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GEOPHYSICAL ABSTRACTS 87

JULY–DECEMBER 1936

COMPILED BY

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PREFATORY NOTE

The geophysical section of the United States Bureau of Mines was transferred to the United States Geological Survey July 1, 1936. Prior to that date mimeographed abstracts of geophysical literature had been published monthly, numbered 1 to 86. The present bulletin contains abstracts for the period July to December 1936 and an index of abstracts for the whole year. Under the present plan the abstracts will be issued hereafter in separate chapters, each chapter covering three months and four chapters forming a complete bulletin for the calendar year. The next number, Geophysical Abstracts 88, will therefore cover January, February, and March, 1937, and will appear as Bulletin 895–A.

1. GRAVITATIONAL METHODS

3235. Abakelia, M. S., On the present state of gravimetrical studies in the Caucasus [in Russian]: Problems of Soviet Geology, vol. 6, no. 4, pp. 360–365, Moscow, 1936.

After a brief historical outline of gravimetrical work in the Caucasus since 1829, the author examines the gravimetrical map compiled by him based on the determination of the relative gravity carried out from 1900 to 1934. Two positive zones corresponding to the mountain massifs of the Great Caucasus and Trans-Caucasus are well expressed. Two negative zones, one between Baku-Makhach Kala-Kisliar, etc., and the other through Kurdamir-Tiflis-Sukhum, are also shown.

The zone of positive anomalies in the region of Kurdamir deserves special attention. The maximum values of the anomalies in the Caucasus, calculated according to Faye's reduction, vary between wide limits from 140 to 240 milligals; the negative anomalies amount to −130 milligals (near Baku).—*W. A.*

3236. Arkhangelsky, A. D., and Fedynsky, V. V., Geological results of gravimetric investigations in Central Asia and southwestern Kazakhstan [in Russian]: Acad. sci. U. R. S. S. Bull., Sér. géol., no. 1, pp. 3–33, 1936.

Observations at 679 points on the determination of the force of gravity in Central Asia and southwestern Kazakhstan are summarized in this article. From these data the authors compiled maps of full anomalies as well as of Bouguer's anomalies of the region under consideration,

which are of great interest for the study of the geologic structure of the region connecting Europe with Central Asia. On the basis of the gravity anomalies discussed in the first part of the article the authors in the second part criticise principles of isostasy which fail to explain the peculiar gravimetric phenomena of Central Asia. They propose as another explanation of the anomalies that the areas of low gravity at the surface may overlie matter of low density at depth.—*Authors' abstract, translated by W. A.*

3237. Barton, D. C., Calculation of the cap from torsion-balance data, Hoskins Mound salt dome, Brazoria County, Tex.: Am. Inst. Min. Met. Eng. Tech. Pub. 719, 10 pp., 1936.

The practical results of this survey and of the calculations based on it were that the cap rock was extended 1,000 to 1,500 feet northward and eastward beyond the hitherto surmised portion of its edges, and that the Freeport Sulphur Co. was induced to step out much farther with its exploratory wells than it might have cared to do without these data; and that with a few exploratory wells, it could block out the extent of its sulphur reserves over a large area. The first exploratory well after the completion of the calculations was located 1,000 feet farther north than the company might have cared to locate it otherwise and encountered the cap approximately at the predicted depths. Although the predictions of the depths were not confirmed so closely by subsequent wells on other parts of the dome, all the predictions of depth and quantity of cap have proved well within the accuracy required by the sulphur-mining operations.—*Author's summary.*

3238. Bowie, William, Local densities affect values of gravity: Jour. Geology, vol. 44, no. 4, pp. 510-514, 1936.

Virginia and Maryland, with parts of adjoining States, are included in the present gravimetric study, which shows that the isostatic anomalies are closely related to densities of underlying geological formations in this area. No definite relationship of the anomalies to the topography of the area is found.—*Author's abstract.*

3239. Bullard, E. C., and Jolly, H. P. L., Gravity measurements in Great Britain: Royal Astron. Soc. Monthly Notices, Geophys. Suppl., no. 3, pp. 443–477, April 1936.

A history of gravity observations, with full tables, is given from Kater's in 1817 down to the present day. Gravity anomalies are calculated on Hayford's hypothesis for various depths of compensation. The anomalies increase westward and are partly accounted for by the difference in density between the younger rocks to the southeast and the older to the north and west. To account fully for the anomalies it is necessary to assume that the Paleozoic rocks of the Hebrides are denser than those under the east of England.—*W. A. R., Sci. Abstracts, vol. 39, no. 463, 1936.*

3240. Bullard, E. C., Gravity measurements in East Africa: Royal Soc. London Philos. Trans., ser. A, vol. 235, no. 757, pp. 445–531, 1936.

The paper consists of two parts. Part 1 is entirely concerned with the measurements; part 2 deals with the interpretation of the results.

Measurements of the intensity of gravity at 56 stations in East Africa and at Cape Town are described. The measurements have been made by comparing the periods of pendulums swinging in Africa with those of pendulums swinging in Cambridge, by means of wireless signals.

Ordinary Morse messages were used, and no special transmissions were necessary.

The results of this work and of Professor Kohlschütter's 1899–1900 expedition are discussed. The attraction of the topography of the whole earth and of its compensation at 87 stations in East Africa has been calculated on various hypotheses as to the vertical distribution of the compensation. It is found that the African plateau is closely in isostatic equilibrium with the exception of the Rift Valleys. The Rift Valleys usually show a gravity deficiency. This deficiency can be accounted for if they are the result of compression, but not if they have been formed by tension. The compression theory is discussed in detail.—*Author's summary.*

3241. Gulatee, B. L., Gravity formulas in geology: Indian Acad. Sci. Proc., vol. 3A, pp. 221–235, March 1936.

The more important gravity formulas are discussed from the point of view of the degrees of approximation involved, as well as of the interpretation of the various terms.—*W. A. R., Sci. Abstracts, vol. 39, no. 462, 1936.*

3242. Haalck, H., Der neue statische Schweremesser des Geodätischen Instituts in Potsdam [The new statical gravimeter of the Geodetic Institute in Potsdam]: Zeitschr. Geophysik, vol. 12, no. 1, pp. 1–21, Braunschweig, 1936.

In a series of articles previously published in the Zeitschrift für Geophysik (vol. 7, no. 1/2, 1931; vol. 8, nos. 1 and 5, 1932; vol. 9, no. 1/2, 1933; vol. 11, nos. 1 and 2, 1935) Haalck described the development of the new statical gravimeter. In this article he gives details of the developed instrument manufactured in 1934–35 and used in the summer of 1936. Contents of this article: (*a*) Description of the instrument; (*b*) Examples of measurements; (*c*) Comparison of the results of measurements obtained by statical gravimeter and gravity-pendulum; (*d*) Conclusions regarding the carrying out of surveys.—*W. A.*

3243. Haalck, H., Barometrische Höhenmessung bei statischen Schweremessungen mit Hilfe einer praktischen Form des Luft-Barometers [Barometric altitude measurement with the aid of a practical form of an air barometer during the taking of statical gravity measurements]: Zeitschr. Geophysik, vol. 12, no. 5/6, pp. 249–253, Braunschweig, 1936.

The author describes an air barometer suitable for measuring small differences in air pressure. In making statical gravity measurements the altitudes of the single points of measurement can be measured with this instrument barometrically with sufficient rapidity and an accuracy of ± 0.5 meter.—*Author's abstract, translated by W. A.*

3244. Hopfner, F., Die potentialtheoretischen Grundlagen der Lehre von der Isostasie [Potential-theoretical foundations of isostasy]; Zeitschr. Geophysik, vol. 12, no. 1, pp. 24–29, Braunschweig, 1936.

The author makes some remarks in connection with the objectives and conclusions raised recently concerning mass compensation inside of the earth's crust, based on the distribution of undulations according to Ackerl and Hirvonen.—*Author's abstract, translated by W. A.*

3245. Hopfner, F., Stellungnahme zum vorangehenden Artikel; Potentialtheorie des Schwerefeldes [Opinion taken with regard to the above article on the potential theory of the field of gravity]: Zeitschr. Geophysik, vol. 12, no. 2/3, pp. 66–67, Braunschweig, 1936.

Expresses the view that Jung's arguments discussed in the article above do not approach the essential part of the question. Therefore he recommends a way in which these arguments should be criticised by scientists in order to solve this problem of physical geology.—*W. A.*

3246. Hoskinson, A. J., Gravity survey at Crosbyton, Tex.: Jour. Geology, vol. 43, no. 4, pp. 436–439, 1936.

Because of strong deformations of gravity anomalies in the vicinity of Crosbyton, Tex., which changed within shorter distances more rapidly than in any other area so far tested, a survey was undertaken by the Coast and Geodetic Survey in July 1934 to verify the indications obtained previously by the torsion balance and magnetometer surveys. The new perfected Brown gravity apparatus was used. A brief description of the improvements of the apparatus is given. The positions of the stations, the values of the anomalies, and some other principal facts regarding them are given in a table. The locations of the stations are shown on the sketch of the area.—*W. A.*

3247. Jung, Karl, Bemerkung zur Potentialtheorie des Schwerkraftfeldes [Remark on the potential theory of the field of gravity]: Zeitschr. Geophysik, vol. 12, no. 2/3, pp. 65–66, Braunschweig, 1936.

The author feels that, in applying gravity values reduced according to Prey for determining the figure of the geoid, Laplace's equation of the potential theory cannot be substituted for Poisson's equation.—*Author's abstract, translated by W. A.*

3248. Kazansky, I. A., Attempt of gravimetrical deduction of the deviation of the plumb line [in Russian]: 7th Conference Baltic Geodetic Comm. Trans., no. 7, pp. 3–44, Leningrad, 1936.

According to the author, gravimetry has so far not been much applied in determining the figure of the earth, owing on the one hand to insufficient gravimetric data and on the other to undeveloped methods of calculation. If a suitable method for calculating gravimetric data could be developed, much could be learned about the surface of the geoid.

Two main advantages of the gravimetric method for determining the fundamental characteristics of the geoid are especially mentioned—(1) absoluteness (as the figure of the geoid is obtained with regard to a normal spheroid with its center coinciding with the center of the earth) and (2) possibility of solving the problem for any point, thus obtaining the local figure of the geoid. The present article deals with the practical verification of the gravitational method based on the existing reliable data.—*W. A.*

3249. Laboccetta, L., Dimensions of the earth: R. accad. Lincei Atti, vol. 22, pp. 517–522, Dec. 1, 1935.

The radius of the earth, assumed spherical, is obtained as a function of the sidereal day and the period of oscillation of a meter pendulum at the pole and at the Equator. The analysis is based on the author's concept of proper time. For the actual earth pendulum measurements along a meridian would give the variation of radius with latitude.—*W. S. S., Sci. Abstracts, vol. 39, no. 462, 1936.*

3250. Lejay, Pierre, Nouvelles déterminations de l'intensité de la pesanteur en France [New determinations of the intensity of gravity in France]: Acad. sci. Paris Comptes rendus, vol. 203, no. 1, pp. 13–16, July 6, 1936.

Values of the intensity of gravity measured at 57 new stations are given in a table. Measurements were made with pendulums 42 and 510-bis. The values obtained by the two pendulums agreed well with one another, and the means were taken. The accuracy of the measurements was of the order of 2 milligals.—*W. A.*

3251. Meisser, O., Tabelle der Normalschwere von 47° bis 56° Breite für sehr genaue relative Schweremessungen [Normal gravity table for latitudes from 47° to 56° for very accurate relative gravity measurements]: Zeitschr. Geophysik, vol. 12, no. 2/3, pp. 63–64, Braunschweig, 1936.

A table is given showing the values of normal gravities, according to Helmert's formula, for latitudes from 47° to 56°. The table has proved to be very suitable in making reductions of gravity values which require a great relative accuracy equal to about $\frac{1}{10}$ milligal.—*W. A.*

3252. Mercier, André, Effet d'une erreur d'estimation des densités du sial et du sima dans l'évaluation des anomalies de la pesanteur [Effect of density errors of sial and sima in evaluation of gravity anomalies]: Archives sci. phys. et nat., vol. 18, pp. 21–23, January–February 1936.

The author regards the continents as blocks of sial in hydrostatic equilibrum in sima. Any error in the assumed densities will affect the mean level of contact of sial and sima and the calculated gravity anomaly. It is shown that the difference of the two densities is of prime importance for the value of the anomaly, while the possible range of error is affected rather by the assumed density of the sial. The necessary formulas are given.—*T. L. M., Sci. Abstracts, vol. 39, no. 461, 1936.*

3253. Mikhailov, A., Über die Anwendung der Formel von Stokes und die dabei zu gebrauchende Reduktion der Schwerkraft [On the application of Stokes' formula and the consequent reduction of gravity to be used]: 8te Tagung der Baltischen geodetischen Kommission in Tallin und Tartu in 1935 Verh., pp. 207–231, Helsingfors, 1936.

A translation of K. Jung's abstract, published in Geophys. Berichte (Zeitschr. Geophysik, vol. 12, no. 4, 1936), page 97, reads as follows: "Some arrangements of masses are given in which the gravity anomaly and the surfaces can be calculated. From the examples given it is proved that Stokes' formula shows with sufficient accuracy the relation between the gravity anomaly and the level surface and that it is inadmissible to insert in the Stokes formula the gravity values reduced according to Prey."—*W. A.*

3254. Miller, A. H., and Norman, G. W. H., Gravimetric survey of the Malagash salt deposit, Nova Scotia: Am. Inst. Min. Met. Eng. Tech. Pub. 737, 11 pp., 1936.

Definite gravitational effects, including a distinct and characteristic lowering in gravity, were observed in the area over the deposit. In the square mile that was surveyed one other region of low gravity was discovered. The question as to whether or not it also contains a buried deposit of salt, in commercial quantities, remains unsettled. A traverse with magnetometers across the deposit showed only small anomalies, and these were not confined entirely to the section over the deposit.—*Mining and Metallurgy, vol. 18, no. 357, 1936.*

3255. Milne, E. A., Inverse-square law of gravitation: Royal Soc. London Proc., vol. 156 A, pp. 62–85, 1936.

The problem of "local" gravitation is investigated by kinematic methods. By forming a condensation in the substratum or smoothed-out universe it is shown that the acceleration of a free particle may be dissected into two components, one due to the substratum alone and the other associated with the departure of the system from homogeneity. It is shown that the latter component, for a particle in the vicinity of a condensation, is inversely proportional to the square of its distance from the nucleus of the condensation, with a constant of proportionality identical with that which emerged in a previous study of accelerations due to the substratum alone. No appeal is made, in the deduction, to any specific theory of gravitation, or to the supposed existence of any universal constant of gravitation. The inference is that the phenomenon of gravitation does not depend on the micro- or macro-structural properties of matter but is an inevitable element in the motions which particles undergo in one another's presence if they are to be consistently observed by observers in a universe satisfying Mach's principle. Miscellaneous consequences are briefly considered.—*Author's abstract.*

3256. Nikiforov, P. M., The problem of isostasy [in Russian]: 7th Conference Baltic Geodetic Comm. Trans., no. 7, pp. 53–60, Leningrad, 1936.

A critical discussion in which Nikiforov attacks some of the present hypotheses of isostasy (Pratt, Airy, Dutton, Hayford, Bowie, etc.). The author's remarks are summarized as follows:

1. Any connection between the external gravitational field of the earth and the distribution of masses inside the crust cannot be established by geodetic data alone.

