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JULY–SEPTEMBER 1939

COMPILED BY

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GEOPHYSICAL ABSTRACTS 98, JULY–SEPTEMBER 1939

Compiled by W. AYVAZOGLOU

1. GRAVITATIONAL METHODS

5006. Barton, D. C., Gravitational methods of prospecting: Science of petroleum, vol. 1, pp. 364–381, New York, Oxford Univ. Press, 1938.

After a short introduction in which the author gives the geological basis for the use of gravimetric surveys in the search for petroleum, he presents the mathematical-physical basis of these methods. In the latter section the quantities measured, namely, the gradient of gravity and the differential curvature, are considered first and their significance illustrated; and, secondly, the measurement of said quantities by the torsion balance is well explained. Relative measurements of the force of gravity with a pendulum and with a gravimeter are described. Extraneous effects and their elimination and the reduction of observations precede a section of mathematical interpretation in which type cases are illustrated and discussed. The "Geology of gravitational petroleum prospecting" is the title of the portion of the article in which examples of surveys are given. These cover salt domes, anticlinal maxima and minima, buried ridges and faults, and also the elimination of regional effects. Under retrospect, geological interpretation versus geological probability limitations of the gravitational methods are treated.—*D. W., Annot. Bibl. Econ. Geology, vol. 11, No. 1, 1939.*

5007. Boulanger, J., On the determination of errors of a gravimetrical connection between two stations: Acad. sci. U. R. S. S. Comptes rendus (Doklady), vol. 22, No. 4, pp. 166–169, Moscow, 1939.

A classical solution of the problem of determining the precision of a gravimetrical connection between two stations by relative pendulum observations was given by Borrass in 1902. Borrass gave formulas by which it was possible to calculate the chief errors of observations and then, by summarizing, to calculate the average value of the mean square error of a station of a given series of formulas. But errors of every station cannot be calculated according to Borrass' formulas.

The present paper contains a mathematical analysis of such a method of calculation of errors, whereby it is possible to obtain directly, with sufficient accuracy, the mean square error in the determination of gravity acceleration for every separate station.—*W. A.*

5008. Graf, Anton, Grossentfernungsmessungen mit dem Askania gravimeter in Texas [Long-distance measurements with the Askania gravimeter in Texas]: Zeitschr. Geophysik, vol. 15, No. 3/4, pp. 117–121, Braunschweig, 1939.

Gravity measurements made with the new electromechanical Askania gravimeter along profiles 800 km. and 1,600 km. in length from Houston

through San Antonio to Dallas are discussed. The purpose of the measurements was to determine whether this instrument is suitable for continuing the work after its interruption for a certain period of time; that is, whether adequate gravity values may be obtained if a return is made to the base station after a few days. It was found that the mean error (which included secular changes, tidal error, and instrumental error) over a section 340 km. long, with resumption of work after one day of idleness, consisted of ±0.18 milligal, and over a section 460 km. long, with resumption of work following 3 days of idleness, was ±0.29 milligal. Therefore, it was concluded that the above-mentioned gravimeter can be used instead of a pendulum apparatus within a diameter of about 1,000 km. and that the measurements can be made with even greater accuracy.—*Author's abstract, translated by W. A.*

5009. Heiskanen, W., Einige neuere isostatische Untersuchungen [Some new isostatic investigations]: Baltische geodät., Komm. 10 Tagung, Verh., pp. 94–102, Helsinki, 1938.

A report is given of the preliminary results of calculations made by the Isostatic Institute founded in 1936 in Edinburgh by the International Association for Geodesy. The Institute, in Helsinki, is under the direction of the author. Coefficients of the gravity formula were recalculated and were based on the greatly increased number of stations of observation. The new formula departs only slightly from the international gravity formula. Consideration of a linear member results in a triaxiality with a difference of 352 m. between the axes. A regional summary made from the groups of stations shows an agreement with this result. New isostatic tables were calculated for thicknesses of 20 and 30 km. of the earth's crust in addition to those for 40 km. and 60 km. A catalog of 3,500 gravity stations containing all the data was compiled. The chief work of the Institute consisted in the calculation and production of a world map, from which the influence of topographic isostatic reductions for Hayford's zones to a radius of 340 km. may be read. Some other investigations, for example those of the Fergana Basin, were also made.—*Schmerwitz's abstract in Zeitschr. Geophysik, vol. 15, No. 3/4, 1939, translated by W. A.*

5010. Lagrula, Jean, Mesures de l'intensité de la pesanteur en Tunisie [Measurements of the intensity of gravity in Tunisia]: Acad. sci. Paris Comptes rendus, vol. 208, No. 16, pp. 1207–1208, April 17, 1939.

Measurements of the intensity of gravity made at 65 stations in Tunisia, extending from the north to the extreme south (Fort Saint), are described. Holweck-Lejay's pendulum 42 was used. A zone of negative anomalies in Sahel, presumably an oil-bearing region, has been established. The course of the isanomalous curves could not be well determined in the region of Kébili-Tozeur. A negative anomaly was recorded near the station of Aghir. Final results of the survey will be published after the calculations are completed.—*W. A.*

5011. Lagrula, Jean, Résultat de mesures récentes de l'intensité de la pesanteur en Tunisie [Results of recent measurements of the intensity of gravity in Tunisia]: Acad. sci. Paris Comptes rendus, vol. 208, No. 21, pp. 1627–1629, 1939.

The results of measurements of the intensity of gravity at 65 stations in Tunisia, made during November and December 1938 and January 1939, are shown in a table.—*W. A.*

5012. Mihal, N., Über die Bestimmung der Differenzen zwischen den äquatorialen und meridionalen Trägheitsmomenten der Erde mit Hilfe von Gravitationsbeobachtungen [On the determination of differences between equatorial and meridional moments of inertia with the aid of gravity observations]: Acad. sci. U. R. S. S. Comptes rendus, vol. 19, No. 9, pp. 689–692, Moscow, 1938.

Differences of the moments of inertia are mathematically discussed with the aid of Stokes' formula.—*W. A.*

5013. Mihal, N., On the determination of gravity anomalies from the astronomical-geodetical deflection of the plumb line: Acad. sci. U. R. S. S. Comptes rendus (Doklady), vol. 21, No. 5, pp. 232–234, Moscow, 1938.

This contains a mathematical discussion of an indirect method for determining the figure of the earth. The method is proposed in order to avoid knowing the distribution of gravity anomalies for the surface of the whole earth. According to the method proposed, the surface of the whole earth is divided into several regions, n; gravity forces are measured in a direct way in regions m; the number of regions where the force of gravity is unknown will be equal to $n—m$; the astronomical-geodetical deflection of the plumb line is determined in $\frac{n-m}{2}$ points; and then a system of linear equations with $n—m$ unknowns is constructed. After the equations have been solved, the anomalies of gravity referring to $n—m$ regions may be obtained.—*W. A.*

5014. Nettleton, L. L., Determination of density for reduction of gravimeter observations: Geophysics, vol. 4, No. 3, pp. 176–181, Menasha, Wis., 1939.

This paper outlines a method whereby the density factor used in the Bouguer correction for elevation of a gravity station may be determined. Frequently in the past it has been the practice to assign a density factor based on measurements made upon samples of surface materials in such a manner as to give the density in situ, depending upon the judgment of the field man to select samples representative of the near-surface materials. At best, this is a cursory determination which only fortuitously might lead to the correct density for large topographic features. The method outlined here in effect weighs the topography by gravimeter observations taken along a profile crossing the feature. From these data the effective density of the material comprising the topographic feature is determined by a simple graphical method.—*Author's abstract.*

5015. A valuable aid to geophysical investigation [editorial]: South African Min. and Eng. Jour., vol. 50, No. 2407, pp. 61–63, Johannesburg, 1939.

After a brief description of the Thyssen gravimeter, results of observations made with this instrument in the Witwatersrand Basin are shown in a diagram of a profile across the Basin. The main conclusions drawn from this survey are that (1) the Witwatersrand Basin is filled with a succession of rocks, most of which are heavier than the underlying granite; and (2) the rocks lying immediately upon the granite, namely, those of the Lower Witwatersrand System, appear to be the heaviest. Another diagram shows the gravimetric intensity profile obtained from a reconnaissance across an area in the Orange Free State.

The practical value of measurements with the gravimeter, especially as compared with all other gravimetrical methods, is that they are inexpensive and can be made speedily.—*W. A.*

5016. von Thyssen, Stephan, Über die Wirkungsweise von einigen feldfähigen Federgravimetern [On the mode of operation of some spring gravimeters suitable for field work]: Zeitschr. Geophysik, vol. 15, No. 3/4, pp. 121–130, Braunschweig, 1939.

Modes of operation of the Hartley, Truman, and Thyssen gravimeters are described. As the Hartley gravimeter is the only one that is not astatized, it has the smallest sensitivity to inclination but is more sensitive to ground oscillations. The Thyssen gravimeter has the smallest sensitivity to temperature. The temperature coefficient of the spring is compensated by the coefficient of expansion of the tube of the spring.—*Author's abstract, translated by W. A.*

5017. Truman, O. H., Variations of gravity at one place: Astrophys. Jour., vol. 89, No. 3, pp. 445–462, Chicago, April 1939.

This paper deals with a 4 months' series of gravity observations made at Houston, Tex., with an instrument having a probable error for one reading of about 0.00002 cm./sec.^{2} There are slow apparent changes depending upon the weather, a diurnal and a semidiurnal change depending upon the sun, and periods depending upon the tidal effect of the moon in distorting the earth or in shifting water on it. These are discussed at length. There is no proof of any variation arising from the earth's absolute motion through space, and none is to be expected unless from a much longer series of observations.—*Author's abstract.*

5018. Vajk, Raul, Gravitationswirkung unterirdischer geologischer Strukturen in besonderen Fällen [Gravitational effect of subterranean geological structures in special cases]: Földtani Közlöny, vol. 67, No. 10–12, pp. 260–279, Budapest, 1937.

The fact that gravity anomalies may represent very different geologic structures is discussed. It is shown that a gravity maximum may represent not only an anticline but, under special conditions, *also* a fault or even a syncline. Furthermore, many faults and synclines may correspond to the same gravity maximum. And finally, a gravity maximum may be produced simply by an increase in density of the ground without reference to any special structure. Thus it cannot be maintained from torsion-balance measurements only that a gravity anomaly represents the effect of a definite geologic structure. It is shown that without a knowledge of the distribution of density even the type of structure cannot be determined with certainty. Therefore, all available geological information on the region under consideration must be obtained and used in interpreting results of torsion-balance measurements. If geological information is not available, seismic-survey data should be obtained and considered in addition to torsion-balance measurements.—*W. A.*

2. MAGNETIC METHODS

5019. Barret, W. M., Structures in Sparta-Wilcox trend disclosed by magnetics: Oil Weekly, vol. 93, No. 10, pp 42–43, Houston, Tex., 1939.

Two factors account for the suitability of magnetometric methods in disclosing anticlinal structures in this area: (1) They are adapted

to cover large areas rapidly and at comparatively low cost; and (2) the Sparta-Wilcox trend is technically suited to magnetics because (a) the surface materials that cover the trend are but feebly magnetic; (b) the magnetizable basement rocks lie at such great depths in the trend that their magnetic reflection will not interfere with the anomalies traceable to folding in the sedimentary section; and (c) the Wilcox section is the shallowest lithologic unit encountered in the trend, which carries appreciable quantities of magnetic material.

A map of the magnetometric survey of the Cheneyville and Eola oil fields shows magnetometric stations and anomalous vertical intensity contours corrected for regional variation.—*W. A.*

5020. Bartels, J., Harmonic analysis of diurnal variations for single days: Terres. Magn. and Atmos. Electr., vol. 44, No. 2, pp. 137–156, Baltimore, Md., 1939.

The forthcoming volume of results at the Watheroo and Huancayo Magnetic Observatories will contain an extensive table of about 40,000 harmonic coefficients for the diurnal variations in the horizontal magnetic intensity H at Huancayo Magnetic Observatory (Peru) for every individual day of the years 1922 to 1936. This collection of coefficients, a new feature in observatory compilations, represents an advanced stage of reduction of the original magnetic records beyond the usual hourly means and will be used as material for discussions on the variability of the solar and lunar diurnal variations. H at Huancayo has been selected for the first table of this kind because of the unusual features of its large diurnal variation. A new scheme for numerical harmonic analysis of diurnal variations for this mass reduction had to be developed for yielding, in the most economical way, the coefficients of the periods 24, 12, 8, and 6 hours. This scheme and allied topics are described in detail in this paper, because they may be useful in similar geophysical work. The scheme itself may be found in section 8.—*Author's abstract.*

5021. Filchner, W., Meine geophysikalischen Arbeiten in Zentral Asien [My geophysical work in central Asia]: Current Sci., vol. 7, No. 3, p. 95–97, Bangalore, India, 1938.

The object of the last expedition in 1938 to China, Tibet, India, and the Union of Soviet Socialist Republics was the magnetic investigation of a region between The Pamirs, The Himalaya, Sungari, and Shanghai, which so far had not been magnetically surveyed. On the first expedition, during 1926–28, a chain of observation posts from Tashkent to Nagchu was established. The distances between these posts varied from 20 to 30 km. The second expedition was undertaken during 1934-38 with the object of establishing a series of posts on an east-west axis from Lanchow to Chotan.

In all, 520 stations have been established. About 300 of these were established during the latest expedition.—*W. A.*

5022. Gassmann, Fritz, Magnetische Messungen auf dem Mont Chemin bei Martigny [Magnetic measurements on Mount Chemin near Martigny]: Helvetia Phys. Acta, vol. 11, No. 7, pp. 543–544, Basel, 1938.

This contains brief preliminary information on prospecting for magnetite deposits that are covered by moraine. An area 2.6 by 0.4 km. was investigated by a universal magnetic variometer. The results will

be published later by the "Geotechnische Kommission der Schweiz. naturforschenden Gesellschaft."—*W. A.*

5023. Jenny, W. P., Magnetic methods: Science of Petroleum, vol. 1, pp. 328–345, New York, Oxford Univ. Press, 1938.

A small treatise on magnetic methods illustrated by numerous diagrams, maps, and graphs. Geological and physical problems in the interpretation of regional and local anomalies cover (1) magnetic susceptibility of rocks, and (2) stratigraphic, petrographic, and structural anomalies. The relationship between depth and size of a disturbing mass and its magnetic anomaly and various interpretation procedures are discussed. Instruments and methods for magnetic observation consider absolute and relative measurements, a section on field procedure being included. The author's magnetic vector method of representation and interpretation of anomalies is described, and examples of its use are given together with a section on experimental interpretation of magnetic anomalies. Practical examples of magnetic-field surveys which are discussed and maps presented include the Garber and Oklahoma City oil fields, the Hobbs, N. Mex., field, the Yoast field of Texas as representative types, together with regional anomalies of the Gulf Coast area and "micromagnetic" and gravimetric profiles through a Gulf Coast prospect. Thirty-one references and a short bibliography end this excellent article.—*D. W., Annot. Bibl. Econ. Geology, vol. No. 11, No. 1, 1939.*

5024. Jenny, W. P., Preliminary micromagnetic survey of the Eola structure: Oil Weekly, vol. 93, No. 12, pp. 34–35, Houston, Tex., 1939.

