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GEOPHYSICAL ABSTRACTS 95

OCTOBER–DECEMBER 1938

COMPILED BY

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GEOPHYSICAL ABSTRACTS 95, OCTOBER–DECEMBER 1938

Compiled by W. AYVAZOGLOU

1. GRAVITATIONAL METHODS

4571. Andreev, B. A., Calculation of the density of the net of observations in gravity prospecting [in Russian]: Geophysic, No. 5, pp. 55–69, Leningrad, 1938.

Determination of the density of the stations of observation in order to secure reliable interpretation of the data obtained is one of the fundamental questions in prospecting by gravimetrical methods. Theoretical analysis of the density of the net of observations is given. General considerations are developed for the prospecting of (1) chromites, (2) iron deposits, and (3) faults. Theoretical conclusions are illustrated by data obtained from practical prospecting by gravitational methods.—*W. A.*

4572. Angenheister, G., Beziehung zwischen Meereshöhe und Schwere in gestörten Gebieten [Relation between sea level and gravity in disturbed regions]: Zeitschr. Geophysik., vol. 14, No. 5/6, pp. 219–230, Braunschweig, 1938.

Close relation between sea level h and the value of the gravity anomaly $\Delta g''_0$ is observed in certain profiles at the western border of the Pritzwalker massif and at the northwestern border of the subterranean extent of the Flechtinger Mountain Range. The disturbing masses are at a depth of a few kilometers. The value of $\Delta g''_0$ is approximately ½ milligal/m.—*Author's abstract translated by W. A.*

4573. Barton, D. C., Gravitational methods of prospecting in the science of petroleum: Oxford Univ. Press, pp. 364–381, 25 diagrams, maps, and section, London, 1938.

A, Mathematical-physical basis of gravitational prospecting: Quantities used; measurement by torsion balance of gradient and differential curvature; measurement of relative gravity by torsion balance, pendulum, and gravimeter; mathematical interpretation.

B, Geology of gravitational prospecting: Geological basis; salt domes (Nash and Esperson); regional framework of an area (central-southern Oklahoma and adjacent part of Texas); anticlinal maxima (Fort Collins anticline, Colo.); anticlinal minima (Lost Hills, Calif.); "granite" ridges (Nocona-Muenster, Tex.); faults (Luling).

C, Retrospect: Geographical interpretation versus geological probability; limitations of the gravitational methods.

In spite of the serious limitations inherent in the instruments and method the gravitational methods making use of the torsion balance and gravimeter have won a permanent place in petroleum geophysics.—*Author's abstract.*

4574. Berroth, A., Schweremessungen zur See, Übersicht über die neue prinzipielle Fortschritte [Gravity measurements at sea, an outline of new fundamental improvements]: Zeitschr. für Verm., vol. 67, No. 2, pp. 33–38, Aachen, 1938.

The corrections of measurements of gravity on moving ships as calculated and verified by Browne and Vening-Meinesz are classified and explained.—*Schmerwitz's abstract in Zeitsch. Geophysik, vol. 14, No. 3/4, 1938, translated by W. A.*

4575. Breyer, Friedrich, Dichtebestimmungen an Gesteinen aus deutschen Erdölgebieten [Determinations of density of rocks from German oil-bearing regions]: Beitr. angew. Geophysik, vol. 7, No. 3, pp. 245–259, Leipzig, 1938.

The causes for the differences in specific gravity of sedimentary rocks are discussed on the basis of many determinations of density of core samples. In addition to the mineralogic and chemical content, porosity and pressure of overlying masses are of major importance. The age, that is, time does not have a direct influence. Conditions of specific gravity of separate regions are investigated, and possible application and necessary limitations of torsion-balance measurements are discussed.—*Author's abstract translated by W. A.*

4576. Breyer, Friedrich, Zusammenstellung der Auszähldiagramme in der Gravimetrie [Graphic representation of results in gravimetry]: Beitr. angew. Geophysik, vol. 7, No. 3, pp. 317–336, Leipzig, 1938.

From a complete review of the existing literature on graphic computation of diagrams, two tables are compiled showing formulas used for plotting the gradient and curvature, gravity and deviation of the plumb line, and the potential. Four different systems of coordinates are used. In two more tables the numerical values of the functions in question are recorded. Finally, in table 5, numerical values corresponding to these formulas and values are given so that the graphs can be traced and used directly. Previous use of the formulas is explained in notes, and finally a review is given on the development of the method of correction and evaluation.—*Author's abstract.*

4577. Graf, Anton, Ein neuer statischer Schweremesser zur Messung und Registrierung lokaler und zeitlicher Schwereänderungen [A new static gravity meter for measuring and recording local and temporal gravity variations]: Zeitschr. Geophysik, vol. 14, No. 5/6, pp. 152–172, Braunschweig, 1938.

A new type of gravity meter is described which, without any modifications, can be used for measuring and recording local as well as temporal anomalies of gravity. The principle of the design is based on the electrical determination of the lengthening of a vertical spring due to changes of the gravitational field. Weight and spring are suspended in such a way as to avoid wedges, spring joints, or threads of any kind. The design is free from friction and assures highly reliable readings. There being no astaticism, the period of oscillation is reduced to approxi-

mately 1 second. Consequently, the calibration is constant throughout the entire scale range, which amounts to more than 1,500 millidynes. The calibration only depends on the ratio of weight plus half of the spring weight, as compared with the calibration weight. The accuracy of the scale value, therefore, is influenced in the first place by the possibility of determining the calibration weight as exactly as possible. Owing to the fact that the gravity meter is airtight, variations of the atmospheric pressure do not have any influence on the readings. The inclination error is very small and under favorable conditions amounts to less than 0.1 millidyne, the instrument being inclined by 90 seconds in both horizontal directions. The reading of the gravity variation is made by means of a microammeter (without amplifier) or a recording drum. The sensitivity can be modified within rather a wide range. For practical field use, three- to six-scale intervals of the microammeter are made to correspond with 1 millidyne. In the case of tidal recording, a mirror-type ammeter can be used or, instead of that, a pen or thread recorder in connection with an amplifier. A double thermostat is provided on the instrument, which, however, is to be used only when the apparatus is moved between two observation stations far apart from each other. For local investigations no temperature control is necessary. Temperature compensation is provided for. The elastic after-effect of the spring is practically without importance, as the weight remains in the measuring position even when being fixed. The time required for one reading, including the set-up, is 4 to 5 minutes. The daily output under good road conditions amounts to 20 or 25 new stations, 1 or 2 km. apart. The gravity meter is elastically suspended within a ½-ton field truck in such a way that the observer can lower the instrument directly to the ground. Both coarse and fine adjustment is provided for leveling the design. While taking the readings the observer remains inside the truck so that no interruption by wind or rain will occur. The instrument weighs 57 kg. (about 125 pounds).—*Author's abstract.*

4578. Haalck, Hans, Der statische (barometrische) Schweremesser für Messungen auf festem Lande und auf See [Static (barometric) gravity meter for measurements on land and sea]: Beitr. angew. Geophysik., vol. 7, No. 3, pp. 285–316, Leipzig, 1938.

A full description of this instrument is given. The details of design, progress of development, results of experiments, sources of error, and methods of observation on land and sea are explained.—*W. A.*

4579. Hedstrom, Helmer, A new gravimeter for ore prospecting: Am. Inst. Min. Met. Eng. Tech. Pub. 953, 23 pp., New York, 1938.

Gravity surveying with the torsion balance or the pendulum for ore-prospecting purposes has generally been considered impractical or even impossible. It is shown in this paper that a fast and sensitive gravimeter can be very useful in ore prospecting as an auxiliary to electrical and magnetic instruments. A description is given of such a new instrument, the Boliden gravimeter, which was developed in Sweden in recent years. The first successful practical tests of the instrument were made in January 1936. In 1937, the Boliden gravimeter was perfected, and now it is used in regular practice in Sweden. Some examples of practical tests are given. Recent surveys over large areas, with the instrument car-

ried in a motor car, gave a mean error of 0.53 milligal for each observation, and of 0.31 milligal for stations surveyed three times. As the stations were only a few kilometers apart, seven to nine of them were surveyed each hour.—*W. A.*

4580. Hoskinson, A. J., Gravity at sea by pendulum observations: Am. Inst. Min. Met. Eng. Tech. Pub. 955, 7 pp., New York, 1938.

Three expeditions for gravity determinations have been conducted by the United States from submarines in the West Indies. By means of the Meinesz three-pendulum instrument for observations of gravity at sea, a strip of large negative anomalies was found lying just outside the island arc of the West Indies and extending its entire length. The position of this negative strip with respect to the islands and the active volcanoes of the region corresponds closely to the one located in the East Indies by Meinesz. The construction and use of the Meinesz instrument and of the chronometer is described. The results of the latest expedition to observe gravity at sea indicate that the value of gravity at any sea station may be determined by present instruments with an accuracy of 1 to 5 milligals.—*W. A.*

4581. Hoskinson, A. J., Gravity in the Empire State Building: Washington Acad. Sci., vol. 28, No. 8, p. 377, Menasha, Wis., 1938.

The purpose of this work was to test the vertical gradient of gravitational attraction. The Empire State Building was selected on account of its height. The instrument used for the work was the Meinesz three-pendulum apparatus, which has been used with great success for sea observations and would therefore measure gravity in a tall building with the required accuracy, the sway of the building being taken care of by the construction of the instrument. The time interval was determined from a crystal chronometer designed and constructed by the Bell Telephone Laboratories for the expedition that observed gravity at sea in the West Indies during the winter of 1936–37. The indicated accuracy of the chronometer was 1 part in 10 million. Twenty gravity observations were made in the building, with observation points spaced about 10 floors apart. No value was more than 1 milligal from the mean curve of the series. The indicated accuracy of the observations is about plus or minus 1 milligal. The tests checked the theoretical law within 1 milligal or about 1 percent. This is also about the accuracy of the observations, so that the difference may be either a real difference or an observational error.—*Author's abstract.*

4582. Klaus, H., An introduction to the second-derivative contour method of interpreting torsion-balance data: Geophysics, vol. 3, No. 3, pp. 234–246, Houston, Tex., 1938.

After auspicious beginnings in the interpretation of torsion-balance data, that is, gradients and curvatures, the balance has been misused as a gravity instrument, the gradients being integrated into gravity and the curvatures either neglected or not even observed in the field. Gravity was then made the sole basis of interpretation work, the regional effects being determined with more or less luck, subtracted from the total either before or after integration (regional gravity or regional gradient), and the residue held to be "local effect." The latter method appears to be now in vogue for most torsion-balance and gravity-

meter work. In contrast to this method, the one here described is based on the quantities measured directly by the torsion balance—the gradients and curvatures or second derivatives—and it constitutes a considerable amplification of the original methods of investigating these quantities. Gravity is simply a byproduct of this method and is not needed at all for its functioning. The essential parts of this method are: (1) The redetermination of all second-derivative components with respect to a new system of rectangular coordinates, one axis of which has been made parallel to the direction of elongation of anomalous features, (2) the contouring of these second-derivative components on four separate maps, and (3) the interpretation of the resulting contour patterns. The outstanding advantages of this method over the total-gravity methods are the following: (1) Full utilization of the two independent aspects of the gravitational field furnished by the gradients and curvatures, (2) virtual independence from regional effects, (3) much greater resolving power when compared to gravity, and (4) complete absence of assumptions, such as are involved in estimating the regional and in computing gravity from the gradients.—*Author's abstract.*

4583. Mader, Karl, Der Anteil der Schwerkraftmessungen an der geophysikalischen Bodenforschung in der Ostmark [The share of gravity measurements in the geophysical exploration of the ground in Austria]: Berg- u. hüttenm. Monatsh., vol. 86, No. 9, p. 218–224, Vienna, 1938.

Geophysical exploration of the ground in Austria (Ostmark) on a large scale is included in the 4-year plan of the general geophysical survey of Germany. The role that is to be assigned in this plan to gravity measurements by using the pendulum, torsion balance, and gravimeter is discussed. A plan is developed for new gravity measurements in the Ostmark. A map shows the old gravity stations.—*W. A.*

4584. Meisser, O., Relative Schweremessungen mit Quarzglasstabpendeln in einem neuzeitlichen Vierpendelvakuumapparat [Relative gravity measurements with quartz-glass bar pendulums in a modern four-pendulum vacuum apparatus]: Veröffentl. Reichsanstalt für Erdbebenforsch, No. 30, 31 pp., Jena, 1937.

A detailed description is given of instruments and methods of observation developed by the author in the Reichsanstalt. With these instruments and methods an accuracy of measurement equal to ±0.5 milligal may be attained.—*Riewe's abstract in Zeitsch., Geophysik, vol. 14, No. 3/4, 1938, translated by W. A.*

4585. Muto, Katsuhiko, The possibility of determining the geoid by means of leveling: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 1, pp. 60–69, March 1938.

Measurements were made by trigonometric leveling to determine the difference in altitude between two triangulation points. This difference was found to be of the same order as that obtained by precise leveling, that is, the height above the geoid. Errors due to refraction were small. By taking into consideration the deviation of the vertical it is thus possible to determine the form of the geoid from altitude data obtained by geometric and spirit leveling.—*R. S. R., Sci. Abstracts, vol. 41, No. 487, 1938.*

4586. Niethammer, Th., Bemerkungen zum Artikel von Karl Jung, "Über vollständig isostatische Reduktion" [Discussion of Karl Jung's article, "On total isostatic reduction"]: Zeitschr. Geophysik, vol. 14, No. 5/6, pp. 119–122, Braunschweig, 1938.

In one of his articles (see Geophys. Abstracts 94, No. 4432), Jung developed a mathematical foundation for the calculation of the "total isostatic reduction." It is shown here that the anomalies of isostatic gravity calculated so far may be, to a great degree of approximation, also considered "total isostatic" anomalies if the distribution, assumed by Jung over a surface of a sphere at 60 km. of depth, is over a sphere at about 30 km. of depth.—*Author's abstract translated by W. A.*

4587. Nörlund, N. E., Figure of the earth: Bull. géodésique, No. 55, pp. 193–210, Paris, July-August-September 1937.

The paper consists largely of a historical survey regarding triangulation, the form of the geoid and spheroid, the deflection of the vertical, isostatic compensation, and gravity measurements. The theories of Airy, Pratt, and Meinesz for isostatic compensations are discussed, and finally the existing problems in determining the geoid are mentioned.—*R. S. R., Sci. Abstracts, vol. 41, No. 488, 1938.*

4588. Sanchez, P. C., La isostasia y las convulsiones terrestres [Isostasy and terrestrial undulations]: Instituto Panamericano de Geografía e Historia, Pub. 23, 13 pp., Mexico, D. F., 1937.

The importance of gravimetric observations, methods of obtaining values of the intensity of gravity, and modern apparatus used in making determinations of gravity are discussed.—*W. A.*

4589. Steinmann, K. W., Portability and speed feature new gravimeters: Oil Weekly, vol. 91, No. 1, pp. 58–66, Houston, Tex., 1938.

The features of the common types of gravimeters in use today are summarized in a table, and the principles of different types are briefly discussed. Field procedure is described, with a map of a gravimeter survey of the Pierce Junction field given as an illustration.—*W. A.*

4590. Tsuboi, Chuji, Gravity anomalies and corresponding subterranean mass distributions: Imp. Acad. Japan Proc., vol. 14, No. 5, pp. 170–175, Tokyo, 1938.

Although the determination of subterranean mass distributions from the corresponding gravity values is, from a purely mathematical point of view, an indeterminate problem, it may often be reduced to a determinate one by means of assumptions regarding the mode of the mass distribution. A method of calculation for solving the problem and the application of this method to actual problems, with three examples, are discussed mathematically.—*W. A.*

4591. Tsuboi, Chuji, Thickness of the isostatic earth's crust: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 2, pp. 285–287, 1938.

Using a double Fourier series for the surface topography of the area in question, and the Bouguer anomalies in this area, the author obtains an expression for the depth, d, at which the load of the surface mass is compensated. The value of d can be calculated directly from surface gravities and topographies. To get the thickness of the isostatic earth's crust, which corresponds to zero altitude, the thickness

of the mass compensating the constant term of the topography must be subtracted from *d*. Tests of the method show satisfactory results.—*R. S. R., Sci. Abstracts, vol. 41, No. 489, 1938.*

4592. Vening Meinesz, F. A., Second-order disturbance terms in pendulum observations at sea: Royal Acad. Sci. Amsterdam Proc., vol. 41, No. 6, pp. 540–551, 1938.

Since the first paper on this subject (see Geophys. Abstracts 94, No. 4443) the writer has made a trip with H. M. Submarine 012 from Curaçao to Holland (see Geophys. Abstracts 94, No. 4442). The trouble experienced with the provisional instrument for measuring the horizontal acceleration of the ship during that trip resulted in the construction of a more durable type of apparatus. The apparatus was successfully tested during a trip of 1 week in 1938. This paper describes significant features of that trip, the apparatus, and the determination of the ship's horizontal acceleration. It contains also the list of corrections to the results of 454 gravity stations at sea, published by the Netherlands Geodetic Commission in "Gravity expedition at sea, 1923–1932," Waltman, Delft.—*W. A.*

4593. von Thyssen, Stephan, Vergleiche zwischen direkten und Schleifenmessungen mit dem Thyssen-gravimeter [Comparison of direct and loop measurements with the Thyssen gravimeter]: Beitr. angew. Geophysik, vol. 7, No. 3, pp. 218–229, Leipzig, 1938.