2. In about one-half of the area, for which data on gravity at the surface of the earth are available, considerable deviations are found from the postulates basic to present theories of isostasy.

3. If the principle of isostasy is taken as foundation, gravity anomalies lead to incorrect conclusions about vertical epeirogenetic movements in many localities.

4. Attempts to explain the isostatic raising and sinking of the earth's crust by applying the process of metamorphic transformations of minerals ignore thermodynamic principles.

5. The existence of earthquakes with depths of focus equal to about 400 kilometers contradicts the idea of a sima layer of tenacious liquid with hydrostatic distribution of pressures.

The author concludes that the principle of isostasy cannot be accepted as a geophysical conception—that is, as a theory of the internal structure and physical conditions of the earth's crust.—*W. A.*

3257. Ochapowski, B. L., Schweremessungen mittels Pendeln, ausgeführt auf dem Pamir und in Karelien in den Jahren 1932 und 1933; Mushketov, D., Geologische Erwägungen zu den neuen Schweremessungen auf dem Pamir und in Karelien [Gravity measurement by pendulums carried out on the Pamir and in Karelia in 1932 and 1933; Geologic considerations in connection with the new gravity measurements in the Pamir and in Karelia]: Beitr. angew. Physik, vol. 5, no. 4, pp. 451–479, Leipzig, 1936.

The authors give a detailed description of the gravimetric observations made by Ochapowski with the Lenox-Cunningham pendulum apparatus of the Cambridge Instrumental Co. in the region of Pamir, in Ferghana, and in Karelia. The map of Ferghana-Pamir gives isanomalies of gravity

with air reduction according to Fay, and one map of Karelia gives the same information; another map of Karelia shows the corrections by Bouguer.

Some previous values, especially the very large anomalies observed by Zalesski in Central Asia, are proved to be erronous; the reasons for the errors are discussed. A precise determination of the height of the pendulum station above sea level is essential. The parallelism of the topographic relief and of $g_0-\delta$ is shown in a figure.

The principal conclusions drawn by Mushketov are:

For Asia: 1. From the geologic data the conclusion is drawn that the Pamir-Alay mountain system has a large recent epeirogenetic rising; this is confirmed by the region of negative anomalies (to −200 milligals), which extends from India to Kazakhstan.

2. The depression of Ferghana is a part of this negative region which is not isostatically compensated.

3. The East Pamir and Serindia have positive anomalies; therefore they are in a state of recent sinking.

4. All anomalies have a regional significance and do not correspond to the geologic surface map or to the Alpine or Hercynian tectonics.

For Karelia: 1. The anomalies have also a regional character.

2. The border between the negative and positive values corresponds to the null line bordering the large epeirogenetic rise of Fennoscandia.

For Pamir and Karelia: The distribution of the seismic epicenters agrees approximately with the rising tectonic zones.—*Author's abstract.*

3258. Passarge, H., Flattening and mass of the earth: Gerlands Beitr. Geophysik, vol. 48, no. 1, pp. 81–83, Leipzig, 1936.

The fundamental idea is that the mass of the earth rotating and traveling around the sun is greater than that of a similar fictitious earth that only rotates but is otherwise fixed in space; if gravity of the former is g, that of the latter is $G=g(86144/86400)^2$, while $g-G$ would be gravity on a second fictitious earth which traveled round the sun without rotating. Hence, regarding the acceleration of gravity as a state of motion rather than as due to attraction of masses, it is deduced that the apparent rotation of the earth only affects the lithosphere, the original rotation and that which affects the core being in the opposite direction; the axes of the two rotations are slightly inclined to each other, and the flattening only affects the lithosphere, the amount of which is deduced as $(1-g_0/g_{90})$ $(1-L^3\delta\sqrt[3]{\Delta/\delta/M}$, where M is the mass of the earth, L the reduced pendulum length for sidereal time, and Δ, δ the mean densities of the earth and lithosphere respectively. Friction between the oppositely rotating core and lithosphere accounts for terrestrial electricity and magnetism.—*C. A. S., Sci. Abstracts, vol. 39, no. 465, 1936.*

3259. Patzke, Werner, Untersuchungen über die Genauigkeit von Pendelmessungen an fester Station [Investigations on the accuracy of pendulum measurements at a fixed station]: Zeitschr. Geophysik, vol. 12, no. 5/6, pp. 253–268, Braunschweig, 1936.

In the first part of this article the author determines the accuracy of pendulum measurements attained at the Göttingen base station in 1935. The accuracy of the time data for the period of measurements, from September to December 1935, obtained with the time-measuring devices used could be attained at 4×10^{-7} in 93 percent of all the measurements; the error in gravity measurement corresponding to this figure is equal to 0.8 milligal. This error could not be reduced by increasing the accuracy of observation.

Part 2 gives the experimental investigations by which the causes of the pendulum jumps are explained. Changes of the magnetic moments of the invar-pendulum cannot be accepted as an explanation of pendulum jumps. The irregular pendulum jumps are rather caused, as it seems, by the changes in the contacts with the knife edges. When dry friction was eliminated by oiling the pendulum tables the variations in the period of oscillation were reduced (increase of the internal accuracy of pendulums).—*Author's abstract, translated by W. A.*

3260. Die Verwendung von "Askania" Feld- und Drehwaagen [Application of "Ascania" field balances and torsion balances] [editorial note]: Petroleum, vol. 32, no. 39, pp. 9–12, Berlin, 1936.

The fundamental principles and the development of Eötvös' torsion balances and of Schmidt's magnetic field balances are briefly described. Schematic designs and photographic pictures of the balances are added.—*W. A.*

3261. Schleusener, A., Die Leistungsfähigkeit des Thyssen-Gravimeters bei Messungen an Salzdomen, Antiklinalen, u. s. w. [Productivity of Thyssen gravimeter in surveying salt domes, anticlines, etc.]: Öl und Kohle, vol. 12, no. 18, pp. 381–384, 1936.

The high accuracy and reliability of the Thyssen gravimeter has been discussed in previous papers. The mean error in making regional measurements was established to be about ±0.25 to ±0.3 milligal. In making detailed surveys the accuracy attained was even ±0.2 milligal or less. The increased accuracy made it possible to use this instrument for field work and, owing to its simple operation, to increase the number of stations measured in one day. In measurements made around the Benthe salt dome, near Hannover, where 26 stations were measured twice during 2 days, working 8 hours a day, the mean error was less than ±0. 02 milligal. The isogams drawn from these 26 points are shown in a figure. To obtain better results more stations (probably from 100 to 200) are required. Four profiles across the salt dome are shown in figures. Three of them disclose the abrupt change above the edge of the salt dome. One of the profiles does not cross the salt dome but still shows a small decrease in gravity.

Regional measurements have been made in Hannover, Braunschweig, and Schleswig-Holstein.—*W. A.*

3262. Schleusener, A., Über die Reproduzierbarkeit von Messungen mit Thyssen-gravimetern [On the possibility of reproducing the measurements made with the Thyssen gravimeters]: Beitr. angew. Physik, vol. 6, no. 1, pp. 1–6, Leipzig, 1936.

In a previous article (Das Thyssengravimeter; see Geophys. Abstracts 83) Schleusener has shown that apparently accurate measurements made with pendulums may be incorrect to the extent of many milligals. Consequently all measurements made with the Thyssen gravimeter were repeated at least once. From 80 measurements, for example, of which 68 were repeated once, the difference in the mean value amounted only to ±0.25 milligal and less. The remaining 22 points were repeated twice, and in these the mean error (M. E.) amounted to ±0.22 milligal. The mean error of the measurements on 68 points repeated once was equal to ±0.15 milligal. With 400 set-ups of the apparatus 200 gravity differences were measured at 90 points, and only one measurement was rejected. The largest deviations more than 0.5 milligal amounted to 0.7, 0.64, 0.60, 0.55, 0.54, 0.52 milligal. The average distance between the

stations was 1 kilometer. The figures show that measurements made with the same apparatus produce the same results. It is further shown that the same results were obtained by different apparatus used at the same points. To prove this the gravity differences at six points were measured against a base point three times with apparatuses nos. 8 and 11. The results are given in a table. The mean errors obtained were ± 0.2 and ± 0.25 respectively.

The accuracy of the measurements made by the gravimeter was increased within 1 year from about M. E. $= \pm 1$ milligal to M. E. $= \pm 0.25$ milligal, and it is probable that in the near future it will be possible to make measurements with a mean error equal to only ± 0.1 milligal.—*Author's abstract.*

3263. von Thyssen, Stephan, Über die Überbrückung von grosseren Entfernungen durch das Thyssengravimeter [On the spanning of greater distances by the Thyssen gravimeter]: Beitr. angew. Physik, vol. 6, no. 1, pp. 7–13, Leipzig, 1936.

More than 800 gravimetric points were measured to December 1935 in connection with the geophysical survey of the Reich; among them were 35 stations of the first order. Measurements with distances between stations over 50 kilometers were made with the average error of the single measurements not exceeding ± 0.6 milligal. Hannover was connected with Potsdam by measurements made through Gifthorn-Magdeburg over distances of several hundred kilometers. The average error of the results was less than ± 0.5 milligal for distances between the stations of about 100 kilometers. The relation of the distances between the stations to the mean error of the gravimeter measurements is shown, based on the material collected from more than 1,000 independent stations.—*Author's abstract, translated by W. A.*

3264. Tsuboi, Chuji, and Fuchida, Takata, Supplementary notes on the most suitable formula for the Japanese gravity values: Tokyo Imp. Univ., Earthquake Research Inst., Bull. 3, pp. 555–557, September 1936.

In a former paper (Earthquake Research Inst. Bull., vol. 11, no. 4, 1934; Geophys. Abstracts 59) Tsuboi derived by approximate calculation the most suitable formula for the Japanese gravity values. In this paper the authors give the following new formula, based on Helmert's method of condensation reduction:

$$\gamma = 977.998\ (1 + 0.005538 \sin^2 \varphi)$$

The probable errors of the constants in the formula are ± 0.019 and ± 0.000053 respectively. The ellipticity of the geoid that corresponds to this gravity formula is $1{:}319.5 \pm 5.4$.

The fact still remains that the ellipticity of the actual geoid in Japan is considerably smaller than that of the normal one determined from the world-wide gravity determination.—*W. A.*

2. MAGNETIC METHODS

3265. Babienko, D. V., Magnetic anomalies of South Ukraine as a basis of the problem of the great Krivoy Rog [in Ukrainian]: Wiss.-tech. Mitt., no. 3, pp. 8–25, 1935.

Eleven anomalous zones extending meridionally are considered.—*W. A.*

3266. Bahnemann, Fritz, Eine Erweiterung des Einzelpol-Verfahrens [An extension of the single-pole method]: Beitr. angew. Physik, vol. 6, no. 1, pp. 14–24, Leipzig, 1936.

The so-called single-pole method as advanced by Nippoldt for the interpretation of magnetic anomalies is extended to the case of a line. This helps to solve some geologic problems (dikes, etc.) which are difficult to treat by the single-pole scheme. The application of the line method to a practical case is just as easy as that of the single-pole method. An example of abnormal magnetization is treated accordingly.—*Author's abstract.*

3267. Bartels, J., The eccentric dipole approximating the earth's magnetic field: Terrestrial Magnetism and Atmospheric Electricity, vol. 41, no. 3, pp. 225–250, Baltimore, September 1936.

The magnetic dipole, situated at the earth's geometric center O, and whose magnetic field furnishes the best approximation to the observed field of the earth for the year 1922, has an axis alined along the direction from a point A (near the geographic south pole) to the antipodal point B on the earth's surface, with B situated in latitude 78.5° north and longitude 291.2° east. The strength of the dipole is 8.1×10^{25} Gauss cm^3, yielding a maximal horizontal intensity of 0.315 Gauss at the earth's surface.

If the observed field is to be approximated by that of a magnetic dipole not necessarily situated at the earth's center, the best approximation (in a sense to be defined) is furnished by a dipole of the same strength as before and with an axis parallel to AB, the dipole being situated at a point C (magnetic center) 342 kilometers distant from the earth's center O and in a direction toward a point C' in latitude 6.5° north and longitude 161.8° east. The field of this eccentric dipole is computed by formulas similar to those given by Adolf Schmidt, expressed in tables and charts, and discussed.

The approximation of the observed earth's magnetic field furnished by the eccentric dipole is compared with that furnished by the geometrically centered dipole (uniform magnetization) by discussing the differences, or regional anomalies. The improvement in the approximation due to the shift of the dipole from the geometric center O to the magnetic center C is hardly noticeable for the field in the Northern Hemisphere, but quite distinct in the Southern Hemisphere.—*Author's abstract.*

3268. Bronstein, K. G., and Babienko, D. V., Magnetic anomalies in the central and southern parts of European U. S. S. R. [in Russian]: Soc. naturalistes Moscou Bul., new ser., vol. 43, Sec. geology, no. 13, pp. 264–270, 1935.

A brief description of magnetic anomalies in the Ukraine and in the central part of the European U. S. S. R. is given. The tendency of these anomalies to extend to the north and south is mentioned. The paper contains a map of magnetic anomalies of the Kursk and the Ukrainian magnetic anomalies.—*W. A.*

3269. Davis, C. W., Geological significance of magnetic properties of minerals: Econ. Geology, vol. 30, no. 6, pp. 655–662, 1936.

1. Lodestones are of variable composition, and the manner and degree of their magnetization is accidental; hence their actual magnetic properties show little relation to their present state of magnetization ("residual remanence").

2. Many natural and artificial magnetites, if their coercive forces and remanences are sufficiently great, will, after magnetization, simulate lodestones.

3. Ferric oxides formed by regulated dehydration of gamma ferric-oxide hydrate, exemplified by lepidocrocite, are strongly ferromagnetic and have high coercive force and remanence, while alpha ferric-oxide hydrate, of which goethite is representative, forms ordinary ferric oxide on dehydration.

4. The diagnostic possibilities of magnetites for ore genesis are discussed, evidence being given to show that new methods and apparatus for the determination of magnetic properties of mineral powders and a new interpretation of the nature of the magnetism of minerals should provide an impetus to investigations seeking to establish a relationship between the magnetic properties of minerals and the geological occurrence of their ores.—*Author's summary.*

3270. Fanselau, G., Über den Einfluss der mitschwingenden Luft bei den magnetischen Schwingungsbeobachtungen [On the influence of the co-oscillating air during the magnetic observations of oscillation]: Zeitschr. Geophysik, vol. 12, no. 2/3, pp. 58–63, Braunschweig, 1936.

Measurements made at the magnetic observatory in Potsdam had shown that the influence of co-oscillating air cannot be neglected during the magnetic oscillations. Errors calculated in this article as examples are much greater than the attainable accuracy of measurement.—*Author's abstract, translated by W. A.*

3271. Fanselau, G., Über Messungen mit dem Quarzfaden-horizontal-intensitätsmagnetometer von La Cour in Potsdam, Seddin und Niemeck [On the measurements with the La Cour quartz-fiber horizontal-intensity magnetometer in Potsdam, Seddin, and Niemeck]: Zeitschr. Geophysik, vol. 12, no. 4, pp. 192–197, Braunschweig, 1936.