The reconnaissance magnetic survey of the Cheneyville and Eola fields, the results of which were published by Barret (see abstract 5019) prove conclusively that these two structures have magnetic anomalies, which can be discovered by an accurate magnetic survey. Such a survey was made by the author of this article in January 1939, and the results are shown by a map. The interpretation of the results has been substantiated by recent drilling.—*W. A.*

5025. Kutscher, Fritz, Magnetische Untersuchungen im Vulkanfelde der Bergfreiheitsgrube von Schmiedeberg im Riesengebirge [Magnetic investigations in the volcanic field of the Bergfreiheits mine of Schmiedeberg in the Riesenegebirge]: Zietschr. f. Prak. Geologie, vol. 47, No. 4, pp. 67–71, Halle, 1939.

According to recent investigations made by Petraschek, the Schmiedeberg magnetite deposits may be interpreted as a metamorphic development of iron-ore deposits of the Lahn-Dill type. Detailed magnetic *Z*-variometer measurements were made in 1937 in the volcanic field of the Bergfreiheits mine of Schmiedeberg in the Riesengebirge. Values of disturbances, calculated from field measurements, are represented in a map of isanomalies. Only a general discussion of the results of measurements is given, as the interests of the management of the mines prevent disclosure of all details. The borders of the deposit and a series of anomalies caused by magnetite lenses within the ore formation are disclosed by the isanomalies. In the eastern part of the deposit, these lenses have an east-west direction; in the western field, a northwesterly direction. Out of a total of 30 profiles, 4 are examined in detail. Depths of the ore lenses are established. Values

of the disturbances are compared with those found at several other places of magnetite occurrences.—*Author's abstract, translated by W. A.*

5026. Ljungdahl, G. S., The Swedish magnetic-survey boat *Kompass:* Terres. Magn. and Atmos. Electr., vol. 44, No. 2, pp. 171–173, Baltimore, Md., 1939.

A brief description is given of a small vessel named *Kompass*, which is used for magnetic measurements in the waters surrounding Sweden. Her length is 17 m., her beam 5.4 m., and her displacement 50 tons. She makes 7.5 knots and is driven by a twin-cylinder crude-oil engine of 60 horsepower.

According to preliminary computed results, the accuracy of the determinations of D seems to be, as a rule, within $\pm 6'$ to $\pm 9'$; of H, within $\pm 0.0010\ H$ to $\pm 0.0015\ H$; and of Z, within $\pm 0.0010\ Z$ to $\pm 0.0020\ Z$. As regards Z, it will be necessary perhaps to apply an additional correction of some of 100 γ, owing to an error of deviation. The boat seems to be suitable for her main purpose, namely, the magnetic survey of Swedish waters.—*W. A.*

5027. Minakami, Takeshi, Magnetic surveys of volcano Kusatu-Sirane: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 1, p. 117, 1938.

Although geological and petrological studies of the volcano Kusatu-Sirane have been made by R. Ohashi and H. Tsuya, nothing has yet been attempted from the geophysicist's point of view. As the first step in studying Sirane from this standpoint, the author carried out magnetic-dip surveys at 40 stations within and at the circumference of the crater during the period between August 19 and 28, 1937. The results show that values at stations higher than 2,000 m. above sea level mostly exceed 50°; whereas values on the crater floor, although their heights are more than 2,000 m. above sea level; are very much smaller because they are affected by abnormal topography. Of the dips of 40 stations, the maximum and minimum are 52°23.9′ at Yosinotaira and 48°50.3′ at the station on the crater floor, and the mean dip is 49°56.3′. Although an outline of the magnetic character of the volcano Kusatu-Sirane has been obtained by the present surveys, one of our main objects was to bring out clearly the time variations in the magnetic changes that accompany volcanic activity, so that in order to facilitate resurveys the stations where the present surveys were made have been marked by posts driven into the ground.—*Author's abstract.*

5028. Minakami, Takeshi, Magnetic surveys of volcano Asama: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 1, p. 100, 1938.

The present surveys of the magnetic dip at the volcano Asama were made with the object of obtaining an outline of the earth's magnetism of Asama as a whole, to serve as the first step in the absolute measurements of declination and the vertical and horizontal intensities to be made shortly. The contour lines at the principal mass of Asama are represented by closed curves which are almost concentric circles with the crater as the center. Here the isoclinic lines also form closed curves approximately parallel to the contour lines. Of the values of the dip at the 76 stations in the present surveys, the maximum is 53°15.5′ on the summit of Kurohu-Yama, the first somma; the minimum is 46°29.1′ in the bottom of a ravine; and the difference in the two

values is 6°46.4′. However, the present measurements do not cover Kengamine, Gippa-Yama, the first somma, and Amidagazyo, an explosion crater. When the survey of Asama is completed, it may be possible to find a difference of 10° in the dip notwithstanding that the region is circumscribed within a radius of only 10 km. from the crater.—*Author's abstract.*

5029. Nikiforoff, N. A., Working out the data of a magnetic survey [in Russian]: Annales de l'Institut des Mines à Leningrad, vol. 9, No. 3, pp. 119–130, 1939.

Diurnal variations of the magnetic field are, as a rule, most carefully applied during magnetic prospecting. The author compares data of maximum amplitudes of diurnal variations of the magnetic field obtained at many magnetic observatories during several years. He comes to the conclusion that either the influence of diurnal variations may sometimes be partly eliminated or corrections may not be introduced at all owing to their insignificant magnitudes. The following facts may be considered:

1. Values of amplitudes of diurnal variations of the magnetic field for the vertical component decrease with diminution of the latitude of the place of observation. This regularity is observed in middle latitudes of the Union of Soviet Socialist Republics.

2. For an insignificant magnitude of the maximum amplitude of diurnal variations of the vertical component of the magnetic field, it is possible to omit corrections for variations in middle latitudes (from lat. 42° N. to 54° N.) of the Union of Soviet Socialist Republics if the measurements can be confined to approximations less than ±20 gammas.

3. Diurnal variations of the magnetic field must be taken into account in latitudes higher than 54° north latitude if it is desired to obtain results of measurements with a precision for the vertical intensity of not more than ±40 gammas. In measurements of horizontal intensity, it is necessary to introduce corrections depending on variations in observations in every part of the Union of Soviet Socialist Republics if data with a precision of more than ±40 gammas are desired.—*W. A.*

5030. Poisson, Charles, Quelques données numériques sur le magnétisme des roches de Madagascar [Some numerical data on the magnetism of rocks of Madagascar]: Gouvernement Général de Madagascar, Annales géol. du service des mines, vol. 9, pp. 7–14, Tananarive, 1938.

In the previous volume of these "Annals," attention was called to the frequency and magnitude of magnetic anomalies of the terrestrial field observed in the crystalline massif of Madagascar (see Geophys. Abstracts 93, No. 4297).

In this article, an attempt is made to find the relation between the order of magnitude of the anomalies and the coefficient of magnetization, or the remanent magnetism, of adjoining rocks. Data on remanent magnetization obtained by E. Thellier for several quartzites, granites, granodiorites, orthogneiss, lavas, and magnetite are cited in a table. It was found that the influence of remanent magnetization on the terrestrial magnetic field, which so far has been almost entirely neglected, is of surprisingly great importance. Magnetic susceptibilities of rocks studied by G. Grenet are given in another table.—*W. A.*

5031. Stearn, N. H., Geomagnetic exploration in 1938: Geophysics, vol. 4, No. 2, pp. 118–122, Austin, Tex., 1939.

The importance of geomagnetics as a means of scouting in geophysical exploration is emphasized. Some geomagnetic activities for 1938 are given to show that this method serves as a trail breaker for other methods.—*W. A.*

3. SEISMIC METHODS

5032. Adler, J. L., Improvements in seismic prospecting in 1938: Geophysics, vol. 4, No. 2, pp. 115–117, Austin, Tex., 1939.

The noteworthy thing for 1938 is that improvements made in the reflection seismograph during the past 2 or 3 years have now been applied successfully for the first time to areas that were abandoned 4 or 5 years ago as unworkable. The author indicates the ways in which recent instrumental research and field operations have proceeded.—*W. A.*

5033. Bellamy, Ethel F., Epicentres of earthquakes, 1913–1932: Nature, vol. 143, No. 3621, pp. 504–506, London, 1939.

From 1913 to 1932 350 deep-focus and 30 shallow-focus epicenters were located; their positions are shown on a map. Another map shows the positions of 2,865 epicenters as determined in the International Seismological Summary. The maps emphasize the need for a more uniform distribution of seismological stations. Although approximately one-third of the recorded earthquakes in the period under review occurred in the southern hemisphere, fewer than one-eighth of the existing 500 seismological stations are in that hemisphere.—*W. A.*

5034. Bullen, K. E., A method of calculating epicentres of New Zealand earthquakes: New Zealand Jour. Sci. Technology, vol. 20, No. 5b, pp. 265b–267b, Wellington, 1939.

A method is described for determining the epicenters of certain classes of earthquakes. The method makes use of readings of the phase *PKP* and is likely to be specially suitable for use with New Zealand earthquakes of moderate intensity.—*Author's abstract.*

5035. Bungers, Rolf, Zur Methodik der Nahbebenbearbeitung [On the method of working out results of earthquakes close by]: Zeitschr. Geophysik, vol. 15, No. 3/4, pp. 160–167, Braunschweig, 1939.

A method of compensation is derived by using geographic coordinates directly instead of Schmerwitz's method of compensation, which uses rectangular coordinates. Wiechert's formula for calculating the distance is represented in a nomogram. Schmerwitz's determinations of focal depths, and conclusions drawn from them, are criticized.—*Author's abstract, translated by W. A.*

5036. Cairns, W. D., Seismology from a mathematical viewpoint: Science, vol. 89, No. 2302, pp. 113–118, Lancaster, Pa., 1939.

A review is given of (1) the mechanism of earthquakes; (2) the transmission of the shock by longitudinal, transverse, and surface waves; (3) reflected and refracted waves; and (4) methods of obtaining velocities below the surface, and the depth of focus and of various discontinuities below the earth's surface. The types of instruments used are described briefly, and the formulas used to analyze the

records into *P*, *S*, and *L* waves are examined. It is suggested that, as in optics, dispersion may play a part in the form of the record.—*R. S. R., Sci. Abstracts, vol. 42, No. 496, 1939.*

5037. Caloi, Pietro, Analisi periodale delle onde sismiche e problemi ad essa connessi [Periodic analysis of seismic waves]: Ricerca Scientifica, vol. 10, No. 4, pp. 275–290, Rome, April 1939.

A chosen seismogram was subjected to harmonic analysis. All five components detected in the *S*-phase had the same velocity of propagation, the maxima corresponding to that of the resultant wave; in other words, diversity of period among the constituent waves does not imply diversity in their velocities. Analysis of the *SS* wave supports the hypothesis that only a limited number of the *S*-constituents are reflected at the surface. Under continental masses the velocity of propagation of long waves varies almost linearly with the period; under the oceans the velocity of propagation of these waves is greater than under continents.—*W. A. R., Sci. Abstracts, vol. 42, No. 498, 1939.*

5038. Dix, C. H., Refraction and reflection of seismic waves, part 1, Fundamentals: Geophysics, vol. 4, No. 2, pp. 81–101, Austin, Tex., 1939.

We give in this paper an exposition of the fundamental theory underlying the theory of reflection and refraction seismic waves. It was thought useful to include material not strictly new along with the new material, because the sources are not easily obtained by many readers of this magazine. Knott's energy equation is given a simple interpretation. Conditions at the interface are discussed, together with the limitations of these conditions, as conditions by which our problem is to be solved. It appears that the energy flow must be considered as well as the interface conditions.—*Author's abstract.*

5039. Grenet, G., and Quency, P., Comparaison de sismographes électromagnétiques [Comparison of electromagnetic seismographs]: Acad. sci. Paris Comptes rendus, vol. 208, No. 3, pp. 218–219, 1939.

Tests were made over periods of 1 and 2 months with both a Wenner-type and a long-period Benioff-type seismograph. The latter was found better for short-period *P* waves and the former for *S* waves, as the *P* waves were less amplified with the Wenner type.—*W. A.*

5040. Gutenberg, Beno, and Richter, C. F., On seismic waves [4th paper]: Gerlands Beitr. Geophysik, vol. 54, No. 2, pp. 94–136, Leipzig, 1939.

Three papers on seismic waves have been published previously (see Geophys. Abstracts 71, 83, and 87, Nos. 2350, 3058, and 3316, respectively).

Traveltimes and velocities of seismic waves have been revised by using observational data from deep-focus earthquakes. Traveltimes for zero focal depth are given for all important phases. The revised velocity distribution closely represents the observations of *PcP*, *PcS*, and *ScS*, as well as the arrival times of waves at the epicenter and anticenter. The revision includes a reinterpretation of the observations of P^1 and *SKS*. Velocities and elastic constants are tabulated as functions of depth.—*Authors' abstract.*

5041. Gutenberg, Beno, Zur Entwicklung der seismischen Aufschlussmethoden [Development of seismic methods of prospecting]: Ergebnisse der Kosmischen Physik, vol. 4, pp. 169–218, Leipzig, 1939.

After an historical review, the author gives an account of the organization of a field party for seismic prospecting. The refraction method and the determination of the wave velocity are then considered. The reflection method, with a description of the instruments necessary, is also reviewed. The author discusses the effective explosive charge and methods of detonation and gives actual examples of the use of both methods.—*W. A. R., Sci. Abstracts, vol. 42, No. 497, 1939.*

5042. Heiland, C. A., Geophysical investigations concerning the seismic resistance of earth dams: Am. Inst. Min. Met. Eng. Tech. Pub., No. 1054, 28 pp., New York, 1939.

Seismic resistance may be defined as the ratio of ultimate strength to stress, preferably stated for a point in a structure most likely to fail, and referred to a ground motion of given frequency and amplitude. It is an important factor in the construction of structures where ground vibrations occur naturally, such as in an earthquake region, or are produced artificially. This paper covers methods of investigation and calculations involved in determining the seismic resistance of the Hansen Dam, near Los Angeles.—*Author's abstract.*

5043. Hodgson, E. A., Seismic prospecting: Royal Astron. Soc. Canada Jour., vol. 33, pp. 121–150, Toronto, April 1939.

The following description of seismic prospecting is based on the modifications of that method as practiced by one company in a single area in southern Alberta.

The object of this report is to present a complete but simple picture of the routine procedure in conducting a seismic survey. It is to be repeated that all complicating phases have been avoided, that in addition to the procedure outlined the same company would use alternative methods in particular cases, that other companies using other equipment would use slightly different methods, and, finally, that any company operating in other geological structure would use still other modifications. It is hoped that this outline of one complete procedure will serve to acquaint those who wish only a general idea of the method with the difficulties to be met and with the possibilities of the reflection method of seismic prospecting.—*Author's abstract.*

5044. Ikeda, Yosiro, and Aramata, Mituo, On the propagation of shock through sand on the beaches of Iwanai and Isikari: Hokkaido Univ., Fac. Eng., Mem., vol. 4, No. 3, pp. 275–278, Sapporo, 1938.

Measurements of the velocity of propagation of a shock produced in beach sand are described. Distances measured were from 3 to 20 m. The velocity was about 150 m. a second.—*W. A.*

5045. Ishimoto, Mishio, Iida, Kumizi, and Kinosita, Zyun'iti, Mechanical microseismograph for vertical component: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 17, No. 1, pp. 144–150, 1939.