Direct and loop measurements with the Thyssen gravimeter carried out over an area near Hanover are compared. It is shown that satisfactory results were obtained from measurements made at the stations 0.5 to 6 km. apart. The loop measurements show mean errors not exceeding on the average twice those shown by the direct measurements. For loop measurements an instrument little affected by temperature variations is preferred. Up to the present an area of about 80,000 square miles has been covered by the Governmental geophysical survey in Germany with the Thyssen gravimeter. The stations in the surveyed area average 2½ miles apart. To obtain the highest possible accuracy only direct measurements were made.—*Author's abstract.*

2. MAGNETIC METHODS

4594. Alexanian, C. L., Étude magnétique en Alsace; Interprétation géologique des mesures [Magnetic study in Alsace; Geological interpretation of the measurements]: Annales des combustibles liquides, vol. 12, No. 6, pp. 1085–1158, 1937, and vol. 13, No. 1, pp. 53–110, Paris, 1938.

The purpose of this investigation was to determine the relationship between anomalies of the vertical component of the terrestrial magnetic field and the regional geology of Alsace. Evolution and the existence of such relationship, as well as facts known in this domain, are summarized. Detailed geologic interpretation is based on data obtained with the Haalck variometer at 506 magnetic stations.

Numerical values of magnetic susceptibility of most of the rocks in Alsace, as determined by the balances of Curie and Cheneveau, are given. These values are used for the analytical calculation of the structures. The operation, sensitivity, accuracy, and other features of the Haalck variometer are discussed. Means are studied to avoid or reduce errors in the measurements of *Z*. The method of work in the field, the diffi-

culties encountered, and the proceedings adopted for drawing maps are discussed. Detailed tables are given summarizing the values of ΔZ at the 506 stations. Magnetization of several subordinate levels is investigated as a basis for deducing the direct applications to the regional geology of Alsace. General conclusions are drawn. A critical study is made of the methods of calculating structures adopted by authors. New data are obtained from a geologic interpretation of the map of isanomalies of the Plain of Alsace. A distinct magnetic difference exists between the sandstone region of the Vosges in the north and the Hercynian structure in the south. Geologic interpretation derived from this difference is given. The author establishes that the outcropping edge of the basalt of the Kaiserstuhl massif corresponds exactly to the zero line on the map of isanomalies.

The work is divided into three main parts. The first deals with empirical work in laboratory and in field; the second is essentially analytical, as it deals with the form of isanomalies and theoretical profiles relative to different simple geological structures; and the third consists of quantitative interpretation connected with the regional geology of Alsace. It contains a bibliography of 148 titles.—*W. A.*

4595. Athanasiu, G., Mesure de magnétisme terrèstre en Transylvanie [Measurement of terrestrial magnetism in Transylvania]: Buletinul Societătii de Ştiinţe, No. 8, pp. 482–502, Cluj, 1937.

A declination map shows a considerable deviation west of Cluj (Klausenburg), which extends in a NW.–SE. direction and passes through the cities of Stana, Someshul Cald, and Beishoara. From a further series of investigations made with regard to the horizontal component of magnetic fields, the author determined a third axis with the same NW.–SE. direction passing through the cities of Cluj, Feleac, and Turda. Traces of magmatic intrusion or the presence of ore veins of hydrothermal origin could be determined along the lines Cluj-Turda and Stana-Beishoara. Magnetic anomalies found by the author coincide well with the directions of the intrusions and veins.—*Abstract by E. Stoicovici and von Gliszczynski in Neues Jahrb. Min. Geol. Paläont., No. 4, 1938; translated by W. A.*

4596. Bahnemann, Fritz, Die Magnetisierung geologischer Körper [Magnetization of geological bodies]: Beitr. angew. Geophysik, vol. 7, No. 3, pp. 281–291, Leipzig, 1938.

The magnetization of geological bodies is a function not only of the earth's field but also of elastic deformation sustained by the bodies. The frequent occurrences of anomalous magnetization (negative anomalies) are caused by strain and shear on definite geological bodies and not, as recently has been stated, by a total change of direction of the earth's field. More experimental and theoretical work on this problem must be done, owing to its importance to applied geophysics and to the effects of tectonic and seismic forces on the magnetization of the earth's crust (secular variation).—*Author's abstract.*

4597. Bartels, J., and Fanselau, G., Der erdmagnetische Sturm vom 16 April, 1938 [Magnetic storm of April 16, 1938]: Naturwissenschaften, vol. 26, No. 19, pp. 296–298, Berlin, May 13, 1938.

On the morning of April 16, 1938, at 5 hours 46.7 minutes, world time, there began a magnetic disturbance of unusual intensity which was

recorded at the Adolf Schmidt Observatory in Niemegk. The range of the disturbance was D 5°28′, H 1900γ, and Z 600γ, the greatest since 1890. By the use of instruments with a sensitivity of 26γ/mm., the whole disturbance was recorded, and the result was regarded as the strongest which has ever been recorded outside the polar-light zone. The main disturbance took place in the first 2 hours. During the storm, polar light was observed from German ships on the east coast of North America. In Norway earth-current effects set up voltages of over 300 in line systems, caused fuses to melt, and made sparks in telegraph offices. The greatest sun eruption hitherto observed in Zurich took place on the morning of April 15 and preceded the magnetic storm by about 21 hours.—*G. E. A., Sci. Abstracts, vol. 41, No. 487, 1938.*

4598. Bosler, Jean, Courants telluriques et perturbations magnétiques [Earth currents and magnetic perturbations]: Acad. sci. Paris Comptes rendus, vol. 206, No. 13, pp. 964–966, March 28, 1938.

An examination of the curves obtained at Parc Saint-Maur over many years shows an exact parallelism with (1) the N-S component of the earth current (i) following the magnetic declination changes and (2) the E-W component following the horizontal force (H) changes. The relation takes the form $H=K2+$constant, where K is a constant. At some stations inertia in the moving system causes an apparent time lag between the two quantities. The earth currents are not due to induction caused by fluctuations in the terrestrial magnetic field, but both have an extraneous cause.—*R. S. R., Sci. Abstracts, vol. 41, No. 487, 1938.*

4599. Chapman, S., Geomagnetism or terrestrial magnetism?: Terres. Magn. and Atmos. Electr., vol. 43, No. 3, p. 321, Baltimore, Md., 1938.

Workers who write in English on the science of the earth's magnetism should regularly adopt the title "geomagnetism" and the corresponding adjective "geomagnetic" instead of the more usual "terrestrial magnetism" and "terrestrial magnetic." The reasons for such changes are briefly explained.—*W. A.*

4600. Fleming, J. A., Terrestrial magnetism and oceanic structure: Am. Philos. Soc. Proc., vol. 79, No. 1, pp. 109–125, Philadelphia, Pa., 1938.

Diagrams show the residual magnetic fields in different parts of the earth's surface as determined from accumulated observations made throughout the world. A map is included of world magnetic and electric surveys made by the Department of Terrestrial Magnetism, Carnegie Institution of Washington, from 1905–37.

The established fact that the earth's crust is not homogeneous in its magnetic behavior is explained by the existence in many regions of local magnetic disturbances caused by magnetic ore deposits. Variations of terrestrial magnetization may also have their origin in deep-seated earth movements. The anomalous magnetic features observed over continental areas must naturally have their counterparts in the great ocean basins. These features may thus serve as an aid in the study of oceanic structure. A brief description is given of Piggot's apparatus for taking core samples from the bottom of the ocean. The procedure developed by the Department of Terrestrial Magnetism for studying these cores is described. The information obtained may contribute to the geophysical observer of terrestrial magnetism in both field and laboratory by providing a complete picture of the earth's crust and particularly of that great part which is the ocean bottom.—*W. A.*

4601. Hasegawa, Mankiti, and Tamura, Yūiti, On the regular progressive changes of the magnetic field of diurnal variations of terrestrial magnetism. Part 2: Tokyo Imp. Acad. Proc., vol. 14, No. 1, pp. 4–8, 1938.

From the examination of the observed data given in a previous paper (see Geophys. Abstracts 93, No. 4294), it is now clear that the average diurnal variation of terrestrial magnetism is composed mainly of two parts, one a variation of magnetic force due to the rotation of a magnetic field round the earth and the other the contribution from regular changes of this rotating magnetic field with the universal time. A general idea of the whole aspect of the phenomenon is given by expressing numerically the facts illustrated in the previous paper.—*W. A.*

4602. Katō, Yosio, Investigation of the changes in the earth's magnetic field accompanying earthquakes or volcanic eruptions: Tōhoku Imp. Univ., Sci. Rept., vol. 27, No. 1, pp. 1–90, Sendai, Japan, 1938.

The problem discussed is whether or not earthquakes and volcanic eruptions disturb the earth's magnetic field in the regions where they occur, and if so, whether the field is disturbed before or after such an occurrence. Remote as well as recent magnetic disturbances that were accompanied by earthquakes and volcanic eruptions are examined in detail. The relation of the tilting of the earth's crust to a magnetic disturbance is discussed and a simple case of a magnetic disturbance caused by an earthquake is described. The author concludes that the relation between seismic or volcanic activities and changes in the earth's magnetic field is significant. The magnetic field in an active seismic or volcanic region is always remarkably disturbed because of changes in the magnetic properties of magma or rocks that are moving in the earth's crust. The magnetic survey carried out in the epicentral region of the recent great earthquakes or in the vicinity of an active volcano shows that the magnetic disturbance bears an intimate relation to the results of precise leveling that reveal crustal deformation. The magnetic disturbance probably appears shortly before the occurrence of an earthquake or a volcanic eruption. Finally, the writer concludes that an earthquake or a volcanic eruption is merely a phenomenon that takes place as the last stage of "seismic or volcanic action." Magnetic and electric disturbances would therefore appear before an earthquake or a volcanic eruption accompanying "seismic or volcanic action" in the earth's interior.—*W. A.*

4603. Katō, Yosio, Magnetic properties of the rocks constituting the earth's crust: Tōhoku Imp. Univ., Sci. Rept., vol. 27, No. 1, pp. 91–100, Sendai, Japan, 1938.

In a previous paper (see abstract 4602) the author discussed the magnetic disturbances accompanying earthquakes or volcanic eruptions and found that the magnetic elements in the seismic or volcanic regions underwent remarkable changes as the result of seismic or volcanic activities. These magnetic disturbances were ascribed to changes in the magnetic properties of magma or rocks constituting the earth's crust. Magmatic movements naturally produce changes in the pressure and temperature of rocks. In this article the author describes his experiments concerning the effect of temperature on the magnetization of rocks in a weak field. The results are shown in tables and graphs.—*W. A.*

4604. Koenigsberger, J. G., Natural residual magnetism of eruptive rocks, Part 2: Terres. Magn. and Atmos. Electr., vol. 43, No. 3, pp. 299–320, Baltimore, Md., 1938.

This is a continuation of Koenigsberger's article published in Terres. Magn., vol. 43, No. 2, 1938 (Geophys. Abstracts 94, No. 4450). Apparatus used for the measurement of residual magnetism and of the susceptibility of rocks is mentioned, and results of measurements of many kinds of rocks are given.—*W. A.*

4605. Lamey, C. A., A dip-needle survey of the Toivola-Challenge mine area, Michigan: Econ. Geology, vol. 33, No. 6, pp. 635–646, Lancaster, Pa., 1938.

A dip-needle survey of a heavily drift covered part of the Keweenawan copper district of northern Michigan in which there are few outcrops, was undertaken in an effort to trace the major Keweenawan units beneath the drift. Small but persistent variations in dip-needle readings made it possible to locate several belts of basic flows and to trace a number of faults and shattered zones. From the dip-needle readings a geologic map was prepared. Interpretation of this map indicates that a large part of the Keweenawan series is present in the area, including horizons from the Baltic, or lower, to the Great conglomerate, and that the Keweenaw fault is cutting higher into the series to the southwestward, eliminating some of the lower horizons.—*Author's abstract.*

4606. Lubiger, F., Fehlerhäufigkeitskurven als Messgenauigkeitskriterium und ihre Anwendung auf Thyssen-Gravimeter [Error frequency curves as a measure of accuracy and their employment with the Thyssen gravimeter]: Beitr. angew. Geophysik, vol. 7, No. 3, pp. 230–244, Leipzig, 1938.

The accuracy of measurements with several Thyssen gravimeters is investigated mathematically by means of error-frequency curves, which give a clearer insight into the accuracy obtainable than error-probability curves, as these measurements involve not the actual errors of an observation but merely the difference between the errors of two observations. The error-frequency curves of the several instruments closely resemble each other, and there is some indication of the existence of systematic as well as of accidental errors.—*C. A. S., Sci. Abstracts, vol. 41, No. 488, 1938.*

4607. Mariani, J., Sur une interprétation possible des champs magnétiques terrestre et solaire [On a possible interpretation of the terrestrial and solar magnetic fields]: Acad. sci. Paris Comptes rendus, vol. 206, No. 17, pp. 1247–1249, April 25, 1938.

The electromagnetic equations generalizing the inertia principle of Galileo are presented by geometry but not the geometry of the universe as given by Weyl and Einstein-Meyer. They rest on the hypothesis that temporal spatial rotation in the universe of Minkowski with reference to a Galilean mark is also a movement of inertia. A kind of equivalence is thus established between motion caused by an electromagnetic field and the infinitesimal generalized rotation. Comparison of observation and theory for the sun and earth shows that the theoretical result for the earth is too small. The theory does not explain why the charge

is conserved in spite of appreciable conductivity of the air, while atmospheric precipitation, solar radioactivity, and cosmic rays exert an influence.—*R. S. R., Sci. Abstracts, vol. 41, No. 487, 1938.*

4608. Nagata, Takesi, Magnetic anomalies and the corresponding subterranean structure: Imp. Acad. Japan Proc., vol. 14, No. 5, pp. 176–181, Tokyo, 1938.

A preliminary mathematical discussion is given of the method by which the relationship of magnetic anomalies and the corresponding subterranean structure may be solved. The details of the method described, discussion of its accuracy, and examples of applying the method will be published later in the Bulletin of the Earthquake Research Institute.—*W. A.*

4609. Nagata, Takesi, Magnetic anomalies around volcanic craters: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 2, pp. 288–299, 1938.

The method employed in obtaining observations of magnetic declination around the crater of the volcano Mihara is explained, and the results are tabulated. The anomalies obtained are supposed to be due to variations in the topography of the crater and probably to induced magnetism in rocks with large magnetic susceptibility around the crater. The susceptibility is calculated from the observed data. It is shown that the earth's magnetic field in the island has an anomalous distribution almost equal to the magnetic field due to a bar magnet placed in the center of the volcano coaxically with the normal magnetic meridian.—*R. S. R., Sci. Abstracts, vol. 41, No. 489, 1938.*

4610. Nakamura, S. T., and Katō, Yosio, On variations in the magnetic dip in central Japan: Imp. Acad. Tokyo Proc., vol. 14, No. 4, pp. 125–127, April 1938.

The distribution of terrestrial magnetism, particularly its dip, has been studied since 1934. A very striking disturbance of magnetic dip was observed at Minabe. This disturbance resembled closely the disturbances noticed at Nara and Hirano prior to the severe earthquake of February 1937, which originated near these stations. The distribution of the changes between two successive observations is given in diagrams. About 6 months after the disturbance ceased, a strong earthquake occurred off the coast of Minabe. Such intervals suggest two possible ways in which transformations of material operate successively in magma, one connected mainly with their magnetic properties and the other with their mechanical stress, for example, their changes in volume.—*W. A.*

4611. Pekár, Desider, Finding bauxites by magnetic measurements [in Hungarian]: Math. u. Naturwiss., Anzeiger der Ungarischen Akademie d. Wissenschaften, vol. 46, No. 1, pp. 215–226, Budapest, 1937.

Measurements were made in the neighborhood of the "Aluminiumerz Bergbau und Industrie Aktiengesellschaft" near Gánt, where the existence of bauxite deposits was well known. Kohlrausch's variometer and the vertical field-balance were used. The mean value of susceptibility of the bauxites investigated was $\mu=45\times10^{-6}CGS$. The curves of the earth's magnetic anomalies are given in a diagram. Horizontal and vertical intensities were determined at 181 stations. In all, 690

measurements were made. Based on these investigations the author's belief is that notwithstanding the small magnetic susceptibility of bauxites magnetic measurements can be made successfully with the above-mentioned instruments, provided that great care and caution are observed.—*W. A.*

4612. Ramanathan, K. R., Effect of near lightning discharges in a magnetometer: Nature, vol. 140, No. 3544, p. 587, London, 1937.

Some characteristic fluctuations noticed in the declination magnetograms obtained at Alibag, near Bombay, are explained as being due to the magnetic field of near lightning discharges. It is pointed out that the magnetometer behaves as the needle of a ballistic galvanometer for these impulsive discharges, and it is suggested that this may be made the basis of an instrument for measuring the discharges of individual lightning flashes.—*Editorial abstract.*

4613. Schmidt, Adolf, Zum Aufsatz von Th. Koulomzine and A. Boesch über die Vertical-Feldwaage [Regarding Th. Koulomzine and A. Boesch's article on the vertical field balance]: Zeitschr. Geophysik, vol. 14, No. 3/4, pp. 63–67, Braunschweig, 1938.