Relative measurements of the horizontal intensity of the earth magnetic field made with the new quartz horizontal-force magnetometer nos. 3, 5, and 7, constructed by La Cour are summarized in two tables. The instrument is considered very practical and reliable. The average period of one measurement was 25 minutes and the accuracy $\pm 1\gamma$. The method of taking measurements is considerably simpler.—*W. A.*

3272. Fisher, James, and Service, J. H., Maximum sensitivity setting of the dip needle: Terrestrial Magnetism and Atmospheric Electricity, vol. 41, no. 2, pp. 137–142, Baltimore, June 1936.

Neglecting pivot friction and air resistance, the authors set up the equilibrium equation of moments for the common Gurley dip needle. By differentiation of this equation, expressions are obtained that give the best setting of the needle in any given area. In order to apply these expressions in a given area, it is necessary to know the normal inclination in the area and the approximate ratio of probable percentage increase in intensity to probable degrees increase in inclination. Graphs are given showing (1) variation of sensitivity with setting for various values of the above ratio and (2) variation of best setting with changes in the value of this ratio.—*Authors' abstract.*

3273. Fleming, J. A., Intercomparisons of magnetic standards and control of standards, 5 pp., Internat. Assoc. Terrestrial Magnetism and Electricity, Edinburgh assembly, September 1936.

The necessity of accurate determinations of possible systematic errors and corrections for the standard instruments at different observatories is emphasized. Experience has indicated that contact of observers is helpful in ironing out difficulties and differences of procedure and is at the same time of mutual stimulating value in the interchange of ideas. Significant differences of the three magnetic elements found at individual observing piers are described.

A copy of the standard instructions for intercomparisons of magnetic instruments is added to this article. These instructions, entitled "Procedure of Department of Terrestrial Magnetism, Carnegie Institution of Washington, for intercomparisons of magnetic instruments and standards at observatory or field stations", contain the following items: (1) Preliminary, (2) stations, (3) exchange of stations and simultaneity of observations, (4) observations, (5) miscellaneous remarks.—*W. A.*

3274. Forberger, Karl, Magnetische Bodenforschungen im Ausseralpinen Wiener Becken und am Alpenrand bei Wien [Magnetic prospecting in the outer Alpine Vienna Basin and on the border of the Alps near Vienna]: Bohrtech. Zeitung, vol. 54, no. 4, pp. 75–78, Wien, 1936.

This is a detailed summary of Forberger's work issued by the Oesterreichische Petroleum Institut, as Publication 4, 1935, available from the Kommission des Verlages für Fachliteratur Gesell. m. b. H., Vienna, price 6 schillings. (See also Geophys. Abstracts 84, p. 1786.) Maps are added showing (1) magnetic disturbance-profiles through the region of the survey south of the Danube; (2) sketch of the geological conditions of the region surveyed; (3) magnetic disturbance-profiles of the region of the survey north of the Danube; (4) course of isanomalies of two profiles of the outer Alpine Vienna Basin.—*W. A.*

3275. Haalck, H., Über eine neue physikalische Erklärung der Ursache des Erd- und Sonnenmagnetismus und des luftelektrischen Vertikalstromes [On a new physical explanation of the cause of earth's and sun's magnetism and of the air-electrical vertical current]; Zeitschr. Geophysik., vol. 12, no. 2/3, Braunschweig, 1936.

Considering the electrostatic forces existing between the ions and the free electrons in an ionized solid mass, the author shows that in a mass exposed to a very high pressure a certain division of the charge must occur if this mass contains a pressure gradient; an excess of positive charge is observed in the parts of higher pressure and a negative charge in the zones of lower pressure. The rotation of such a mass produces a magnetic field, which corresponds qualitatively and quantitatively to the magnetic field measured on this mass (by applying to the earth and the sun the mathematical relations resulting from the theory). It is then shown that the cause of the air-electrical vertical current can also be satisfactorily explained by the developed theory.—*Author's abstract, translated by W. A.*

3276. Jenny, W. P., Micromagnetic surveys: Oil Weekly, vol. 81, no. 7, pp. 23–32, 1936.

Recent improvements of the magnetic method are discussed as follows:

1. The magnetometer has been greatly improved.

2. The field technique has been improved to such a point that it is now possible to measure the magnetic field with an accuracy of plus or minus 2 gammas as compared with the average accuracy in former years ranging from plus or minus 10 gammas to plus or minus 25 gammas.

3. The basic assumptions for the interpretation of magnetic anomalies have been changed completely. In former years it was thought that all magnetic anomalies were caused by the basement or shallow igneous rocks. Today it is known that there exists sufficient difference in the magnetic susceptibility within the sedimentary columns to produce noticeable magnetic anomalies above structures of commercial interest.

The author shows the results of a number of successful magnetic surveys carried out in recent years in the Gulf coast region, as follows:

Figure 1. Semiregional magnetic picture of Buckeye field, Matagorda County, Tex.

Figure 2. Magnetic profile for Fannett dome, Jefferson County, Tex. (data from magnetic isogam map published by E. G. Nicar)

Figure 3. Magnetic map of Kittrell area, Houston County, Tex.

Figure 4. A north-south micromagnetic profile across a torsion-balance prospect in the Gulf coast.

Figure 5. Micromagnetic isogams on another torsion-balance prospect in the Gulf coast.

Figure 6. Two micromagnetic profiles across the northern extension of the Anahuac field, Chambers County, Tex.

Figure 7. The results of a preliminary survey of the western portion of the Amelia structure, Jefferson County, Tex.

Figure 8. Comparison of a magnetic profile with the top of the hockleyensis zone on a north-south cross section through the New Waverly area, Walker County, Tex.

The facts presented offer conclusive proof that Gulf coast structural features can be outlined and quantitatively interpreted by the micromagnetic method.—*W. A.*

3277. Joyce, J. W., A manual of geophysical prospecting with the magnetometer: U. S. Bur. Mines MS. Rept. 2, 87 pp., 1936.

This manual on magnetic prospecting with the Schmidt magnetometer is presented with the following objects:

1. To familiarize the reader with the fundamental principles that underlie the operation of the Schmidt magnetometer.

2. To describe the physical features of the Schmidt magnetometer.

3. To discuss various factors that influence observations.

4. To indicate corrections to be applied to field data.

5. To enumerate the precautions to be observed in the handling and use of the instrument.

6. To describe field procedure in operating the instrument.

7. To cover possible sources of difficulty in operation and their remedy.

8. To indicate methods of determining instrument constants.

9. To describe various methods of presenting magnetometer results.

10. To outline certain fundamental ideas that underlie the interpretation of magnetic data.

The author concludes: "Emphasis again is placed on the fact that while in general certain fundamental rules governing the technique of interpretation may be formulated, they are of value only so far as their limitations are recognized and their discreet use is supplemented by ample experience and due recognition of all of the known geological and physical factors involved. Finally, all solutions and predictions based on geophysical data must of necessity be possible and plausible geologically."

The manual contains 63 illustrations.—*W. A.*

3278. Keys, D. A., A magnetic survey of the Ivry ilmenite deposit: Am. Inst. Min. Met. Eng. Contr. 102, 7 pp., 1936.

Results of a survey using a vertical magnetic variometer over a deposit of ilmenite in Terrebonne County, Quebec, are given. Photomicrographs of thin sections of the ilmenite and of the country rock, anorthosite, show that the ore is entirely free from magnetite. Magnetic anomalies were taken along north-south and east-west traverses and sometimes amounted to over 7,000 gammas. On the surface of exposed ore in the main pit from which ore had been mined the vertical anomaly was about 2,250 gammas. The position of the ore was deduced by plotting the anomalies along the respective traverses. Indications were that the ore occurs in pods rather than in veins. Maps of the area surveyed and of the anomalies found are given.

An estimate of the approximate depth of the ore in the pit was made from the measured anomaly on the surface and at a point 14.4 feet above the surface. The value of 93 feet thus deduced is not inconsistent with the geological observations.

3279. Krahmann, R., Magnetometrische Untersuchungen am Witwatersrand [Magnetometric investigations on the Witwatersrand]: Glückauf, vol. 72, no. 23, p. 569, Essen, 1936.

This is a summary by H. Reich of a lecture delivered by Krahmann at the meeting of the German Geological Society, held on May 6, 1936. Krahmann reported on the important results obtained by him from the magnetic surveys in the Witwatersrand gold region. A great number of maps and tables were presented. Nine zones of magnetic deposits (magnetite-slate) were established, and the distance of these magnetic zones from the main reef determined. The region to the west of the Rand was investigated by tracing systematic profiles. The correctness of the interpretations made by geophysical and geologic studies was proved by boring.—*W. A.*

3280. Krahmann, Rudolf, The geophysical magnetometric investigations in west Witwatersrand areas between Randfontein and Potchefstroom, Transvaal: Chem., Met., and Min. Soc. South Africa Jour., vol. 36, no. 9, pp. 247–279, Johannesburg, 1936; Geol. Soc. South Africa Trans., vol. 39, pp. 1–44, 1936.

This paper deals with the magnetometric prospecting carried out on the southwesterly extension of the Witwatersrand gold fields. The author attempts to prove the extension of these gold fields to the southwest.

Preliminary experiments were carried out on two traverse lines. On these two profiles practically all strata of the Lower Witwatersrand system outcrop in normal succession, so that the five major magnetic anomalies of the vertical component of the earth's magnetic field recognized there could be directly lined up to the beds causing them.

The experiments demonstrated that the magnetic mapping of many of the formations of this system is a practical possibility even in areas where the formations lie under deep cover.

The principal magnetic anomalies in the Lower Witwatersrand system were determined and are described in a table.

Ad. Schmidt's magnetic field balances (nos. 98583 and 116996) built by the Askania Werke in 1930 and 1932 were used.

Several theoretic curves based on geologic and geophysical work are shown in figures. By constructing curves for every magnetic bed of the Lower Witwatersrand system the author tried to establish from the variation of the vertical magnetic intensity on the surface, as recorded by the magnetic field balance, the true position of the bodies and, if possible, their dip.

Methods of calculation and interpretation are discussed. Eight completed boreholes and nine boreholes now being drilled were located by means of magnetometric investigations, and the results obtained in the completed holes are described. In view of these results the author states that the magnetometric method used in close cooperation with geologic investigations has demonstrated the practicability of tracing the main reef series.—*W. A.*

3281. Krahmann, Rudolf, The geophysical magnetometric investigations on west Witwatersrand areas between Randfontein and Potchefstroom, Transvaal: Chem., Met., and Min. Soc. South Africa Jour., vol. 36, no. 10, pp. 303–310, Johannesburg, 1936.

This is a discussion of Krahmann's paper of the same title published in volume 36, no. 9, pages 247–279, 1936. (See abstract 3280.)—*W. A.*

3282. Logachev, A. A., Experimental magnetic survey from an airplane [in Russian]: Razvedka Nedr, no. 17, pp. 40–41, Moscow, 1936.

Gives a brief description of the apparatus developed by the author, which consists of an induction coil with a bi-plate collector and brushes on a rotary bridge and is assigned for measuring the relative value of the vertical component of the terrestrial field.

The results of the survey conducted over a known magnetic anomaly from an altitude of about 300 meters along the Novgorod-Valday line are represented in two profiles (both ways). The two profiles are compared with that carried out on the ground with Schmidt's balance. The anomaly was determined very distinctly on all three profiles.

The author concludes that the measurement from an airplane of magnetic anomalies having an intensity over 1,000γ is possible with the apparatus developed by him.—*W. A.*

3283. MacCarthy, G. R., Magnetic anomalies and geologic structures of the Carolina Coastal Plain: Jour. Geology, vol. 44, no. 3, pp. 396–406, April–May 1936.

Reconnaissance magnetometer work has shown that several striking anomalies exist in the Carolina Coastal Plain and that many of these anomalies may be correlated with the structural features of the basement rocks. Northeast-southwest structural trends have been observed, further evidence in favor of a northwest-southeast upwarp in the neighborhood of Wilmington has been obtained, and a concealed Triassic basin has been partly outlined.—*Author's abstract.*

3284. McNish, A. G., A new type of vertical-intensity induction variometer: Terrestrial Magnetism and Atmospheric Electricity, vol. 41, no. 2, pp. 101–172, Baltimore, June 1936.

A new type of vertical-intensity induction variometer is described. Extensive tests reveal that it is free from the faults inherent in the older style balance-type instruments. The theory of its operation and other possible applications are discussed.—*Author's abstract.*

3285. McNish, A. G., The new C. I. W. vertical-intensity induction variometer, 3 pp., Internat. Assoc. Terrestrial Magnetism and Electricity, Edinburgh assembly, September 1936.

Rapid advances accomplished in the development of ferromagnetic alloys have permitted the design and operation of a new type of variometer for measuring changes in the vertical component of the earth's magnetic field. This new variometer, developed by the Carnegie Institution of Washington, Department of Terrestrial Magnetism, diverts the vertical intensity into a horizontal direction so that measurements may be made by means of a magnet system suspended by a vertical quartz fiber. Effect of variations in the normally horizontal component of the earth's field is completely eliminated by the design, and hysteresis effects are negligible, owing to the characteristics of the ferro-magnetic alloy used. Operation of the new instrument for nearly a year has proved its eminent superiority over the common types of vertical intensity balances.—*Author's abstract.*

3286. Miliaev, N. A., and Boldyrev, N. P., Magnetic survey of the Chukchee Peninsula [in Russian]: Arctic Inst. Trans., vol. 39, Geophysics, pp. 114–123, Leningrad, 1936.

The authors describe the magnetic survey carried out by them during 1933–34 on the Chukchee Peninsula, near the village of Uelen. An area of about 400 square kilometers was surveyed. Data were collected from 139 stations. The results of the survey are shown in a table and maps of magnetic isolines.—*W. A.*

3287. A valuable contribution to Klerksdorp geology [editorial note]: Min. and Ind. Mag. Southern Africa, vol. 22, no. 11, pp. 649–651, Johannesburg, 1936.

This is an extract from Dr. P. F. W. Beetz's review of the history of the exploration work of Western Reefs for 1933–36, which he read at the meeting of the Geological Society of South Africa June 23, 1936.

Concerning the geophysical survey only the magnetometric method has been used on Western Reefs areas to reveal the structure of the ground by tracing outcrops and suboutcrops of magnetic shales in the Witwatersrand beds; magnetic lavas in the Ventersdorp system; magnetic shale bands in the Dolomite; ultrabasic dikes and fissures; and certain faults.

In discussing the usefulness of magnetometric methods in the Klerksdorp district the author writes:

"The solution of two problems of economic importance is dependent upon the tracing of the footwall shale and the Jeppestown shale anomalies east of the Buffetsdoorn fault and under the cover of Ventersdorp beds west of Klerksdorp; these problems are to find the suboutcrop of the continuation of the Buffetsdoorn and of the Afrikaner Reefs respectively and to establish the possible suboutcrop of the Main Reef series.

"The downthrow of 2,500 feet on the southeast side of the Buffetsdoorn fault and the rapid increase in the thickness of the Ventersdorp beds connected with the frequent faulting west of Klersdorp has proved

a formidable impediment to the magnetometric survey. The anomalies in the said areas become very faint on account of the great thickness of the covering formations and those of the Jeppestown, and the footwall shale. Only an approximate idea of the suboutcrops of these shale bands could be got, and the interpretation of the anomalies and their dip became very difficult. However, drilling on Hessie, Welgegund, and Wolverand proved that the magnetic shales, as shown by the magnetometric survey, actually occur in the areas so indicated east of the Buffetsdoorn fault and southeast of the Rietkuil syncline.