The instrument is figured diagrammatically and as actually made. The horizontal pendulum weighs 30 kg. and is supported by a vertical spiral spring and two steel plates. The period of vibration is about 0.51 sec. and the geometrical magnification about 570, which can be

multiplied 5 to 10 times photographically. Examples of seismograms obtained with it are given.—*C. A. S., Sci. Abstracts, vol. 42, No. 498, 1939.*

5046. Ishimoto, Mishio, Seismic faults: Imp. Acad. Tokyo Proc., vol. 15, No. 1, pp. 36–38, 1939.

Faults connected with earthquakes show certain characters. Movement is greatest in the center of the fault line and diminishes outwards and seems to indicate that both vertical contraction and expansion take place. Such peculiarities can only be produced by pressure exerted from below, and the author is of the opinion that this pressure arises through expansion caused by solidification of a magmatic body underlying the seat of the quake.—*W. A. R., Sci. Abstracts, vol. 42, No. 498, 1939.*

5047. Jeffreys, Harold, Remarks on the paper of G. Schmerwitz on central European earthquakes: Zeitschr. Geophysik, vol. 15, No. 3/4, pp. 168–175, Braunschweig, 1939.

This remark concerns Schmerwitz's paper "Adjustment of the best observations made at stations with regard to the earthquakes of central Europe" (see Geophys. Abstracts 97, No. 4930), in which a detailed study of the *Pg* and *Sg* observations in eight recent earthquakes is made by using a method of determining the parameters by least squares and by giving valid estimates of the standard errors. Schmerwitz's conclusion is that the accuracies claimed hitherto for estimates of focal depth have been much too great. The question of estimating the uncertainties of velocities is discussed.—*W. A.*

5048. Jeffreys, Harold, Deep-focus earthquakes: Gerlands Beitr. Geophysik, Supplementband 4, pp. 75–104, Leipzig, 1939.

The reality of earthquakes with focal depths as great as 700 km. is thoroughly established by several independent methods. These depths can be determined in some cases to an accuracy of about 8 km. or less. It appears probable that, when such determinations can be made, deep-focus earthquakes will lead to more accurate solutions of some seismological problems than can be obtained from the study of normal earthquakes. These are: (1) the depth of the core; (2) the nature of the 20° discontinuity; (3) the thickness of the intermediate layer; and (4) the times of *S* at distances up to 25°. The great majority of earthquakes have foci in the upper layers at depths not more than 50 km. The foci of most continental ones appear to be in the upper (granitic) layer, at an average depth of about 10 km. These are called normal earthquakes. The frequency of genuine deep-focus earthquakes decreases steadily with depth. There is no evidence for concentration at particular levels, though there is evidence that they occur near certain steeply inclined planes. The existence of these earthquakes is decisive evidence that the material of the earth to a depth of 700 km. has a finite strength, probably comparable with that of surface rocks. There is an interesting correspondence between their distribution and the cooling that might be expected to have taken place since the earth became solid. The evidence about strength is in satisfactory agreement with the indications given by anomalies of gravity. The results of Barrell, given in 1914–15, have been thoroughly confirmed and extended by later observations and discus-

sions. Thermal changes at great depths are fully capable of accounting for the stresses needed to produce these large earthquakes.—*Author's abstract.*

5049. Jones, J. H., The refraction method of seismic prospecting: Science of Petroleum, vol. 1, pp. 282–286, New York, Oxford Univ. Press, 1938.

A brief history of the method is followed by a complete description of the refraction technique illustrated by diagrams showing seismic-wave paths and a complete traveltime curve. The problem of multiple layers is discussed and the fan shooting and arc method as used in the field are explained. Isochron contour maps for detailed mapping and the values of compressional wave velocities in various rocks are treated. The article thoroughly covers the refraction procedure of seismic exploration.—*D. W., Annot. Bibl. Econ. Geology, vol. 11, No. 1, 1939.*

5050. Joos, G., and Teltow, J., Propagation of explosion waves at the surface of separation of two media: Physikal Zeitschr., vol. 40, No. 8, pp. 289–293, April 15, 1939.

A description has recently been given by O. von Schmidt of a type of propagation of explosion waves, which has long been known in seismics. (See Zeitschr. f. Tech. Physik, vol. 19, No. 12, pp. 554–560, 1938: Propagation of waves due to explosion in liquids and solids.) A wave propagated in a direction in the less dense medium parallel to the surface of separation from a denser medium gives rise to a new wave front entering the denser medium at the angle corresponding to total internal reflection. An explanation of this new wave front given by von Schmidt was based on Huygens' principle. Objections are raised to this explanation, and it is now shown that an explanation free from such objections is obtained from Somerfeld's stationary solution of the fundamental problem of radiotelegraphy. The question of applicability or non-applicability of Fresnel's formula is also discussed.—*A. W., Sci. Abstracts, vol. 42, No. 498, 1939.*

5051. Kanai, Kiyoshi, Model experiments for confirming the dissipation phenomena [scattering] in the seismic vibration of a structure: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 17, No. 1, pp. 37–48, 1939.

The dissipation of vibrational energy in the ground was confirmed by means of model experiments using gelatin models. Although the viscous damping in the model was too high to show the dissipation phenomena quantitatively, it was possible to confirm the dissipation qualitatively. The experimental results were checked by mathematical calculations. It was also ascertained that the viscosity in the structure itself and the dissipation are effective on the vibration damping in the same sense.—*R. S. R., Sci. Abstracts, vol. 42, No. 498, 1939.*

5052. Kopcewicz, T., Fazy sejsmiczne Gutenberga i metody analizy sejsmogramow dla dalekich zaburzeń [Gutenberg's seismic phases and methods of analysing far-distant disturbances]: Towarzystwa Geofizikow w Warszawie Builetyn, No. 15, pp. 5–12, Warsaw, 1938.

Various kinds of seismic waves and their respective positions on seismograms are briefly reviewed. An analysis of records allows us to find the corresponding epicentral distances Δ, the probable depth of focus, and the angle of emergence of rays. The function $T=f(\Delta)$,

called the hodochrone, plays an important role in seismology as it allows us to examine results with greater accuracy and rapidity. In far-distant disturbances, the propagation of seismic waves produces an interference of the core of the earth in which longitudinal waves have been observed. Based on the results obtained by Gutenberg, the irregularities of hodochrones of *P* and *S* for distances of 130° to 143° are explained. Finally, the method of analysis of seismograms for far-distant disturbances for obtaining epicentral distances Δ is briefly discussed. The *SKP*-phase is taken into account.—*Author's abstract, translated by W. A.*

5053. Lettau, Heinz, Eine einfache Zeitmarkierung für optisch registrierende Seismographen [A simple time-marking device for optically registering seismographs]: Leipzig Univ. Geophys. Inst., Veröff, ser. 2, vol. 10, pp. 74–75, 1938.

Two circuits are connected with small recording lamps that mark the time during photographic registration. One of these circuits is controlled by a resistance so that the lamp burns below the proper working voltage. The second circuit produces, by means of an additional voltage that corresponds to a time impulse, a strong increase in brightness that is photographically registered.—*Schmerwitz's abstract in Zeitschr. Geophysik, vol. 15, No. 3/4, 1939, translated by W. A.*

5054. McCollum, B., Reflection method of exploring subsurface geology: Science of Petroleum, vol. 1, pp. 387–397, New York, Oxford Univ. Press, 1938.

The author states that "the reflection method in its present state of development can now be used with commercially valuable results in nearly every type of geology of interest encountered in commercial oil exploration work." The utilization of reflected seismic waves in the mapping of subsurface geological structure is first explained. The organization and personnel of a seismic party, automotive and drilling equipment necessary, and typical field procedure are described. Instruments and apparatus for making reflection seismic surveys are discussed. Interpretation of seismograms and the calculation of the depth of a reflection horizon by the dip method and by the correlation method are treated. A section covers velocity determinations and corrections for surface irregularities. The article is concluded with a discussion of the accuracy of reflection profiling and the scope of application of the reflection seismograph.—*D. W., Annot. Bibl. Econ. geology, vol. 11, No. 1, 1939.*

5055. Mildner, P., Zur Bestimmung der Konstanten der Benioff Seismographen [Contribution to the determination of the constants of the Benioff seismograph]: Leipzig Univ. Geophys. Inst., Veröff., ser. 2, vol. 10, pp. 71–73, 1938.

A few simplifications in determining the constants of the Benioff seismograph are suggested.—*W. A.*

5056. Mildner, P., Über einige durch künstliche Einflüsse entstehende Störungen in den Erdbebenregistrierungen [On some disturbances that occur in the registration of earthquakes that are due to artificial influences]: Leipzig Univ. Geophys. Inst., Veröff., ser. 2, vol. 10, pp. 60–65, 1938.

Basing his explanation on the registration of oscillations produced artificially, the writer proves that the mounting of seismographs in a new observatory and the choice of the means of isolating the pillars are satisfactory.—*W. A.*

5057. Mildner, P., Bemerkungen zur Arbeit G. Fritsche, Untersuchungen über die von Maschienen Fahrzeugen und Wind hervorgerufenen Boden und Gebäudeerschütterungen nach Registrierungen eines Benioff-vertikal-Seismographen [Remarks on G. Fritsche's article, Investigations of the oscillations of the ground and of buildings, produced by machines, vehicles, and wind, and based on registrations made with a Benioff vertical seismograph]: Leipzig Univ. Geophys. Inst., Veröff., ser. 2, vol. 10, pp. 66–70, 1938.

The peculiar behavior of a highly sensitive seismograph was observed by Fritsche with regard to ground oscillations produced by steam engines mounted at a certain distance from the seismograph (see Geophys. Abstracts 94, No. 4470). It is now known that this peculiar behavior must be attributed to the loading capacity of the engines, which was not always constant. Small corrections in the map of the distribution of amplitudes as given by Fritsche must be made.—*W. A.*

5058. Nomura, Y., Propagation of elastic waves over the surface of a spherical body: Tohoku Univ., Sci. Reports, vol. 27, No. 3, pp. 212–254, Sendai, January 1939.

The theory of the propagation of vibrations over the surface of an isotropic elastic sphere of large radius is studied without taking into consideration heterogeneity and gravity. Three kinds of sources of disturbance that admit of simple interpretations are assumed: First, a dilatational point source; secondly, a distortional point source whose displacement has no azimuthal component; and thirdly, a distortional point source whose displacement has an azimuthal component only. In each kind it is first supposed that the disturbance is a simple harmonic function of time having a complex frequency; and then the fact is considered of a function that gives an abrupt rise, followed by a damped periodic fall, and so resembles in a general way an explosion. The complete expressions were first found for the displacement at the surface in a series of spherical harmonics, and then the series was transformed into contour integrals. Assuming the point source to lie near the surface and taking only the terms involving the smallest power of the reciprocal of the radius, the author obtained the representation of these integrals as the sum of residues of all enclosed poles and successfully deduced the expressions for the component waves spreading out from the source and traveling round the sphere in either direction. The expressions for waves coming directly from the source include the well-known solutions of similar problems, but for a plane boundary.—*Author's abstract.*

5059. Pannocchia, G., Vertical seismograph with characteristic period of 20 seconds: Ricerca Scientifica, vol. 10, No. 3, pp. 119–123, Rome, March 1939.

A description is given of a new type of seismograph with a period much longer than that of the seismographs actually in use. The instrument is based on the principle of the clinograph with two important innovations: an electromagnetic system of registration and an arrangement for making the instrument astatic.—*J. J. S., Sci. Abstracts, vol. 42, No. 497, 1939.*

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5060. Ramspeck, A., Der Einfluss eines mit der Tiefe veränderlichen Elastizitätsmodulus auf den Weg elastischer Wellen im Boden [Influence of a modulus of elasticity varying with depth on the path of elastic waves in the ground]: Zeitschr. Geophysik, vol. 15, No. 3/4, pp. 148–160, Braunschweig, 1939.

If the modulus of elasticity in the ground increases constantly with depth, the traveltime curve of elastic waves in such a ground becomes necessarily a deflected line. The theory of such deflected traveltime curves is derived for nonstratified as well as stratified semispace. Occasional existence of deflected traveltime curves is proved by an example taken from practice.—*Author's abstract, translated by W. A.*

5061. von Schmidt, O., Über Kopfwellen in der Seismik [Concerning top waves in seismics): Zeitschr. Geophysik, vol. 15, No. 3/4, pp. 141–148, Braunschweig, 1939.

According to the author's theory, top waves (Kopfwellen) can be photographically shown by streak photography (Schlieraufnahme) at the border between two liquid layers, as well as between a solid and a liquid layer. The course of longitudinal and transverse waves in nontransparent solid bodies can be proved by means of top waves in water. It is proved that transverse waves, unlike longitudinal waves, do not penetrate a model of the earth's metallic nucleus but encircle the model along the surface. It is shown that not only the new wave front but also the reflected and penetrating wave fronts may be assumed to be top waves and that with regard to top waves a phenomenon consistent with the general wave principle is involved.—*Author's abstract, translated by W. A.*

5062. Seismological report from New Zealand stations: Dominion Observatory, Bull. E. 85, 10 pp., Wellington, April 1939.

This report is divided into two parts. Part 1 gives readings of distant earthquakes, and part 2 gives readings of local earthquakes. Whenever they are definitely indicated, the trace amplitude and the direction of the vertical component of P are given. A list of provisional epicenters in New Zealand and the southwest Pacific is appended.—*W. A.*

5063. Sezawa, Katsutada, Amplitudes of Rayleigh waves with discontinuities in their dispersion curves: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 1, pp. 1–6, 1938.

In a paper published in this Bulletin, vol. 13, pp. 245–250, 1935, Kanai and the author have shown that when elastic constants of a superficial layer are extremely small as compared with those of a subjacent medium, it is possible for two dispersion curves to exist, each of which bends discontinuously for certain ratios of the wave length (L) to the thickness (H) of the layer under consideration.

The present paper shows that the values of both horizontal and vertical displacements in resonance curves are also discontinuous under the same condition with respect to wave length and thickness of layer, say, $L/H=c$. Although the vertical displacement is larger than the horizontal for $L/H<c$, the reverse is true for $L/H>c$. At all events, the amplitude of Rayleigh waves is maximum at $L/H=b(<c)$. Another important fact is that, although the orbital motion of the surface for

$L/H<c$ is of the same sense as that of the usual Rayleigh waves, the same motion for $L/H>c$ is opposite to that of such waves.—*Author's abstract.*

5064. Sieberg, August, Seismologie [Seismology]: Geologische Jahresberichte Verlag Gebr. Bornträger, vol. 1, pp. 236–244, Berlin, 1938.

A few works are mentioned, mainly those of geologic importance, with the purpose of giving an insight into the main problems of theoretical and applied earthquake research such as (1) construction of maps, (2) origin of earthquakes, (3) causes for the initiation of earthquakes, (4) epicenters and propagation of waves, (5) velocity of propagation, (6) depth of focus, (7) stratification of the earth's crust, (8) earthquake scales, (9) study of earthquakes in connection with construction of buildings and mechanics of the soil, (10) oscillations produced by industry and traffic, and (11) seismic prospecting.—*W. A.*

5065. Simon, Béla, Über den Aufgabenkreis des seismologischen Observatoriums in Budapest [in Hungarian] [On the field of action of the seismological observatory in Budapest]: Földtani Közlöny, vol. 67, No. 10–12, pp. 315–330, Budapest, 1937.

The field of action of the seismological observatory in Budapest is discussed in connection with international earthquake-research work (macroseimology, microseismology, and applied seismics). A seismic map of Hungary is given.—*W. A.*

5066. Stuedle, E. C., Care and maintenance of seismic exploration instruments: Oil Weekly, vol. 93, No. 12, pp. 23–30, Houston, Tex., 1939.