This article refers to Koulomzine and Boesch's article, published in Zeitschr. Geophysik, vol. 8, No. 3/4, 1932, "Treatise" concerning Schmidt's vertical field balance manufactured by Askania workshops" (see Geophys. Abstracts 40, No. 911). It is shown that the critical remarks made by Koulomzine and Boesch do not apply to the balance designed by Schmidt and manufactured by R. Toepfer for the Potsdam Magnetic Observatory but refer exclusively to the older types of slightly simplified instruments manufactured in series by the Askania-Werke. The possible error resulting from this misunderstanding is determined, and its essential importance is estimated.—*Author's abstract translated by W. A.*

4614. Steinmann, K. W., Field procedure in magnetometer work: Oil Weekly, vol. 90, No. 5, pp. 25–28, Houston, Tex., 1938.

After giving a brief outline of the principles of magnetometer surveying, the writer presents by a series of photographs and diagrams the procedure followed in the field: (1) Cross section of round-type magnetometer, (2) the magnet system, (3) operator with instrument, (4) operator unpacking equipment, (5) tripod set-up, (6) assembled instrument with Helmholtz coil, (7) reading the magnetometer, and (8) magnetic maps.—*W. A.*

4615. Strona, A. A., Magnetic anomalies of the northwestern part of the Kursk region [in Russian]: Geophysic, No. 6, pp. 59–67, Leningrad, 1938.

Results of magnetic surveys made in several districts of the Kursk region are given. 1,260 stations were investigated by the Tieberg Thalen magnetometer. A large magnetic anomaly has been discovered in the vicinity of the village of Menshikovo with a maximum intensity along the axis of the anomalous band $V_{amax.}=0.57$ *CGS*. The anomaly represents a band of northwest strike and may be traced approximately for 30 km.; the central part of the anomaly in the vicinity of the village of Menshikovo has been studied in detail for 10 km. The magnetic anomaly is due to the pre-Cambrian magnetite-bearing crystalline schists occurring at a depth not exceeding 200 m. below the surface.

The area of high intensity of the anomaly $Va>0.1$ $CGS=13.3$ km.^{2} is of great interest to prospecting in view of the great extent and thickness of the iron-bearing beds causing the magnetic anomaly and probable slight depth of these beds.—*Author's abstract.*

4616. Tarkhov, A. G., On the possibility of locating magnetic anomalies with the aid of an airplane moving along a straight line [in Russian]: Razvedka Nedr, vol. 8, No. 3, pp. 45–46, Moscow, 1938.

A method of making magnetic surveys from an airplane has been proposed previously by Logachev (see Geophys. Abstracts 90, No. 3832). The application of the method was rejected because of the opinion current at that time that the induced electromotive force obtained by this method was too small to be measured. In this article the question is reconsidered and a mathematical discussion of the problem given. As a result of this investigation the author states that the objection raised against the aerial magnetic survey is without foundation because measurable values of the induced electromotive force may be obtained even over small magnetic anomalies of the order of about 300γ.—*W. A.*

4617. Vestine, E. H., Asymmetrical characteristics of the earth's magnetic disturbance field: Terres. Magn. and Atmos. Electr., vol. 43, No. 3, pp. 261–282, Baltimore, Md., 1938.

Asymmetries in the earth's magnetic disturbance field are considered in relation to the asymmetries in the earth's main field, using data of 32 stations. The auroral-zone curve of terrestrial magnetism in north polar regions is elongated in a direction roughly parallel to the elongation of isoclinic curves. It agrees roughly with the curve of maximum auroral frequency as given by Fritz, except in regions where his auroral data were scanty. The curve appears to undergo regionally a small diurnal oscillation.

The amplitude of the disturbance diurnal variation (S_D) is approximately symmetrical with respect to the geographical equator in low altitudes, is zonal-symmetrical with respect to the auroral zone, and has a zero vertical component near the north pole given by the eccentric dipole. No change in amplitude with longitude has been detected, and it is concluded that induced earth currents in the oceans contribute little to S_D.

The local time phase of the mainly sinusoidal variation S_D shows a range of about 4 hours with longitude. But if in defining time the geographic north pole be replaced by the north pole given by the eccentric dipole, then at the auroral zone there is no significant variation in time phase with longitude. This suggests that the auroral zone has a controlling and initiating influence over the world-wide electric currents responsible for S_D.

Average asymmetries in the geographical distribution of magnetic disturbance and aurora are compared. The average force vectors for the daily means of disturbances are perpendicular to the average directions of homogeneous auroral arcs, to a high degree of approximation, in polar regions.

The S_D electric-current system of magnetic storms proposed by Chapman shows good general agreement with the extensive data here considered. Certain changes are suggested whereby the fit with observation may be improved.—*Author's abstract.*

3. SEISMIC METHODS

4618. Banerji, S. K., Earthquake problems of India: Sci. and Culture, vol. 3, pp. 637–642, June 1938.

A list is given of the reported earthquakes in India for the past 200 years with the probable positions and depths of the foci. A list of all the various waves (refracted, reflected, surface, etc.) follows with a brief account of their nature. Then the question whether a shock begins with dilatation or compression, the degree of acceleration, possible tilt of the strata affected, and effect on buildings are briefly referred to; and finally the need for further seismological observations in India is emphasized.—*C. A. S., Sci. Abstracts, vol. 41, No. 488, 1938.*

4619. Belluigi, Arnaldo, Seismisch-elektrische Wirkungen und neue mögliche seismische Anwendungen [Seismic electric effects and new possible employment in seismometry]: Beitr. angew. Geophysik, vol. 7, No. 3, pp. 260–264, Leipzig, 1938.

The probable origin of the seismic electric effect is discussed, and the explanation of Thyssen, Hummel, and Rülke that it is due to electrochemical variations caused by electric waves is upheld. The possibility of employing the effect as a basis for the construction of seismometers free from all complications due to inertia is pointed out, and the advantages likely to accrue therefrom are emphasized.—*C. A. S., Sci. Abstracts, vol. 41, No. 488, 1938.*

4620. Bernard, Pierre, Le cycle solaire dans l'agitation microséismique [Solar cycle in microseismic disturbances]: Acad. sci. Paris Comptes rendus, vol. 206, No. 21, pp. 1585–1587, May 23, 1938.

From the observations at Parc Saint Maur yearly means of microseismic disturbances were extracted. It was found that the maxima occurred 2 years after the maxima of solar activity in 1917 and 1927, and curves show the relation of the two quantities. For Eskdalemuir and Strasburg similar curves are obtained. For La Plata the curves are similar but of opposite phase to those for the northern hemisphere. The microseismic disturbances are related to atmospheric disturbances in the vicinity of Europe and in the South Atlantic. The frequency and intensity of microseisms have an 11-year cycle and a maximum as solar activity decreases.—*R. S. R., Sci. Abstracts, vol. 41, No. 488, 1938.*

4621. Berroth, A., Aufgaben des Messingenieurs bei der Lagerstättenforschung, Angewandte Geophysik für Ingenieure [Problems of the surveying engineer in prospecting for ores, applied geophysics for engineers]: Allg. Vermessungs-Nachr., No. 49, pp. 553 and 569, Berlin, 1937.

Mathematical analysis of the refraction and reflection travel-time curves for one-, two-, or several-layer problems is made for horizontal and inclined surfaces of separation. Formulas for determining the inclination and the depth of the borders of the layers are derived from seismic observations. Apparatus and procedure of seismic field work is discussed.—*M. Henglein's abstract in Neues Jahrb., Min. Geol. Palaont., No. 4, 1938. translated by W. A.*

4622. Birch, Francis, and Bancroft, Dennison, Velocities in a long column of granite [abstract]: Earthquake Notes, vol. 10, No. 1/2, p. 14, Washington, D. C., 1938.

A column of Quincy granite 8 feet long and 9 inches in diameter has been excited in various modes of vibration by a simple electromagnetic driving unit. The resonant frequencies were detected with a phonograph pickup, with its needle resting lightly on the rock. The frequencies of a number of harmonics of the longitudinal, torsional, and flexural modes of vibration have been measured. The derived velocities are well within the range for Quincy granite as determined from small specimens and show no systematic variation with frequency over a range of 570 to 4,600 cycles per second for the torsional mode and of 860 to 4,300 cycles per second for the longitudinal mode.

4623. Brunner, G. J., The deep earthquake of May 26, 1932, near the Kermadec Islands: Gerlands Beitr. Geophysik, vol. 53, No. 1–3, pp. 1–64, Leipzig. 1938.

From 90 original seismograms, 23 good photographic copies, and 9 bulletins ranging in epicentral distance from 14.5° to 168.5° the phases were studied in detail. The epicenter was found to be 25° S. 179.4° E. and was determined by the method of successive approximations by shifting the assumed epicenter till the arrival times of the *P*-phase of some 20 good stations came to lie on a smooth curve. The origin time is found to be $16^h09^m58\pm^s$, and the depth is 600± km. The time of origin was determined by two methods, first by the interval of pP–P^1 and the position of its curve with respect to a normal P^1-curve, and secondly by the method employed by V. C. Stechschulte (see Seismol. Soc. America Bull., vol. 22, No. 2, 1932, and Geophys. Abstracts 41, No. 995). Both values of the origin time and depth were then modified as required for the velocities in the Pacific region. A chart of several dozen traveltime curves is compiled of the more prominent phases. The phases pS and sS are found to occur sooner than calculated. The position of P, pP, S, and sS is determined with respect to the normal P- and S-curves, and these are found to be approximately parallel.

Each phase occurring in a normal quake appears also in a deep quake with two reflections near the epicenter, notated by the initials "*p*" and "*s*," respectively. The uncommonly strong phase sSP is discussed at some length. The phases PcP, $pPcP$, and $sPcP$, as well as ScP and PcS are found; also SKP and PKS, with probable second branches. The shear wave through the core, SZS, is found to be doubtful. Surface waves are practically absent. The focal zone of P^1 at 143° is well developed, and the second branches of P^1, pP^1 on sP^1 are very strong. As many as 200 phases, mostly as yet unidentified, are found on good seismograms. Fifty-one seismograms on which the more important phases are marked are selected and reproduced at the end of the paper.—*Author's abstract.*

4624. Bullen, K. E., Tables for reduction of apparent traveltimes of the seismic pulses PKP, PKP_2, SKS (corresponding to the use of geographic latitudes): New Zealand Jour. Sci. Technology, vol. 19, No. 11, pp. 708–713, Wellington, 1938.

The effect of the earth's ellipticity on the traveltimes of earthquake waves have already been estimated for normal *P* and *S* waves,

and a previous paper (see Geophys. Abstracts 91, No. 3989) contains the results adapted to the use of geographic latitudes in calculating epicentral distances. The present publication is a companion paper to the previous one and gives tables for the similar ellipticity corrections for the phases *PKP*, *PKP*$_2$, and *SKS*.—*W. A.*

4625. Bullen, K. E., The Wairoa earthquake of September 15, 1932: New Zealand Jour. Sci. Technology, vol. 20, No. 1, pp. 31b–44b, Wellington, 1938.

The Wairoa earthquake of September 15, 1932, is rediscussed in the light of certain additional seismological evidence. The revised solution gives the epicenter as 38.9° S., 117.55° E., and the origin time as 13 hours 55 minutes. The bearing of the new solution on the problem of crustal structure in the New Zealand region is discussed.—*Author's abstract.*

4626. Dam tested by artificial earthquakes [editorial note]: Eng. News-Record, vol. 121, No. 6, pp. 184–185, New York, 1938.

A series of observations on the effect of vibration on Morris Dam, of the Pasadena water system, is described. The tests and studies were directed toward checking vibrations in the dam against values calculated by observing the effect of vibrations made by a shaking machine, which set up vibrations similar to those made by an earthquake. A vibration-recording meter with magnification factor 1,400 was used. Deflection curves showing amplitude of vibration at different locations for two settings of the shaking machine are illustrated in a diagram. The tests are interpreted as verifying the computed periods of vibration of the dam.—*W. A.*

4627. Gassmann, Fritz, Zur Bestimmung von Bodenbewegungen aus Registrierungen von Schwingungsmessern und Seismographen [On the determination of ground movements from records made by vibration indicators and seismographs]: S.-A. Festschrift Sia T. H., 15 pp., Zürich, 1937.

Differential equations for the movement of an oscillating system are derived on the assumption that subsurface rocks make translation and rotation movements of any magnitude. To find the real movements, the registration curves must be integrated. Difficulties and inconveniences caused by the displacement of the zero line arising in connection with this are eliminated by using Conradi's integrator.—*Schmerwitz's abstract in Zeitschr. Geophysik, vol. 14, No. 3/4, 1938, translated by W. A.*

4628. Green, C. H., Velocity determinations by means of reflection profiles: Geophysics, vol. 3, No. 4, pp. 295–305, Houston, Tex., 1938.

Though the idea of making an indirect determination of average subsurface velocities by means of reflection profiles is far from new, it is nevertheless considered worth reporting inasmuch as it has been recently employed with fair success by the writer in areas beyond any wells that could be "shot" for direct velocity measurements. Two examples of such surface velocity profiles are described—one located in the Means Field area of Andrews County, west Texas, and the other about 8 miles south of the Refugio Field, in Refugio County, on the Texas Gulf Coast.—*Author's abstract.*

4629. Gutenberg, Beno, On focal points of SKS: Seismol. Soc. America Bull., vol. 28, No. 3, pp. 197–200, Berkeley, Calif., 1938.

The traveltime curve of the first section of *SKS* depends much on the velocity in the outer part of the core. It begins on the traveltime curve of *ScS* at an epicentral distance somewhere between 65° and 90°, depending on the velocity of longitudinal waves just below the surface of the core. The extreme values correspond to velocities there of approximately 8.0 and 7.4 km./sec., respectively. If the distance where *SKS* begins is relatively large, its first section extends to decreasing distances and is convex towards the axis of distance, and *SKS* must have an odd number of cusps with focal points (at least one) where it reverses in direction and changes from convex to concave or vice versa. If *SKS* begins at a relatively short distance, its first segment extends to increasing distances and is concave toward the axis of distance, in which case the number of cusps is even (possibly zero). If intermediate, SKS begins with a focal point. In any case, the first segment of the traveltime curve of *SKS* is below the traveltime curve of *ScS*. Similar conclusions are correct for *SKKS*. A preliminary study of the observations seems to indicate a focal point of *SKS* at a distance between 70° and 80°. More detailed investigations which are under way may be used to draw conclusions respecting the velocity of longitudinal waves in the outer part of the core.—*Author's abstract.*

4630. Heck, N. H., Earthquakes and seismic methods in submarine geology: Am. Philos. Soc. Proc., vol. 79, No. 1, pp. 97–108, Philadelphia, Pa., 1938.

The connection between earthquakes occurring in or in the vicinity of the mid-Atlantic ridge is discussed, and the need of further investigation by means of additional seismic stations and of the explosion method stressed, especially suitable stations being named. The necessity of more or less similar investigations elsewhere of suboceanic ridges and oceanic deeps is also urged. In this way it is hoped that information on the structure and nature of the ocean floors may be obtained.—*C. A. S., Sci. Abstracts, vol. 41, No. 488, 1938.*

4631. Iida, Kumizi, Velocity of elastic waves in sand: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 1, pp. 131–144, 1938.

The velocities of transverse and longitudinal elastic waves (V_t, V_l) were determined in sands of four different degrees of fineness and closeness of packing and containing varying amounts (0 to 24 percent) of moisture. V_t decreases rather rapidly with increased moisture content; V_l increases when this exceeds 19 percent. Both V_t and V_l are greater through fine-grained than through coarse-grained sand. The elastic constants were also determined.—*C. A. S., Sci. Abstracts, vol. 41, No. 486, 1938.*

4632. Inouye, Win, Notes on the origin of earthquakes. Part 5: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 1, pp. 125–130, 1938.

As a result of further mathematical investigation of the forces producing earthquakes, the author concludes that seismic waves may result from change in stress in the elastic medium around the seismic focus, due to plastic yielding within the focus under the action of external forces.—*C. A. S., Sci. Abstracts, vol. 41, No. 486, 1938.*

4633. Jeffreys, Harold, Aftershocks and periodicity in earthquakes: Gerlands Beitr. Geophysik, vol. 53, No. 1/3, pp. 111–139, Leipzig, 1938.

It is shown that any tendency of earthquakes to stimulate one another after short intervals of time will lead to an increase of the random amplitudes expected to be obtained in a Fourier analysis, and that this may explain the apparent periodicities found when the test of significance used assumes that the earthquakes are independent occurrences and the data include aftershocks. In the aftershocks of the Tango earthquake of March 7, 1927, no sign of mutual dependence is found, except that upon the main earthquake and its strong successor on April 1 the frequencies fall off with time in a way consistent with regular law of chance, depending only on the times since these two earthquakes. No amplitude found for any periodicity superposed on this variation provides any evidence for its genuineness. It appears that if any periodicities in earthquakes exist they would be best sought in earthquakes from new epicenters.—*Author's abstract.*

4634. Johnson, C. H., Locating and detailing fault formations by means of the geosonograph: Geophysics, vol. 3, No. 3, pp. 273–291, Houston, Tex., 1938.