"The tracing of ultrabasic dikes helped to locate the bore holes in areas not disturbed by those dikes.

"The occurrence of magnetic lavas in a certain horizon of the Ventersdorp beds has proved very useful in unraveling the complicated structure prevailing in the important area around the Orkney mine, south of Klerksdorp."—*W. A.*

3288. Savornin, André, and Ranarivelo, André, Observation d'un orage magnétique à Ambatoabo (Madagascar) [Observation of a magnetic storm in Ambatoabo, Madagascar]: Acad. sci. Paris Comptes rendus, vol. 203, no. 16, pp. 741–742, Oct. 19, 1936.

The authors describe their observations on a magnetic storm that occurred during the magnetic survey made with the Schmidt vertical balance from July 26 to August 2, 1936, at Ambatoabo, about 60 kilometers west-northwest of Fort Dauphin. On August 1 an abnormal course of the diurnal variation was recorded. ΔZ reached $+260\gamma$ at 11:45 a. m. (against 200 mean normal value); at 4 p. m. $+325\gamma$ was observed, and at 5:45 p.m. $+545\gamma$—that is, about 300γ above the normal value. At 7 a. m. August 2 the value was $+420\gamma$, and at 9:15 a. m. $+520\gamma$. The measurements made after an interruption of 2 days had shown again normal values. In order to prevent the possibility of any error, measurements were made during the storm by two operators at intervals of 2 or 3 minutes. The variation of temperature did not exceed 5°.

The course of this phenomenon is shown on a figure in which the curves drawn from the normal data observed between July 26 and August 1 and the abnormal values obtained on August 1 and 2 are compared.—*W. A.*

3289. Savornin, André, Études géologiques et magnétiques dans la région de Tsimbolovolo [Geologic and magnetic studies in the region of Tsimbolovolo]: Gouvernement gén. Madagascar et dépendances, Service des mines, Annales géol., no. 6, pp. 69–84, Tananarive, 1936.

A brief geologic description of the region is given in the first part of the article. The second part deals with geophysical studies, including magnetic methods; measurements with Schmidt's vertical balance no. 97104, by Askania; interpretation of the results; magnetic studies of rocks; study of zones with strong anomalies; anomaly of the valleys; and anomaly north of Bemangoraka.

Savornin explains the difficulties encountered and the precision obtained by measurements: (*a*) The presence of laterite of strong and very variable susceptibility makes the interpretation of weak anomalies difficult; (*b*) the diurnal variation at a certain point cannot be deduced from the records of an observatory; and (*c*) finally, at the hours of the most regular diurnal variations the temperature is usually the highest and most irregular. This influences considerably the precision. and.

according to the author, an error of about $\pm 20\gamma$ must be considered for Schmidt's balance of $\pm 10\gamma$—error observed in moderate climates.

The following general conclusions are drawn: Many valuable deposits in Madagascar are associated with ferromagnetic ores. Prospecting for these ores may certainly help in discovering them, especially mica, garnet, and some gems contained in pegmatitic deposits. The dikes in the metamorphic regions could undoubtedly be discovered in certain beds by the presence of magnetite. Great help may be obtained from magnetic prospecting in determining the places for drillings. Prolongations of the veins and dikes, their depths, and other necessary elements could also be determined in advance and at a low cost.—*W. A.*

3290. Swanson, C. V., The dip needle as a magnetometer: Soc. Petroleum Geophysicists Bull., vol. 1, no. 1, pp. 48–96, Houston, Tex., January 1936.

An account of investigations conducted with the object of testing the practical usefulness of the dip needle as a magnetometer. The paper is divided into the following parts:

1. Basic mechanical principles.
2. Corrections to observed readings.
3. Theoretical probability errors in calculated components.
4. Field data on errors in calculated components.
5. Suggested field and office methods.
6. Examples of the benefits obtained.

Twenty-five figures illustrate the article.—*W. A.*

3291. Thellier, Émile, Détermination de la direction de l'aimantation permanente des roches [Determination of the direction of the permanent magnetization of rocks]: Acad. sci. Paris Comptes rendus, vol. 203, no. 16, pp. 743–744, Oct. 19, 1936.

The following new procedure for determining the directions of the permanent magnetization of rocks is proposed by the author: The sample to be taken is cleaned with a chisel and, while it remains in its place, a wooden frame (a square 12 centimeters on a side and 5 centimeters high), the inside walls of which are covered with sheets of zinc, is put over it. The frame is filled with plaster, making the upper surface horizontal. After 10 minutes the frame is removed from the mold and may be used for preparing another sample. The direction is determined as follows: At a point a few hundred meters from the place where the samples of rocks are prepared a theodolite is installed and oriented toward the sun. On the horizontal surface of each sample a clinometer (or an alidade) is placed successively, a sight to the theodolite is taken, and the direction thus obtained is ruled on the plaster. After this a backsight to the clinometer is taken with the theodolite and the azimuth of the direction line determined.

The piece of rock dressed with plaster is then collected. By this method the author obtained a number of basalt samples from several places in Auvergne. The magnetization of these samples is then studied and the results published later.—*W. A.*

3292. von Bubnoff, S., Ein magnetisches Profil durch Vorpommern [Magnetic profile through Hither Pomerania]: Geol. Rundschau, vol. 27, no. 4, pp. 365–380, Stuttgart, 1936.

The procedure and the calculation of measurements (adjustment of instruments, temperature compensation, etc.) and the geologic results are described.

The profile of magnetic vertical intensity across Vorpommern (Stahlbrode-Treptow on the Toll) based on the measurements made by Schlomka and Schmücking is compared with the geologic profile; a good conformity between the two profiles was obtained. It was proved that the picture of Hercynian axes devised by Schuh and Richter is interspersed by transversal disturbances of northwest direction. A comparison with the region of Schuh's isanomal map of Mecklenburg adjoining at the west shows peculiar deviations, the possible causes of which are discussed. Of the three possible causes mentioned, the author decides that the most probable may be the existence of strongly magnetized intrusive bodies of laminar form in the subsoil which have an unilateral incidence and therefore appear to be displaced horizontally at the transversal disturbances. In any case this gives the best explanation of disturbances of the second order, while disturbances of the third order may have some other causes also.—*Author's abstract, translated by W. A.*

3293. Waagen, Lukas, Bemerkungen zu Forbergers Magnetischen Bodenforschungen im ausseralpinen Becken und am Alpenrand bei Wien [Remarks on Forberger's "Magnetic prospecting in the outer Alpine Basin and on the border of the Alps near Vienna"]: Bohrtech. Zeitung, vol. 54, no. 4, pp. 78–82, Wien, 1936.

A critical examination of the results obtained by Forberger. By interpreting the results of the magnetic investigations from other viewpoints, Waagen comes to the conclusion that his ideas probably agree more closely with the present knowledge of the deep structure of this region than those represented by Forberger.—*W. A.*

3294. Weiss, Oscar, Typical magnetic anomalies of Lower Witwatersrand shales and younger dikes in the Witwatersrand: Chem., Met., and Min. Soc. South Africa Jour., vol. 36, no. 9, pp. 227–234, Johannesburg, March 1936.

Through the measurements of the variations in the vertical component of the magnetic intensity it is possible to locate the approximate position of the suboutcrop of certain strongly magnetic shales of the Lower Witwatersrand system. From the magnetic anomalies the presence of the Witwatersrand beds in unknown areas can be ascertained, and their strike obtained. From the combination of the magnetic data with geology, it is possible to correlate the magnetic anomalies with well-defined geological horizons in areas where outcrops are available. By using this knowledge and the magnetic data in adjoining areas covered by younger rocks, it is possible to obtain the approximate value of the angle of dip. Using the value of the dip, together with the average thickness of the beds, it is possible to delineate the approximate zone of the suboutcrop of the Main Reef horizon. Complications and errors in these determinations can be introduced by strike and oblique faulting, both of which are typical in the area west of the known portion of the Witwatersrand.

Karroo dikes can be detected with the magnetometer, while the older dikes may or may not produce magnetic anomalies.

The intensity and polarity of the dikes may show erratic changes owing to the erratic magnetite concentration and to the effects of temperature, pressure, differential cooling, and dipping over of partly solidified portions of the dike material and induction.

It is a regular practice in the Rand to investigate the sites of deep bore holes and shafts with earth-magnetic measurements and to map

the hidden dikes over new producing areas for the assistance of the laying out of the general development program.—*Author's abstract.*

3295. Weiss, O., Simpson, D. J., and Paver, G. L., Some magnetometric and gravimetric surveys in the Transvaal: Union of South Africa Dept. Mines Bull., Geol. ser., no. 7, 27 pp., Pretoria, 1936.

A preliminary statement of the results obtained in the trial of the two methods mentioned in the title under localized conditions.

The preface contains a note on the earth-magnetic and gravimetric methods of geophysical prospecting with an appendix on the densities of rock samples from the Karroo, Transvaal, Ventersdorp, and Witwatersrand systems, and a map (pl. 1) showing portions of geophysical traverses on the West Rand.

Chapter 1 describes magnetometric traverses across the Lower Witwatersrand system. Plate 2 shows the traverses with the three main anomalies. The data shown in the curves are summarized in two tables.

Chapter 2 describes a gravimetric survey of the Doornkop fault. The torsion-balance traverse (shown on pl. 3) is in an approximately north-south direction, and its position relative to the geologic features of the West Rand is shown on the map (pl. 1). The authors state that the Doornkop fault was well defined as a zone of gravitational anomalies and could be delineated by use of the torsion balance.

Chapter 3 describes a gravimetric survey of the Witpoortje fault and Lower Witwatersrand beds on Witpoortje no. 44 (pl. 4).

Chapter 4 describes the determination of the hade of the Witpoortje fault by a magnetometric survey. The relative position of the four magnetometric traverses across the Witpoortje fault on Rietvlei no. 113 are shown in diagram 1, plate 5. Diagram 2 shows the determination of the dip of the Witpoortje fault, and diagram 3 the method of estimation of the hade of the fault in this area.

Chapter 5 describes a torsion-balance survey for locating nickel-ore pipes on Vlakfontein no. 902 (pl. 6). From the results of this survey the authors conclude that the torsion balance can be successfully applied to the location and delineation of nickel-ore pipes, notwithstanding their relatively small diameters.

Chapter 6 describes a magnetometric survey of a gossan on Vogelstruisnek no. 602. Four traverses, each 200 feet long, laid down over the gossan and an isogam plan of the gossan are shown in plate 7.

Chapter 7 describes a magnetometric survey of the chromite seams on Groenfontein no. 302. Two traverses 200 feet apart were laid down over the three chromite seams, with a station interval of 40 feet, reduced to 20 feet and even 10 feet over the outcrops of the ore. The results of these traverses are shown on plate 8.—*W. A.*

3296. Weiss, O., Simpson, D. J., and Paver, G. L., Some magnetometric and gravimetric surveys in the Transvaal: Min. and Ind. Mag. of Southern Africa, vol. 22, no. 16, pp. 903–905, Johannesburg, 1936.

A review of Bulletin 7, issued by the Union Geological Survey Department, Pretoria. (See abstract 3295, above.)

The authors give extracts from the bulletin dealing with the problem of the dip of the Witpoortje fault under the following headings:

1. Note on the earth-magnetic and gravimetric methods.

2. Gravimetric survey of the Witpoortje fault and Lower Witwatersrand beds on Witpoortje.

3. The determination of the hade of the Witpoortje fault by a magnetometric survey.—*W. A.*

3297. Zhongolovich, I. D., Magnetic survey on the Pamir [in Russian]: Acad. Sci. U. S. S. R. Trans. Tadzhik Exped. 1932, no. 6, pp. 1–38, Leningrad, 1934.

Contains the following items:

1. Historical outline.

2. Itinerary (scheme of magnetic points in the region of Lakes Yashil-Kul and Sarezskoe).

3. Investigation of instruments and methods of work (Chasslon's magnetic theodolite no. 80).

4. Accuracy of determinations of the magnetic elements (34 stations of observation are described).

5. Results of magnetic observations (tables).

6. Reduction of the observed values to the epoch (1932.5).

7. Materials for maps showing the distribution of magnetic elements on the territory of the Pamir and South Ferghana.

8. Appendix: List of 104 magnetic stations.—*W. A.*

3. SEISMIC METHODS

3298. Adams, C. E., Report of the Dominion astronomer and seismologist for the year ended December 31, 1934 (extract from the Annual Report of the Department of Scientific and Industrial Research, 1934–35): Wellington Dominion Observatory Bull. 105, 7 pp.

Contains data on astronomy, seismology, and publications issued by the Observatory, also a map of New Zealand showing approximate earthquake epicenters for the calendar year 1934.—*W. A.*

3299. Birch, Francis, and Dow, R. B., Compressibility of rocks and glasses at high temperatures and pressures; seismological application: Geol. Soc. America Bull., vol. 47, no. 8, pp. 1235–1255, Aug. 31, 1936.

For six artificial glasses, for Solenhofen limestone, and for Vinal Haven diabase, the compressibility has been measured to a pressure of 10,000 kg/cm^2, combined with temperatures of 0° to 300° or 400° C. For all these materials, except silica glass, the compressibility is found to increase with the temperature above about 200°, although in a number of cases the behavior below this temperature is more or less complicated. The values observed for the diabase are notably lower than any heretofore recorded for similar rocks; estimates are given of the velocity of seismic waves in this diabase at different depths, down to 40 kilometers.—*Author's abstract.*

3300. Bois, Charles, Sur les séismes à foyer anormalement profond [On earthquakes with abnormally deep focus]: Acad. sci. Paris Comptes rendus, vol. 203, no. 1, pp. 101–103, July 6, 1936.

From the seismograms recorded in Strasbourg, the author gives a table of focal depths calculated by various authors using different methods. Bois studied the seismograms by using Wadati's tables.—*W. A.*

3301. Bois, Charles, Sur les séismes à foyer profond [On deep-focus earthquakes]: Acad. sci. Paris Comptes rendus, vol. 203, no. 4, pp. 341–343, July 27, 1936.

From the examination of seismograms recorded at Strasbourg in 1923–34, by using Wadati's tables, 57 earthquakes were determined to have had focal depths greater than 80 kilometers. The following conclusions were drawn from the examination:

1. *Geographic distribution.*—The earthquakes may be divided into two groups—(*a*) border of circum-Pacific geosynclinal and (*b*) zone of Alpine folds.

2. *Classification according to the depths.*—A table gives the number of shocks observed for various focal depths. The table is not considered to be complete, as reference is made only to distances between 3,000 and 11,000 kilometers, and the period of study did not exceed 12 years. The temporary conclusions drawn are formulated as follows: (*a*) The decrease of frequency at depths of 80 kilometers and more does not seem to follow a regular law; (*b*) the distribution of foci seems to follow certain laws at medium depths; (*c*) two maxima of frequency, one at a depth of about 120 kilometers and the other at about 320 kilometers, are noticed.

3. *Mechanism of the starting of shocks.*—The examination of seismograms obtained with the aid of vertical components makes it possible to determine whether the P phase originated with a compressional or a dilatational wave.