It is obvious that the quality and even the quantity of records obtained by instruments used for prospecting depend not only upon correct original design of instruments but also, in a considerable measure, upon the manner of which instruments are cared for in actual field work.

Several phases of the upkeep of instruments are discussed, such as (1) the normal care that is or should be given instruments by field personnel in their daily work, (2) additional care that may be supplied by specially trained personnel detailed for this purpose, (3) methods by which obsolescence and dilapidation of instruments may be minimized, (4) factors of design that affect maintenance, and (5) general benefits derivable from a systematic maintenance program.—*W. A.*

5067. Takahasi, Ryutaro, Nagata, Takesi, and Hirano, K., Geophysical studies of volcano Mihara, Osima Island; microtremor measurements in Osima: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 1, pp. 87–99, 1938.

Volcano tremors were observed by means of a pair of microseismographs of magnification 2000, at stations uniformly distributed over island of Osima. The tremors observed at the station within the somma [upper border of a crater] are composed of several oscillations of various periods, and they become gradually simpler in type with the distance from the crater. At the seacoast they again become irregular, being mixed with irregular oscillations probably of sea origin. Frequency analyses of the records obtained show that tremors of the period of 0.3 sec. appear at all stations except one. The tremors diminish in amplitude with the distance from the crater, as if they are generated from the present crater bottom or from a point 100 m. below it. The re-

sults led the writers to conclude that the volcanic microtremors in Osima are secondary oscillations of the ground surface excited by tremors of the period of 0.3 sec., which are propagated from the crater bottom.—*Authors' abstract.*

5068. von Thyssen, Stephan, and Rülke, O., Beschreibung des neuen Gerätes zur Bestimmung der Fortpflanzungsgeschwindigkeit elastischer Wellen in Gesteinsproben und einige Messergebnisse [Description of a new instrument for determining the velocity of propagation of elastic waves in rock samples, and some results of measurements]: Zeitschr. Geophysik, vol. 15, No. 3/4, pp. 130–141, Braunschweig, 1939.

A new electrical device is described that is based on the method of free longitudinal oscillations and that can be used for measuring traveltimes in rock samples. Results of measurements are given.—*Authors' abstract, translated by W. A.*

5069. Tillotson, Ernest, P_cP and S_cS: Seismol. Soc. America Bull., vol. 29, No. 2, pp. 345–408, Berkeley, Calif., 1939.

The traveltime and relative amplitudes of primary and secondary waves reflected once at the outer surface of the earth's core have been obtained from the Baluchistan earthquakes of August 24 and 27, 1931, and the Alaskan earthquake of March 25, 1932. These mutually confirmed one another as far as five pulses of each, and a traveltime table has been drawn up for each. All are confirmed by Gutenberg and Richter except P_cP about 65°, as far as these authors give readings; and also confirmed by Jeffreys except for P_cP between 30° and 65° and S_cS about 50°, where slight adjustments are necessary. Jeffreys and Gutenberg list only one P_cP pulse each, and Jeffreys and Bullen list only one S_cS pulse.—*Author's abstract.*

5070. Woollard, G. P., and Ewing, Maurice, Structural geology of the Bermuda Islands: Nature, vol. 143, No. 3630, p. 898, London, 1939.

A seismic-refraction survey of the Bermuda Islands indicates that they consist of four main volcanic cones, together with several minor ones, which are surrounded by a series of concentric folds that die out in amplitude with distance from the islands. According to two depth profiles made in the island area, the tops of the volcanic cones lie at depths of 273 feet and 243 feet below sea level. These determinations are in excellent agreement with the depth reported for the top of a volcanic cone in a deep well in the islands, 245 feet below sea level. The volcanic formations are characterized by a velocity of 16,000 feet/sec., whereas the overlying calcareous eolianite composing the visible part of the islands has a velocity of 8,800 feet/sec.—*W. A.*

5071. Yoneta, Katuhiko, On wave propagation on the surface of a sand mass: Hokkaido Univ., Fac. Eng., Mem., vol. 4, No. 3, pp. 265–273, Sapporo, 1938.

The writer describes some experimental investigations on the velocity of propagation of elastic waves in sand that were produced by a buzzer or similar device. Frequencies between 120 and 575 Hertz were used. It is shown that when the position of the source of the vibration is near the surface of the sand mass, the wave produced in the sand mass is chiefly propagated as a surface one. The determination of the velocity for the various cycles gave the dispersion curve. It is also shown that the velocity is greatly affected by the thickness and the density of the layer of sand.—*W. A.*

4. ELECTRICAL METHODS

5072. Alekseev, V. V., Experimental investigation of ondometric transmitters [in Russian]: Trudy Geol. Inst., Akad. Nauk U. S. S. R., No. 9, pp. 349–363, Moscow, 1939.

From a theoretical study of the possibility of applying electric methods for prospecting in permanently frozen regions (see abstracts 5080 and 5081) it was established that ordinary methods in which electrodes are grounded cannot give satisfactory results owing to the fact that grounding in frozen regions yields very variable and obscure results. Consequently, only wave methods could be considered. The construction of suitable ondometric apparatus became necessary, and two types of radio transmitters were designed by the Leningrad Mining Institute and the laboratory for studying permanently frozen ground. These two transmitters are based on Petrowsky's theory; their characteristic feature consists in utilizing a radio transmitter in the form of a special type of an alternator. Descriptions of the two types of ondometric transmitters and results of experiments with them are given.—*W. A.*

5073. Doborzynski, Dobieslaw, Mitteilungen über Kurzwellenempfang in Kalksteinhöhlen [Short-wave reception in limestone caves]: Hochfrequenztechnik u. Elektroakustic, vol. 52, No. 2, pp. 67–69, Leipzig, 1938.

Tests in a cave in the south Polish Jura, near Krakow, showed that short waves, after pentrating a layer of sandstone about 30 m. thick, were markedly absorbed and weakened but not so strongly as could be expected from theoretical considerations.—*W. A.*

5074. Fritsch, Volker, Einiges über die Eigenschaften der geologischen Leiter [Some remarks on the properties of geologic conductors]: Schweizer. naturf. Gesell., 119 Jahresversammlung, Chur, Verh., pp. 161–162, Aarau, 1938.

Definition of a geologic conductor is given, and its general electric and dielectric properties are discussed. Ores and solid components are good insulators; materials dissolved in water produce different values of conductivity by which radio prospecting may become possible. Three superficial layers are distinguished from the electrician's viewpoint: (1) A well-conducting homogeneous humus layer; (2) a heterogeneous layer reaching the ground-water horizon; and (3) dry fields below this horizon.—*W. A.*

5075. Fritsch, Volker, Geological conductors: Gerlands Beitr. Geophysik, Supplementband 4, pp. 219–289, Leipzig, 1939.

The paper is a review of electrical conditions in strata. As electrical conductors, their properties vary within wide limits, and the conditions for conduction are complex. Moisture is the most important factor.—*W. A. R., Sci. Abstracts, vol. 42, No. 497, 1939.*

5076. Fritsch, Volker, Funkgeologische Untersuchungen in Spateisensteinlagern [Radiogeologic investigations in siderite deposits]: Glückauf, vol. 75, No. 18, pp. 385–390, Essen, 1939.

Measurements of propagation show the Hertzian fields may penetrate to considerable depths. Their damping depends to a certain extent on the structure of the ground as well as on frequency. Anomalies of damping are sometimes observed within the limits of short waves. Functional dependence of the absorption on frequency is characteristic

of some geologic conductors (radiogeologic curves). Radio prospecting has so far been tried in Rotterbach mostly by the resistance methods. By the use of simple assumptions, essential facts on the radiogeologic structure of the subsurface could be obtained with these methods.—*Author's abstract, translated by W. A.*

5077. Gassmann, Fritz, Zur Watsonschen Methode der Auswertung geoelektrischer Widerstandsmessungen [On Watson's method of evaluating geoelectric resistivity measurements]: Beitr. angew. Geophysik, vol. 7, No. 4, pp. 347–349, Leipzig, 1939.

In order to evaluate geoelectric resistivity measurements, Watson supposes parallel layers of equal thickness (see R. J. Watson, A contribution to the theory of the interpretation of resistivity measurements obtained from surface potential observations: Am. Inst. Min. Met. Eng. Trans., vol. 110, pp. 201–236, 1934). His formulas for evaluation of apparent resistivity are corrected and supplemented. By means of introducing formulas of recursion, they are simplified in order to abbreviate numerical calculation.—*Author's abstract.*

5078. Martin, M., Murray, G. H., and Gillingham, W. J., Feststellung der Ergiebigkeit von Erdölhorizonten durch Widerstandsmessungen [Determination of the potential productivity of oil-bearing formations by resistivity measurements]: Bohrtech. Zeitung, vol. 57, No. 5, pp. 85–90, Vienna, 1939.

This is a translation of the article published in Geophysics, vol. 3, No. 3, 1938 (see Geophys. Abstracts 95, No. 4666).—*W. A.*

5079. Müller, Max, Die Messverfahren zur Restimmung des Dispersionseffektes des Widerstandes von Gesteinsmedien [Methods of measurement for determining the dispersion effect of the resistance of rock media]: Zeitschr. Geophysik, vol. 15, No. 3/4, pp. 176–182, Braunschweig, 1939.

Several methods of measurement, by which it is possible to determine the effect of dispersion of the resistance of rock media by dynamic phase regulation, are briefly described. These methods have the advantage of high selectivity and great penetrative effect.—*Author's abstract, translated by W. A.*

5080. Petrowsky, A. A., Operation [performance] of an ondometric transmitter [in Russian]: Trudy Geol. Inst., Akad. Nauk U. S. S. R., No. 9, pp. 301–325, Moscow, 1939.

A method of geophysical prospecting that involves the application of some properties of electromagnetic waves is called ondometry. The use of ondometry in the Union of Soviet Socialist Republics is closely connected with the study of permanently frozen ground in general and especially with measurements of the thickness of permanently frozen ground.

This article deals with the theory of operating an ondometric transmitter, which must satisfy the following main requirements: (1) It must produce sinusoidal oscillations; (2) it must work according to a scheme in which surrounding conditions do not influence noticeably the frequency (or the length of waves) of oscillations generated; and (3) no grounding can be used, as this would introduce into the work a new, very variable, and an obscure factor. Fundamental conditions under which the theory of the operation of such a radio transmitter may be established are discussed mathematically. Diagrams and tables complete the article.—*W. A.*

5081. Petrowsky, A. A., Physical constants of the ondometric transmitter [in Russian]: Trudy Geol. Inst., Akad. Nauk U. S. S. R., No. 9, pp. 327–347, Moscow, 1939.

In the previous article (see abstract 5080) Petrowsky showed that the performance of an ondometric transmitter is determined by a group of differential equations containing the following quantities: (1) E, amplitude of the electromotive force of an equivalent alternator; (2) R_1, resistance of the primary circuit of the alternator; (3) L_1, self-induction of the primary circuit of the alternator; (4) C_1, capacity of the primary circuit of the alternator; (5) R_2, resistance of the secondary circuit of the alternator; (6) L_2, self-induction of the secondary circuit of the alternator; (7) C_2, capacity of the secondary circuit of the alternator; and (8) M, mutual induction between the primary and secondary circuits.

These quantities are called "physical constants" of the transmitter. The operation of such a transmitter can be judged only if all these quantities are known. Quantities L_1, C_1, L_2, C_2, and M depend on adjustments of the coils and condensers in the transmitter; quantities E_1, R_1, and R_2 may be considered constant only for a certain set up. As great difficulties thus arise in determining quantities E_1, R_1, R_2, and M, only these four quantities and the methods by which they can be found are discussed mathematically in this article.—*W. A.*

5082. Rayner, J. M., and Nye, P. B., Geophysical report on the Croydon-Golden Gate area, Croydon gold and mineral field: Aerial, Geol., and Geophys. Survey of northern Australia, Rept. Queensland, No. 9, 27 pp., Canberra, 1939.

A geophysical survey based solely on the electromagnetic method, with other methods used only as trials, was made in the Croydon gold field between July 1 and December 16, 1936. The area covered during that time was 1,645 acres, and 284,600 feet of traverses were surveyed. The survey was confined to the granite belt, as 80 percent of the total gold production came from mines in this belt. Large parts of it are covered by caprock and Cretaceous sandstone, which makes prospecting by usual methods rather difficult. Test profiles over old mines showed that the electromagnetic method could be used with success. Indications of a good conductor were obtained, not from the reef outcrop but from some depth. As the reefs in the Croydon field dip flatly to the northeast, the indications are offset to the northeast of the outcrop by amounts that depend on the depth of current concentration beneath the surface. As the reefs themselves consist of quartz and consequently are poor conductors, the explanation for the good conductivity along the reefs lies in the zones of shearing and fracturing in the graphitic granite. These zones contain water that is highly mineralized from pyrite and arsenopyrite and that acts, therefore, as a good conductor. This conclusion has been confirmed by determinations of the specific resistivity of rock formations in the field and by determination of the electrical resistivity of water samples taken from old shafts in the surveyed area. The strength of the electric indications depends on such factors as the strength of shearing, the ratio of conductivity of the good conducting zone to that of the country rock, and also on the continuity of the good conductor. It is assumed from geologic mapping that the gold shoots are close to the junction of fracture systems striking at different angles. Thus the continuity of the conductors is broken,

and it is believed that comparatively weak indications near the junction of different indication lines or sharp bends in the indication lines are better places for testing by drilling than straight uninterrupted lines of strong indications. The surveyed areas were near and around the following old mines: Golden Gate, Content, Sunset, True Blue, Queen of Croydon, Iguana, and Highland Mary. The results in various surveyed areas are given. Generally, the results over known mines checked well with the known facts. Table one shows: (1) Number of layouts, (2) surveyed areas in acres, (3) total length of profiles surveyed, and (4) number of observation points in each of the areas surveyed. The specific resistivity of rock formations and of water samples are given in tables 2 and 3, respectively. The final results of the survey are shown on many maps, profiles, vector diagrams, and other illustrations.—*Authors' summary, condensed by W. A.*

5083. Rose, R. B., Geophysical equipment for the individual: Queensland Gov. Min. Jour., vol. 40, No. 465, pp. 49–50, Brisbane, 1939.

A brief description is given of the *MT*-scope (metallascope) and its operation in search of ore deposits at shallow depths. The instrument is assembled on rigid handles and balanced over barren ground to "null." This done, no tone is heard in the phones. Walking over or close to a conducting deposit creates a great ground radiation, which drives the visual needle down and induces a loud tone in the headphones. Typical field results and varying proper interpretations are shown in accompanying graphs.—*W. A.*

5084. Schlumberger, Conrad, Electrical prospecting for oil: Science of Petroleum, vol. 1, pp. 346–350, New York, Oxford Univ. Press, 1938.

The writer classifies electrical methods applied to oil prospecting as to whether the quantity measured consists of the potential difference between surface electrodes or the magnetic vector created by an alternating-current field sent into the ground. The resistivity of rocks, the measurement of ground resistivity, and the method of electrical soundings are discussed. Examples of field application illustrated by maps include the Aricesti dome (Rumania) and the Bucsani area of the same country. Electromagnetic methods are discussed in a separate section, with illustrations of the principle of the Swedish induction method.—*From D. W., Annot. Bibl. Econ. Geology, vol. 11, No. 1, 1919.*

5085. Schlumberger, Conrad, Electrical coring: Science of Petroleum, vol. 1, pp. 351–363, New York, Oxford Univ. Press, 1938.