Mapping of faults has previously presented great difficulties for the reflection method. These difficulties have often arisen from a confused reflection pattern rather than from entire absence of reflections near the fault. The use of the geosonograph in making a directional analysis of such confused patterns is described and is illustrated with several examples of faults located and mapped by this method.—*Author's abstract.*

The following supplementary note is added by the author to the article: "Since this paper was presented before the Society much further experience with the geosonograph has been obtained. In the light of this experience, the author believes the paper placed too much emphasis, in both theory and results, on diffractions as a major factor in geosonograph performance. Far more impressive than its use of diffractions is the ability of the method to extract pertinent reflections from masking waves of undetermined origin and to separate two or more sets of pertinent reflections, relating each to its geologic origin. Thus, in filling in details in the 'blank spaces' described in the paper, the extension of reflecting horizons far into the 'blank spaces' and the separations of reflections arriving at the same time from strata on both sides of faults are more common occurrences than the detailing of the fault face by diffractions."

4635. Kanai, Kiyoshi., Model experiments of a dynamic damper for seismic structural vibration: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 1, pp. 21–29, 1938.

The effectiveness of the seismic vibration damper for irregular vibrations is shown; also, the vibration of the model structure agrees with the law of forced vibration of simple harmonic type.—*C. A. S., Sci. Abstracts, vol. 41, No. 486, 1938.*

4636. Langguth, L. C., Long-period disturbances in the Weston Benioff: Earthquake Notes, vol. 10, No. 1/2, pp. 21–24, Washington, D. C., 1938.

Ever since the three components of the Benioff type seismometer were put in operation in Weston College, in November 1936, certain

long-period disturbances of unknown origin have appeared on its seismograms. No information on these or similar disturbances has been found in the available literature; inquiries of several colleagues have failed to explain the phenomenon, and so far the members of the observatory staff have been unsuccessful in assigning a cause. The case is presented in the hope that it may be of interest and that the author may be put on the trail of a solution. A description is given of the disturbances and of attempted explanations.—*W. A.*

4637. Leet, L. D., Earthquakes in northeastern America, July–December 1937: Seismol. Soc. America Bull., vol. 28, No. 3, pp. 169–176, Berkeley, Calif., 1938.

Twelve earthquakes that occurred during the period July–December 1937 have been reasonably well located and are shown on a map. The data on these earthquakes are summarized in a table.—*W. A.*

4638. Leet, L. D., Longitudinal velocities in some weathered and unweathered Carboniferous rocks: Seismol. Soc. America Bull., vol. 28, No. 3, pp. 163–168, Berkeley, Calif., 1938.

The instruments for this experiment consisted of a special set of seismometers, galvanometers, and a camera designed for short-refraction profile investigations of problems of depth of weathering and thickness of glacial drift. Two hundred timing lines per second were used with a drum speed that placed them 3 mm. apart. A vertical velocity calibration was obtained by records from a seismometer lowered to positions 500, 1,000, 1,500, and 2,000 feet below the surface. Depths were measured by a Halliburton measuring line that supported the seismometer. Reversed refraction "weathering" profiles 400 feet in length were run at the surface. The rocks involved are of Mississippian and Pennsylvanian age. The discussion of results is illustrated by two figures: (1) Longitudinal velocities averaged over various intervals (the "salt sand" is at the base of the Pennsylvanian); (2) Traveltimes and diagrammatic wave fronts, with ray paths to 25, 50, 75, and 100 feet for weathering profiles.—*W. A.*

4639. Lynch, Joseph, The earthquake of November 14, 1937: Seismol. Soc. America Bull., vol. 28, No. 3, pp. 177–189, Berkeley, Calif., 1938.

In this preliminary paper on the earthquake of November 14, 1937, the *S* and *SKS* curves of the quake (h=250 km.) are compared with those of Gutenberg and Brunner for the same depth. The *S* curve of both Gutenberg and Brunner is confirmed from 50° to 100° within a few seconds. The *SKS* curve of Gutenberg is confirmed from 85° to 105° within a few seconds, whereas that of Brunner over the same range would seem to have an average error of 13 seconds. From 105° to 115° Brunner's curve is in fair agreement with that of the author, whereas Gutenberg's diverges rapidly after 105° to a difference of 14 seconds at 115°. The *SKKS-SKS* interval decreases with increasing distance between 103° and 107°.—*Author's abstract.*

4640. Lynch, Joseph, New theory of earth's core: Royal Astron. Soc. Canada, Jour., vol. 32, pp. 262–263, May–June 1938.

It has been proved from seismic reflections and refractions that there is a core about halfway toward the earth's center; and the author discusses the amount of its rigidity. It has been generally

assumed that if a shear wave does not penetrate the core it is fluid, but several recent investigations indicate that the shear wave does pass through the core. The author discusses (1) the conditions under which a liquid core will transmit a shear wave, (2) a core, solid but less rigid than the crust, and (3) a core that is neither a liquid nor a solid, but a "solid solution—a metal heavily occluded with a gas," that is, a metallic sponge. He illustrates his argument by an experiment with a *Pd*-torsion-pendulum occluded with H_2 which greatly reduces its rigidity.—*A. S. D. M., Sci. Abstracts, vol. 41, No. 488, 1938.*

4641. Lynch, W. A., Traffic and other local disturbances registered at Fordham by the vertical Benioff seismometer: Seismol. Soc. America Bull., vol. 28, No. 3, pp. 217–225, Berkeley, Calif., 1938.

The Fordham seismic station, located on the Fordham University campus, is surrounded by a network of motor roads, trolley-car lines, and railroad lines, both elevated and surface. The short-period and the long-period components of the vertical Benioff are affected by the traffic, the former much more strongly than the latter. The effects due to fast, heavy freight trains and through passenger trains are especially marked and can be definitely identified. Automobile traffic and that of trolley cars, elevated trains, and light freight and passenger trains merge into the general micro-unrest that varies throughout the day as the traffic load changes.

Single blasts of several hundred pounds of explosive are readily recognized, but blasts fired in successive "delays" are not registered. A recent brewery explosion, occurring probably 30 feet above ground, propagated waves of much longer period than the ordinary blast. Several disturbances have not been identified although they have appeared again and again, particularly one disturbance with a period of about 0.7 second. Vibrations of machines in nearby automobile repair shops, etc., join in the general disquiet and are not identified separately.—*Author's abstract.*

4642. Muskat, Morris, The reflection of longitudinal wave pulses from plane parallel plates: Geophysics, vol. 3, No. 3, pp. 198–218, Houston, Tex., 1938.

A wave theory treatment is given of the reflection of elastic wave pulses from plane parallel plates. The analysis automatically resolves the reflected wave system into a series of undistorted individual pulses which have the same shape as that impinging on the reflecting plate, but which are characterized by varying amplitudes and phase shifts corresponding to various internal reflection and refraction processes within the plate. The numerical values for the reflection coefficients for the three most prominent longitudinal reflected pulses resulting from an incident longitudinal wave pulse are given in both tabular and graphic form, for angles of incidence between 0° and 30°, for velocity ratios between the plate and incident medium of 1.0 to 2.0, and for density ratios of 0.9 to 1.3. The actual superposition of the individual reflected waves is shown graphically for three cases where the ratio of the thickness of the reflecting plate to the length of the incident pulse has the value 2, 1, or 1/2.—*Author's abstract.*

4643. Omote Syunitiro, Results of seismic prospecting at the Daidoko River, Korea [in Japanese]: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 1, pp. 155–170, 1938.

With a view to ascertaining the depth of the bedrock under the Daidoko River the author resorted to seismic prospecting. High-magnification seismographs were used. Wireless was used in timing the shots and in communicating between shot points and receivers. Time-distance curves and geological structures deduced from them are shown in figures. The depth of the bedrock was about 15–20 m. The velocities found were as follows: Through the superficial soil, 525 m./sec.; through the gravel layer underlying the superficial soil, 1,130 m./sec.; through the gravel layer under the river, 1,700 m./sec.; through the bedrock, 4,770 m./sec. In prospecting of this kind care must be taken not to overlook the velocity of the gravel layer under the river.—*Author's English abstract.*

4644. Pogány, Béla, and Fekete, Jenö, Seismic-reflection investigations in the Hungarian lowland [in Hungarian]: Math. u. Naturwissenschaftlicher Anzeiger d. Ungar. Akad. d. Wissenschaften, vol. 56, No. 2, pp. 505–522, Budapest, 1937.

Results of seismic measurements carried out in the region of Hajduszoboszló-Debrecen are shown in a series of maps and are compared with a map of isogams obtained from measurements made during the past 10 years with the torsion balance.—*W. A.*

4645. Ramírez, J. E., Air oscillations and ground oscillations [abstract]: Earthquake Notes, vol. 10, No. 1/2, p. 18, Washington, D. C., 1938.

On the basis of investigations carried out with seismographs and microbarographs, the following conclusions have been reached:

1. There are many types of ground oscillations and of air oscillations.

2. Evidence has been found against a wave-to-wave correspondence between microseisms and air oscillations. This lack of direct relationship is true for wave form, group form, periods, and duration of the storms near the places of observation.

3. A recent and abnormally deep atmospheric low over Florissant, Mo., with a very steep gradient, has shown the lack of correspondence between microseisms and deep lows of steep gradients near the seismological station.

4. As a conclusion, on the basis of the investigations, it can be said that microseisms are not directly caused by short-period atmospheric oscillations like the rapid pumping of the air on the forward side of a low-pressure area.

The arrival times of the above-mentioned phases were plotted against their distances, and they all fall on the respective curves for a depth of 130 km. in Brunner's depth chart. There are a few stations which are evidently out of place, because of a consistent time error. However, if the time axis is shifted a certain amount, the phases will fall in line with the rest. In fact, it has been an easy task to identify the observed phases, once the epicenter is determined.—*Author's abstract.*

4646. Ransone, W. R., Seismic exploration in eastern Venezuela: Geophysics, vol. 3, No. 3, pp. 219–224, Houston, Tex., 1938.

A map and cross section are presented to give a brief and generalized idea of the area. A limited discussion of the geology and physiography

is given. Working conditions are discussed with their particular relations to physiography, climate, and state of development of the country. Emphasis is placed on Anzoategui because of the amount of work done in that area.—*Author's abstract.*

4647. Rouse, J. T., and Priddy, R. R., Recent earthquakes in western Ohio: Ohio Jour. Sci., vol. 38, No. 1, pp. 25–35, Columbus, 1938.

The paper describes the method employed to locate the epicenter by a noninstrument type of study and to study and to briefly outline the pertinent geologic conditions in the vicinity of the epicenter. After each earthquake a survey of western Ohio was made dealing with the intensities of the shocks in the different regions as revealed by disturbances of objects on the earth's surface. These disturbances were in the form of property damage, movement of objects in buildings, displacement of monuments in cemeteries, and numerous other miscellaneous phenomena. Careful analysis of the displacement of objects showed that the direction of movement of the earthquake waves at specific points could be determined.—*Author's summary.*

4648. Sawdon, W. A., Geophysics has proved its importance in California prospecting: Petroleum Engineer, vol. 9, No. 11, pp. 23–24, Dallas, Tex., 1938.

This report contains a map of an area north and west of Bakersfield, Calif., in which geophysical prospecting was very active during the past year. The reflection seismograph has been used more than other instruments in exploratory work in all parts of California.—*W. A.*

4649. Sezawa, Katsutada, Anomalous dispersion of elastic surface waves: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 2, pp. 225–232, 1938.

From a mathematical investigation it was found that while the dispersion of Love waves is normal, the dispersion of Rayleigh waves in certain special conditions of stratification is anomalous. This condition can exist for a certain range of wave lengths transmitted through the surface layer if the velocity of bodily waves in the upper layer is greater than that in an adjacent layer of greater density. For this kind of dispersion the propagational velocity of surface waves exceeds that for transverse waves in the upper or lower media. Except for a few conditions the distribution of displacements with depth does not differ greatly from that of the usual Rayleigh waves.—*R. S. R., Sci. Abstracts, vol. 41, No. 489, 1938.*

4650. Sieberg, August, Bodenmechanische Erdbebenforschung [Ground-mechanical investigation of earthquakes]: Pub. Bur., Central seismol. internat. union géod. géophys. (A), No. 15, pp. 217–225, Toulouse, 1937.

Special investigations made by the Reichsanstalt für Erdbebenforschung have proved that the experience gained from macroseismic investigations may be applied to practical questions of industrial importance. It is shown how a more thorough judgment and evaluation of the subsurface may be obtained by macroseismic investigation than by geological investigation alone, especially in taking precautionary measures in constructing buildings. In addition to pure seismic means, secular tectonic movements, subsidence of the ground and its cause, and other geophysical data are used, according to their weight, for the

general evaluation of the possible geologic process.—*Schmerwitz's abstract, Zeitschr. Geophysik, vol. 14, No. 3/4, 1938, translated by W. A.*

4651. Ulrich, F. P., Progress report for 1937 of the seismological field survey of the United States Coast and Geodetic Survey: Seismol. Soc. America Bull., vol. 28, No. 3, pp. 205–215, Berkeley, Calif., 1938.

This report contains a summary of the work carried on during 1937. *Questionnaire program:* During 1937, 2,477 questionnaire cards of reports relating to 335 earthquakes were received. *Strong-motion work:* A total of 42 records was obtained from 9 earthquakes. All these records have been analyzed by the Washington Office. Records obtained on the strong-motion instruments during 1937 are given. *Tiltmeter work:* Three tiltmeters have been kept in operation at the University of California during the entire year. The tiltgrams for 1937 are shown in a figure. *Vibration work:* Vibration observations made on buildings, bridges, and on the ground are listed. *Instrumental work:* The set of Benioff portable seismometers was completed and tried out. A number of instruments were tested out on the shaking tables. A special shaking table was constructed for the displacement meter. *Work at Boulder Dam:* Vibration observations were made at several places about the dam, and a plan is being worked out whereby vibration observations will be made regularly at certain points on the dam and on the adjoining banks. *Other field work:* Thirty ground observations were made in a vibration survey covering the Veterans' Administration Facilities at Los Angeles and San Francisco. *Washington office:* The three accelerographs installed at Boulder Dam were checked, all the strong-motion records were analyzed, and shaking-table tests of the accelerometers were made in cooperation with the Massachusetts Institute of Technology.—*W. A.*

4652. Voiutsky, V. S., Recording of directed reflected waves in seismic prospecting [in Russian]: Razvedka Nedr, vol. 8, No. 6, pp. 26–29, Moscow, 1938.

The fundamental principle of a new receiving method consists in using for receiving seismic waves not one but several seismometers, placed at intervals. This arrangement results in phase displacements in the oscillations of single seismographs. The total effect of the reflected waves upon the seismographs becomes smaller than that produced by surface waves and thus makes it possible to distinguish these two kinds of waves on the seismogram. (See also Geophys. Abstracts 94, No. 4494.)—*W. A.*

4653. von Thyssen, Stephan, Hummel, J. N., and Rülke, O., Über das Wesen des seismisch-elektrischen Effekts [The nature of the seismic-electric effect]: Beitr. angew. Geophysik, vol. 7, No. 3, pp. 209–217, Leipzig, 1938.

It is proved that there is a close relation between the seismic-electric effect and electrochemical polarization. It seems that as the electrolyte is elastically deformed the depolarization increases. By using a seismograph constructed according to the principles of the seismic-electric effect, a true reproduction of the elastic deformations of the ground is now possible.—*Authors' abstract.*

4. ELECTRICAL METHODS

4654. Akimov, A. T., Specific electrical resistance of frozen soils: Acad. Sci. U. R. S. S., Comptes rendus, vol. 16, No. 8, pp. 405–407, Moscow, 1937.

This paper describes laboratory studies on the changes of the specific electrical resistance of samples of soils subjected to different degrees of moistening and at different temperatures. Three samples representing the most typical soils—sand, sandy soil, and clayey soil—were studied. The study of electrical resistance was conducted in a box in which a mixture of ice and salt served to reduce the temperature to a minimum of —20° C. A sample of the soil was placed in a metallic box 24 by 24 by 12 cm. in size, on the upper plate of which was mounted a miniature four-electrode Schlumberger plant. The author made his measurements by the compensation method and used a Raps potentiometer, with which he attained great accuracy by elimination of contact resistance and polarization. Curves show the interdependence of specific resistance and temperature.—*W. A.*

4655. Chakravarty, M. K., and Khastgir, S. R., E. H. F. electrical constants of soil: Phil. Mag., vol. 25, No. 170, pp. 793–801, London, May 1938.