According to the author, the results suggest the existence between the depths of 80 and 600 kilometers of three surfaces of discontinuity, or at least of three levels at which the elastic properties of the subsoil are changing very rapidly.—*W. A.*

3302. Bradford, D. C., Microseisms and their relationship to changing meteorological conditions: Seismol. Soc. America Bull., vol. 26, no. 1, pp. 29–53, 1936.

In this paper the following conclusions have been drawn from the data at hand:

1. That the period of microseisms tends to vary with the amplitude.

2. That the various types of lows delineated in this paper vary in their degree of correlation with microseismic displacements.

3. That microseisms are under direct influence of changing meteorological conditions.

It is therefore the writer's general conclusion that the type and intensity of cyclonic depressions are the dominant factors in the propagation of microseisms.—*Author's abstract.*

3303. Bungers, Rolf, Theorie der Schwebungen [Theory of vibrations]: Zeitschr. Geophysik, vol. 12, no. 5/6, pp. 229–245, Braunschweig, 1936.

The theoretical investigation of the superposition (Überlagerung) of two harmonic oscillations of almost similar frequency requires in the first place an exact definition of the notion "variable frequency." Oscillation pictures which possibly may occur are discussed, and examples are given. Anomalous conditions, not yet discussed, may appear in the oscillation minimum. In the second chapter the author discusses oscillation pictures which appear in the modern applied geophysics and in which the partial oscillations are only approximately harmonious. In the last part the results are discussed with regard to the superposition of waves, and the mathematical analogy between the interference phenomena and vibration phenomena is determined.—*Author's abstract, translated by W. A.*

3304. Buwalda, J. P., and Gutenberg, Beno, Investigation of overthrust faults by seismic methods: Science, new ser., vol. 81, no. 2103, pp. 384–386, Apr. 19, 1935.

Attempts to measure the thickness of overthrust plates were made on the Beartooth Plateau, in northwestern Wyoming and south-central Montana, about 12 to 20 miles southwest of Red Lodge, Mont., along the new Red Lodge-Yellowstone Park highway (July 1934), and on Frazier Mountain, about 90 miles northwest of Los Angeles, Calif. (November 1934).

According to the authors the investigations clearly demonstrate that it is possible to measure the thickness of overthrust plates by use of the seismic-reflection method and from a number of such measurements to determine the form of the fault surface. The method cannot be used successfully on those parts of overthrust surfaces that separate rock bodies in which elastic wave velocities are nearly equal, because the fault itself does not reflect the waves. The best results were obtained with charges ranging from a fraction of a pound to a very few pounds.—*W. A.*

3305. Bykhovsky, V., The scales of seismic intensity [in Russian]: Acad. sci. U. R. S. S. Comptes rendus, Seismol. Inst. Pub. 73, 42 pp. 1936.

1. A review of seismic scales has shown that at the present state of science they cannot be considered to be satisfactory.

2. Methods advanced by Terada and developed by Benioff, Martel, and Suyehiro deserve the widest application and promulgation in seismic regions.

3. The seismic intensity of a given locality is to be determined from (*a*) a chart showing the distribution of epicenters of earthquakes occurring within the area; (*b*) the intensity of quakes expressed in the form of a spectrum of motion frequencies, and of respective amplitudes for different types of constructions in the locality; (*c*) the range of ground-motion frequencies prevailing during earthquakes in the locality.

4. Mathematical interpretation of all the necessary data presents no difficulties.

5. The more essential factors in designing earthquake-proof buildings are the characteristics of their dynamic behavior during the quake, mainly conditioned by (*a*) the form of vibration of the building; (*b*) the natural period of its motion; and (*c*) the period and amplitude of the earth's crust motion during earthquakes.—*Author's summary, translated by W. A.*

3306. Caloi, P., Two new types of seismic waves: R. Accad. Lincei Atti, vol. 23, pp. 507–511, Apr. 5, 1936.

If the vector, representing a seismic vibration, consists of a component along the normal of the wave (this gives place to a longitudinal movement) and also of a component normal to the direction of propagation. This, in its turn, is decomposed into two—the one lying in the principal plane, and the other normal to the plane of propagation.—*W. A. R., Sci. Abstracts, vol. 39, no. 466, 1936.*

3307. Caters, C. de, La machine à tremblements de terre [The earthquake machine]: La Nature, no. 2977, pp. 406–467, Paris, May 15, 1936.

The author gives a brief description of a device for investigating earthquakes, developed by Arthur C. Ruge in collaboration with Vannevar Bush. The machine was constructed in the Massachusetts Institute of Technology. (See abstract 3346.)

An electrical analyzer coupled with a photosensitive cell operates the machine so that the undulatory curve corresponding to that of the seismogram may be observed. Any shock of the earth is reproduced by exactly the same movement. The machine is very supple; the expensive and bulky mechanical cam is avoided; any shock, no matter how irregular it may be, is realized. According to the author, this machine shows improvements in comparison with the old ones.—*W. A.*

3308. Dahm, C. G., Velocity of P waves in the earth calculated from the Macelwane P curve: Seismol. Soc. America Bull., vol. 26, no. 1, pp. 1–11, 1936.

The Macelwane P curve is based on the data of the Tango, Hawke Bay, and Long Beach earthquakes, all of 10 to 12 kilometers focal depth. This curve was modified and adjusted to fit a spheroid of 6,355-kilometer radius, the outer part of which has the same properites as those of the material immediately under the Mohorovičić discontinuity in Japan. The original and the adjusted P curve are given as well as the velocity-depth and depth-distance data obtained by applying the Herglotz-Wiechert method to the adjusted P curve. The inversion and slight descrease of the velocity-depth function at 2,730 kilometers depth are discussed, and the continued validity of the Herglotz-Wiechert method under those circumstances is shown.—*Author's abstract.*

3309. Dahm, C. G., Velocities of P and S waves calculated from the observed travel times of the Long Beach earthquake: Seismol. Soc. America Bull., vol. 26, no. 2, pp. 159–171, 1936.

Comprises the results of calculations of the velocities of P and S waves based on the measurements of original seismograms or contact prints from 60 stations in all parts of the world. The article is accompanied by a series of curves and six tables.—*W. A.*

3310. Davison, Charles, Post-eruptive movements of the earth's crust: Discovery, vol. 17, pp. 148–149, London, May 1936.

Davison records in this article some interesting observations on the post-eruptive movements of the earth's crust in Japan. A few maps show the depressions of the earth's crust and movements of the crust blocks around Sakura-jima, and graphs are given of changes of level in Japan as revealed by precise leveling. Reference is made to the papers published by Omori, Imamura, Tsuboi, and Miyabe.—*W. A.*

3311. Luca Moro, F. P. de, Possibilities of the seismic method in the study of elastic reflected waves: Bol. inf. petroleras, vol. 12, no. 140, pp. 25–28, Buenos Aires, April 1936.

Reference is made to a previous article, in which the author recommended research to identify the longitudinal and latitudinal waves and separate them from one another, and also to identify the angles of emergence. It is now claimed that the Ambronn piezo-quartz seismograph has succeeded in getting a reception of the reflected waves, by variation of the amplitude of the vibrations, eliminating the natural and artificial microseisms and the large waves, and by limiting, in some cases, the filtrations. This application of the known electrical properties of quartz is not new, but Ambronn was the first to introduce it with success into applied geophysics, and by his seismograph he has created the possibility of applying all the discoveries of modern electric technique to amplification, filtration, and recording of electric oscillations. This evolution of an instrument susceptible of recording electric reflecting waves is very far from realizing perfection in seismic reflection methods,

as has been shown by practical field tests. It was found that, according to the geologic structure, an adaptation of the filter for each special case was necessary. The field work led to the conclusion that by applying the reflection method the observer could utilize the times of arrival of the longitudinal reflection waves to procure a clear record of them, in consequence of the elimination, by means of filters, of the latitudinal waves of low frequency, which would otherwise have so confused the reception that identification of the longitudinal waves would have been impossible. When the latitudinal waves are of low frequency and the longitudinal of high frequency, it is very simple, by means of filters, to eliminate the perturbing frequencies. But in some areas the highest frequencies of the longitudinal waves are absorbed, leaving only the low frequencies, and then a system that eliminated or reduced the latitudinal waves of low frequency would defeat its object by eliminating or reducing also the longitudinal waves of low frequency, thus creating the false impression that a horizontal reflector did not exist. Thorough research on this problem has been undertaken by well-known geophysicists experimenting with new models of seismographs fitted with microphonic cells and with the latest systems of mechanical, acoustic, and electric filters. The progress of their work urges the author to stress the importance of close collaboration, or even alliance, of seismic and geoelectric research. With the aid of a diagram, the author outlines the principles on which a process ought to be evolved whereby a good record of reflected waves could be obtained, and combining with that the fullest utilization of the seismic energy. It is pointed out finally that the extraordinary progress made in the field of electric measurements opens the door to the possibilities of great achievements by modern electrotechnique and that instrumentation, being of supreme importance in applied geophysics, is the reason for the great oil companies having organized special laboratories where apparatus invented therein are tested and all new inventions examined.—*Condensed from B. F. N. M., Inst. Petroleum Technologists Jour, vol. 22, no. 155, September 1936.*

3312. Einaudi, R., Seismic waves: Accad. sci. Torino Atti, vol. 71, no. 1, disp. 2a, pp. 299–309, January-April 1936.

The first phase of the principal seismic waves can be explained mechanically without recourse to the hypothesis of a lithosphere overlying a fluid magma.—*W. A. R., Sci. Abstracts, vol. 39, no. 465, 1936.*

3313. Grenet, G., and Coulomb, J., Construction d'un seismographe d'essai [Construction of a trial seismograph]: Inst. et obs. de physique du globe du Puy-de-Dôme Bull. 8, 6 pp., 1935–36.

As a result of theoretical research the authors constructed a trial seismograph. In this article, which is the first of a series in connection with this work, the authors give a description of the apparatus. Some details accompanied with a photographic picture and a schematic design are given. The working of the seismograph is explained briefly.—*W. A.*

3314. Gutenberg, B., Microseisms: Seismol. Soc. America Bull., vol. 26, no. 2, pp. 111–117, April 1936.

The various suggestions as to the origin of microseisms are discussed, and it is shown that the only probable cause that produces sufficient energy and can be correlated with recorded microseisms is surf on a steep coast—for example, on the coasts of Norway, Alaska, and British

Columbia, and of Labrador, for microseisms recorded respectively in northern and western Europe, at Pasadena and its neighborhood, and eastern United States.—*C. A. S., Sci. Abstracts, vol. 39, no. 465, 1936.*

3315. Gutenberg, B., and Richter, C. F., Revised and additional geocentric coordinates of seismological stations: Gerlands Beitr. Geophysik, vol. 46, no. 1/2, pp. 198–201, Leipzig, 1935.

In a recent paper (Gerlands Beitr. Geophysik, vol. 40, p. 380, 1933), the authors published a list of selected seismologic stations with verified coordinates, including geocentric latitudes and heights above an arbitrary sphere. Comparison with the publication by K. E. Bullen (The constants of seismological observatories, 1933) revealed certain discrepancies, which have been investigated by the authors by direct correspondence with the stations concerned. A few stations were removed to new positions, and other new installations were made. The authors give tables showing corrections, changes, and additions to the previous list.—*W. A.*

3316. Gutenberg, B., and Richter, C. F., On seismic waves (third paper): Gerlands Beitr. Geophysik, vol. 47, no. 1/2, pp. 73–131, 1936.

In two previous papers under the same title (Gerlands Beitr. Geophysik, vol. 43, p. 56, 1934; vol. 45, p. 280, 1935; see Geophys. Abstracts 71 and 83) the authors have presented data on bodily waves. The present paper contains the corresponding data on surface waves (including seismic sea waves), the magnitude and energy of earthquakes, and miscellaneous topics. The seismograms used were those studied in the previously published investigations; the numbers assigned to individual shocks are as given in the previous paper.—*W. A.*

3317. Gutenberg, B., and Richter, C. F., Magnitude and energy of earthquakes: Science, new ser., vol. 83, pp. 183–185, Feb. 21, 1936.

The authors point out the necessity of grading earthquakes in catalogs according to the magnitude of the shock. Indiscriminate use of instrumental data gives undue weight to minor shocks. Using their own arbitrary scale, they find that in California the minor shocks account only for a very small part of the liberated energy. The smaller shocks do not appreciably mitigate the strains which are released in the larger earthquakes, but must be regarded as minor incidents in and symptoms of the accumulation of such strains.—*W. A. R., Sci. Abstracts, vol. 39, no. 461, 1936.*

3318. Hagiwara, Takahiro, The air damper: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 4, pp. 783–789, December 1935.

Discusses the effect of the compressibility of the air on the resisting force of the dampers. The resisting force exerted by the ordinary damper is calculated by taking into consideration the compressibility of the air as well as its rate of flow between the piston and the containing cylinder, and the most suitable dimensions for various rates of vibration of the seismoscope are determined.—*W. A.*

3319. Hayes, R. C., Focal depth of the Hawkes Bay earthquake of February 2–3, 1931: Nature, vol. 138, no. 3481, pp. 126–127, London, July 18, 1936.

In view of the divergence in the interpretation of the seismograms of the Hawkes Bay earthquake of 1931 and the calculations of the focal depth therefrom, R. C. Hayes has reexamined the original Takaka seismogram. Its record, he states, confirms in the main the original

interpretation, from which a focal depth of 16 to 24 kilometers was inferred.—*Editor's summary.*

3320. Hayes, R. C., Seismic waves and crustal structure in the New Zealand region: Wellington Dominion Observatory, Dept. Sci. and Ind. Research, Bull. 101, pp. 1–10, 1936.

Observations of 10 well-recorded New Zealand earthquakes during the period 1931–34 indicate a continental crustal structure in the New Zealand region resembling that postulated by Jeffreys for the European Continent, but with velocities distinctly higher than those found in typically continental regions.

Based on the suggestion by Gutenberg regarding the significance of deep-focus earthquakes, the observations of such earthquakes in the southwest Pacific to date support the evidence of crustal structure obtained from the observations of seismic waves.

Geological evidence favors the existence of a continental crust in the New Zealand region.

The relatively high velocities of seismic waves suggest a feature in common with "Pacific" crust alstructure.—*Author's abstract.*

3321. Hayes, R. C., A new phase in deep-focus earthquakes: Wellington Dominion Observatory, Dept. Sci. and Ind. Research, Bull. 107, pp. 553–562, 1936.

A prominent phase appearing a few minutes after ScS on the Milne-Shaw seismograms at the Dominion Observatory, Wellington, of seven abnormally deep-focus earthquakes in the southwest Pacific has been identified as a transverse wave reaching the station after having been reflected, first at the earth's surface near the epicenter and then at the boundary of the core. The designation of such a phase in accordance with current nomenclature is sScS. This phase does not appear to have been recognized on any previous occasions. It is similar in character to ScS, and both phases are of remarkably large amplitude on some of the records. The time interval (sScS–ScS) provides a comparatively accurate method for determining the focal depths of abnormally deep earthquakes from a single seismogram at short distances, the interval for a given depth being practically independent of epicentral distance.—*Author's abstract.*

3322. Hayes, R. C., Normal and deep earthquakes in the southwest Pacific: Wellington Dominion Observatory, Dept. Sci. and Ind. Research, Bull. 109, 1936.