The article is a complete summary of the method of electrical coring and its major applications. Its principles and technique are illustrated by pictures of field equipment, and graphs and descriptions illustrate the use of the procedure in correlation, tectonic studies, detailed studies of oil zones, discovery of new oil sands, and a study of edge water. The relation between resistivity and productivity of an oil horizon, the electrical resistivity of rocks, and the measurement of resistivity and of spontaneous potentials in drill holes are discussed, as well as permeability measurements and the principles of the interpretation of electrical logs.—*From D. W., Annot. Bibl. Econ. Geology, vol. 11, No. 1, 1919.*

5086. Thompson, R. R., A note on the seismic electric effect: Geophysics, vol. 4, No. 2, p. 102–105, Austin, Tex., 1939.

An experiment is described which apparently eliminates electrode surface effects as a cause of the seismic-electric effect. Evidently a

volume variation of some electrical property or properties of the earth is necessary to explain the experimental results.—*Author's abstract.*

5087. Tölke, F., Die geophysikalische Baugrunduntersuchung [Geophysical investigation of building plots]: Naturwissenschaften, vol. 26, Nos. 50 and 51, pp. 809–818 and 825–833, Berlin, 1938.

The theoretical foundation of the geoelectrical direct-current method of prospecting (resistance method) as developed by Wenner, Schlumberger, and Hummel is briefly discussed. Many examples and practical results are given in the solution of two-layer problems, in the determinations of borders of deposits and faults, and in the investigation of building plots.—*W. A.*

5. RADIOACTIVE METHODS

5088. Herold, F., Bemerkung zu Zählrohrmessungen im Gelände [Remark on counting-tube measurements in the field]: Zeitschr. Geophysik, vol. 15, No. 3/4, pp. 182–183, Braunschweig, 1939.

This is a brief report on information gained during measurements in the field with an electrically operated high-voltage apparatus.—*W. A.*

5089. Howell, L. G., and Frosch, Alex, Gamma-ray well logging: Geophysics, vol. 4, No. 2, pp. 106–114, Austin, Tex., 1939.

Point-to-point measurements of radioactivity in boreholes were made with an ionization chamber. The correlation between the curves obtained and the electrical logs for the same holes led to the construction of a more rugged apparatus containing two Geiger counters, coupled separately to two amplifiers and two frequency meters on the surface of the ground. This instrument can be run continuously and logs taken in both cased and open holes. Correlation was obtained between two cased-hole records taken several miles apart in west Texas. Remarkable correlation in many instances between radioactivity and electrical logs has been found in the Gulf Coast. The method seems to open up a broad field in cased-hole well logging.—*Author's abstract.*

6. GEOTHERMAL METHODS

5090. French, R. W., Geothermal gradients in California wells: Oil and Gas Jour., vol. 37, No. 40, pp. 43–44 and 48, Tulsa, Okla., 1939.

The scientific search for true geothermal gradients and their causative determinants has been in progress at least 53 years, with C. E. Van Orstrand foremost in the United States. It is hoped that the presentation in this paper of approximate curves with the brief explanation of their present deficiencies and future usefulness will benefit those interested and will serve to heighten interest in advancing the general study of earth temperatures.—*Author's abstract*

5091. French, R. W., Geothermal gradients in California oil wells; communicated before American Petroleum Institute, Pacific Coast District, Los Angeles Meeting, April 1936 [abstract]: World Petroleum, vol. 10, No. 7, pp. 46–47, Los Angeles, April 1939.

A tabulation is given to show depths at which a temperature of 175° F. is recorded; this varies from a minimum of 3,200 feet in the

Lompoc to 7,170 feet in the San Miguelito field and affords a means of comparison by which hot can be distinguished from cool fields. Perhaps the most important causes of these temperature variations are differences in the heat-conductivity characteristics of various rocks and the relative proximity of the basement complex. Annual average atmospheric temperature hardly appears to have any noticeable influence in comparison with other factors in California, where comparatively recent sedimentation has undergone intensive diastrophism. A generalized picture of the relations to depths up to 7,000 feet are shown in an accompanying chart. The practical uses of a knowledge of temperature gradients in oil wells are numerous and important for the following reasons: Reservoir-content studies and space-volume relations are vitally dependent upon temperatures; geological correlation with structure, as well as detection of faults, is sometimes possible; possibilities exist for detecting or observing subterranean-water movement (based upon transient temperatures in wells); mud performance and stability in drilling wells is affected by heat; chemical treatment of wells in cleaning out or plugging water sands may be affected by heat; selection and application of cement as well as calculation of safe drilling-out time should be based on accurate temperature data; designs of tools, instruments, and materials for use in drilling or producing wells must recognize temperature conditions, which may be critical in some instances; thermodynamic analysis of flow-tube design and the use of phase-equilibria tables require detailed temperature observations; temperature surveys are accepted for the location of freshly placed cement outside casing and in scattered instances have logged formations behind casing, detected water sources in both open and cased hole, and located gas- or oil-producing horizons in open hole.

5092. Recording thermometer gives temperature at all depths [editorial note]: Oil and Gas Jour., vol. 38, No. 7, p. 108, Tulsa, Okla., 1939.

"Martin-Decker Corp., Long Beach, Calif., has announced a device for accurately measuring oil-well temperatures. The Martin-Decker radium recording thermometer does not indicate maximum temperature only but charts in a clear legible line complete information on temperature at all depths during one run. The recording thermometer features a radium-tipped pointer that charts a record of heat variations as it moves over a sensitized paper chart. The pointer is actuated by an extremely sensitive and accurate thermal element that expands and contracts with variations in heat, thus moving the pointer around the chart. The pointer provides a friction-free method of operation, as it does not contact the chart. The instrument can be used on any drilling or producing well and is small enough to be run inside 'spaghetti' tubing."

Illustrations are given of the 1½-inch thermometer for use with a circular-type chart and of the 1¼-inch one for use with a strip-type chart.

5093. Strong, M. W., Bottom-hole temperature measurement: Science of Petroleum, vol. 1, pp. 516–522, New York, Oxford Univ. Press, 1938.

A study of the distribution of heat in the upper crust of the earth and the relation between underground temperatures and geologic formations is given under the following headings: (1) Utility of geothermal data; (2) apparatus and practice; (3) recording geothermal data; (4)

elimination of disturbing and irrelevant factors; (5) geological causes of temperature variation, such as (a) old structures, and (b) strata not in geothermal equilibrium; and (6) temperature gradients.

In his summary of results the author mentions some geothermal work in the United States, Galicia, the Pechelbronn oil-bearing region, and Iran.—*W. A.*

7. UNCLASSIFIED METHODS

5094. Aerial, geological, and geophysical survey of northern Australia, Parliament of Commonwealth of Australia, 98 pp., 16 pls., L. F. Johnston, Commonwealth Gov. Printer, Canberra, 1938.

This is a report of the committee appointed to direct and control the aerial, geological, and geophysical survey of northern Australia for 1 year ending December 31, 1937 (for the previous year see Geophys. Abstracts 94, No. 4526). Plates 6 to 16 show plans and profiles. Geophysical surveys, described on pages 71 to 94, were made in Western Australia, Queensland, and Northern Territory. The descriptions contained in this report outline briefly the results of the surveys. The following methods were applied: (1) Electromagnetic, (2) potential, (3) self-potential, (4) resistivity, and (5) magnetic.—*W. A.*

5095. American Geophysical Union, 20th annual meeting [editorial note]: Terres. Magn. and Atmos. Electr., vol. 44, No. 2, p. 180, Baltimore, Md., 1939.

The meetings of the seven sections of the American Geophysical Union were held in Washington, D. C., April 26, 27, 28, and 29, 1939. During these meetings 94 scientific papers and reports dealing with geophysical research were presented.

At the General Assembly, April 28, the first award of the Union's medal "for distinguished attainment and outstanding contribution to the advancement of cooperative research in fundamental geophysics" was made to Dr. William Bowie. The Assembly's symposium was on geophysical prospecting, during which the following papers were presented and discussed: Geophysical methods in petroleum exploration, by J. Brian Eby; Electrical and magnetic exploration in the mining industry, by Sherwin F. Kelly; The application of telluric currents to surface prospecting, by Marcel Schlumberger; Measurements of radioactivity for stratigraphic apparatus, by H. Landsberg and M. R. Klepper; and Geophysical prospecting by the Federal Government, by F. W. Lee, J. H. Swartz, and Irwin Roman.

5096. Barton, D. C., Petroleum geophysics: Science of Petroleum, vol. 1, pp. 319–327, New York, Oxford Univ. Press, 1938.

The methods of petroleum geophysics consist of the application of sensitive physical instruments and special techniques to the problem of mapping concealed geologic features. The general procedure followed is set forth. A section covers the history of the methods, and their success is treated under (1) the methods collectively, (2) seismic and gravitational methods, (3) magnetic method, (4) electrical method, and (5) other methods. Choice of method, and of physicists, geologists, and geophysicists, are subheads in the article.—*From D. W., Annot. Bibl. Econ. Geology, vol. 11, No. 1, 1939.*

5097. Closs, H., and Wolff, Wilhelm. Die Entwicklung der geophysikalischen Reichsaufnahme Deutschlands bis Ende 1938 [The development of the governmental geophysical survey of Germany to the end of 1938]: Oel und Kohle, vol. 15, No. 14, pp. 275–284, Berlin, 1939.

A brief description is given in the first part of the article on (1) the organization of a systematic geophysical survey of Germany since 1934, (2) problems of the survey, (3) methods of the survey and their application, (4) preliminary work, and (5) carrying out the work.

The second part of the article deals with statistical results obtained from pendulum, gravimeter, and torsion-balance measurements, as well as with the application of seismic, electrical, and radioactive methods of prospecting. Maps and diagrams show the areas involved under each method and the results obtained. Work done in the geophysical laboratory is mentioned.—*W. A.*

5098. Eve, A. S., Geophysical methods, introduction: Science of Petroleum, vol. 1, pp. 316–318, New York, Oxford Univ. Press, 1938.

Section 8 of this five-volume work contains eight articles on the general principles of different geophysical methods by authorities in the respective fields. In the introduction the author discusses these articles and geophysical methods in general. He points out that geophysicists working in the field find that the laws of physics hold out of doors just as they do in the laboratory, with the marked difference that in the laboratory the experimenter works with selected materials while in the field he must take things as they occur.—*From D. W., Annot. Bibl. Econ. Geology, vol. 11, No. 1, 1939.*

5099. Fabre, H., Density of earth's interior: Bull. astronomique, vol. 11, No. 5/6, pp. 313–326, Paris, 1938.

This gives an historical review and a mathematical discussion of the research on variation of density in the interior of the earth.—*W. A.*

5100 Gabriel, V. G., Geophysical prospecting; its part in American mining: Eng. and Min. Jour., vol. 140, No. 4, pp. 50–54, New York, 1939.

The writer makes an evaluation of the contributions of geophysical prospecting to mining, and he takes into account certain general conditions and factors prevailing in the mining industry for the past two decades. Average prices and production of some of the common metals (copper, lead, and silver) in the United States, in comparison with similar data pertaining to oil, are shown in two diagrams. Two tables give detailed information on electrical, magnetic, seismic, gravitational, and geothermal methods of prospecting in the mining industry, exclusive of the oil industry, in the United States.—*W. A.*

5101. Hagiwara, Takahiro, Observations of changes in the inclination of the earth's surface at Mount Tukuba: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 16, No. 2, pp. 366–371, 1938.

Observations were made with Ishimoto's clinographs from October 1935 to November 1937. To reduce the effects of temperature on the clinographs, a gallery 1 m. wide and 2 m. high was bored in partly weathered granite. The boring was horizontal for a distance of about 25 m. from the entrance. Two chambers were excavated, one at the end of the gallery and the other near the entrance. Curves show the daily mean values of secular variations. Room temperatures, air temperatures, and precipitation are plotted together with these curves.

The courses of the curves obtained in the two chambers were very different. No evidence could be established as to which changes were due to temperature and which to possible geophysical causes. Further investigations are necessary to solve this problem.—*W. A.*

5102. Heck, N. H., From the center of the earth to the sun: Washington Acad. Sci. Jour., vol. 29, No. 5, pp. 189–218, Menasha, Wis., 1939.

The broad picture of an earth and an atmosphere in which the concentric shell is an outstanding feature is illustrated by a diagram. Seismology shows that the earth consists primarily of a core, a mantle, and a crust. The mantle is perhaps subdivided into several layers, but the surfaces of discontinuity between them are not yet fully defined. The most likely are on the order of 400 and 1,000 km. below the surface. The crust is a fairly definite conception, but its thickness depends to some extent on definition and on the geophysical method used in determining it. From seismology there appear to be several layers under the continents—layers much less in thickness under the Atlantic and Indian Oceans and nonexistent under the Pacific Ocean. Their depths from isostatic considerations have been discussed.

At least 94 percent of the earth's total surface field magnetism is of internal origin. An accurate knowledge of this field is of great practical as well as theoretical value. The main field undergoes a secular variation. There are also periodic and aperiodic variations in the field appearing in superimposed form, caused by electric currents flowing above the ground and giving rise to induced currents flowing within the earth. The space distribution of these currents cannot be inferred from magnetic measurements at the earth's surface, but additional nonmagnetic considerations determine them with a fair degree of probability. From these variations is deducted information about the earth's interior, the atmosphere, and the sun not forthcoming in any other way.

It is generally accepted that far ultraviolet light is the cause of the ionization which is responsible for diurnal variations, but that magnetic storms are probably associated with slower traveling emanations from the sun. These are associated with sunspots but so indirectly that they appear to rise from disturbed areas on the sun, which may or may not have sunspots.

These are some of the things that have been accomplished, and all those who have taken part can feel pride in their share of the accomplishment. On the other hand, scarcely a start has been made on some of the principal problems. Explanations have not been reached for the magnetic field and its secular change or for the cause of magnetic storms. The immediate cause of deep-focus earthquakes is not known, and the ultimate cause of all earthquakes is yet to be discovered, as well as many of the facts about the interior of the earth.

One of the needs is for data at many places, but new observatories should not be added until the interpretation of their records is provided for. One of the great problems in the world-wide studies is to obtain the needed observational data and yet not to do it in such a way as to restrict the interpretation of the results.

There is, therefore, ample challenge in both fields, and the complexity of the problems need not become a bar to progress if the advance is made on a sufficiently broad front and is maintained.—*Author's summary.*

5103. Heiland, C. A., Report of the year's activity in electrical, geothermal, radioactive, and soil-analysis methods: Geophysics, vol. 4, No. 2, pp. 130–137, Austin, Tex., 1939.

The year's activities in the geophysical methods of prospecting mentioned in the title are briefly reported in connection with their application in mining, oil exploration, engineering geology, and in other scientific or theoretical ways.—*W. A.*

5104. Kelly, S. F., Cutting exploration costs with geophysics: Canadian Min. Manual, 8 pp., Toronto, 1938.

Efficient and economical operation can be attained only if a mining-exploration program includes the integration of geology, geophysics, drilling, engineering, and finance. The proper role of geophysical method in such a program is to discover and map concealed geologic formations and structures. The spontaneous-polarization method and the magnetic method of prospecting are discussed. Examples of surveys made by these methods and the geological interpretation of results are given. Although it is impossible to say how much a geophysical survey will cost, as this will depend on such factors as overburden thickness, surface conditions, and the detail required, nevertheless some approximate figures are cited as a guide and cover the usual extremes of rough reconnaissance and complete detail.