The attenuation of ultra short waves traveling along a Lecher wire system immersed in a specimen of Dacca soil was determined for a certain range of ultra high frequencies (73 to 89 Mc./sec.) and for varying moisture contents from 8 to 41 percent. The values of the electrical conductivity O and the dielectric constant E of the soil were then determined by the application of the standard formulas. The value of the dielectric constant of the specimen of the soil varied from 3.95 e. s. u. at a moisture content of 8 percent, to 29.4 e. s. u. at a moisture content of 41 percent. The value of the electrical conductivity was of the order of 10^{-14} e. m. u. It increased with moisture content. The electrical conductivity of the soil was found first to increase and then to diminish with the increase of frequency. The dielectric constant of the soil was found to diminish with the rise of frequency, as is expected from Debye's theory of high frequency dispersion in polar liquids. It is to be noted that the values of the electrical conductivity and the dielectric constant of the soil obtained by the direct laboratory method agree well with the values estimated from the attenuation measurements.—*Authors' abstract.*

4656. Craig, R. L., Testing resistivity of soil: Petroleum Engineer, vol. 9, No. 5, pp. 80–86, Dallas, Tex., 1938.

A description is given of the usual field equipment used for measuring soil resistivity, and in particular of the various configurations of the electrodes used. Although the mathematical theories involved in the calculations have been developed for direct current methods, the use of commutated rectified methods offers simplification of equipment. Details of the set-up of the complete apparatus, including a new type of disc commutator, and of the mathematical and empirical interpretations of the results obtained are given.—*C. L. G., Jour. Inst. Petroleum Technologists, vol. 24, No. 176, 1938.*

4657. Electrical exploration of drill holes [editorial note]: Louisiana Cons. Rev., pp. 12–16, spring 1938.

Principles are outlined of the Schlumberger process and their application in electrical surveys of drill holes. A noteworthy feature of the

process is that no productive horizon can be missed in the course of drilling because of the continuous record obtained.—*W. A.*

4658. Fritsch, Volker, Beiträge zur Funkgeologie. *IV.* Die praktisch anwendbaren Verfahren der Funkmutung nach der sog. "Kapazitäts methode" [Contribution to radio geology. Part 4. Practical application of radio prospecting by the so-called "capacity method"]: Beitr. angew. Geophysik, vol. 7, No. 3, pp. 265–280, Leipzig, 1938.

In articles published previously (see Geophys. Abstracts 87 and 91, Nos. 3386, 3387, and 4039) the author discussed the principles of possible application of the so-called capacity method for radio prospecting. Examples were examined. It was noticed that the final results may differ greatly according to the choice of a substitute for the geologic conductor. In this article the author (1) discusses the possible arrangements of measurements and reasons for their selection, (2) derives the proper frequency of the circuit in question and shows under what assumptions it should be applied, and (3) describes the technique of measurements.—*Author's abstract translated by W. A.*

4659. Fritsch, Volker, Die Bedeutung der Funkgeologie für die Montanistik [Importance of radio geology to mining]: Schlägel u. Eisen, vol. 36, pp. 16–23, 1938.

Radio prospecting deals with the mutual relations between the geological conductor and a high-frequency alternating current or Hertzian field. The main methods of radio prospecting are (1) the absorption method, by which the conclusion on the kind, thickness, and structure of the conducting layer penetrated is made from the field-intensity decrease (Feldstärkerückgang) determined by the absorption, (2) the frequency method, in which the sender and the receiver remain at the same place, the wave length is changed and the conclusions on the nature of rocks are reached from the curves obtained, and (3) the so-called resistance method, in which the electrical conductor under investigation is inserted into the circuit, all the other factors of which are known.—*H. V. Philipsborn's abstract in Neues Jahrb. Min. Geol. Paläont., No. 4, 1938, translated by W. A.*

4660. Fritsch, Volker, Die Messung der Antennenersatzkapazität in der Funkmutung [Measurement of the antenna compensation capacity in radio prospecting]: Zeitschr. Geophysik, vol. 14, No. 3/4, pp. 93–96, Braunschweig, 1938.

A device for measuring capacity is described. Frequency control is made by means of a quartz crystal. The compensation capacity is subdivided in such a way that a quick and accurate adjustment is possible. Great value is attached to using only movable essential parts. Therefore, only one single rotary condenser is used. The work must be done according to determined viewpoints discussed in the article.—*Author's abstract translated by W. A.*

4661. Fritsch, Volker, Der heutige Stand der Funkgeologie [The present state of radio geology]: Bohrtech. Zeitung, vol. 56, No. 7, pp. 102–104, Vienna, 1938.

The main purpose of radio geology is the study of the mutual relation between geological conductors and high-frequency Hertzian fields. The important problems and the effects arising from this relation are

discussed. It is concluded that although many difficulties have yet to be overcome, important foundations for applying radio to geology are established. The use of radio geology in the search for oil seems certain.—*W. A.*

4662. Fritsch, Volker, Einige funkgeologische Gesichtspunkte für die Anlage von Blitzschutzeinrichtungen [Some radio geological ideas for construction of lightning arresters]: Elektrotechnik u. Maschinenbau, vol. 56, No. 9, pp. 1–8, Vienna, 1938.

The properties of geological conductors are discussed, especially the influence of atmospheric conditions upon conductivity and dielectric constant. It is shown that lightning affects the geological conductor in a way similar to high-frequency alternating current. The author describes the uppermost earth's crust as a geological conductor, and he shows how its geological structure can be clearly represented. With these considerations as a basis, he examines the possible point of lightning impact and the exposure of a certain place to danger from lightning. Finally, factors are developed for scientific construction of lightning rods.—*Author's abstract translated by W. A.*

4663. Gillingham, W. J., and Steward, W. B., Application of electrical logging methods to west Texas problems: Petroleum Engineer, vol. 9, No. 7, pp. 52–55, and No. 8, pp. 84–92, Dallas, Tex., 1938.

Resistivity curves have given good correlation of sand and shale formations in west Texas and in spite of the gradational nature of these sediments can be carried over considerable distances. Electrical logging differentiates between formations even better than cable tool logs and eliminates the personal factor. By this means the Rustler, Base of Salt, Yates Sand, and Top of Line geological markers can be determined with ease over a distance of 50 miles. The electrofiltration effects are small and are masked by electrochemical effects, for the muds usually used are saturated with salt. Hence the determination of porosity or permeability is very difficult and sometimes impossible, but it can be achieved at times by using fresh muds.

Temperature surveys have been run and have detected and clearly outlined gas- and oil-bearing formations. Gas gives a cooling effect in both drilling and producing wells. Oil gives a smaller anomaly. It is important to locate the base of the gas so that oil is not shut off or a very high gas/oil ratio obtained. The best results for gas are obtained after circulating from the bottom for 2 hours. Oil anomalies show up better a few hours after circulation and with a lighter mud. The degree of cooling depends on too many factors to be used as a measure of the potential productivity. The ideal conditions for determining the position of a gas horizon are that the well should be filled with mud and that the mud should be circulated. Wells can also be surveyed when filled with oil. By swabbing a well down and making the survey while it is filling, a complete set of data is obtainable as the temperature gradient curve is then obtained under dynamic conditions, and the oil and gas bodies stand out clearly.

Dale photoelectric surveys have been made for the detection of water flows. These are most successful on swabbing or pumping wells, as flowing wells have first to be killed and as the killing fluid, usually water, is forced into the formations irrespective of whether they are water bearing or not. When the fluid level for the survey is lowered,

the injected water is returned and consequently gives a false idea of the position of water-bearing horizons.—*G. D. H., Jour. Inst. Petroleum Technologists, vol. 24, No. 177, 1938.*

4664. Kalenov, E., Electrical prospecting of Karst formations in the basin of the Don [in Russian]: Razvedka Nedr, vol. 8, No. 7, pp. 65–70, Moscow, 1938.

Electrical prospecting in the region of the Elenovsk limestone deposits is described. The problem concerns two layers. Profiles were made at intervals of 40 m., with points of observations 20 m. distant. To prevent any possibility of missing Karst formations, the writer reduced the distances between the profiles to 20 m. in some places. Based on the data obtained, a map of equal resistances was drawn. The method of a two-layer reference chart (pallet) was then applied for constructing the structure contour map on the base of the limestone. The two maps agree well in nearly all details. The accuracy of determining the depths was verified by drilling, and the mean error was found to be less than ±10 percent.—*W. A.*

4665. Markov, A., Surface distribution of direct current in an inclined conducting layer [in Russian]: Geophysic, No. 5, pp. 40–54, Leningrad, 1938.

The surface distribution of direct current for an inclined layer of satisfastory conductivity is discussed mathematically. The method of solving this problem is based on the application of the theory of mathematical physics. Approximate formulas are given for numerical calculations based on the distribution of the potential on the surface.—*W. A.*

4666. Martin, M., Murray, G. H., and Gillingham, W. J., Determination of the potential productivity of oil-bearing formations by resistivity measurements: Geophysics, vol. 3, No. 3, pp. 258–272, Houston, Tex., 1938.

Electrical logging is now almost universally applied in oil and gas fields of the world. The usual practice is to record the self-potential and resistivity curves which, together, reveal the location and thickness of strata penetrated by the drill and a great deal of their lithology and fluid content. The resistivity log thus obtained serves very well to disclose in detail formations penetrated and to distinguish between oil and water.

With the device used for ordinary electrical logging purposes, the true resistivity of the formation is not measured. The recorded resistivity is only an apparent value which is governed by several influencing factors besides the true resistivity of the formation and its fluid content. As applied to the oil content of a formation, it is a qualitative measurement and merely shows the vertical extent of the oil accumulation.

Experience has shown that the electrical conductance of oil sands is due to connate water held by molecular forces to the sand grains. Research has disclosed a definite mathematical relationship between the true resistivity of an oil sand and the ratio of its oil and connate water. This leads the way to a new practical application of electrical logging. If a suitable combination of measuring devices is used, the true resistivity of an oil sand may be measured in an oil well. The true resistivity measurement, used in conjunction with other field and laboratory data, may sometimes be used quantitatively to make a deter-

mination of the net oil content of a productive layer. The method by which these measurements are obtained is described, and examples are cited.—*Authors' abstract.*

4667. Minaw, F., and Antoun, H., Simultaneous transmission and reception of electric waves: Gerlands Beitr. Geophysik, vol. 53, No. 1/3, pp. 223–235, Leipzig, 1938.

A method is explained for the simultaneous grid modulation of a valve transmitter and a valve receiver. Working on the same frequency and coupled to the same aerial, the transmitter can affect a distant receiver but not the neighbouring one, and the receiver can detect a distant transmitter but not the one close by. The method has several possibilities of application: (1) Measurement of heights of ionosphere, (2) prospecting for ore and ground water in dry regions, (3) duplex telegraphy and telephony.—*Authors' abstract.*

4668. Morozov, G. S., and Didura, I. G., Adu-iurt (north Caucasus) [in Russian]: Groznenskiy Neftianik, No. 5, pp. 7–23, Grozny, 1936.

After a brief discussion of the location and topography of the region, the authors give the results of electrical methods of prospecting for establishing the axis of folding. Maps and profiles show the schematic distribution of tectonic lines and of lines of equal electrical resistances. The Adu-iurt electrometric anomaly is believed to represent an independent structure of anticlinal type formed by basement rocks (Miocene) covered by later deposits (Pliocene and Recent). The anomalous zone of high resistances between the Tersk and Adu-iurt folds corresponds to the syncline dividing these two folds. The relationship between the Adu-iurt structure and the folds adjoining it is described, as are also the characteristic features of this structure. In the second part of the article the results of reconnaissance borings made over the Adu-iurt anomaly are examined, and the results are summarized in two tables. As there is a probability of finding oil in this region, further investigations are recommended.—*W. A.*

4669. Nesterov, L. J., Some data on the effect of glacial drift in the electrical prospecting of steeply dipping layers that are poor conductors [in Russian]: Geophysic, No. 6, pp. 1–12, Leningrad, 1938.

In analyzing the results of experimental work made with models of steeply dipping layers covered by glacial drift of different thickness, the author shows graphically the interdependence of the effect of thickness and the conductivity of glacial drift and the results of electrical prospecting upon layers of different conductivity. The study of the effect of an angle of incidence that is 60° to 90° to the horizontal, leads the author to consider the possibility of neglecting such an effect. Therefore, electroprofiles over steeply dipping layers may be regarded as electroprofiles over vertical layers. When the glacial drift or cover is a poorer conductor than the rocks enclosing the layer, the thickness of drift under which a bed may be detected does not exceed the fivefold thickness of the layer. An electroprofile over one of the Kuzbass coal fields is shown.—*Author's abstract.*

4670. Petrucci, G., Solar radiation and the electric charge of the earth: Com. geod. e geofis. Boll., vol. 7, pp. 228–237, Rome, October 1937.

The author puts forward the hypothesis that the electric charge of the earth is caused by the photoelectric effect of the solar radiation on

the atmosphere near the earth's surface. The ionization of the air by ultraviolet radiation is greatly increased by the presence of impurities such as dust particles, smoke, and organic vapors. From known data of the intensity and spectral distribution of the solar radiation, from the number of photoelectrons emitted and of dust particles in the air, the author calculates approximately the intensity of the photoelectric effect and comes to the conclusion that the order of magnitude of the effect is sufficient to explain the stability of the electric charge of the earth.—*L. K., Sci. Abstracts, vol. 41, No. 486, 1938.*

4671. Petrucci, G., Solar radiation and the terrestrial electric field: Com. geod. e geofis. Boll., vol. 7, pp. 238–240, Rome, October 1937.

The author publishes curves showing annual variation of the ultraviolet radiation of the sun and of the electric field of the earth. Both variations show complete parallelism, which constitutes a further proof for the author's hypothesis that the electric field of the earth is due to the photoelectric effect of the solar radiation on the terrestrial atmosphere (see abstract 4670).—*L. K., Sci. Abstracts, vol. 41, No. 486, 1938.*

4672. Rosenzweig, I. E., A new method of depth determination in earth resistivity measurements: Am. Inst. Min. Met. Eng. Tech. Pub. 931, 10 pp., New York, 1938.

The new method of calculation of the depth is based on the hypothesis of a two-layer system, in which the use of a special master diagram makes it possible to compute the depth of the boundary surface of both layers.—*Author's abstract.*

4673. Semenov, A. S., Lateral effects [in Russian]: Geophysic, No. 5, pp. 27–35, Leningrad, 1938.

The author explains the influence of lateral effect on the electrical resistance of steep cliffs (walls) and slopes. Lateral effect is of special importance in its application to the building of dams and similar structures. An analysis of the simplest cases shows the possibility of obtaining exact values of the measured apparent resistivities; in more complicated cases only approximate values are derived. The author discusses mathematically the effect of the following: (1) A steep wall (rock) of homogeneous structure, (2) nonconducting rocks in a two-layer structure, (3) two steep walls (rocks) of homogeneous structure, (4) nonconducting walls (rocks) in a two-layer structure when the resistivity of the second layer is greater than that of the first, and (5) two nonconducting rocks in a semicylindrical nonconducting bed. Calculations are illustrated by diagrams.—*W. A.*

4674. Semenov, A. S., Leakage from the feeding circuit to the electrodes [in Russian]: Geophysic, No. 5, pp. 3–26, Leningrad, 1938.

Influence of leakage on the value of the apparent specific resistivity is examined mathematically. Formulas are given for calculation of the measured apparent resistivity at different leakages. The following are discussed: (1) Leakage concentrated in one point of the wire, and (2) leakage distributed along the wire. Data obtained by calculation are given in diagrams. Ways are considered for detecting leakage and for eliminating its effect.—*W. A.*

4675. Semenov, A. S., Measurement of electrical resistivity of water in open basins [in Russian]: Geophysic, No. 5, pp. 36–39, Leningrad, 1938.

Great differences exist in the electrical conductivity of natural waters. A four-electrode arrangement of direct current or one with two electrodes for measuring the conductivity is described. The measurements may be carried out from vessels and, in surveying small springs, on land. The following fundamental problems may be considered: (1) Tracing of the zone of fresh water in the sea and in the mouth of a river, (2) investigation of submarine springs for studying the bottom of the sea, (3) investigation of electrical conductivity of water in coast regions in the zones of slides with the purpose of studying the nature of the slides, and (4) investigation of the salinity of waters in seas, rivers, and other bodies of water.—*W. A.*

4676. Storm, L. W., Electrical coring practices on the Gulf coast: Oil and Gas Jour., vol. 35, No. 48, pp. 145–152, Tulsa, Okla., 1937.

Schlumberger electrical surveys have two main uses, both of which apply especially in the Gulf coast region. They are (1) to provide a log of the formations, and (2) to distinguish the fluids in them. Thermometric surveys and the side-fall coring device also are used in the region. The importance of a complete log is discussed, and it is illustrated by a series of diagrams. A diagram shows how the formations behind the casing may be logged by the temperature method.—*W. A.*

5. RADIOACTIVE METHODS

4677. Barnóthy, Ieno, and Forró, Magdalene, Meteorological-magnetic influence on the intensity of radium emanation [in Hugarian]: Math. u. Naturwissensch. Anzeiger der Ungar. Akad. d. Wissenschaften, vol. 56, No. 1, pp. 207–213, Budapest, 1937.

The results of measurements distributed equally throughout the year and obtained from continuous readings with different devices of coincidence are arranged according to the mean hourly values and evaluated with respect to the magnetic and temperature effect. It is proved that the daily variation of the intensity of emanation depends essentially on the daily variation of the earth's magnetic field. The magnetic effect is calculated to be —0.06 percent for 10^{-5} Gauss. A temperature effect equal to —0.1 percent per degree Cel. was found only in a group measured without any lead filtering. This indicates that the temperature effect must be assigned mainly to its influence upon the softer scattered rays.—*Authors' German abstract translated by W. A.*

4678. Froman, D. K., and Stearns, J. C., Cosmic ray showers and bursts: Rev. Modern Physics, vol. 10, No. 3, pp. 133–192, Lancaster, Pa., 1938.

The purpose of this survey of the publications dealing with cosmic ray showers and bursts is to make available a fairly comprehensive report of the experimental work and theoretical deductions on this subject.

The measured properties of bursts and showers, such as the variation of frequency with altitude and latitude, the specific ionization of their respective rays, and the form and magnitude of their transition effects, are strikingly similar. A figure shows examples of cumulative showers large enough to be detected by ionization chambers as large bursts.