Presents as complete a list as possible of deep earthquakes in the southwest Pacific during the period 1918–34, also some statistics showing the distribution of these earthquakes in space and time, as compared with the distribution of normal earthquakes. Discusses the general distribution of deep earthquakes and deep-focus earthquakes and geophysical problems.—*W. A.*

3323. Hayes, R. C., Earthquakes and atmospheric pressure: Wellington Dominion Observatory, Dept. Sci. and Ind. Research, Bull. 110, 1936.

Investigation of atmospheric-pressure changes associated with the occurrence of 75 of the principal New Zealand earthquakes during the period 1931–34 shows a tendency for earthquakes to be more frequent when pressure is above 30 inches than when it is below that value. This is most marked in the case of earthquakes in the Buller region of the South Island. Pressure changes at intervals within 12 hours before earthquakes show that slightly more earthquakes occur after a fall of pressure than after a rise.—*Author's abstract.*

3324. Ide, J. M., The elastic properties of rocks—a correlation of theory and experiment: Nat. Acad. Sci. Proc., vol. 22, no. 8, pp. 482–496, August 1936.

Dynamic measurements of the modulus of rigidity of rocks are described. These are computed from the torsional resonance frequencies of cylindrical samples.

Dynamic measurements of Poisson's ratio are discussed. These are obtained from the deviation of the longitudinal harmonic frequencies from integral multiples of the fundamental and are found to agree with values computed from Young's modulus and the modulus of rigidity.

The relations between the elastic constants determined in the laboratory and the theoretical formulas, which express the connections between the constants of a perfect elastic medium, are discussed in detail. It is found that $E\beta=3E/\mu$, computed from experimental values, is smaller than the theoretical formula predicts, for all the rocks investigated except diabase. There is agreement between theory and experiment to 1 percent for diabase, copper, and steel. It appears that the values of Poisson's ratio determined from E/μ, static measurements and harmonic series, are relatively much lower than those calculated by means of the formulas involving $E\beta$ or V/ν. It is found, finally, that field measurements of elastic-wave velocities in the Sudbury norite agree to approximately 1 percent with velocities computed from $E\beta$, and to approximately 5 percent with velocities computed from E/μ. The check with field determinations for granite is within 7 percent for velocities computed from $E\beta$, and within 19 percent for velocities computed from E/μ.—*Author's abstract.*

3325. Inouye, Win, Some experiments on the waves generated by the rotation of some eccentric masses [in Japanese]: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 4, pp. 757–762, December 1935.

The waves were generated in the ground by the rotation of an eccentric mass driven by an electric motor. The frequency of the rotation of this electric motor was changed within some range by changing the eccentric mass. The waves were projected to the canal dug in the ground. The amplitudes of the horizontal component of the vibrations of the surface of the ground and the base of the canal were observed by transporting a horizontal seismometer from one place to another.

The author observed the standing waves existed by the reflections of the waves from the canal, in spite of several times lesser dimensions of the depth and the breadth of the canal than the dimensions of the wave lengths. Moreover, it seems to the author that the observed waves are the surface waves of Rayleigh type.—*Author's English abstract.*

3326. Ishimoto, Mishio, Acceleration observations of seismic shocks in the cities of Tokyo and Yokohama [in Japanese]: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 3, pp. 592–607, September 1935.

Acceleration observations were continued during 1934. The author succeeded in recording 15 earthquakes of order 2 and 2 of order 3. The maximum acceleration of each quake was determined and is shown in a figure. On the one hand it was greater at the elevated part of the city when the epicentral distance was less than 50 kilometers. The predominant period in the seismic shocks was, on the other hand, comparatively small at the elevated parts of the city. We established that the predominant period corresponded to that of the proper oscillation of the superficial layer and was in close connection with the damages

caused by earthquakes. We tried to find some relation between the periods of earthquakes produced artificially and the predominant period of seismic shocks, but did not find any agreement between them.—*Author's French summary, translated by W. A.*

3327. Ishimoto, Mishio, Construction d'un microséismographe méchanique [Construction of a mechanical microseismograph]: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 14, no. 2, pp. 248–258, June 1936.

The inconveniences of optical registration of shocks of small amplitude are mentioned: (1) The direct reading of the records during the observation is impossible; (2) the size of the curve recorded is generally very great; and (3) a certain speed is to be given to the photographic paper rolled up on a revolving drum in order to be able to record the oscillations of small periods. With these considerations in mind, the author constructed a mechanical microseismograph. The pendulum, a cylinder weighing 33.9 kilograms, 40 centimeters long and 10 centimeters in diameter, is inverted and held in position by two flattened steel springs; the pointer, recording movements on smoked paper, is attached to the second of two amplifying levers, giving a total amplification of about 350. The instrument is about 300 times as sensitive as the accelerometric seismograph in ordinary use.—*W. A.*

3328. Jeffreys, H., Structure of the earth down to the 20° discontinuity: Royal Astron. Soc. Monthly Notices, Geophys. Suppl. 3, pp. 401–422, London, April 1936.

The ordinary integral equation that gives the velocity of P and S waves requires too many doubtful assumptions for its solution. The structure of the earth above the recently discovered discontinuity at 20° is attempted by the methods for near earthquakes. The velocities of various forms of the P waves are calculated and tabulated.—*W. A. R., Sci. Abstracts, vol. 39, no. 463, 1936.*

3329. Jeffreys, H., Comparison of seismological stations: Royal Astron. Soc. Monthly Notices, Geophys. Suppl. 3, pp. 423–443, London, April 1936.

The standard of accuracy varies from one seismological station to another. The author applies his system of weighting to all the important stations of the world and tabulates the results.—*W. A. R., Sci. Abstracts, vol. 39, no. 463, 1936.*

3330. Jeffreys, Harold, On travel times in seismology: Union géod. et géophys. internat., Assoc. séismologie, Nogent-le Rotrou (France), sér. A, no. 14, pp. 3–86, 1936.

The data contained in the author's recent work with K. E. Bullen on travel times (see Geophys. Abstracts 77) have been rediscussed and combined with those of several special studies, particularly by Scrase, Stechschulte, and Dahm. Five European earthquakes, all well observed at short distances, have been added. A systematic method is provided for dealing with the abnormal low of errors that appears to hold in seismological observations. The standard errors of the resulting tables have been found. The discontinuity in the slope of the time curve for *P* has been substantiated; the *Z* phenomenon, a variation in the arrival times of *S* and *SKS* with respect to *P*, without the effect of focal depth showing in the *P* residuals, when considered alone, is also confirmed. Deep-focus shocks have been used to give times of the pulses reflected on the outside of the core, which have been combined with

those of the principal core waves to give times within the core, and the times of several other core waves have been computed.

The changes from the times already given are in most cases small, and the final results for the fundamental pulses *P*, *S*, *SKS*, and *P'* appear trustworthy to a second or less at most distances. Substantial changes are made in P'_2, in *SKKS* at great distances, and *ScS* at short distances. Certain anomalies in the recorded times of arrival of *S* are discussed.—*Author's abstract.*

3331. Jost, Wilhelm, Die seismischen Eisdickenmessungen am Rhonengletscher, 1931 [Seismic measurements of the thickness of ice on the Rhone glacier in 1931]: Schweizer. naturf. Gesell. Denkschr., vol. 71, no. 2, pp. 29–42, Zürich, 1936.

The seismographs used and their characteristics are briefly mentioned. General remarks on the method of measurement (developed by Mothes) are given. The reflection method and the refraction method are described and compared with respect to the shooting distances. The accuracy of measurements was estimated to be within 2 percent. The results of measurements are shown in a table and a series of profiles. A description of the Rhone glacier based on the investigations is given. The greatest depth of the ice measured was 237 meters. Ten figures and one map are added.—*W. A.*

3332. Kawasumi, Hirosi, and Syosaku, Homma, On a problem concerning the earth as discussed from the time-distance curve of the Formosa earthquake of April 20, 1935: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 14, no. 2, pp. 201–221, June 1936.

Discuss the problem of the existence of discontinuity surface in the mantle of the earth from the examination of the P curve due to the Formosa earthquake of April 20, 1935. The epicenter is determined by the method of least squares. The velocity distribution within the earth, as well as the depth of vertex of the seismic ray emerging at any epicentral distance up to about 20 meters or so, is determined upon the two assumptions of the existence of the velocity discontinuity of first and second order.—*W. A.*

3333. Koch, H. W., and Zeller, W., Der Einschwingvorgang bei Erschütterungsmessgeräten [The process of the original oscillation in seismographs]: Zeitschr. Geophysik, vol. 12, no. 5/6, pp. 220–228, Braunschweig, 1936.

A discussion of the original conditions and of the theory of the original oscillation process is followed by three practical examples. The theory of the original oscillation process may be based on the process of the increase of oscillation. In this case the practical example can be well explained. If a pure sinus oscillation and not the increase process of oscillation is applied the theoretical results can be proved, as far as seismometers are concerned, only on the oscillation table. The theory established agrees sufficiently well with the real phenomena appearing in the practice of measurements.—*W. A.*

3334. Köhler, R., Dispersion und Resonanzerscheinungen im Baugrund [Dispersion and resonance phenomena in building foundations]: Zeitschr. tech. Physik., vol. 16, no. 12, pp. 597–600, 1935.

The propagation of sinus-shaped stationary oscillations shows dispersion phenomena that agree well with the theory of Rayleigh waves. In case of shocklike oscillations (explosions) the initial shocks are represented on the seismograms as longitudinal waves; then two kinds of

shear waves follow. The velocity of the shear wave arriving first increases (as in stationary oscillations) with the decreasing frequency; the velocity of the other shear waves, on the contrary, decreases with the decreasing frequency. The end of the seismogram is represented by the proper oscillation of the underground which dies away according to e-function, probably owing to the dispersion of the energy into deeper layers. A conclusion on the nature of the underground may be drawn from the phenomena of dispersion and from the dying out of the proper oscillations.—*Abstract by K. Jung (Geophysikal. Berichte, 1936, p. 69), translated by W. A.*

3335. Köhler, R., Messung der Schwingungskennziffern und Herabminderung der Erschütterungen in einer Kohlenwäsche [Measurement of characteristic oscillation figures and the reduction of oscillations in a coal-washing plant]: Zeitschr. Geophysik, vol. 12, no. 4, pp. 148–166, Braunschweig, 1936.

The characteristic oscillation figures caused by the machinery of a coal-washing plant 40 meters high and 72 meters long were measured. The building oscillated in the longitudinal as well as transversal directions with the oscillation figures characteristic of the plant as a whole. Suitable steps for reducing the oscillations were derived from the measured resonance curves, and the effect of the oscillations was examined. A decrease of 77 percent in oscillation of the building was obtained by an increase of 11 percent in the number of revolutions of machines by which the main oscillations were caused. The oscillation properties of the building could be observed the best by sudden switching off the machines.—*Author's abstract, translated by W. A.*

3336. Lamont, A., Paleozoic seismicity: Nature, vol. 138, no. 3484, pp. 243–244, London, Aug. 8, 1936.

Indications of the occurrence of earthquakes and of accompanying seismic sea waves (tsunamies) in Ordovician time (Caradog age) are described from observations of strata in the Irish Free State. These may involve revision in the interpretation of certain features, such as crush conglomerates and intrusive tuffs, the origin of which has hitherto been ascribed to other agencies.—*Abstract on page 250 of the same number of Nature.*

3337. Leet, L. D., Seismological data on surface layers in New England: Seismol. Soc. America Bull., vol. 26, no. 2, pp. 129–146, 1936.

The Harvard seismograph station has undertaken a special study of the surface layering in New England. As a preliminary to this, the effects of an average crust on seismological data are considered. For this purpose, R. A. Daly outlined a crust representative of the best available figures from investigations in other regions. An important feature of this structure, which should find expression in seismological data, is a decrease in velocity at one discontinuity.

A preliminary analysis of waves from timed quarry blasts at distances up to 187.5 kilometers is offered. It suggests a surface zone of $V_p=6$ km/sec., $V_s=3.5$ km/sec., bounded by a discontinuity at a depth of 23 kilometers, below which $V_p=8$ km/sec., $t_p=4.9+\Delta/8$, $V_s=4.6$ km/sec., $t_s=8.3+\Delta/4.6$. The tentative nature of the interpretation is emphasized. The postulated structure is not confirmed at any point, with the exception of poor but possible indications of a low-speed layer. Rayleigh waves are described, showing some anomalous features, but a detailed discussion of wave types is reserved for a later report.

Ambiguities and conflicts of opinion in interpretations of near-earthquake data are cited, with special reference to certain reports of H. Jeffreys, to suggest that the fact that so many records of blasts and near earthquakes in scattered areas fail to conform to the requirements of Jeffreys' surface layers, or similar structures, may be due to differences of methods and inadequacy of data, as much as to regional differences of structure.—*Author's abstract.*

3338. Lehmann, J., P^1 waves: Union géod. et géophys. internat. Trav. sci., sér. A, no. 14, pp. 87–115, Toulouse, 1936.

In four records at distances of about 150° pulses have been read which seem to indicate that there are four distinct P' waves at this distance. The first, small wave, recorded on vertical-component instruments only, is likely to be due to small shocks preceding the main shock. The second wave, which is not very large, has been interpreted as the P^1 wave of the main shock, recorded also at greater distances. At smaller distances the same wave is recorded as P^1_3. The movement arising from the third and fourth waves is very large. The phases have been interpreted as the upper P^1_1 and the P^1_2 phases. This interpretation presupposes the existence of an inner core. It cannot be maintained that the interpretation here given is correct, since the data are quite insufficient, and complications arise from the fact that small shocks have occurred immediately before the main shock. However, the interpretation seems possible, and the assumption of the existence of an inner core is, at least, not contradicted by the observations; these are, perhaps, more easily explained on this assumption.—*Author's abstract.*

3339. Lorenz, Dr., Dynamische Baugrund-untersuchungen für den Industriebau [Dynamic foundation investigations for industrial constructions]: Öl und Kohle, vol. 12, no. 18, pp. 387–389, Berlin, 1936.

Results obtained during recent years in investigating construction sites. The investigations were applied mainly in the following two fields:

1. General research was carried out for determining the foundation chosen for a building, such as the sequence of the strata, and their thickness, for the purpose of determining the bearing power of the various strata and the possible gradual sinking of the future construction.

2. The second investigation was made with the purpose of determining the elastic properties of the foundation soil, on the basis of which the oscillations of machines used in the erected buildings could be calculated in advance.—*W. A.*

3340. Matuzawa, Takeo, Seismometrische Untersuchungen des Erdbebens vom 2. März 1933; Erdbebentätigkeit vor und nach dem Grossbeben; Allgemeines über Nachbeben [Seismometric investigations of the earthquake of March 2, 1933; Seismic activity before and after the main shock; General remarks on the aftershock]: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 14, no. 1, pp. 38–67, March 1936.

Seismometric investigations were based on the data obtained in the region of Sanriku-Oki. The following questions were considered: (1) Seismic activity in Sanriku-Oki; (2) periodicity of the frequency of earthquakes; (3) temporal course of frequency of earthquakes after the main shock; (4) investigations in the daily fluctuations of after-shocks; (5) spatial distribution of epicenters in the region of Sanriku-Oki in 1933; (6) succession of the origin; (7) lapse of time of frequency of after-shocks of the North Isu earthquake of November 26, 1930; (8) tides of the sea and frequency of earthquakes; (9) main earthquakes and spatial dis-

tribution of after-shocks. The article has 17 figures and 13 tables.—*W. A.*

3341. Mills, Brad, No pollution problem in development of submerged leases along coastal belt: Oil Weekly, vol. 81, no. 11, pp. 17–23, Houston, Tex., 1936.