For spontaneous-polarization work, the cost should be between $150 and $500 a claim; for magnetic work, about half these amounts; for a ground-comparator resistivity survey, between $200 and $700 a claim. The most satisfactory geophysical survey of a property will include both electrical and magnetic techniques. In this complete type of study the cost should lie between $300 and $900 a claim. The economies that can be effected in later exploration, with the geophysical interpretation in hand, should more than repay the cost of the work.—*W. A.*

5105. Kennedy, W. Q., and Anderson, E. M., Crustal layers and the origin of magmas: Bull. volcanologique, l'Union géod. et géophys. internat. [Assoc. volcanologie], ser. 2, vol. 3, pp. 23–82, Naples, 1938.

Part 1, Petrological aspects of the problem, by W. Q. Kennedy, pages 23–41. During recent years it has become increasingly apparent that the problems of igneous activity are inseparably linked with those of geophysics on the one hand and with crustal tectonics on the other. Any ultimate theory of petrogenesis must therefore seek to explain the origin of magmas and the evolution of igneous rocks both in terms of the physicochemical processes involved and in relation to the major elements in the structure of the earth as a whole. The actual mechanism of the tectonic control has, however, not yet been adequately explained and it is this aspect of modern petrology that is mainly discussed in this paper under the following main headings: (1) The conception of volcanic and plutonic associations, and (2) the role of tectonic environment in the evolution of volcanic associations. Reasons are stated for supposing that there may be formations of primary granitic magma. In conclusion, the author points out that the discussion is purely of an exploratory nature and that many discrepancies are inevitable.

Part 2, Geophysical data applied to the magma problem, by E. M. Anderson, pages 42–82. In this part attention is paid to recent work in seismology, but data of many kinds are used, as every other branch

of geological physics has some bearing on the problem of magma. The principal object of this paper is to explain the distinction, in type and in distribution, of the two main classes of basalts. It has been supposed (1) that olivine basalt forms a distinct layer between the P^* level and the underlying P_n level, the latter being possibly occupied by peridotite, or (2) that the layer referred to grades upward into the more acid material of the P^* level and is thus not so distinct or (3) that the intermediate layer consists entirely of tholeiitic or olivine-poor basalt and that olivine basalt is derived from the upper part of the lower, or P_n layer, where it exists in the form of eclogite. For lack of information concerning the third hypothesis, the investigations discussed in this article are confined to the first two suppositions and are to be regarded as exploratory.—*W. A.*

5106. King, R. H., Summary of oil fields discovered and developed in Louisiana: Petroleum Engineer, vol. 10, No. 8, pp. 87–93, Dallas, Tex., 1939.

During 1938 21 new oil fields were discovered in the State of Louisiana. The oil and gas fields of the State, as of January 1, 1939, totaled 113. A historical record is presented of all fields, together with an indication of the method by which each field was discovered.—*W. A.*

5107. King, R. H., Geophysics has played an important role in oil discoveries: Petroleum Engineer, vol. 10, No. 8, pp. 94–96, Dallas, Tex., 1939.

The reflection and refraction seismograph and torsion balance were applied successfully to locate and delimit structures likely to produce oil or gas or both. In 1938, 49 to 75 crews were working on geophysical projects in Louisiana. The number of crews engaged with the seismograph varied from 38 to 51; with the torsion balance, from 5 to 14. Other geophysical methods were tested experimentally.

The "marsh buggy" is an indispensable piece of equipment in swampy areas of southern Louisiana. This vehicle consists of a tractor or truck-type chassis and body supported by wheels equipped with special balloon tires. These extra-large tires are made of rubber or metal and are of sufficient size to float the vehicle if necessary. Deep lugs, belts, or paddles are affixed to the tires to propel the buggy across water. The marsh buggy is able to transport crews and equipment over any kind of terrain.—*W. A.*

5108. Krasnow, Shelley, A review of progress in geophysical instruments for the year 1938: Geophysics, vol. 4, No. 2, pp. 123–129, Austin, Tex., 1939.

Progress in 1938 is evidenced not only by more or less minor improvements in equipment but also by the announcement of entirely new instruments. Changes in prospecting techniques have brought necessary instrumental changes with them.

Improvements and changes in all kinds of geophysical equipment are briefly described.—*W. A.*

5109. Leonardon, E. G., and McCann, D. C., Exploring drill holes by sample-taking bullets: Am. Inst. Min. Met. Eng. Tech. Pub., No. 1062, 13 pp., New York, 1939.

A description of the instrument, method, application, and analysis of cores by means of a side-wall sample taker. It is believed that this practical and proved method will be used either to supplement or to replace entirely the rotary core record and also in conjunction with the electrical log as a means of securing additional geological information.—*Authors' abstract.*

5110. Malamphy, M. C., Petroleum problem of Brazil hinges on law and technique, parts 2 and 3: Oil Weekly, vol. 93, Nos. 4 and 9, pp. 24–34 and 28–34, respectively, Houston, Tex., 1939.

For part 1, see Geophys. Abstracts 97, No. 4966.

Part 2 discusses the potentially petroliferous areas in the coastal area bordering on Alagoas, Riacho Doce, São Salvador, and the territories of Acre and Amazon. Despite the vast area of Brazil, active oil seeps are unknown there except for the minor oil showing in Bahia and a questionable gas seep in Alagoas. The territory of Acre and the adjacent western part of the State of Amazonas offer the most promising prospects for the discovery of petroleum. Although less promising, the coastal areas of Alagoas and Bahia are worthy of extensive investigation. Prospects of the southern states are problematical. The rest of the sedimentary areas of Brazil are unknown. The results of gravimetric surveys in the States of Alagoas and Bahia are given on two maps. Partial results of magnetic surveys in the same areas are shown by diagrams.

Part 3 deals mainly with Brazil's new petroleum laws and closes with definite recommendations for drilling in certain areas.—*W. A.*

5111. Mitera, Z. A., Organizacja i postępy poszukiwawczych prac geofizycznich w Niemczech [in Polish] [Organization and progress of geophysical prospecting work in Germany]: Kopalnictwo Naftowe w Polsce, vol. 14, No. 3, pp. 111–115, Warsaw, 1939.

Organization of geophysical-prospecting work under supervision of the Governmental Commission of Geophysical Survey of Germany, established since 1934, is outlined. The areas covered by such methods of prospecting as the torsion balance, gravimetrical, magnetic, and seismic are shown on maps taken from Reich's article, State of geophysical survey of the Reich, published in Zeitschrift für Geophysik, vol. 15, No. 1/2, 1939 (see Geophys. Abstracts 97, No. 4967).—*W. A.*

5112. Namba, Munetosi, An investigation of earth currents on the volcano Aso: Memoirs of the College of Science, Kyoto Imperial Univ., ser. A, pt. 1, vol. 21, No. 6, pp. 203–217, 1938, and pt. 2, vol. 22, No. 2, pp. 35–39, 1939.

Part 1, The potential difference of the upward earth current flowing toward the top of the volcano. It is a well-known fact that there is always a certain definite ascending current along an inclined earth surface. The writer has measured the distribution of the potential gradient of the earth current near the mountain tops of several volcanic cones and has arrived at the conclusion that the ascending current of a cinder cone is mainly due to the streaming potential caused by the soil-pressure difference.

Part 2, Distribution of the earth current in the old atrio (hearth) of Aso. By studying his measurements, the writer came to the following conclusions: (1) There are some anomalous distributions of the earth current in the neighborhood of the volcanic tectonic lines; (2) under the northwest part of the atrio, a magma reservoir seems to exist; (3) the barranco (a deep ravine with steep sides) of Tateno may be an erosional valley and not a graben; and (4) the writer can say nothing about the problem of the Aso volcanic sink because no measurements of the somma (upper border of a crater) are available.—*Author's abstract.*

5113. Reich, Hermann, Angewandte Geophysik [Applied geophysics]: Geol. Jahresber., Verlag Gebr. Borntträger, vol. 1, pp. 305–314, Berlin, 1938.

This is a brief review of gravimetrical, magnetic, seismic, electrical, and geothermal methods of geophysical prospecting, with reference to some books and articles written on the subject.—*W. A.*

5114. Reich, Hermann, Les travaux géophysiques de la Reichsaufnahme dans les régions pétrolifères allemandes [Geophysical survey of Germany in the German oil-bearing regions]: Rev. pétrolifère, No. 837, pp. 639–642, 1939.

This is a translation of Reich's article published in Oel und Kohle, vol. 15, No. 2, 1939 (see Geophys. Abstracts 97, No. 4968).—*W. A.*

5115. Tams, Ernst, Fortschritte in der Physik der Erde als Ganzes und der Erdrinde [Progress in the physics of the earth as a whole and of the earth's crust]: Geol. Jahresber., Verlag. Gebr. Borntträger, vol. 1, pp. 8–23, Berlin, 1938.

The present state of geophysics is reviewed with reference to the figure of the earth, to the constitution of the earth's crust, and to isostasy. Methods of determining gravity, deviation of the plumb line, local peculiarities in gravity, secular variations of gravity, and tides of the earth are mentioned. Koenigsberger's investigations of geothermal gradients in mines, tunnels, and boreholes are examined.—*W. A.*

5116. Uspenskaia, N. Yu, Lower Volga an object for oil prespecting [in Russian]: Sovietskaia Geologiia, vol. 9, No. 3, pp. 38–55, Moscow, 1939.

Some distinct maxima and minima of gravities very similar to the gravitational anomalies of the Emba and Baskunchak salt-dome regions have been found in the region of the lower Volga. Therefore, an area of about 20,000 km.^{2} was investigated within a triangle formed on one side by the Volga (from the village of Svetli Yar to the city of Enotaevsk), on the second side by the meridian passing through Svetli Yar, and on the third side by Lake Tsaga-Nur. Gravimetrical and seismic methods as well as a gas survey and drilling were used. The results of the gravimetrical survey are shown on a map. The following conclusions are drawn: (1) Salt tectonics were proved to be connected with the tectonics of the Emba region; (2) the southern and western borders of the salt-dome zone could not be determined; (3) the salt-dome zone was limited in its northwestern part by a structure of a different character; and (4) the anomalies decreased considerably toward the northwest.

The most characteristic gravitational minima (near the village of Solenoe Zaimishche) were investigated by the seismic method and a gas survey. Seismic profiles are given. Results of the seismic survey were so valuable that this method was recommended for further investigation of the region of the lower Volga.—*W. A.*

8. GEOLOGY

5117. Dobrin, M. B., Recreating geological history with models: Jour. Applied Physics, vol. 10, No. 6, pp. 360–371, Lancaster, Pa., 1939.

This is an experimental study of the earth's crustal deformations. Subjected to tremendous forces that act from the interior, the thin outer crust of the earth gives evidence of having suffered intense deformations throughout geological time. Because of the complexity

of these movements, it is often impossible to deduce their mechanisms by the use of ordinary physical concepts. Dimensional analysis shows, however, that the rigid rocks of the earth's crust deform, on their own large scale, in much the same way that very soft, plastic materials deform on a much smaller scale. This fact has been utilized with interesting results in the design of scale models to represent the formation of many observed geologic features such as mountains, ocean basins, and salt domes.—*Author's abstract.*

5118. Evans, R. D., Goodman, Clark, Keevil, N. B., Lane, A. C., and Urry, W. D., Intercalibration and comparison in two laboratories of measurements incident to the determination of the geological ages of rocks: Phys. Rev., vol. 55, No. 10, pp. 931–946, Lancaster, Pa., 1939.

In an effort to extend the scope of geological-age measurements based on the accumulation of helium in igneous rocks, researches were initiated which indicated disagreement when compared with previously published results from the same geological horizons. Cooperative investigations by the authors show that the radium determinations used in formulating the previous helium time scale are incorrect by more than a factor or two. The magnitude of the necessary downward revision of ages varies, depending on the *Th/U* ratio of the individual rock specimens. Helium-age determinations have been made on a number of igneous rocks by two entirely different techniques, the alpha-helium method and the radon-thorium-helium method. The alpha-helium method is independent of radioactive standards, and its results are in agreement with the new measurements by the radon-thorium-helium method. These researches represent the first comparison of helium-age measurements on the same specimens by two or more observers. Although the helium ages of many individual geological horizons are lowered by these new results, the total span of geological time remains unreduced. Precision radium standards in the region of 10^{-12} gm. have been verified.—*Authors' abstract.*

5119. Griggs, David, Creep of rocks: Jour. Geology, vol. 47, No. 3, pp. 225–251, Chicago, 1939.

"Creep" is the name applied to the slow deformation of solids under small loads acting over long periods of time. Two types of apparatus have been developed for the purpose of investigating the creep of rocks in response to stresses below the "elastic limit" as ordinarily defined. The present paper describes results obtained with these instruments during runs of various duration, up to 550 days. It is found that there may be measurable flow at stresses below the elastic limit. An empirical law has been derived which resolves this deformation into two types of flow, termed "elastic flow" and "pseudoviscous flow." The creep characteristics of several materials at room temperature and atmospheric confining pressure are described. Preliminary experiments on creep at high pressure and on creep by recrystallization are reported.—*Author's abstract.*

5120. Illing, V. C., Some factors in oil accumulation: Inst. Petroleum Jour., vol. 25, No. 186, pp. 201–226, London, 1939.

The main purpose of the paper is to consider the influence of texture and buoyancy in the flow of oil and water mixtures through sands and their bearing on oil accumulation. In order to drive an oil column continuously forward in a flowing water stream within a sand, a defi-

nite excess pressure, the forefront pressure, must be exerted within the oil column. This forefront pressure is inversely proportional to the grade size. When an oil-water stream comes in contact with sands of varying coarseness, the low forefront pressure of the coarse sand causes the oil to abandon all further movement in the fine sand and to move only in the coarse. Moreover, when the oil reaches the limit of the coarse sand, it is retained there and cannot enter the fine sand until a sufficient pressure is built up within the oil to attain the forefront pressure of the fine sand. This causes the filtration of the oil at the coarse-fine interface. With regard to directional movement, the function of buoyancy increases the ease of upward oil flushing. An oil-water column in motion must maintain a certain critical concentration. This is less for upward flow than for horizontal or downward flow. Hence, when oil has a choice of alternative paths it selects the most upward one, even though it may mean a movement transverse to the main fluid movement. The result is a differentiation of oil from the main water stream and the production of an oil pool.