There is evidence that such showers occur with sufficient frequency to account for most bursts.

In conclusion, some of the important theoretical and experimental findings regarding the two types of cosmic ray showers are presented in tabular form.—*Authors' summary.*

4679. Keevil, N. B., Radon condensation method of determining geologic age: Am. Jour. Sci., vol. 36, No. 214, pp. 304–309, New Haven, Conn., 1938.

A modified method of determining the helium age is described, which overcomes criticisms of the two methods previously described. "The first determines the amount of helium and its rate of production in the specimen by direct α-ray counting from a thin-deposited film of rock. The age is computed by dividing the total number of helium atoms present by the number of alpha particles emitted per unit of time for equivalent masses of material. * * * The second method measures the rate of production of helium indirectly. It involves the measurement of the helium evolved from the carbonate fusion of the ground rock, followed by separate determination of the amounts of radium and thorium present in the hydrochloric acid solution of the fluxed material." The danger of contamination or removal of radon during the chemical procedure is eliminated by condensing the radon directly from the fluxed rock. Another advantage is that all the determinations can be made on the same specimen, thus lowering the errors due to inhomogeneity. Some preliminary results of radon determinations and the comparison of the results by three methods on a specimen of the Quincy granite are given.—*Author's abstract.*

4680. Larmor, Joseph, Intense radioactivity of the superficial ocean floor: Nature, vol. 142, No. 3583, p. 37, London, 1938.

Attention is directed to the greater radioactivity of the ocean floor, a fact explained by Piggot as due to the precipitation of uranium, parent of radium, from the ocean water. Rayleigh and Joly have calculated that the amount of radium at the surface of the earth must be greater than in the interior. These facts have a bearing on the problem of isostasy.—*From editorial abstract.*

4681. Miehlnickel, Erwin, Höhenstrahlung (Ultrastrahlung) [cosmic radiation], 316 pp., 69 figs., Dresden and Leipzig, Verlag von Theodor Steinkopff, 1938.

The volume provides a comprehensive summary of practically all the results of cosmic-ray investigations that had been published up to the end of 1937. The task involved in carefully surveying the existing literature is evidenced by the fact that the bibliographies following each of the 17 chapters of Dr. Miehlnickel's book comprise a total of nearly 2,900 references. The index of these according to both subject and author should in itself make this a valuable reference book for all investigators of the cosmic ray.—*From S. E. Forbush's review in Terres. Magn. and Atmos. Electr., vol. 43, No. 3, 1938.*

4682. Nielsen, W. M., and Morgan, K. A., The absorption of the penetrating component of the cosmic radiation: Phys. Rev., vol. 54, No. 4, pp. 245–248, Lancaster, Pa., 1938.

The nature of the penetrating component of the cosmic radiation has been studied by making Geiger-Müller counter measurements in a

cavern at a depth below rock of approximately 60 m. water equivalent. Observations on the vertical counting rate were made inside and outside the cavern with various thicknesses of lead between the counters. In agreement with the results of previous investigators, the counting rate with no absorber between the counters is about one-twentieth of the counting rate outside. The small absorption of the penetrating ionizing radiation at this depth in 550 gm./cm.^{2} of lead shows that the penetrating component is to be associated with an ionizing particle. It is therefore not necessary to assume the transmission of cosmic-ray energy to these large depths of nonionizing particles, for example, neutrinos. Comparison of the absorption of the penetrating component inside and outside the cavern shows that penetrating ionizing radiation undergoes a hardening on transmission through large thicknesses of material. The percentage of the radiation of the less penetrating type is very nearly the same inside and outside the cavern (25 percent and 30 percent, respectively). This suggests that such soft radiation is in approximate equilibrium with the penetrating component even at the earth's surface. The character of the absorption curve for the soft component under a depth of 60 m. water equivalent shows that it must be possible for the penetrating component to generate secondaries of considerable energy.—*Authors' abstract.*

4683. Poole, J. H. J., A method for determining the radium content of rocks by direct α-ray counting: Royal Dublin Soc. Sci. Proc., vol. 21, No. 54, pp. 595–608, 1938.

After a brief examination of the present (emanation) methods of determining the radium content of rocks, the author suggests that because of recent advances in particle-counting technique it should be possible to measure radioactive contents by directly counting the α- and γ-rays liberated by the rock. He describes a new method that combines the advantages of the emanation and α-particle counting methods. Its advantages are (1) that it can deal with smaller quantities of material than either of the other counting methods, and (2) that it has a low ratio of stray α-particles to those due to the radon from an average rock. The main objection to the method is its complexity and greater expense as compared with the older electroscope or electrometer methods.

The principle of the method is as follows: The radon is liberated from the rock specimen by either the fusion or the solution method. Until now, only Joly's and Evans' fusion methods have been used. The radon is then transferred to a suitable ionization vessel, whose isolated electrode is connected to the grid of the first valve of a Wynn Williams type of resistance-capacity amplifier. The last stage of the amplifier can be connected to a photographically recording oscillograph or if desired to a simple type of thyratron counter, as the speed of counting will not be high. So far, photographic recording has been employed, as it shows at once that the amplifier has been functioning correctly. A detailed description of apparatus and method of use is given, as well as a discussion of results.—*W. A.*

4684. Poole, J. H. J., The theoretical efficiency of cylindrical ionization chambers when used for estimating radon by α-particle counting: Royal Dublin Soc. Sci. Proc., vol. 21, No. 55, pp. 609–614, 1938.

In the preceding paper (see abstract 4683) the author described a method of estimating the radon and consequently the radium content of rock specimens by α-particle counting. The ionization chamber and amplifier used in this method, however, will not count all the α-particles emitted by radon and its disintegration products, but only a definite fraction of them. This is due to the fact that a certain minimum number of ions must be produced in the chamber before a recognizable kick is produced on the oscillograph record, and consequently α-particles whose range in the chamber is too short will escape uncounted. Inasmuch as, at the beginning of their range, all α-particles produce about the same number of ions per millimeter of path, it is assumed that particles whose path in the chamber is less than a certain value will not be counted. The problem discussed in this paper is that of calculating the percentage of such particles. The design of the chamber considered is given, and the efficiency for α-rays from active deposit and the efficiency for α-rays from radon is calculated. The results of calculation of the total efficiency of the chamber are shown in a table.—*W. A.*

4685. Shpak, V. A., Principle of new methods of logging drill holes [in Russian]: Sovietskaia Geologiia, vol. 8, No. 6, pp. 105–114, Moscow, 1938.

The development of new methods of logging, as well as electrical logging, is described. Radioactive and magnetic properties of rocks and their application for the differentiation of rocks penetrated by drilling are investigated. The method of "gamma coring," in which the Geiger-Müller counter is used, is described, and the results of its application for the investigation in a series of drill holes are examined. One of the disadvantages of the method is the necessity of keeping the counter for at least 10 minutes at each point. The need for the development of a counter to reduce this time to about 1 minute is emphasized, as the possibility of using the "gamma method" for determining the nature of the rocks in cased holes, which is now impossible by the method of electrical coring, is of great importance.—*W. A.*

6. GEOTHERMAL METHODS

4686. Bell, A. H., Temperature gradient in the world's deepest well: Mining and Metallurgy, vol. 19, No. 381, p. 410, New York, 1938.

Readings of temperature taken in the deepest hole in the earth (15,004 feet), drilled by the Continental Oil Co. about 4 miles west of Wasco, Calif., in the San Joaquin Valley, indicate temperatures ranging from 196° F. at 6,000 feet to 268° F. at 15,000 feet, or an increase of 1° for every 125 feet (see Bell's article in Mining and Metallurgy, vol. 19, No. 379, 1938). Since the completion of this well, additional temperature readings have been taken under both shut-in and flowing conditions and have thereby both eliminated the retarding effect of the colder drilling mud and given a closer approximation to accurate temperature gradients. Readings at the depth of 13,134 feet give a temperature of 277° and a geothermal gradient of

91 feet for each degree near that level. On the basis of the gradient established by means of a graph the true temperature at 15,000 feet is estimated to be 297°.—*W. A.*

4687. Dahlblom, Th., The downward increase of temperature in the rocks of the crust: Zeitschr. Geophysik, vol. 14, No. 5/6, pp. 131–141, Braunschweig, 1938.

The difficulties in determining the downward increase of temperature in the earth are discussed. Measurements of temperature at varying depths in California (Grass Valley) and in Transvaal (Village Deep mine) are shown in six tables. The viewpoints of several scientists working on this subject are critically examined.—*W. A.*

4688. Dakhnov, V. N., Thermometric measurements in boreholes of oil-bearing regions in the Soviet Union [in Russian]: Neftianoe Khoziaistvo, vol. 19, No. 6, pp. 9–12, Moscow, 1938.

The possibility of determining oil-bearing horizons by using data obtained from thermal coring is based on the adiabatic expansion of oil and gas in layers under exploration. As heat is absorbed during the expansion, the result is that the producing horizon becomes cooler than the formations surrounding it. This decrease in temperature lasts as long as the process of expansion and evaporation continues, and as it is recorded on thermograms by distinct minima, it thus makes possible the determination of the existence of oil and gas in rocks penetrated by a borehole. Diagrams of boreholes in oil-bearing regions of Nebitdag, Emba, and Dossor illustrate the results of thermometric measurements. A comparison is made between these diagrams and those obtained from measuring spontaneous polarization.—*W. A.*

4689. Diakonov, D. J., Thermal coring of wells [in Russian]: Neftianoe Khoziaistvo, vol. 19, No. 6, pp. 5–9, Moscow, 1938.

The addition of the electrothermometer to electrical-coring equipment permits the securing of a complete record of temperature along the well. The application of such thermal coring is based on the difference in heat conduction of rocks and geologic formations. The thermal conductivity of many rocks is given in a table. The possibility of obtaining additional data for determining gas-bearing horizons by applying thermal coring is discussed. Several special problems that may be solved by thermal coring are also mentioned, such as (1) determination of the height of the cement behind the casing during the plugging of the hole, (2) investigation of the circulation of liquids in cased holes, and (3) determination of the points of inflow of ground water.—*W. A.*

7. UNCLASSIFIED METHODS

4690. Barton, D. C., Geophysical education and exploratory geophysics as a career; from "Round table of geophysical education": Am. Inst. Min. Met. Eng. Tech. Pub. 950, New York, 1938.

A discussion of the chances of advancement for those now entering the profession and of the amount and kind of training those in allied fields should receive.—*Abstract from Mining and Metallurgy, vol. 19, No. 380, 1938.*

4691. Cowles, L. G., The adjustment of misclosures: Geophysics, vol. 3, No. 4, pp. 332–339, Houston, Tex., 1938.

The adjustment of misclosures in slope traverses by the method of least squares is effected by solving a system of simultaneous equations, which may be written by inspection of the traverse diagram. These equations can be solved by measurements of currents in an analogous electrical resistance network. This paper is devoted mainly to the development of the electrical analogy.—*Author's abstract.*

4692. Deussen, Alexander, Discoveries: Geophysics, vol. 3, No. 3, pp. 177–197, Houston, Tex., 1938.

This paper is a review of the history of the discovery of oil reserves not covered by any previous investigator. Tables and diagrams are given summarizing estimates of oil reserves and discoveries of oil fields in various parts of the United States; also a map of Harris County, Tex., showing location of structures and fields on January 1, 1938.—*W. A.*

4693. Eby, J. B., Geophysics role in deep drilling: World Petroleum, vol. 9, No. 6, p. 40, New York, 1938.

It is shown that geology and geophysics have been not only important but dominant factors in deep exploration.—*W. A.*

4694. Eby, J. B., Newer trends and methods in geophysical petroleum exploration: Petroleum Engineer, vol. 9, No. 10, pp. 31–40, Dallas, Tex., 1938.

The relation of geology and geophysics to exploration for oil is indicated. Maps and detailed data concerning the electrical or "Eltran" method and the soil-analysis method are given. "Eltran" is a contraction of the words "electrical transients"; it refers directly to this particular method of prospecting (see Geophysics, vol. 1, No. 2, Electrical transients in geophysical prospecting, by Louis Statham). Eltran anomalies are said to represent the electrical expression of shallow mineralization that occurs over buried structures. A map of a portion of Yoakum and Cochran Counties, Tex., is used as an example of an Eltran structure map. Results of about 140 miles of Eltran traverse are shown, and field methods are discussed in detail.

Analysis of soils for significant hydrocarbon gases that indicate the presence of oil-bearing reservoirs below is increasing in importance as a method of exploration. A map of the Hastings oil field, Brazoria and Galveston Counties, Tex., shows a preliminary soil-analysis survey of this field. The technique is based on obtaining samples of soil, of treating them in the laboratory to volatilize the adsorbed hydrocarbons, and of separating the ethane, which is the fundamentally significant constituent. The ethane content usually ranges from 0 to 200 parts per billion parts of soil. "Ethane counts" in so-called "billigrams" are then spotted on a map, and the data are studied for significant patterns.

Summarizing the exploratory plan for both Eltran and soil analysis, the author points out that the influence of these two new methods is predicated upon the hypothesis that in low relief traps, leaking hydrocarbons and shallow mineralization are better clues than the evidence for relief indicated by other methods. Finally, costs of the Eltran and soil-analysis processes are compared with those of the torsion balance and reflection seismograph.—*W. A.*

4695. Elkins, T. A., and Hammer, Sigmund, The resolution of combined effects with application to gravitational and magnetic data: Geophysics, vol. 3, No. 4, pp. 315–331, Houston, Tex., 1938.

A simple but rigorous and general mathematical method is given for finding the minimum separation of two nearby bodies at which their observed combined effect indicates the presence of two separate bodies. Geophysical applications of the method are illustrated by investigating the resolution of gravity and torsion balance data for the two limiting cases of spheres and infinite horizontal cylinders, the resolution of the vertical magnetic intensity for infinite rectangular plugs, and the direct interpretation of the infinite horizontal rectangular block. The possible usefulness of such analysis in the selection of a geophysical field method and in the choice of station spacing is discussed.—*Author's abstract.*

4696. Haalck, Hans, Über einige die Physik des Erdinnern betreffende atomtheoretische Beziehungen [On some relations concerning application of the atomic theory to the physics of the earth's interior]: Zeitschr. Geophysik., vol. 14, No. 5/6, pp. 111–119, Braunschweig, 1938.

Relations existing between the exponents of repulsion of ions, compressibility, and pressure inside the earth are derived. Calculations of the factor of compressibility, based on the atomic theory, agree well with the values obtained for the nucleus of the earth and with those obtained by seismic methods, but too small values result for the earth's crust. The relation between the repulsion constant, pressure, and the electrical field strength inside the earth is determined, and the result is briefly discussed as to the possibility of explaining the cause of terrestrial magnetism.—*Author's abstract translated by W. A.*

4697. Heiland, C. A., and Wantland, Dart, Organization of a department of geophysics; from "Round table of geophysical education": Am. Inst. Min. Met. Eng. Tech. Pub. 950, New York, 1938.

A survey of the department at the Colorado School of Mines, which is based on the fundamentals of a broad engineering training with a ground work in geology, supplemented by instruction in mathematics and physics as a corollary to courses in the various geophysical methods—*Abstract from Mining and Metallurgy, vol. 19, No. 380, 1938.*

4698. Horvath, Sepp., Moderne Hilfsmittel beim Erzschürfen [Modern aids in drilling for ore]: Berg- u. hüttenm. Monatsh., vol. 86, No. 9, pp. 225–234, Vienna, 1938.

A brief outline is given of methods used to determine the location of drill holes. Electrical and magnetic methods are considered, and examples of both these methods are discussed.—*W. A.*

4699. Kelly, S. F., A perspective of geophysics; from "Round table of geophysical education": Am. Inst. Min. Met. Eng. Tech. Pub. 950, 11 pp., New York, 1938.

A perspective of geophysics, considered broadly as a science fundamental to the understanding of earth phenomena, is here presented with the idea of emphasizing the fact that it dates back over three centuries.—*Abstract from Mining and Metallurgy, vol. 19, No. 380, 1938.*

4700. Keys, D. A., Teaching geophysics in the department of physics; from "Round table of geophysical education": Am. Inst. Min. Met. Eng. Tech. Pub. 950, New York, 1938.

As applied geophysics is the application of experimental and theoretical physics to determine variations and discontinuities in underground structures, the department of physics is consequently the natural place in a university where the principles and methods involved should be taught and developed. The course as now given to all mining engineers and geologists in their senior year at McGill University is briefly outlined.—*Abstract in Mining and Metallurgy, vol. 19, No. 380, 1938.*

4701. Lorenz, H., Beiträge zur Theorie des Erdaufbaus [Contributions to the theory of earth structure]: Zeitschr. Geophysik, vol. 14, No. 5/6, pp. 142–152, Braunschweig, 1938.

General conditions are derived for the distribution of density inside the earth. The layered character (Shollennatur) of the solid crust of the earth is demonstrated, and the determination of the thickness of the sima layer from the geothermal gradient, together with a reason for a gaseous nucleus, is discussed. Thicknesses of continental and sea blocks are determined by means of the increase of gravity with depth and of the increase of densities of rocks, with isostasy taken into consideration. A few potential laws of density-distribution are discussed, as well as the following: Agreement with Helmert's statement and determination of additional values from the general conditions, the mean earth density, and the moment of inertia. The general validity of the nondimensional formula of density for all spherical celestial bodies with congealed surfaces is demonstrated.—*Author's abstract translated by W. A.*

4702. Lundberg, H. T. F., Practical results obtained from geophysical surveys: Am. Inst. Min. Met. Eng. Tech. Pub. 954, 29 pp., New York, 1938.