Describes geophysical prospecting by seismic survey on leases in Galveston Bay. The equipment consisted of a large houseboat which served as a recording station, a barge for drilling the test holes, and subsidiary craft for the use of the testing crew. The test holes were drilled at 1-mile intervals. The explosive charge was half a pound to 2 pounds of dynamite. The shock from the charge was not great enough to be felt at the surface; no marine life was destroyed.—*W. A.*

3342. Nash, H. E., and Martin, J. M., Explosives theory for the geophysicist: Explosive Engineer, vol. 14, no. 7, pp. 200–213, Wilmington, Del., 1936.

Some fundamental properties of explosives with special reference to geophysical prospecting are discussed, such as (1) pressure developed in the drill hole when an explosive charge is detonated, (2) the temperature of the explosive gases, (3) the amount of available energy released, and (4) the proportion of this energy that is converted into useful seismic energy at the shot point.—*W. A.*

3343. Nishimura, Genrokuro, On the effect of discontinuity surfaces on the propagation of elastic waves [in Japanese]: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 3, pp. 540–554, September 1935.

In the present paper are studied the vibratory motions of a surface layer and a subjacent semi-infinite elastic body when a dilatational wave is obliquely incident on the common boundary where the two solids adhere closely. In the first chapter are studied the general properties of free waves propagated in the two solids—namely, in the surface layer and the subjacent solid—when a dilatational wave of harmonic wave type of infinite extent is obliquely incident on the bottom surface of the surface layer. In the second chapter are explained analytically the general phenomena of wave motion in the two solids when a dilatational wave of shock-wave type is obliquely incident on the common boundary.—*Author's English summary.*

3344. Nisimura, Eiiti, Vibrations of the Aso Volcanological Laboratory building and its surrounding ground: Kyoto Imp. Univ., Coll. Sci., Mem., ser. A, vol. 19, no. 4, pp. 191–206, July 1936.

The ordinary vibrations of the tower of the Aso Volcanological Laboratory and its surrounding ground were observed with five horizontal and two vertical-component microseismographs of very high magnification (about 20,000 maximum), and the following results were obtained:

1. The periods of prevailing vibrations observed are as follows:

The fundamental volcanic rock	0.55^s.
The superficial volcanic ash-layer	0.32^s and 0.10^s.
The building:	
North-south	0.34^s and 0.43^s.
East-west	0.37^s and 0.50^s.
Vertical	0.32^s and 0.20^s.

2. The amplitudes of oscillations observed in the superficial ash layer suffer a rapid decrease in nearly exponential form with increasing depths. The shorter the period of oscillation, the greater the decrease of the

amplitude. The amplitudes in the vertical component decrease less than those in the horizontal component.

3. The ordinary vibrations observed in the tower of periods ranging from 0.34^s to 0.37^s show considerably larger amplitudes in an east-west direction than those of the north-south direction. On the other hand, the shorter elastic vibrations of the tower of 0.13^s periods are conspicuous in the north-south direction. Thus the building behaves differently in different directions, its motions being characterized by its structural configuration.

4. Simple beatlike vibrations of 0.35^s periods were observed in the tower and at positions adjoining it. These vibrations are regarded as bounding vibrations of the tower, probably generated by the sudden sinking of the ground beneath the tower.

5. The building vibrates somewhat elastically in the lateral and the vertical directions.

6. The motion of the ground immediately surrounding the building is influenced by its vibrations, but beyond such distances from the building as are comparable to its length the motions are not even slightly influenced by the vibrations of the building, even when excited by a severe wind.

7. A stone weighing 160 kilograms was dropped at a ground position near the building, and vibrations generated by it were observed in and outside the building. The azimuths of these vibrations, their wave length being about half the length of the building, were strongly deflected from their normal planes of vibration by the effect of the lateral vibrations of the wings of the building, the elastic vibrations of the tower, and other disturbances. Thirteen seismograms are added.—*Author's abstract.*

3345. Rozova, E., Construction of travel-time curves and determination of the fundamental seismic elements for Central Asia [in Russian]: Acad. sci. U. R. S. S., Inst. séismol., Pub. 72, 28 pp., Leningrad, 1936.

A time-distance graph and fundamental seismic elements for Central Asia are derived from data furnished by the seismic network of Central Asia from 1929 to 1933. The epicenters of the earthquakes were determined by the method of hyperbolas. The results are summed up by the author as follows:

1. Formula for computation of the first impulse of the quake from the arrival of P waves:

$$t=9+\frac{\Delta}{7.81}$$

2. Velocities of propagation of seismic waves (apparent):

	Km./sec.
Longitudinal normal waves P	7. 82
Longitudinal intermediary waves P*	5. 99
Longitudinal individual waves P	5. 54
Transverse intermediary waves S*	3. 79
Transverse individual waves S	3. 29

3. Two focal surfaces—one at the depth of 25 kilometers ± 5 kilometers and the other at the depth of 40 kilometers ± 5 kilometers—were found.

4. The first surface of discontinuity, or the thickness of the first layer, is estimated at 17 to 25 kilometers.

5. The second main surface of discontinuity was found to be at the depth of 40 to 50 kilometers.

If we admit, according to H. Jeffreys, that the upper layer in Central Asia is constituted of granite or similar rocks, and the second layer of basalt, we may declare that the main area of foci is the boundary between the layer of granite and that of basalt.—*Author's abstract.*

3346. Ruge, A. C., A machine for reproducing earthquake motions direct from a shadowgraph of the earthquake: Seismol. Soc. America Bull., vol. 26, no. 3, pp. 201–206, July 1936.

The new earthquake machine developed at the Massachusetts Institute of Technology does away with the expensive and cumbersome mechanical cam drives and yet has no limitations with respect to the irregularity of an earthquake it can reproduce. Furthermore, it can reproduce nonrepeated irregular motions which continue for so long a time that no mechanical cam could be made for producing them.

The principles of operation are explained with the aid of the schematic diagram. The primary driving power of the machine is derived from oil under pressure working against a piston connected to the moving table. The cylindrical valve controls the oil flow by means of a set of matched parts, so that the shaking table moves in the direction the valve is opened, the speed of the motion depending upon how far the valve is opened. A coil attached to the cylindrical valve moves in a strong magnetic field. By passing current through this coil forces tending to move the valve are produced (a ¾-ampere current produces a 45-pound pull on the valve).

The author notes that the valve is quite free, having no restoring force whatever to return it to its closed or center position. To make the table reproduce arbitrary motions it is only necessary to discover how to control properly the currents flowing in the driven coil.

The control of the valve is described. A picture of the table in operation is given. The design of the machine was developed in consultation with Dr. Vannevar Bush.—*W. A.*

3347. Sassa, Kenzō, Micro-seismometric study on eruptions of the volcano Aso: Kyoto Imp. Univ., Coll. Sci., Mem., ser. A, vol. 19, no. 1, pp. 11–56, 1936.

Detailed description of studies on the eruptions of the volcano Aso; accompanied by a great number of pictures, seismograms, tables, and maps. It is not difficult to forecast the commencement of an active period of the volcano as well as its intensity, and even the commencement of an eruption group in an active period, if it is constantly observed with micro-seismometers and tiltmeters. There are some other interesting problems concerning the mechanism of volcanic activity, the study of which may be extended to other branches of geophysics.—*W. A.*

3348. Sassa, Kenzō, Anomalous deflection of seismic rays in volcanic districts: Kyoto Imp. Univ., Coll. Sci., Mem., ser. A, vol. 19, no. 2, pp. 65–78, March 1936.

A preliminary report on the anomalous structure of the upper crust in volcanic districts, based on the data accumulated in the Beppu Geophysical Laboratory and Aso Volcanological Observatory. Results of observations are shown in a table. Figure 1 shows the azimuthal distribution of the angle of deflection of seismic rays observed. A comparison between the records of earthquakes registered by the Wiechert seismographs and by the carefully adjusted microseismographs, type G_A, was made at the Aso laboratory and is shown in a table. In another table the author gives the results of the comparison made

between the records of earthquakes registered by the Wiechert seismograph and by the Omori portable tremor recorder. In all cases it was proved that the anomalous deviations obtained could not be attributed to instrumental or observational errors. Therefore the main causes for the anomalous deflections must be due to the anomalies in the geologic structure of the upper crust in the two volcanic districts described.—*W. A.*

3349. Sawdon, W. A., New geophysical method provides reliable data for structure mapping: Petroleum Engineer, vol. 8, no. 1, pp. 25–29, Dallas, Tex. October 1936.

A new method of seismic prospecting that segregates the reflected waves and permits their proper identification, developed by the Rieber laboratory in Los Angeles and named the Rieber geo-sonograph method, consists of a new method of recording and means for transferring the field record into a visual record. Ten receptors are arranged in an appropriate pattern on the earth's surface and the wave impulses picked up by all 10 are photographed on a strip of 35-millimeter film in the form of 10 sound tracks. Though this variable density record on the film may be inspected visually, it is especially adapted to electro-optical analysis and therefore is run through a specially designed apparatus that sums up the wave impulses and records them in a clearly defined line. By means of this analysis, the difference in time of arrival at successive receptors and the total travel time to any point in the receptor group may be found mechanically from the variable density record without the intervention of human observational errors. The field crew used in this new method is about equivalent in numbers to that used in other reflection work. The drilling requirements also are about the same except that shallower shot holes may be used. The speed of operation in the field probably is a little greater than that obtainable with the other reflection methods. The article is accompanied by 10 figures.—*W. A.*

3350. Schmerwitz, Gerhard, Der Koppelungsfaktor bei galvanometrisch registrierenden Seismographen [The coupling factor in galvanometrically recording seismographs]: Zeitschr. Geophysik, vol. 12, no. 5/6, pp. 206–220, Braunschweig, 1936.

Galvanometrically recording seismographs are systems with damping coupling. A theoretical deduction of the process of movement undisturbed from the outside results in the fact that owing to the coupling two natural vibrations of varied frequency and damping appear in this system simultaneously. In case of a strong coupling (coupling factor almost 1) the damping disappears almost entirely for one oscillation, while the other oscillation becomes strongly aperiodical. This result of calculations is proved by the experiments carried out for this purpose. By applying the usual Calitzin arrangement the coupling factors are approximately between 0.1 and 0.5. The disturbances appear here only in a weaker form. The new designs of the instruments of this kind with small seismometer mass (it is proved that the ratio of the moments of inertia is decisive) do not possess, owing to the coupling factor, any simple harmonic natural oscillation. Therefore an indisputable interpretation of seismograms recorded by these instruments cannot be secured.—*Author's abstract, translated by W. A.*

3351. von Schmidt, O., Zur Theorie der Erdbebenwellen; Die "wandernde Reflexion" der Seismik als Analogon zur "Kopfwelle" der Ballistik [Contribution to the theory of earthquake waves; The "wandering

reflection" of seismics as an analog to the "head wave" of ballistics]: Zeitschr. Geophysik, vol. 12, no. 5/6, pp. 199–206, Braunschweig, 1936.

The author's theory of "wandering reflection" was imperfect as yet owing to the fact that analogous processes were seemingly not existent in physics. The author shows that the "head wave" in ballistics represents an analog not only qualitatively but also with respect to formulas; in seismics as in ballistics a "head wave" appears only when there is an oversound velocity (Überschallgeschwindigkeit); in this case sin $\alpha_0 = V_1/V_2$. The "wandering reflection" is further generalized with the spreading process in short waves and with the total reflection in optics.—*Author's abstract, translated by W. A.*

3352. Sezawa, Katsutada, and Kanai, Kiyoshi, The M_2 seismic waves: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 3, pp. 471–475, September 1935.

From their previous studies (see Geophys. Abstracts 75) the authors have found that there were two dispersion curves of Rayleigh waves of different types for a stratified body, particularly when the elastic constants of the stratum differed greatly from those of the subjacent medium. In the present paper they show that it is still possible for two dispersion curves to exist even where the differences in the elastic constants and in the densities of the media are not very marked. The existence of these M_2 and M_2' waves in actual seismic disturbances was confirmed by the seismic record of the India earthquake of January 15, 1934, obtained in Tokyo.—*W. A.*

3353. Sezawa, K., and Kanai, K., The rate of damping in seismic vibrations of a surface layer of varying density or elasticity: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 3, pp. 484–495, September 1935.

Theoretical discussion of the method of damping the vibrations in a layer with varying density or elasticity. Although the method of damping differs greatly according to the distribution of densities or elastic constants in both the layer and the subjacent medium, the authors conclude that the damping is due mainly to the dissipation of vibrational energy into the subjacent medium and very little to other causes, such as internal friction in the ground.—*W. A.*

3354. Sezawa, K., and Kanai, K., Decay in the seismic vibrations of a simple or tail structure by dissipation of their energy into the ground: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 3, pp. 681–697, 1935.

The main reason for comparatively small damages to structures during earthquakes is investigated and is explained by the dissipation of vibrational energy in the form of seismic waves transmitted into the ground. A theoretical discussion of the decay of vertical, shearing, and flexual vibrations in a simple and in a tall framed structure is given.—*W. A.*

3355. Sezawa, K., and Kanai, K., Energy dissipation in seismic vibrations of a framed structure: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 3, pp. 698–714, 1935.

In their previous studies of the problem of energy dissipation in seismic vibrations of structures the authors assumed that the movement of the lower end of the foundation of the structure is the same as that of a free ground surface. Owing to the fact, however, that a structure and the ground have essentially different elastic properties and that a great part of the earthquake energy below the structure is reflected back into the ground, the authors revise their previous work and, on the basis of new

calculations, conclude that owing to the dissipation of vibrational energy into the ground, the amplitudes of vibrations of the structure do not exceed a certain limit. The mathematical discussion of the problem is given.—*W. A.*

3356. Sezawa, Katsutada, and Kanai, Kiyoshi, The nature of microseisms of local type: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 4, pp. 729–739, December 1935.

Several microseisms are discussed mathematically, and from the comparison of them it seems now established that microseismic vibrations of local type are formed mainly by selective forced vibrations of the surface layers due to the pulsation in air pressure on the surface of the earth, and also that the rigidities of the underlying strata are not very large compared with those of the upper layers.—*W. A.*

3357. Sezawa, Katsutada, and Kanai, Kiyoshi, The effect of sharpness of discontinuities on the transmission and reflection of elastic waves: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 4, pp. 750–756, December 1935.

The theory of reflection and refraction of waves at discontinuities within an elastic body as studied by Knott and developed by Kawasumi and Suzuki involved very sharp changes of density or elasticity. But according to the authors, the conditions thus assumed could hardly exist in reality, the probability being rather that the distribution of material in the immediate vicinity of the discontinuities in the earth would vary more or less gradually, the amplitudes of transmitted (refracted) and reflected waves through these discontinuities differing somewhat with difference in the lengths of the incident waves.

Knott's values agree well when the wave length is large compared with the thickness of the intermediate layer. However, for shorter waves the amplitudes of transmitted waves generally take greater values and those of reflected waves smaller values than those given by Knott, but for a certain intermediate range of thickness the respective amplitudes differ greatly as the wave length alters.—*W. A.*

3358. Sezawa, Katsutada, and Kanai, Kiyoshi, Elastic waves formed by local stress changes of different rapidities: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 14, no. 1, pp. 10–17, March 1936.