The application of this idea to various geological structures is discussed.—*Author's abstract.*

5121. Miser, H. D., Our petroleum supply: Washington Acad. Sci. Jour., vol. 29, No. 3, pp. 93–109, Menasha, Wis., 1939.

The importance of a supply of petroleum for human welfare and progress and the share of the United States in providing this supply are discussed under the following headings: (1) Present production and uses of petroleum in the United States (figures are given); (2) Early development and uses of petroleum (historical outline); (3) Relation of geology to the petroleum industry (the contribution of geologists to the industry); (4) Methods employed by the petroleum geologist (some major developments, such as aerial photography, surface structural mapping, core drilling, microscopic examination, micropaleontology, and geophysical methods of prospecting including electrical logging); (5) Progress of petroleum geology (as clearly shown in many publications of Federal and State Geological Surveys and in the mounting store of geologic data supplied by wells); (6) Contributions of petroleum geology to the general science of geology (contributions concerning such subjects as anticlines, buried hills, salt domes, temperatures at depths, and stratigraphy); (7) Deep drilling and search for petroleum reveal other mineral products (interesting statistics on natural gas, helium, natural carbon dioxide, potash in New Mexico, and sulfur in the coastal areas of Louisiana and Texas); (8) Petroleum reserves of the United States (estimates); (9) Future petroleum supply of the United States (some concrete accomplishments of recent years; possible substitutes for petroleum). Twenty-four references are cited.—*W. A.*

5122. Umbgrove, J. H. F., Rhythms in history of earth: Geol. Mag., vol. 76, No. 897, pp. 116–129, London, 1939.

An attempt is made to trace a rhythmic connection between relative height of sea level and continental elevation, as shown by geological history, and magmatic activity or the reverse, as deduced from radioactive heating. The conclusion is that the various phenomena discussed are probably explained geophysically by the changing condition of the substratum.—*C. A. S., Sci. Abstracts, vol. 42, No. 496, 1939.*

9. NEW BOOKS

5123. Davison, E. H., Field determination of rocks, 87 pp., illus., London, Chapman & Hall, Ltd. Price, 7s. 6d.

Following an introduction on procedure and equipment, subsequent chapters deal with rock-forming minerals, igneous rock in the field, origin and classification of igneous rocks, secondary or sedimentary rocks, and metamorphism. With the help of this book a prospector should be able to determine rock types with sufficient accuracy to enable him to plan his field work to the best advantage.—*W. A.*

5124. Earthquake notes, R. R. Bodle, editor, vol. 10, No. 4, 13 pp., Seismol. Soc. America, Eastern section, Washington, 1939.

This issue contains the following notes: (1) Fourteenth annual meeting, eastern section; (2) Spring meeting, section of seismology, American Geophysical Union; (3) Grand Coulee Dam—not a seismological problem; (4) First-class seismological station for Bogota, Colombia; (5) Seismograph installations in progress; (6) Geophysical research at Johannesburg; (7) Bermuda Seismograph Station; (8) Comprehensive report on earthquakes available; (9) New aid for distance computation; (10) Discontinuities by seismological and electrical-conductivity methods; (11) The 20° discontinuity; (12) International seismological summary; (13) The S-phase between 12° and 28°; (14) St. Louis monthly supplements; (15) Destructive Chile earthquake, January 24, 1939; (16) Geophysics and the Encyclopedia Britannica; (17) Seismology in Philadelphia; (18) Renewed activity at Pittsburgh; (19) Catalog of Pacific Coast earthquakes; (20) Listening program restricted; (21) Ellipticity corrections; (22) Earthquake history of the United States; (23) Vibration-meter named; (24) September 1938 hurricane and microseisms; (25) Correspondence and discussion on Chile earthquake of November 10, 1922; (26) The relation of earthquakes to known geological faults; and (27) Notes of interest.

5125. Geofisica pura e applicata [Pure and applied geophysics] [editorial note]: Terres. Magn. and Atmos. Electr., vol. 44, No. 2, p. 180, Baltimore, Md., 1939.

We are in receipt of the first number of a new journal dealing with pure and applied geophysics, published under the direction of Professor Mario Bossolasco at the Royal Geophysical and Geodetical Institute of Messina, Italy. The numbers of this periodical will not appear at fixed times and not more than one volume, consisting of four numbers and containing a total of about 250 pages, will be issued in 1 year.

The contents of the first number are divided into three sections: original articles, communications and news, and bibliographical notes. The leading article in the issue is entitled, "Distribuzione geografica dell attivita magnetica terrestre" (Geographic distribution of terrestrial magnetism activity), by M. Bossolasco and F. Dalmasso. It is intimated in the preface that articles on any geophysical subject will be published in the new journal. As it is entirely in Italian, it should perform an important service in disseminating geophysical information in Italy.

5126. Gutenberg, Beno, Internal constitution of the earth, 413 pp., 27 figs., New York, McGraw-Hill Book Co., 1939. Price, $5.

The book is edited by Beno Gutenberg and contains the following chapters: (1) Introduction, by B. Gutenberg, pp. 3–10; (2) The origin of the solar system, by Harold Jeffreys, pp. 11–40; (3) Relevant facts and inferences from field geology, by R. A. Daly, pp. 41–70; (4) Elastic properties of materials of the earth's crust, by L. H. Adams, pp. 71–90; (5) The crust of the earth and its relation to the interior, by H. S. Washington; revised by L. H. Adams, pp. 91–124; (6) Observed temperatures in the earth's crust, by C. E. Van Orstrand, pp. 125–152; (7) The cooling of the earth and the temperature in its interior, by B. Gutenberg, pp. 153–164; (8) Forces in the earth's crust, by B. Gutenberg, pp. 165–176; (9) Hypotheses on the development of the earth's crust and their implications, by B. Gutenberg, pp. 177–218; (10) Evidence of the interior of the earth derived from seismic sources, by J. B. Macelwane, pp. 219–290; (11) Evidence from deep-focus earthquakes, by B. Gutenberg and C. F. Richter, pp. 291–300; (12) Structure of the crust—continents and oceans, by B. Gutenberg and C. F. Richter, pp. 301–328; (13) Density, gravity, pressure, and ellipticity in the interior of the earth, by W. D. Lambert, pp. 329–344; (14) The elastic constants in the interior of the earth, by B. Gutenberg, pp. 345–360; (15) Viscosity, strength, and internal friction in the interior of the earth, by B. Gutenberg, pp. 361–384; (16) Summary, by B. Gutenberg, pp. 385–390. An appendix (frequently used constants; units) and an index (both author and subject) follow.

5127. Holtappel, H. W., Tafels van e^x [Tables of e^x], 132 pp., Utrecht, L. E. Bosch & Zoon, 1938.

Tables of e^x and e^{-x} are given from 10 to 25 decimal places. The use of the tables is explained with a few examples.—*W. A.*

5128. Kirsch, Gerhard, Entwurf zu einer Physik der Erdgeschichte [Physical outline of the history of the earth], 152 pp., 43 figs., Leipzig, Verlag Joh. Ambr. Barth, 1938. Price, RM. 16.

The author attempts to build a physical foundation for geology. Contents: Part 1, On the interior of the earth (constitution of the earth, processes in the interior of the earth, nature of the intermediate layers). Part 2, Qualitative geomechanics of the processes near the surface of the earth (continents, seas). Part 3, Quantitative geomechanics (orogenic force, mechanism of pole-wandering, action of the heat of the earth, glacial ages, magma currents, continental displacements, and flowing movements in solid sima). Appendix (sun, moon, and stars).—*W. A.*

5129. Kober, Leopold, Der geologische Aufbau Österreichs [Geologic structure of Austria], 204 pp., 20 figs., 1 table, Vienna, Verlag Julius Springer, 1938. Price, RM 13.50.

Besides giving a geological description, the author discusses geophysical exploration in a chapter on the distribution of earthquakes, gravity anomalies, and magnetism. General lines of the structure of the Ostalpen and of the foreland are shown by five clear tectonograms.—*W. A.*

5130. Lovering, T. S., chairman, Report of the interdivisional committee on borderland fields between geology, physics, and chemistry, 1937; Nat. Research Council, Div. Geology and Geography, 73 pp., Washington, March 1938.

The major purpose of the committee was to stimulate research in borderland fields between chemistry, physics, and geology. The following reports are included in this volume: (1) Fundamental constants of geologic materials (report of the subcommittee on "Fundamental constants of rocks and minerals"), by F. Birch, L. Don Leet, and R. W. Goranson; (2) Deformation and rupture of geologic materials (report of the subcommittee on rock deformation), by M. K. Hubbert, W. H. Bucher, D. T. Griggs, and A. Nadai; (3) Elasticity, gravity, electricity, and magnetism (report of the subcommittee on geophysics), by B. Gutenberg, I. S. Bowen, W. H. Bucher, R. T. Chamberlin, N. H. Heck, W. D. Lambert, F. W. Lee, L. Don Leet, T. S. Lovering, L. B. Slichter, and W. T. Thom; (4) Report of the subcommittee on application of hydrodynamics to problems of geology, by R. A. Daly, H. N. Eaton, D. T. Griggs, N. C. Grover, T. S. Lovering (ex officio), W. C. Lowdermilk, G. T. Rude, and W. W. Rubey (chairman); (5) Heat, by T. S. Lovering; (6) Report of the subcommittee on radioactivity and geology, by K. T. B. Bainbridge, R. A. Daly (chairman), and R. D. Evans; (7) Problems in the thermodynamics of geochemical processes, by G. W. Morey; (8) Chemical effects of differential pressures, by T. S. Lovering; (9) Magmatic emanations, by C. N. Fenner and T. S. Lovering; (10) Subcommittee on colloids, by C. C. Murdock, E. S. Bastin, T. S. Lovering, and W. W. Rubey; (11) The problem of metasomatic replacement, by E. S. Bastin; (12) Simplification of rock analysis, by H. H. Willard; and (13) Analytical investigations of rocks and minerals, by T. S. Lovering.—*W. A.*

5131. Maurain, Charles, Physique du globe [Physics of the globe], 223 pp., 21 figs., 3d ed., Librairie Armand Colin, 103, Blvd. Saint-Michel, Paris, 1937.

Contents by chapters: (1) Form and constitution of the terrestrial crust. (2) Periodical movements of the terrestrial crust; rigidity of the globe. (3) Sudden movements of the terrestrial crust; seismology. (4) Terrestrial magnetism. (5) Terrestrial electricity. Bibliography.

5132. Miller, W. J., Elements of geology, 2d ed., 524 pp., 367 figs., New York, D. Van Nostrand Co., Inc., 1939.

The second edition of this book represents a thorough revision both as to text matter and as to illustrations. It contains the following:

Part 1, Physical geology. Chapters, (1) Introduction, (2) Instability of the earth's crust, (3) Materials of the earth minerals, (4) Materials of the earth rocks, (5) Rock weathering, (6) Structure of the earth's crust, (7) The work of streams, (8) Glaciers and their work, (9) Geological action of wind, (10) The sea and its work, (11) Volcanoes, (12) Subsurface water, (13) Mountains, plateaus, and plains, and (14) Origin and history of lakes.

Part 2, Historical geology. Chapters, (15) General principles, (16) Origin and pregeologic history of the earth, (17) The Archeozoic era, (18) The Proterozoic era, (19) Paleozoic rocks and history, (20) Paleozoic life, (21) Mesozoic rocks and history, (22) Mesozoic life,

(23) Cenozoic rocks and history (excluding the ice age), (24) Quarternary ice age, and (25) Cenozoic life. Appendix (organic evolution). Index.—*W. A.*

5133. Milne, John, Earthquakes and other earth movements, 244 pp., 24 pls. London, Kegan Paul & Co., Ltd., 1939. Price, 10s. 6d. net.

This is a new edition, revised and rewritten by Dr. A. W. Lee. A detailed review of the book is given in Nature, vol. 143, No. 3630, pp. 872–873, May 27, 1939, by R. Stoneley.—*W. A.*

5134. Shaw, H., Applied Geophysics, 102 pp., 10 pls., London, His Majesty's Stationery Office, 1936. Price, 2s. net.

This is the third (revised) edition of the book. It contains a brief survey of the development of apparatus and methods employed in the investigation of subterranean structural conditions and the location of mineral deposits. Photographic pictures of some instruments are given. The author discusses the application of the magnetic, gravitational, seismic, and electrical methods of prospecting.—*W. A.*

5135. Townley, S. D., and Allen, M. W., Descriptive catalog of earthquakes of the Pacific Coast of the United States, 1769 to 1928: Seismol. Soc. America Bull., vol. 29, No. 1, pp. 1–297, Berkeley, Calif., 1939.

Contents: Preface. Introduction (extract from the introduction to Holden's catalog; acknowledgments—McAdie catalog, and remarks concerning compilation from 1907 to 1928). Chapters: (1) Earthquakes in California, 1769 to 1928; (2) Earthquakes in Oregon, 1846 to 1928; (3) Earthquakes in Washington, 1833 to 1928; (4) Earthquakes in Idaho, 1879 to 1928; (5) Earthquakes in Nevada, 1860 to 1928; (6) Earthquakes in Utah, 1872 to 1928; (7) Earthquakes in Arizona, 1850 to 1928.

5136. Wegener, Adolf, Die Entstehung der Kontinente und Ozeane [The origin of the continents and oceans]: Die Wissenschaft, vol. 66, 242 pp., 63 figs., Friedr. Vieweg und Sohn, Braunschweig, 1936.

This is the fifth edition of the book. Contents: (1) Historical notes, (2) The nature of the theory of shifting and its relation to the existing ideas of the changes of the surface of the earth during geological periods, (3) Geodetical arguments, (4) Geophysical arguments, (5) Geological arguments, (6) Paleontological and biological arguments, (7) Paleoclimatic arguments, (8) Fundamental remarks on the shifting of continents and pole movements, (9) The moving forces, (10) Supplementary remarks on the sial sphere, (11) Supplementary remarks on the deep-sea bottoms, and (12) Supplement to chapter 3, Proof of shifting of North America by new measurements of longitude. A list of about 500 tables of articles and books is added.—*W. A.*

10. PATENTS

5137. Apparatus for and method of measuring the terrestrial magnetic field; Victor V. Vacquier, Oakmont, Pa., assignor to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,151,627, issued March 21, 1939.

This invention relates to an apparatus for the absolute measurement on the null principle of the vertical intensity of the terrestrial magnetic field comprising in combination a magnet; supporting means for the magnet constructed and arranged to allow it to tip up and down

but preventing movement thereof in other directions; means for applying a uniform magnetic field in the vicinity of the magnet of intensity sufficient to neutralize substantially the effect of the terrestrial magnetic field on the magnet; means for measuring the intensity of said applied magnetic field; and means for reversing the polarity of the magnet at will. Claims allowed, 5.

5138. Seismic surveying; Benjamin B. Weatherby, Tulsa, Okla., assignor to Geophysical Research Corporation, New York, N. Y., a corporation of New Jersey: U. S. patent 2,151,878, issued March 28, 1939.

This invention relates to the method of seismic surveying by correlation of reflection records produced by detonation of explosive charges in boreholes in an area characterized by a surface layer composed of different types of earth strata, the procedure of which comprises arranging in a borehole in such layer an explosive charge extending into at least two different strata; detonating said charge substantially instantaneously; receiving reflected seismic waves thus produced at plurality of points differently spaced from the mouth of the borehole; and aking records of the waves received at said points. Claims allowed, 2.

5139. Method of prospecting underground ore bodies; Atsushi Matsubara, Kamikyo-ku, Kyoto, Japan: U. S. patent 2,153,636, issued April 11, 1939.

This invention relates to a method of prospecting underground ore bodies, comprising the steps of comparing the back potentials due to the presence of an ore body at different points in the area under investigation by polarising the ore body with an intermittent direct current of a constant intensity flowing through a transportable electrode earthed at various different points on the ground surface in turn and a fixed electrode, and measuring the potential difference between two non-polarisable electrodes, one of which is earthed in the vicinity of the point at which the transmitting, transportable electrode is earthed. Claims allowed, 3.

5140. Method and apparatus for continuous exploration of boreholes; John Jay Jakosky, Los Angeles, Calif.: U. S. patent 2,153,802, issued April 11, 1939.