Examples are given showing the value of a geophysical survey as a logical first step in the development program of any mining property where overburden conditions necessitate exploration by trenching, diamond drilling, or shaft sinking. A description of the survey of the Arizona Meteor Crater is also included.—*Author's abstract.*

4703. Mitera, Z. A., Present status and future aspects of geophysical exploration in Poland: Geophysics, vol. 3, No. 3, pp. 225–233, Houston, Tex., 1938.

Large-scale geophysical activity was begun in Poland after the introduction by the Pioneer Exploration Co. in 1934 of the reflection seismograph and establishment of its own geophysical department under the name "Pioneer Institute of Applied Geophysics." Greatest activity was concentrated in the Carpathian Foreland and the Carpathian Mountains, where the major oil and gas deposits are located, as shown on a map. Seismic-reflection profiles and geologic sections through a few oil fields are given. A map of Poland shows the areas, which total about 150,000 square miles, covered by different geophysical methods during the period from 1923 to 1938. In 1937 the Polish Geological Survey became an important factor in promoting and expanding geophysical activity in Poland. A 4-year exploration program in which geophysical surveys play an important role has been worked out. In carrying out this

program, the geophysical department of the Polish Geological Survey in 1937 covered 18,000 square miles with magnetic vertical intensity measurements, 4,000 square miles with gravimeter surveys, and about 600 square miles with detailed seismic refraction and reflection surveys.—*W. A.*

4704. Mogilevski, G. A., Gasometry of wells by means of gas samples extracted from cores [in Russian]: Razvedka Nedr, vol. 8, No. 4/5, pp. 68–70, Moscow, 1938.

Gas surveys have so far been limited to depths from 2 to 10 m. The author proposes to increase these depths by extracting gas from cores obtained during drilling. Special equipment (consisting of steel tubes and pumps) and technique of extracting the gas from the cores (putting the core into a tube filled with water, pumping out first the water and then the gas) are described. About 1 l. of gas could be pumped out from cores 99 mm. in diameter and 1.5 m. in length. Considerable increase in concentration of hydrocarbons with depth was proved (0.007 percent at the depth of 3 m., 0.1 percent at 28 m., and 6 percent at 94 m.). Chemical analysis of gas taken at 94 m. of depth had shown: O_2, 14.2 percent, CO_2, 0.7 percent, and CH_4, 6.1 percent. The rate of increase of hydrocarbons was higher in cores taken from holes drilled over the known maximum of gas and lower in those over the minimum of gas.—*W. A.*

4705. Mogilevski, G. A., Microbiological investigations in connection with gas surveys [in Russian]: Razvedka Nedr, vol. 8, No. 8/9, pp. 59–68, Moscow, 1938.

Many phenomena accompanying and complicating the process of the diffusion of gas are still not sufficiently known to permit the application of a gas survey on a large scale at the present time. The following questions, considered to be the most important, are discussed: (1) Uncertainty of chemical composition and nature of single fractions determined by microanalysis, and (2) causes of the instability of hydrocarbon concentrations in the soil air. Characteristics, intensity, and other influences of bacteria upon the data obtained by gas surveys were studied, but definite conclusions could not be drawn. Two maps are given, one showing the distribution of microbiological investigations of the subsoil in the oil-bearing region of Asfaltovaia Gora-Shirokaia Balka and the other showing the isolines of a gas survey on the Khadizhensk oil-bearing region.—*W. A.*

4706. Petrascheck, W., Die geophysikalischen Bodenforschungen in der Ostmark [Geophysical exploration of the ground in Austria]: Berg- u. Hüttenm. Monatsh., vol. 86, No. 9, pp. 217–218, Vienna, 1938.

This is a brief description of possibilities of exploration by several geophysical methods of prospecting.—*W. A.*

4707. Price, P. H., and Headleé, A. J. W., Regional variations in composition of natural gas in the Appalachian province: Am. Assoc. Petroleum Geologists Bull., vol. 22, No. 9, pp. 1153–1183, Tulsa, Okla., 1938.

A study of the composition of natural gas in the Appalachian province shows it to have certain definite regional variations. The amounts of the chemical identities present and their areal distribution are shown, (1) in detail for the Elk-Poca and Campbell Creek Oriskany sand fields, Kanawha County, W. Va., (2) in partial detail for the

entire Big Injun sand production in West Virginia, and (3) by a composite for all producing horizons in the Appalachian province. These regional variations are discussed in relation to structure, sedimentation, and regional metamorphism as indicated by carbon ratios based on coal. The composition of natural gas offers criteria for prospecting for gas and oil, and indicates relative areal positions of gas and oil in a given reservoir.—*Authors' abstract.*

4708. Rude, G. T., Marine surveying: Am. Philos. Soc. Proc., vol. 79, No. 1, pp. 9–25, Philadelphia, Pa., 1938.

The paper outlines recent progress in marine surveying around the coasts of the United States of America and its possessions. A description is given of the Dorsey fathometer used for echo depth sounding and of various modified forms of radio acoustic ranging for locating the survey vessel. The depths are rapidly plotted in relation to the positions obtained from the sono-radio-buoys. The latter contain small radio transmitters "keyed" by a hydrophone which receives the under-water explosive signal. A recorder on the survey vessel records the instant of explosion of an under-water bomb and the arrival of the explosion at the sono-radio-buoys. During 5 months of the summer of 1937 one survey ship covered an area of 6,513 square miles in the Gulf of Mexico. Within the past 6 years 285,000 square miles of marine surveys have been made of the coastal waters of the United States of America and its possessions.—*A. B. W., Sci. Abstracts, vol. 41, No. 488, 1938.*

4709. Savchenko, V. P., and Kozlov, A. L., On the gas survey [in Russian]: Neftianoie Khoziastvo, vol. 19, No. 7, pp. 17–20, Moscow, 1938.

This paper is a critical discussion of Sokolov's theory of the gas survey. Results of analyses of gases at different depths, taken from a few examples of gas surveys, show that the facts obtained do not agree with the theoretical foundations of the gas survey. The main defects of the theory are as follows: (1) The value of penetration of gas through rocks under natural conditions is highly exaggerated, (2) water-bearing horizons lying above gas-bearing layers are not taken into consideration, and (3) physical processes only are taken into consideration, whereas geochemical and biochemical processes are neglected. Summarizing their discussion, the authors conclude that the method of gas survey by taking samples of soil air is not applicable in most regions. Application of this method in favorable regions must necessarily include the study of biochemical, chemical, and physical destruction of hydrocarbons, as well as the study of processes of formation of hydrocarbons and similar organic matter in the ground. Besides, such factors as climatic conditions and season cannot be neglected. The process of diffusion of gas from gas-bearing horizons at great depths must be studied by using data obtained from deep wells.—*W. A.*

4710. Selzer, Georg, and Weber, R., Ergebnisse von Gasmessungen über Erdöllagerstätten [Results of gas measurements over oil deposits]: Petroleum Zeitschr., vol. 34, No. 39/40, pp. 11–13, Berlin, 1938.

Two gas surveys, based on Laubmeyer's method (see Geophys. Abstracts 51, No. 1481), were made over known oil deposits in Midjimurje, Croatia, and along the Mur River, near Peklenica, Croatia. The results are shown on a map with isogas-lines (lines of equal gas con-

centration) and gradients. Small gas concentrations in the soil air could be measured quantitatively with the new apparatus developed by the authors (a description of the apparatus and the method of its application will be published later). The relationship between geological structure and distribution of gas was established. The possibility of a direct and quantitative proof of the existence of oil may, therefore, serve as a valuable additional means of geophysical prospecting for oil.—*W. A.*

4711. Sergeev, A., Preliminary results of a gas survey made in the Sivash seacoast region of the Ukrainian S. S. R. in 1936 [in Ukrainian]: Jour. Geology, vol. 5, No. 1/2, pp. 177–187, Kiev, 1938.

This paper contains the results of soil-gas investigations conducted in 1936 by the Ukrainian Geological Institute, which used the gas-survey method developed by Sokolov. The existence of two anticlines is considered possible, and a connection of the Sivash seacoast region with Carboniferous deposits is considered probable on the basis of the surveys.—*W. A.*

4712. Shepard, E. R., Electrical resistivity and seismic exploration for roadbeds and other engineering structures: Washington Acad. Sci., vol. 28, No. 8, p. 374, Menasha, Wis., 1938.

Simple, compact, and portable electrical-resistivity and seismic instruments, suitable for relatively shallow subsurface explorations have been designed and built by the Bureau of Public Roads. For determining the presence and location of solid rock and for classifying soils and other underlying strata with respect to their relative degree of compaction, the seismic method is more accurate and dependable than the electrical-resistivity method. The seismic method is of practical use in highway design and construction for classifying materials of excavation, for determining the condition of bridge foundations, and for locating suitable materials for fills and road surfacing. It is of even greater value in connection with large engineering structures such as locks, dams, and reservoirs. On such projects a large amount of preliminary core boring can be dispensed with where preliminary seismic tests are made.—*Author's abstract.*

4713. Steinman, K. W., Geophysical work maintains important coastal standing: Oil Weekly, vol. 90, No. 7, pp. 114–118, Houston, Tex., 1938.

Increasing reliance is being placed on geophysical science as many advancements in equipment and methods enhance the possibilities of outlining structures. Tables show the number of geophysical crews working along the Gulf coast of Louisiana and Texas.—*W. A.*

4714. Todd, J. D., and Roper, F. C., Sparta has possibilities in Pointe Coupee Parish: Oil Weekly, vol. 90, No. 2, pp. 34–35, Houston, Tex., 1938.

Geophysical work has indicated the presence of a number of structures favorable to the accumulation of oil in Pointe Coupee Parish, and a test well recently drilled found a section of good upper sands, a poor Cockfield series, and 20 feet of Sparta sand. The well was probably located too far down dip, as otherwise a thicker section of Sparta sand would have been found. Now that production has been found in the Sparta at Ville Platte, it is thought that one or two structures in Pointe Coupee Parish will prove productive from this horizon.—*J. A. G., Jour. Inst. Petroleum Technologists, vol. 24, No. 178, 1938.*

4715. Weiss, Oscar, The theory of rockbursts and the possibilities of geophysical methods in predicting rockbursts on the producing mines of the Witwatersrand: Chem. Met. Min. Soc. South Africa Jour., vol. 38, No. 10, pp. 469–471, No. 11, pp. 491–505, and No. 12, pp. 562–570, Johannesburg, 1938.

In No. 10 of the Journal the author publishes corrections made by him in a few figures of his original article under the same title (see Geophys. Abstracts 93, No. 4397). The figures are recalculated, and new values of the Young modulus are derived.

Nos. 11 and 12 give a detailed discussion of the original article at the meetings of the Society held on May 25 and June 22, 1938.—*W. A.*

8. GEOLOGY

4716. Bartosh, E. J., Wilmington oil field, Los Angeles County, California: Am. Assoc. Petroleum Geologists Bull., vol. 22, No. 8, pp. 1048–1079, Tulsa, Okla., 1938.

The Wilmington oil field, located 20 miles south of Los Angeles and adjacent to the Los Angeles harbor, is one of the largest oil fields in California. Oil was first produced from the Lower Pliocene in January 1932. The General Petroleum Corporation's Terminal No. 1, the first large well, was completed in December 1936 with an initial production of 1,500 barrels per day, 20.5° American Pertoleum Institute gravity, from the Puente formation (upper Miocene) at a depth of 3,625 feet.

Discovery was made by correlation of outpost wells, together with a seismograph survey which added materially to the general outline of the structure. The structure is an irregularly shaped dome with faulting transverse to the principal axis. The dip ranges from 2° to 15°. The major faulting apparently occurred near the close of Miocene time and continued progressively throughout deposition of the Repetto formation (lower Pliocene). Production is obtained from the Repetto formation (lower Pliocene) and the Puente formation (upper Miocene). There are five producing zones: Tar, Ranger, upper Terminal, lower Terminal, and Ford.

The gravity of oil ranges from 12° to 31°. The lower 700–800 feet of Pliocene and 2,500 feet of the Miocene formation contain oil and gas at different stratigraphic levels. The field has produced a total of 17,608,495 barrels of crude oil from the discovery date, December 7, 1936, to February 15, 1938, inclusive. Recent development in the city of Long Beach has increased the proved area from 2,100 to 3,200 acres. Production on March 2, 1938, was 101,382 barrels daily from 374 wells. A large part of the proved area is undeveloped.—*Author's abstract.*

4717. Halbouty, M. T., Probable undiscovered stratigraphic traps on Gulf coast: World Petroleum, vol. 9, No. 6, pp. 27–40, New York, 1938.

Advancing knowledge in geology and geophysics during the past 37 years, together with an additional decade of study and experience, will eventually lead to the discovery of other oil reservoirs.—*W. A.*

4718. Imamura, Akitune, Crustal deformations as revealed through revisions of levels linking Hiroshima with Sindi: Imp. Acad. Japan Proc., vol. 14, No. 3, pp. 108–111, March 1938.

The line of precise levels that links Hiroshima with Sindi and that was run in 1891 and 1921 was revised during October and November 1937 over a total distance of about 182 km. As the main line was run first in 1891, then in 1921, and finally in 1937, the changes in land level worked by means of the first and second surveys cover a period of 30 years, whereas those of the second and third cover 16 years. The data obtained are given in a table and are illustrated by figures. Significant features of the changes are discussed.—*W. A.*

4719. Williams, Neil, Search for oil in southern Mississippi encouraging: Oil and Gas Jour., vol. 37, No. 5, pp. 21, 22, 36, Tulsa, Okla., 1938.

Discoveries in the southern part of Mississippi have led to the belief that an old basin or embayment of the Gulf of Mexico underlies this area. The basin structure is not apparent in formations younger than Wilcox or basal Claiborne, but it is definitely indicated by a well which entered the Wilcox 2,000 feet lower than two other wells 20 miles to the north and south, respectively. The exact boundaries have not yet been fully determined, but the northern limit is believed to be the Hatchetigbee anticline, and the southern limit also is thought to be an anticline. The eastern boundary is probably just over the border, in Alabama.

Geophysical surveys have indicated several "highs," and drilling has proved two of them to be salt domes. Apart from possible salt-dome production in the middle of the basin, there is the chance that shore-line conditions may occur on the northern limit. As the formations rise from the center of the basin toward the coast, it is improbable that an extension of the Texas-Louisiana coastal salt domes will be found. Although no oil shows have been noted in the wells so far drilled, the Cockfield and Wilcox formations are considered to be potential producers if drilled on suitable structures.—*J. A. G., Jour. Inst. Petroleum Technologists, vol. 24, No. 178, 1938.*

9. NEW BOOKS

4720. Breed, C. B., and Hosmer, G. L., Principles and practice of surveying, vol. 1, 7th ed., 717 pp., illus., price, $4; vol. 2, 5th ed., 674 pp., illus., price, $3.50. New York, John Wiley and Sons, 1938.

Vol. 1. Elementary surveying: A standard textbook containing the essentials of a comprehensive knowledge of practical surveying. Part I covers the use, adjustment, and care of instruments designed to measure distances, directions, angles, and elevations. Part II describes surveying methods, including astronomical observations and mine survey. Parts III and IV cover, respectively, computations and plotting. Necessary tables are included. The planimeter is discussed in an appendix.

Vol. 2. Higher surveying: Part I deals with triangulation, with astronomical observations, and with precise, trigonometric, and barometric leveling. Part II deals with stadia and plane-table work and with the relation of geology to topography. Part III covers terrestrial and aerial photographic surveying, and part IV, hydrographic work. It concludes with a section on map construction.

4721. Central Scientific Geological Research and Prospecting Institute, Symposium of inventions and technical improvements [in Russian], 124 pp., Leningrad, 1937.

This symposium contains the following papers relating to geophysical methods of prospecting: (1) New geophysical methods of prospecting based on the study of the "Aureoles of dissemination," by N. I. Sofronov, A. P. Solovov, and E. A. Sergeev, pp. 81–85; (2) Measurement of small quantities of radium emanation, by L. I. Bochkov, pp. 85–97; (3) Application of drop analysis in prospecting for ores, by E. A. Sergeev, pp. 97–101; (4) Method of determining the elements of occurrence of a vertical deposit according to magnetometric data, by A. G. Tarkhov, p. 101; (5) Radiometric apparatus, by B. S. Aidarkin, pp. 102–110; (6) Self-setting induction frame, by B. I. Shparber, pp. 110–111; (7) Rational measures by using oscillographs of the system of Konstantinov, by V. M. Shipelkevich, pp. 112–113; (8) Improvement of Schweyder's recorder, by F. F. Nikanorov, pp. 113–114; (9) New field oscillograph of the system of Golbek, by G. P. Golbek, pp. 114–116; (10) Method of universalization in the application of reference charts, by A. G. Tarkhov, pp. 116–118; and (11) Reference chart for quick calculation of gradients, by B. A. Andreev, pp. 118–122.

4722. Dunstan, A. E., Nash, A. W., Brooks, B. T., and Tizard, Sir H. T., The science of petroleum, 4 vol., illus., London, Oxford Univ. Press, 1937. Price, 15 guineas net.

