune to meet in Batavia with a countryman, Mr. ALEXANDER FRASER, one of the few freeholders of land in Java, who though just starting for England, kindly offered me the privilege of collecting over his vast property situated in the western province of Bantam, and the hospitality of his house if I should choose to stay there. This offer I was only too pleased to accept, in order, while still within reach of civilisation, to become acquainted with, and gain some practical experience of, the necessities and modes of tropical life and camping, of which the novitiate traveller has such crude ideas — for collecting among tropical vegetation is very different from the ideas formed of it from like operations conducted amidst the sparse woods of our temperate climate; — but principally to isolate myself from all European-speaking people for the purpose of acquiring, with the aid of a few books and chiefly with my native servants, the Malay language as rapidly as possible. In addition, the late Dr. SCHEFFER, the kind Director of the Botanical Gardens in Buitenzorg, had recommended to me Bantam as a profitable and by no means, botanically at least, well in vestigated province to visit.

Having hired a couple of cahars — a sort of spring-cart with one horse, the general mode of conveyance when one travels as I was about to do, off the main roads — one for myself and one for my baggage, I left Batavia at sunrise on the 12th of March [1879], by the western road along the low northern shore lands towards Rangkasbetong, by the famous highway which DAENDELS, one of the most energetic and far-seeing of all the early Governors-General of the Dutch Indies, constructed along the whole length of the island, and which has proved one of its greatest benefits and colonizers. To expedite the journeys of their various officials round their districts, at every five or six miles stable stations have been erected by the Government, where horses are changed, and which private travellers can obtain permission to make use of on payment of small mileage dues.

All along the road we passed little sign-posts with Arabic inscriptions indicating how many yards of the road on each side of them must be kept in repair by the various neighbouring villages. As the keeping of the roads is most strenuously enforced, they are never out of condition, and are a pleasure to drive over. Here and there it has been impossible to bridge the larger rivers in steep defiles where the stream is deep and swift, and these are crossed in large picturesque rafts which can accommodate horse and carriage and quite a little crowd of people at once. These rafts, by sliding on rattan rings along two strong cables of thick rattan canes securely fixed to

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