In the drilling of a borehole with a drilling apparatus comprising a drill stem extending within the borehole and a drill bit at the lower end of said drill stem, the method of exploring the strata traversed by the borehole, which comprises taking a measurement in an electrical circuit including the drill stem, the drill bit as one electrode, another electrode connected to the earth at a position remote from the borehole, and the portion of the earth included electrically between said electrodes; and repeating such measurement to determine variations in an electrical characteristic of said included portion of the earth, with the drill-bit electrode at different depths within the borehole; while maintaining a body of poorly conductive fluid in the borehole and around said drill stem, said other electrode being sufficiently distant from said borehole so that variations in said measurements will be produced by changes in an electrical characteristic of the different portions of the earth included electrically between said electrodes as said drill-bit electrode is moved to different depths in said borehole. Claims allowed, 15.

5141. Seismograph prospecting; Louis W. Gardner, Pittsburgh, Pa., assignor to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,153,920, issued April 11, 1939.

This invention relates to a method for determining subsurface geological structure in regions in which there is at least one buried stratum of known relatively high characteristic speed, which method comprises setting up a source of seismic waves adjacent the surface of the earth so as to cause waves to penetrate downwardly to the high-speed stratum; to intercept the stratum at a first refraction point corresponding to the critical angle at the interface between the high-speed stratum and overlying strata; to follow the top of the high-speed stratum and to be refracted upwards at the critical angle, detecting such refracted waves at a position on the earth, said position having associated therewith a second refraction point on the high-speed stratum corresponding to the critical angle, then setting up another source of waves at a location on the surface of the earth different from the first and lying on the circumference of a circle, the center of which is at an offset position point on the earth directly above the first refraction point and the radius of which is equal to the offset distance between the first source and said offset position point, so that waves are again caused to penetrate downwardly; to intercept the high-speed stratum at substantially the same first refraction point; to follow the top of the high-speed stratum; and to leave upwardly at the critical angle, and detecting waves at a position spaced from said second source and lying in a vertical plane including it and the said common first refraction point, said position having associated therewith another second refraction point, whereby the differential depth between the two second refraction points can be calculated and inferences drawn as to the contour of the high-speed stratum. Claims allowed, 12.

5142. Seismic surveying; Benjamin B. Weatherby, Tulsa, Okla., assignor to Geophysical Research Corporation, New York, N. Y., a corporation of New Jersey: U. S. patent 2,154,548, issued April 18, 1939.

This invention relates to the method of seismic surveying by correlation of reflection records produced by detonation of explosive charges in boreholes in an area characterized by a surface layer of such nature that a charge detonated at some depth or depths in a borehole produces a seismic record which is not correlatable with records obtained by detonating charges in other similar boreholes in that area, the procedure of which consists in successively detonating a plurality of charges at different depths in each borehole; making at each of a plurality of recording stations associated with said boreholes separate records of the seismic waves produced by the detonation of each individual charge; and, for correlation purposes, selecting from the series of records made at the various recording stations a group of records consisting of one record from each recording station having the greatest similarity each to the other. Claim allowed, 1.

5143. Electrical method and apparatus for determining the characteristics of geologic formations; John Jay Jakosky, Los Angeles, Calif., assignor to Schlumberger Well Surveying Corporation, Houston, Tex., a corporation of Delaware: U. S. patent 2,155,133, issued April 18, 1939.

This invention relates to a method for determining the character and thickness of the strata traversed by a drill hole at different depths,

which comprises passing an electrical current through the formation adjacent the drill hole in a direction substantially parallel to the bedding planes of the strata, between two electrodes connected with a measuring circuit; moving one of said electrodes along the drill hole; and measuring the changes in conductivity of the path of said current between said electrodes as said one electrode is moved to different depths. Claims allowed, 14.

5144. Wave record analyzer; Frank Rieber, Los Angeles, Calif., assignor of one-half to Continental Oil Co.: U. S. patent 2,155,507, issued April 25, 1939.

This invention relates to apparatus and methods for analyzing complex waves, and particularly to a form of analyser which is especially adapted for use in connection with the methods described in patent 2,051,153; a wave-record analyser comprising means for driving a trace record; means for driving a phonographic record in fixed space relation to the movement of said trace record; means for simultaneously reproducing a plurality of sound tracks from said phonographic record into a common sound channel, a recording point connected to be driven from said sound channel and positioned to form a trace on said trace record; and means for altering the relative time-phase relationship of the points on the various sound tracks from which reproduction occurs. Claims allowed, 10.

5145. Method for seismic prospecting; Serge Alexander Scherbatskoy, Tulsa, Okla., assignor to Engineering Laboratories, Inc., Tulsa, Okla., a corporation of Oklahoma: U. S. patent 2,156,198, issued April 25, 1939.

This invention relates to the seismic-reflection method, in which the waves reflected from a geologic horizon are used to determine the contour of the said horizon, comprising determining the frequency characterizing waves reflected from the said horizon; arranging a plurality of explosive charges substantially at the same point below the earth's surface; and detonating said charges successively with a frequency substantially equal to the said frequency characterizing the reflected waves. Claims allowed, 3.

5146. Seismic electric prospecting by means of continued waves: Ludwig W. Blau, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,156,259, issued May 2, 1939.

This invention relates to the method of ascertaining anomalies in the earth's substructure, which comprises applying periodic impulses to the earth at a given point; thereby sending waves through the ground; receiving the waves from the ground at a point removed from the sending point; recording a phase characteristic of said received waves at said receiving point; independently recording, at said receiving point, a phase characteristic of additional waves having a constant phase relation with the applied impulses; and observing the phase relation between the received waves and said additional waves. Claims allowed, 10.

5147. Subsurface seismic surveying; Lawrence Y. Faust, Tulsa, Okla., assignor to Geophysical Research Corporation, New York, N. Y., a corporation of New Jersey: U. S. patent 2,156,624, issued May 2, 1939.

This invention relates to the method of seismic surveying by correlation of reflection records produced by detonation of explosive charges in boreholes in an area characterized by a surface layer of such nature

that a charge detonated at some depth or depths in the borehole produces a seismic record which is not correlatable with records obtained by detonating charges in other similar boreholes in that area, the procedure of which consists in making a time-depth graph of the material traversed by a test shot hole; determining the depth in said test shot hole at which an explosive charge produces a high-quality reflection-wave record; establishing the corresponding point on said test-hole time-depth graph; making a time-depth graph of a second shot hole; selecting the point on said second shot-hole time-depth graph having the same traveltime as said point on said test-hole time-depth graph; detonating an explosive charge in said second shot hole at the depth corresponding to said point on said second shot-hole time-depth graph; and making a reflection record on the seismic waves thus produced. Claim allowed, 1.

5148. Method and apparatus for making geological explorations; Harold R. Prescott, Ponca City, Okla., assignor to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2,158,198, issued May 16, 1939.

This invention relates to a method of making geophysical explorations in which earth vibrations are generated, the vibrations and reflections thereof from geological strata are converted into electromotive forces of varying voltages in sympathy with said vibrations and reflections, and said voltages are amplified and recorded, the steps of amplifying voltages below a predetermined value a predetermined amount; amplifying voltages between said predetermined value inversely as a function of the voltage; and amplifying voltages higher than said second predetermined value an amount equal to the amplification voltages of said second predetermined value. Claims allowed, 8.

5149. Apparatus for making gravity measurements; Kenneth Hartley, Houston, Tex., assignor, by mesne assignments, to Humble Oil & Refining Co., Harris County, Tex., a corporation of Texas: U. S. patent 2,159,082, issued May 23, 1939.

This invention relates to a measuring instrument comprising a mass; means indicative of the position of the mass; a spring for exerting a major vertical effort upon said mass; a second spring for exerting an additional minor vertical effort upon said mass to bring the mass to a determinable position; means whereby the effort exerted by the second spring may be determined; means for locking the mass and springs in a zero position; and supporting devices, said devices comprising separate supporting elements for the locking means and the mass and a common member, said supporting elements being joined only at the common member. Claims allowed, 9.

5150. Electrical logging apparatus; Earl Babcock, Duncan, Okla., assignor to Halliburton Oil Well Cementing Co., Duncan, Okla.: U. S. patent 2,159,418, issued May 23, 1939.

This invention relates to an arrangement for electrically logging an oil well or the like, including a cylindrical casing; a pair of electrodes, one mounted on each end of said casing; and electrical devices and an indicating instrument mounted within said casing; the entire electrical apparatus being self-contained and adapted to be lowered into the well as a unit to measure and indicate an electrical property of the formation of the well located between said electrodes. Claim allowed, 1.

5151. Method and apparatus for electrical exploration of the subsurface; John Jay Jakosky, Los Angeles, Calif.: U. S. patent 2,162,086, issued June 13, 1939.

This invention relates to a method of electrical exploration of the subsurface, which comprises passing an electric current through the earth to create a potential difference between two spaced points; taking a measurement involving the combined effects of said created potential difference and the natural earth potential between said points; and taking another measurement involving the natural earth potential between two spaced points which are so positioned that the potential difference therebetween is substantially unaffected by said current and that the natural earth potential therebetween has a known relation to the natural earth potential between the first-mentioned two points. Claims allowed, 16.

5152. Means and method of electrical prospecting; Samuel S. West, Houston, Tex., assignor to Esme E. Rosaire, Houston, Tex.: U. S. patent 2,162,147, issued June 13, 1939.

This invention relates to geophysical exploration by electrical methods and particularly to discovery of subsurface anomalies by the generation and detection of alternating currents in the earth. In an apparatus for geophysical prospecting by measurement of wave-form distortion of an alternating current passing through subterranean media, in combination; means for causing a periodic current to flow in the earth; means for indicating the wave form of the potential difference between points subject to the influence of said current; and means for rejecting the band of frequencies containing noise components, whereby the signal-to-noise ratio is improved. Claims allowed, 17.

5153. Improvements in or relating to magnetic balances for field use; Askania-Werke Aktiengesellschaft vormals Centralwerkstatt Dessau und Carl Bamberg-Friedenau, a joint stock company organized under German law of Kaiseralle 87/88 Berlin-Friedenau, Germany, and of Unruhstrasse 1, Dessau, Germany: British patent, 501,974, issued March 7, 1939.

This invention relates to magnetic balances for field use, having a housing for the magnetic system and having a level for permitting horizontal adjustment built into the housing shell or the heat insulating covering thereof so that it is protected against thermal influences. Claims allowed, 2.

5154. Improvements in or relating to apparatus for investigating the subsoil or substructure and for the location and examination of subterranean deposits; August Ruhl, Jr., of 67 Seltersweg, Giessen, Germany, Dr. Ludwig Machts, Richard Machts, and Bernhard Nickel, all of 92 Weidenhauserstrasse, Marburg-on-the-Lahn, Germany: British patent 502,025, issued March 9, 1939.

This invention relates to a portable device for investigating those properties of the subsoil of the earth's surface which influence an electric alternating field, wherein a transmitter and a receiver-part are structurally combined in one unit, within which the one of the said parts is as a whole rotatable in relation to the other part with all its radiating receptive component parts, respectively, in such a way that it is possible to effect a mutual adjustment to minimum reception, such adjustment being preferably made visible by means of meters. Claims allowed, 19.

5155. Geophysical prospecting method and apparatus, Esme Eugene Rosaire, of Esperson Building, 802 Travis Street, Houston, Tex., U. S. A.: British patent 504,617, issued April 27, 1939.

This invention relates to a method of exploring for or detecting subterranean deposits from which leakage of gas occurs, including the steps of systematically procuring soil samples in a predetermined area; confining the samples against contamination of air in closed containers; transferring the contents of the containers to a receptacle forming part of or communicating with a gas analysing apparatus without permitting access of air to the samples; and analysing the gaseous constituents entrained in the samples. Claims allowed, 11.

5156. Improvements in the determination of variations in the horizontal components of the force of gravity; Bolidens Gruvaktiebolag, a joint stock company of 17, Västra Trädgardsgatan, Stockholm, Sweden: British patent 504,999, issued May 3, 1939.

The present invention relates to a method of determining variations in the horizontal components of the force of gravity by measuring relative deflections of a plumb line; for example, for the purpose of detecting ores, metalliferous deposits, or other subterrestrial localities and determining the extensiveness and width of the same, characterized in that the angle between the plumb suspension wires of two plummets suspended in one and the same apparatus is determined. Claims allowed, 5.

5157. Apparatus for indicating variations in strata penetrated by deep boreholes; Gesellschaft für nautische und tiefbohrtechnische Instrumente m. b. H., a German company, and Dr. Oscar Martienssen, a German citizen, both of 1 Rankestrasse, Kiel, Germany: British patent 505,803, issued May 17, 1939.

This invention relates to apparatus for indicating variations in strata penetrated by deep boreholes and particularly variations in porosity, comprising a bare electrode which is lowered on an insulated cable into a borehole when filled with boring mud or water; a source of direct current of low potential having its positive pole earthed and its negative pole connected with the cable, and means for measuring and registering the intensity of the current in the cable in relation to the depth of the electrode in the borehole. Claims allowed, 3.

5158. Multiple gravity meter; Standard Oil Development Co., Linden, N. J., assignee of Frank G. Boucher, Houston, Tex., both in the U. S. A.: Canadian patent 379,439, issued February 7, 1939.

This invention relates to a gravity meter comprising a weight system, including arms protruding at right angles from a hub and a weight carried by each arm; aligned horizontally disposed tension springs, the adjoining ends of which are secured to the hub, the relation between the springs and the weight arms being such that the whole constitutes an oscillatable system; means for applying tension and torque to the opposite ends of the springs, whereby the weight system is maintained in position by the tension and torque of the springs with one arm substantially horizontal and the other arm extending substantially vertically upwardly to control the period of the weight system, whereby variations in the pull of gravity effect the position of the weight system; and means for indicating the displacement of the system due to gravity. Claims allowed, 18.

5159. Dispositif pour déterminer la perméabilité des terrains [Method for determining permeability of the ground]; Louis Georges Edouard Lefranc, residing in Tunis: French patent 49,349/825,443, issued February 17, 1939.

The present addition to the original patent No. 825443 concerns an improvement in the realization of the method for determining permeability of the ground as described in the original patent. The improvement consists in the utilization of two bags made from caoutchouc or a similar product capable of expansion. The two bags are connected by a tube and after being lowered into the borehole are caused to expand by conducting into them from the surface of the ground compressed fluid by means of a pipe. The hollow space formed between the two bags serves for the reception of the liquid flowing through the walls of the borehole intended for investigation. Claims allowed, 5.

5160. Appareil portatif destiné à la recherche des propriétés du sous-sol de la surface terrestre qui influent sur un champ electrique alternatif [Portable apparatus assigned for investigating, from the surface of the ground, properties of the subsoil by which an electric alternating field is influenced]; Ludwig Machts, Richard Machts, Bernhard Nickel, and August Ruhl, Jr., all residing in Germany: French patent 838,739, issued March 14, 1939.

This invention relates to an apparatus consisting of a transmitter and a receiver, both parts being combined in one portable unit so that the horizontal distance between the transmitter and the receiver remains constant during the measurements. The transmitter and the receiver are arranged so that the one of the said parts is as a whole rotatable in relation to the other part in such a way that it is possible to effect a mutual adjustment to minimum reception. Claims allowed, 19.

5161. Method of working up oscillograms obtained during geophysical prospecting; V. D. Zavialov: Russian patent 53,845, issued September 30, 1938.

This invention relates to a method of working up oscillograms obtained during geophysical prospecting by seismic-reflection waves. It is characterized in that the oscillograms serving for the determination of the direction of the reflected waves are transformed into a form convenient for optical analysis, that is, into the recording of them on a cinema film, similar to the method of the transversal recording of sound. Claim allowed, 1.

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