A comprehensive treatise of the principles and practice of the production and refining of petroleum. The 17 sections of volume I have titles as follows: Migration of petroleum; natural accumulation of petroleum; geological methods of exploration; geophysical methods of exploration; methods of drilling; sampling, coring, and borehole surveying; production; oil-field waters; power in oil-field development; measurement of oil, gas, and water in oil fields; crude oil transport; natural gas transport; and storage of oil and gas. Volumes II and III deal with the chemical and physical principles of the refining of petroleum. Volume IV treats of the utilization of mineral oils and their derivatives.

4723. Earthquake notes, R. R. Bodle, editor, vol. 10, No. ½, 27 pp., Seismol. Soc. America, Eastern Section, Washington, September 1938.

This issue contains earthquake notes and abstracts of the proceedings of the 1938 meeting of the Eastern Section, Seismological Society of America, Boston, Mass.

4724. Guinle, R. L., A modern Spanish-English and English-Spanish technical and engineering dictionary, 311 pp., New York, E. P. Dutton and Co., 1938. Price, $4.

This is the work of an English engineer with long experience in South America. The vocabulary covers the terms used in civil, mechanical, and electrical engineering.

4725. Hager, Dorsey, Practical oil geology, 466 pp., 204 figs., 5th ed., New York and London, McGraw-Hill Book Co., Inc., 1938.

Contents, by chapters: (1) Petroleum, its origin and accumulation. (2) Chemical composition of petroleum. (3) Stratigraphy. (4) Fossils and their uses. (5) Structural geology. (6) Prospecting and mapping. (7) Selecting drill-hole sites. (8) Factors in oil-well drilling.

(9) Factors in oil production (table of thermal gradients after Van Orstrand and Spicer). (10) Water and its relationship to oil. (11) Natural gas, natural gasoline. (12) Oil shales. (13) Geological field methods and instruments in use. (14) Geophysics. A description is given of the magnetometer, gravity meter, torsion balance map, seismograph refraction method, electrical seismograph, and of dip shooting, electrical methods, and geochemical methods. (15) What the geologist has done for the oil business. Appendix; list of books on oil and general geology; and index.

4726. Howe, H. H., and Knapp, D. G., United States magnetic tables and magnetic charts for 1935: U. S. Coast and Geodetic Survey, Department of Commerce, serial No. 602, 161 pp., issued June 1938. Orders for purchase should be directed to the Superintendent of Documents, Washington, D. C. Price, 60c.

The publication contains summarized results of magnetic observations throughout the United States, most of which have been made by the Coast and Geodetic Survey within the past 40 years. The publication consists largely of a single table which contains observed values of the magnetic declination, inclination, and horizontal intensity for all places in the United States where reliable observations have been made, together with corresponding reduced values for January 1, 1935, and references to sources that give further details of the observations.

4727. Leet, L. D., Practical seismology and seismic prospecting, 430 pp., 185 figs., New York, D. Appleton-Century Co., Inc., 1938.

The study of earthquakes is introduced by chapters on their cause and distribution. Treatment of instrumental observations of earthquakes is confined to practical details and observed facts and almost completely excludes theoretical matters either geological or mathematical. A series of illustrations shows the appearance on modern seismograms of earthquake vibrations over a complete range of distances from a few miles to nearly half the circumference of the earth. The discussion of seismic prospecting includes refraction methods of reconnaissance and detail, as well as reflection technique, and an extensive list of formulas employed. A list of patents on seismic prospecting methods is added.

Contents, by chapters: Part 1, Cause and distribution of earthquakes: (1) Cause of earthquakes; (2) Distribution of earthquakes.

Part 2, Elasticity and elastic waves: (3) Elastic constants; (4) Propagation of elastic-waves plane cases, and earth's curvature neglected; (5) Paths and travel times for earthquake waves.

Part 3, Instrumental methods: (6) Instruments; (7) Instrumental observations of earthquakes.

Part 4, Descriptive observation of earthquakes: (8) Terminology; (9) Effects of earthquakes; (10) Important earthquakes of history; (11) Mechanics of earthquake occurrence; (12) History of seismology.

Part 5, Seismic prospecting: (13) Data obtained in the field; (14) Reduction of observations; (15) Special commercial applications.

Appendix: Greek alphabet; metric and conversion tables; centimeter-gram-second and foot-pound-second (engineers') systems of units; definition of trigonometric functions; angles. Index.

4728. Taylor, R. E., Origin of the cap rock of Louisiana salt domes: Louisiana Department of Conservation, Geol. Bull. No. 11, 191 pp., 4 figs., 27 pls., 1938.

Definite association of cap rock with salt suggests that there is a direct relationship between them. To determine the nature of this relationship the present study includes both cap rock and salt. Available data concerning the occurrence of both types of rock bodies are collected and combined with petrographic studies of the cap rock and the salt.

Contents: (1) Foreword. (2) Introduction. (3) Literature. (4) General geology of the Louisiana salt domes. (5) The salt: (a) General geology, (b) chemical composition, (c) insoluble residues, (d) minerals, (e) sand inclusions, (f) geochemistry of salt deposition, (g) summary. (6) The cap rock: (a) General geology, (b) petrography, (c) general considerations, (d) minerals, (e) zones, (f) summary. (7) Origin of cap rock: (a) Theories of origin, (b) paragenesis of minerals, (c) summary and conclusions. (8) Appendix A—economic geology. (9) Appendix B—description of cap-rock well cores. (10) Appendix C—bibliography. (11) Index.

4729. Trubiatchinsky, N. N., Manual for the adjustment of magnetographs and reduction of recorded data [in Russian]: 103 pp., Leningrad, Arctic Inst., 1937.

This manual consists of three parts: (1) Eschenhagen magnetograph, (2) adjustment of la Cour magnetograph and its care, (3) reduction of magnetograms.

10. PATENTS

4730. Electrical measuring method and apparatus; John M. Pearson, Aldan, Pa., assignor to Sun Oil Co., Philadelphia, Pa., a corporation of New Jersey: U. S. patent 2,123,545, issued July 12, 1938.

This invention relates to the method of determining characteristics of current flow adjacent the surface of the ground including locating three electrodes in electrical contact with the ground, two of the electrodes being connected to a meter shunted by an impedance, and the third electrode being connected through a second meter to the impedance intermediate the ends thereof, balancing the circuit so that the second meter is nonresponsive to variations in potential produced between the ends of said impedance and then observing simultaneously the indications of current flow through said meters. Claims allowed, 21.

4731. Process and apparatus for the indirect determination of earth and air electrical conditions; Ludwig Machts and Bernhard Rehder, Marburg-on-the-Lahn, Germany: U. S. patent 2,124,825, issued July 26, 1938.

This invention relates to the method of investigating the electrical and magnetic field conditions existing in a given area and the factors causing irregularities of said conditions, comprising transporting a portion of an electrical circuit continuously over said area, moving a portion of said circuit through repeated similar local motions in such a manner as would produce rhythmic maxima and minima in an area having uniform electrical and magnetic conditions to induce currents therein proportional to intensity of the electrical and magnetic field traversed, obtaining signals from said induced currents indicative of

the intensity of said currents, continuously recording said signals for forming a comparative record of the character of the conditions existing in various portions of said area of investigation and indicating whether the maxima of reception due to certain positions of the said circuit are rhythmically followed by corresponding minima, and determining the location of factors causing variations from the normal sequence of maxima and minima. Claims allowed, 11.

4732. Torsion gravimeter; Lewis M. Mott-Smith, Houston, Tex.: U. S. patent 2,130,648, issued September 20, 1938.

This invention relates to a gravity surveying apparatus including a torsion fiber, a weight arm connected to said fiber, and a labilizer connected to said weight arm to accentuate movements thereof. Claims allowed, 12.

4733. Torsion balance; Erich Reeh, Hannover, Germany: U. S. patent 2,131,357, issued September 27, 1938.

In a torsion balance, a frame, a hollow body attached to this frame, a casing vertically displaceable in the hollow body, a beam in the casing, a filament fixed with one end to the hollow body and with the other end to the beam in such a manner that the beam is freely suspended in the one end position of the casing and in the other end position is supported by the wall of the casing. Claims allowed, 5.

4734. Improvements in or relating to seismic surveying; Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij of 30, Carel van Bylandtlaan, The Hague, Holland, a Body Corporate organized under the laws of Holland. Assignees of David Saville Muzzey, Jr., of 4914 Crawford Street, Houston, Tex., United States of America, a citizen of the U. S. A.: British patent 479,310, issued February 3, 1938.

This invention relates to seismic surveying apparatus comprising means for generating a disturbance in the ground, a plurality of spaced detectors for converting said disturbance into electrical impulses, and a plurality of galvanometers connected respectively to said detectors through lines having different time lags, and means for simultaneously recording the indications of all the galvanometers. Claims allowed, 11.

4735. Improvements in or relating to apparatus for depth measurement by echo reception method; Arthur Joseph Hughes, a British subject of "Hainault Hall," Chigwell Row, in the county of Essex, and Henry Hughes and Son, Limited, a British company, whose registered office is at 59 Fenchurch Street, London, E. C. 3: British patent 480,804, issued March 16, 1938.

The present invention consists of a unit adapted to be carried outboard from a ship and comprising transmitting and receiving members (or a combined transmitting and receiving member) contained in a streamlined casing consisting of a transversely curved hood tapering longitudinally and closed at the bottom by a flat plate through which the oscillations are transmitted and received. This casing is divided into compartments for the oscillators and preferably contains, also, an airtight compartment which acts as a screen between the oscillator compartments, and other airtight compartments acting as buoyancy chambers. Claims allowed, 8.

4736. Improvements in gravitational instruments; Stephen Baron von Thyssen-Bornemisza, citizen of Hungary, residing at Lönsstrasse 21, Hannover, Germany: British patent 483,887, issued April 27, 1938.

This invention relates to a gravity meter consisting of a lever system to which masses subjected to the action of gravity and one or several springs attack characterized by the fact that all masses are arranged in such a manner that the point of application of the resultant force of gravity lies not more than 1/20th of its distance from the pivoting point above or below the horizontal plane of the pivoting point. Claims allowed, 4.

4737. Gravitational prospecting device; The Standard Oil Development Co., Linden, N. J., assignee of Ludwig W. Blau, Houston, Tex., both in the U. S. A.: Canadian patent 374,422, issued June 14, 1938.

In an apparatus for geophysical gravitational prospecting, a gravity responsive pendulum, means for converting the beats of the pendulum into pulsations of energy, means for counting the pulsations, a source of vibrations of constant frequency, means for converting the vibrations into pulsations of energy proportional to the vibrations, means for selecting pulsations from the source proportional to predetermined multiples of the vibrations, means for counting the last-mentioned pulsations, and means for recording the three sets of pulsations near the beginning and end of the observation period upon a common record for the purpose of comparing the frequencies of the pendulum and source. Claims allowed, 2.

4738. Electrical prospecting apparatus; John Jay Jakosky, Los Angeles, Calif., U. S. A.: Canadian patent 374,475, issued June 14, 1938.

This invention relates to a method of electrical exploration of the subsurface which comprises maintaining a pair of electrodes in continuous contact with the earth while moving at least one of said electrodes along the surface of the earth to vary the distance therebetween, passing electric current through the earth between said electrodes as the distance therebetween is varied, so as to vary the depth of penetration of said current within the earth, and measuring variations in a quantity influenced by the flow of said current and by the electrical characteristics of the earth traversed thereby, as the distance between said electrodes is so varied. Claims allowed, 34.

4739. Gravity determining apparatus; Axel Rudolf Lindblad, Stockholm, Sweden: Canadian patent 376,029, issued August 23, 1938.

This invention relates to an apparatus for determining the force of gravity or variations in the same with the aid of a movable body, the weight of which is balanced, for instance, by means of a spring arrangement, an electric or magnetic field or in some other way and which in moving influences the electric or magnetic field in such a manner that the exact position of the body can be determined by observing changes in this field, characterized by the feature that the movable body is enclosed wholly or in part in a vessel of relatively great heat capacity and made of a material of good heat conductivity, which vessel is provided with electric heating means, preferably in the form of an electric winding wound around the vessel. Claims allowed, 7.

4740. Gravimeter; Shell Development Co., San Francisco, Calif., assignee of Haakon Muus Evjen, Houston, Tex., both in the U. S. A.: Canadian patent 376,621, issued September 20, 1938.

In a measuring instrument for the determination of gravity acceleration, a spring, a hollow body suspended from said spring, fluid in said body, a flint conduit connected to said body and means whereby upon a change in the position of said body produced by a change in gravitational acceleration, a fluid flow alters the mass of said body increasing said initial change in position. Claims allowed, 7.

4741. Vorrichtung zur Entnahme von Proben aus dem noch nicht verrohrten Teil von Bohrlöchern [Arrangement for taking samples from the uncased parts of boreholes]; Société de prospection électrique procédés Schlumberger of Paris: German patent 656,970, issued February 12, 1938.

This invention relates to an arrangement for taking samples (cores) from the uncased parts of a borehole, especially from its side walls. The arrangement consists of a core-barrel-shaped projectile flexibly connected to a shooting device. In entering the wall the projectile takes the core and is then brought to the surface of the earth together with the core. Claims allowed, 4.

4742. Procédé pour la determination de la nature du sous-sol au moyen de l'électricité [Method for determining the structure of the subsoil by means of electricity]; Conrad Schlumberger residing in France (Seine): French patent 450,784, issued April 3, 1913.

This invention relates to a method for determining the character of the underground and consists of drawing a map of potentials at the surface of the ground, near two points on the ground between which a constant or variable difference of potential is maintained, and of deducing the heterogeneities of the underground from the comparison of this map with the map of potential in a known homogeneous ground. Claim allowed, 1.

4743. Procédé d'examen électrique des formations traverseés par un forage [Method of electrical exploration of formations penetrated by boring]; Standard Oil Development Co. of the United States of America: French patent 819,428, issued October 19, 1937.

This invention relates to a method of electrical exploration of terrestrial layers penetrated by boring, having different electrical properties. It consists in placing one terminal into the borehole and the other on the surface of the ground at a certain distance from the borehole, conducting an electrical current through the circuit and the terrestrial layers and observing the indications modified by the passage of the circuit through different layers, on an apparatus inserted in the circuit. Claims allowed, 4.

4744. Procédé pour determiner la nature des terrains, et notamment de ceux traversés par un forage [Method for determining the nature of the ground, especially that penetrated by a borehole]; Gilbert Deschatre, of France: French patent 48,462/823,099, issued March 8, 1938.

This is an addition to the original patent 823,099, the invention relating to the following modifications in the method: (1) The sender is placed on the surface of the ground and the variations of absorption are observed with the aid of a receiver lowered into the borehole,

(2) the receiver is not utilized and the variations in frequency or absorption are observed directly on the circuit of the sender, (3) the influence of the capacity of the ground is observed directly on the circuit of an oscillator lowered into the borehole. Claims allowed, 4.

4745. Procédé de prospection géophysique au moyen d'ondes électromagnetiques courtes [Method of geophysical prospecting by means of short electromagnetic waves]; Standard Oil Development Co. of the United States of America: French patent 823,297, issued January 18, 1938.

This invention relates to a method of geophysical prospecting in which short electromagnetic waves, or radio waves, or luminous waves are passed through the atmosphere close to the surface of the ground under investigation. The absorption of the waves affected by hydrocarbon gases or other gases from the ground which the atmosphere may contain, is measured. Claims allowed, 6.

4746. Procédé de prospection géophysique [Method of geophysical prospecting]; Esme Eugene Rosaire of the United States of America: French patent 827,682, issued May 2, 1938.

This invention relates to the method of geophysical prospecting consisting of an apparatus for taking samples of the ground, the apparatus comprising an equipment for pulverizing the sample under airtight conditions, separating gas from the sample, and conducting the separated gas into a special equipment serving for the analysis of the gas. Claims allowed, 5.

4747. Magnetometer; A. A. Logachev: Russian patent 52,951, issued April 30, 1938.

This invention relates to a magnetometer, provided with a recording device, assigned for measuring the vertical component of the terrestrial field Z. The apparatus is to be used from a moving airplane, automobile, cutter, etc., with the aid of a rotating frame of an earth inductor with commutator, the brushes of which are mounted on the rotary bridge and fastened in such a way that the commutation of the current occurs at the zero value of the electromotive force of the induced vertical component of the terrestrial magnetic field distinguished by the fact that the minimum value of the vertical component of the terrestrial field Z, expected in the region of the magnetic survey, is compensated by the field of a permanent magnet secured on the body of the apparatus, and the variable part Z is compensated by the field of the current flowing through the rigidly secured frame of the apparatus, the force of which at a constant electromotive force of the feeding battery is determined by the resistance of the circuit for the recording of which, on a chart unrolling in proportion to time and comparative velocity of movement, a pen is fixed to the slide of the rheostat. Claim allowed, 1.

4748. Arrangement for measuring temperature in a well; A. G. Tarkhov: Russian patent 52,954, issued April 30, 1938.

This invention relates to an arrangement for measuring temperature in a well with the aid of an electrolytic resistance thermometer and is characterized by the fact that in order to utilize the ground as a second conductor of the current an electrolytic thermometer is used which consists of a conducting vessel filled with electrolyte and connected to the electrical testing circuit by means of a single conductor cable. Claim allowed, 1.

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