In a previous paper (Sezawa, K., Elastic waves produced by applying statical force to a body or by releasing it from a body: Earthquake Research Inst. Bull., vol. 13, pp. 729–739, 1935) it was shown that if a stress is applied to a body or released from it, the energy transmitted to infinity depends on the rapidity with which the stress is applied or released.

In this article the authors discuss the question whether the energy transmission due to the release of the stress at a certain rapidity would be equal to that due to the application of the same stress—the question raised in view of the prevalent idea that the large energy of some earthquakes is due to sudden release of the strain energy that was stored in the focal region. Mathematical calculations are given under the following items: (1) Criteria of positive and negative change in local stress; (2) elastic waves formed by local stress changes of different rapidities, and (3) remarks on compressional and refractional waves.—*W. A.*

3359. Sezawa, K., and Kanai, K., The nature of transverse waves transmitted through a discontinuity layer: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 14, no. 2, pp. 157–163, June 1936.

Deal with the problem of oblique incidence for transverse waves with displacements oriented parallel to the plane of the discontinuity layer. A mathemetical discussion is given.—*W. A.*

3360. Sezawa, K., and Kanai, K., Improved theory of energy dissipation in seismic vibrations of a structure: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 14, no. 2, pp. 164–188, June 1936.

In several previous papers the authors discussed this problem under some assumptions facilitating the solution. In this paper a theoretical discussion of the more complex problem is given for the following cases:

1. A simplest structure subjected to incident longitudinal waves.
2. A tall structure with rigid floors subjected to incident transverse waves.
3. A tall structure with flexible floors subjected to incident transverse waves.
4. General theory for a framed structure.
5. A structure with rigid floors and clamped base.
6. A structure with flexible floors and clamped base.
7. A structure with rigid floors and hinged base.
8. A four-storied structure with rigid floors and clamped base.
9. A five-storied structure with rigid floors and clamped base.
10. A six-storied structure with rigid floors and clamped base.
11. General law and comparison of the results of the present as well as the original problems.—*W. A.*

3361. Sezawa, K., and Kanai, K., Energy dissipation in seismic vibrations of a seven-storied structure; Nature of co-resonance: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 14, no. 2, pp. 189–200, June 1936.

The authors discuss energy dissipation in seismic vibration with respect to the case of a seven-storied framed structure. (See abstract 3360.) Mathematical formulas are determined; they correspond to the authors' original as well as improved theories.—*W. A.*

3362. Sezawa, Katsutada, On the relation between seismic origins and radiated waves: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 14, no. 2, pp. 149–156, June 1936.

A mathematical discussion showing that the mechanism of seismic origin is probably of the nature of plastic deformation as the result of a relatively sudden movement and mainly of shearing type. The radiated waves would then be mainly distortional. In the usual earthquakes of relatively shallow origins, transverse waves are predominant rather than the longitudinal. My result seems then to be more in line with Jeffreys' particular conclusion that P waves are merely generated from S waves by reflection at discontinuity surfaces than with other theories.—*Author's conclusion.*

3363. Sokolov, P. T., Über einige Eigenschaften der Laufzeitfunktion [On some properties of travel-time function]: Gerlands Beitr. Geophysik, vol. 47, no. 3, pp. 276–289, Leipzig, 1936.

The author supposes that the velocity of elastic waves in the earth is a function of a radius vector. On the condition that the trajectories of seismic waves have only one minimum for the radius vector and the assumption that the focus of an earthquake is on the earth's surface,

a formula for the epicentral distance is derived. The hodograph is worked out and its properties examined.—*W. A.*

3364. Stockman, L. P., Twenty-three crews making seismograph surveys in California: Oil and Gas Jour., vol. 35, no. 12, p. 11, Tulsa, Okla., 1936.

The increase of geophysical exploration for new fields in California is mentioned. Most of the crews are working in the San Joaquin Basin, especially that area in Kern County between the recently discovered Stevens field and Buttonwillow gas field. The reflection method is used.—*W. A.*

3365. Syono, S., Free motion on the surface of a semi-infinite elastic solid: Geophys. Mag., vol. 9, pp. 285–298, Tokyo, December 1935.

In Lamb's treatment of this problem he assumed a concentrated force. This is shown to lead to untenable results in certain circumstances. The free motion of a surface is here worked out without adopting the assumption of a concentrated distribution.—*W. A. R., Sci. Abstracts, vol. 39, no. 461, 1936.*

3366. Terada, Torahiko, Colloids and seismology: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 3, pp. 562–567, September 1935.

Note to draw the attention of seismologists, especially those interested in the secular movement of the earth's crust, to the colloidal properties of some crust materials, as these properties seem not to have been duly taken into account, in spite of their probable importance in connection with many urgent problems of modern seismology.—*W. A.*

3367. von Thyssen, St., Über die Verwendung verschiedenartiger Explosionen zur Erregung seismischer Wellen [On the application of different kinds of explosions for exciting seismic waves]: Zeitschr. Geophysik, vol. 12, no. 2/3, pp. 86–97, Braunschweig, 1936.

The author discusses in the first part important technical viewpoints concerning explosions applied in practical explosion seismics. Then experiments for producing elastic waves by means of the accumulated energy of compressed gases and by driving mechanism enclosed in steel tubes are discussed. The "degree of the seismic effect" of explosives is small if the explosive power of explosives is transferred into seismic energy. Finally, it is shown that the explosion of comparatively small amounts of black powder enclosed in steel tubes is sufficient to produce useful reflection seismograms.—*Author's abstract, translated by W. A.*

3368. Trappe, Fr., Neuere Anwendungen des seismischen Verfahrens der Lagerstättenforschung [Recent applications of the seismic method of prospecting for deposits]: Öl und Kohle, vol. 12, no. 18, pp. 384–387, Berlin, 1936.

Exploration with refracted seismic waves prevailed during the first 10 years of field practice of the seismic method of subsurface exploration founded by L. Mintrop. This was due to the fact that the finding of new structures was the first problem given to the petroleum geophysicist. The detailing of the structures found was of secondary importance during this period.

Seismic reflection surveys are now extensively used to determine the depth to the surface of the coal beds in German coal districts. Postcoal faults are traced, and horsts are outlined in detail. Flank investigations on salt domes of the mushroom type are also carried out with reflected waves. Reflected waves penetrate much deeper than refracted waves.

Emphasis is laid on the importance of seismograph records in deep bore holes in order to obtain accurate average velocities.

On April 1, 1936, the following field parties were at work in Germany: 6 seismograph parties, 1 seismic foundation soil research party, at least 12 torsion-balance parties, and 4 gravimeter parties.—*Author's abstract, translated by W. A.*

3369. Visser, S. W., Some remarks on the deep-focus earthquakes in the International Seismological Summary: Gerlands Beitr. Geophysik, vol. 47, no. 3, pp. 321–332, Leipzig, 1936.

1. *The normal depth.*—There is no indication that Turner's normal depth of 0.04 R (225 kilometers) should be reliable.

2. *The long-wave records.*—The general reliability of Turner's depth determinations is confirmed by the long-wave records in the I. S. S. Great errors, however, occur. The L–N criterion (L, number of genuine long-wave records; N, the number of no long-wave records) may serve as a means of deducing the focal depth up to a limit of 0.09 R.

3. *The mystery of the high focus.*—The high-focus earthquakes are always shallow earthquakes.

4. *The geographical distribution.*—A group of 129 bathyseisms has been selected. The deepest earthquakes are found in well-defined areas, especially at the continental side of the shallow earthquake zones of the circum-Pacific belt. The focal depth increases continent-inward.

5. *The semiannual period.*—The 129 selected cases do not show this period; on the contrary they reveal a well-developed annual oscillation, especially in the Northern Hemisphere. This period suggests a strong interaction between the Asiatic continent and the Pacific Ocean.—*Author's summary.*

3370. Wanner, E., Comparaison d'enregistrements sismométriques obtenus par différents appareils [Comparison of seismometric records obtained by different apparatus]: Archives sci. phys. et nat., vol. 18, pp. 53–54, Geneva, January–February 1936.

Seismographs constructed according to Mainka and Quervin Piccard are compared. Too high values for the true oscillations of the ground are recorded by Mainka's seismograph for times of oscillation less than 4 seconds. The proper frequency of the transformation lever in this seismograph is determined to be the source of the error.—*W. A.*

3371. Westland, A. J., Comparison of old and new methods in analysis of earthquake of September 9, 1931: Seismol. Soc. America Bull., vol. 26, no. 2, pp. 119–124, April 1936.

The reason for the inability to determine satisfactorily the epicenter of certain earthquakes is traced to their foci being at abnormal depths. Such earthquakes are characterized by the insignificance or absence of surface waves, and the appearance of certain new phases—for example, pP, sP, and sS. Application in such cases of the Brunner depth chart gives a satisfactory solution for the epicenter. This is illustrated by comparing this method with that resulting from the use of normal tables of 1931 to the earthquake of September 9, 1931, at 18° N., 145.5° E.—*C. A. S., Sci. Abstracts, vol. 39, no. 465 1936.*

3372. Yamaguti, Seiti, A model experiment on the mechanism of occurrence of earthquakes: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 13, no. 4, pp. 772–782, 1935.

Describes an experiment which confirms the suggestion of Professor Terada that if a spherical part of the crust at the "deep" earthquake origin, lying several hundred kilometers beneath the earth's surface, happens to expand or yield by some cause, the maximum shearing stress may occur in a conical surface with semivertical angle of about 45° and the vertex at the center of the sphere, and the fracture may propagate along these directions toward the earth's surface.—*W. A.*

3373. v. zur Mühlen, W., Seismische Bodenruhe und Brandung [Seismic disturbance of the ground and the surf]: Zeitschr. Geophysik, vol. 12, no. 2/3, pp. 97–111, Braunschweig, 1936.

The correlation coefficients between the seismic disturbance of the ground in Hamburg, Potsdam, Taunus Observatory, Stuttgart, Strassburg, and Kerr, on the one hand, and the surf in northern and western Europe, on the other hand, are examined for two periods of time during the years 1930 and 1932. The discussion is carried on in consideration of the mutual relationship of the intensity of the surfs, the magnitude of their variations, and possible connection to the course of the primitive rocks, the latter viewpoint being raised by Schwinner. After a brief discussion of other possible explanations of the disturbance of the ground, the author finally examines the diurnal positions of the cyclones in northern Europe during the days of the maxima and minima of the disturbance of the ground for the two periods mentioned. These positions of the cyclones are shown in two maps.—*Author's abstract, translated by W. A.*

4. ELECTRICAL METHODS

3374. Bayard-Duclaux, Mrs. F., Recherches sur la conductibilité électrique des roches [Investigations on the electrical conductivity of rocks]: Annales de physique, vol. 6, pp. 5–107, Paris, July–August 1936.

The electrical conductivity of rocks is connected with a great number of other special questions, such as resistivity of minerals and factors that may influence the conductivity. Owing to the fact that knowledge concerning rocks in general is still very incomplete, the purpose of this article is to give a summary of a systematic investigation on rocks made by the author and to compare their electrical properties with those of the bodies adjoining them. The rocks selected are of very different origin.—*W. A.*

3375. Belluigi, A., Sui metodi interpretativi delle curve ρs per piu strati paralleli sovrapposti [On the methods of interpreting the ρs curve for several superposed parallel layers]: Beitr. Geophysik, vol. 6, no. 1, pp. 14–24, Leipzig, 1936.

The author discusses the empiric rules of interpreting the ρs curves and indicates the possible error even in the simple case of two layers. He draws the curve of the turning points (Wendepunkte) of Hummel's curve group $\left(\rho s \cdot \frac{a}{h}\right)$. The author considers the component method the most suitable one for interpreting the ρs curves. He confirms the validity of Tagg's method for the case of two layers but he proves, from examples, the inapplicability of this method for several layers. Finally, he gives an example of the application of the component method in the

alluvial region of the Paduan Valley.—*Author's abstract, translated by W. A.*

3376. Belluigi, A., Theoretical outlines of electrical coring: Beitr. angew. Geophysik, vol. 6, no. 1, pp. 25–37, Leipzig, 1936.

By this paper the author completes the series of his studies on electrical coring, three of which appeared last year in the "Bolletino del Comitato per la geodesia e la geofisica del Consiglio nazionale delle ricerche." Theoretical course of the drop of tension for some fundamental causes along the uncased part of a bore hole is established with regard to the method of measurement. Favorable conditions for measurements in determining the anomalies are mentioned, and the rules to be applied for the exact location of the physico-geological "discontinuities" (oil-bearing layers and ground-water horizons) are given. These "discontinuities" are not always in simple spatial relation with the electrical anomalies. This fact has been noticed several times in petroleum fields and can be derived directly from the theory.—*Author's abstract.*

3377. Brown, J. G., The effect of wind upon the earth's electric field at the surface: Terrestrial Magnetism and Atmospheric Electricity, vol. 41, no. 3, pp. 279–285, Baltimore, September 1936.

In a recent paper by Brown (see Geophys. Abstracts 83, p. 1772) a method of obtaining the local diurnal variation by eliminating the unitary variation from mean curves was adopted, and a theory of the local variation based upon the daily cycle of turbulence, convection, and subsidence in the atmosphere was proposed. C. W. Allen's observation (Commonwealth Observatory Mem. 4, May 1934) that on days of continuous wind the diurnal variation of the gradient at Mount Stromlo, Australia, approaches the unitary or world variations observed over the oceans, whereas on calm days the departure from the variations over the ocean is much greater, is of considerable interest in connection with this theory.

The mean local variations of the days of continuous wind and the calm days at Mount Stromlo have been computed, and the results are shown in a graph, along with the local variation computed from all electrically quiet days. From these curves it is evident that wind is an important factor in determining the amplitude and form of the local variation.

A series of examinations of gradient and meteorologic records for the detailed study of the effect of wind is given.—*W. A.*

3378. Collard, J., A search coil method of measuring the A. C. resistivity of the earth: Inst. Electrical Engineers Jour., vol. 78, no. 469, pp. 100–104, January 1936.

A description of the method of measuring the A. C. resistivity of the earth on the Carson-Pollaczeh theory for the mutual impedance of earth return circuits. The method consists in the measurement of the e. m. f. induced in a search coil at various distances from an earth return circuit carrying alternating current. The experimental points are superimposed on a set of theoretical curves calculated for different values of resistivity, and the curve with which the points coincide gives the resistivity.

The method has been used to measure the resistivity of the earth at various sites in England and Italy.

The results are given in table 1, showing the resistivity in ohm-cm and the geological formation at each site, and table 2 gives the resistivity in ohm-cm of the various geological formations, varying from a minimum

for alluvium of 200–400 ohm-cm to a maximum for igneous rocks of 50,000–100,000 ohm-cm.—*B. F. N. M., Inst. Petroleum Technologists Jour., vol. 22, no. 151, 1936.*

3379. Coulomb, J., La mesure du champ électrique au sommet du Puy de Dôme [Measurement of electric field at the summit of the Puy de Dôme]: Inst. et obs. de physique de globe du Puy de Dôme Bull., vol. 8, 12 pp., 1935–36.

Describes the installation for measuring the electric field at the summit of the Puy de Dôme adapted to the local meteorologic conditions. The results obtained in 1934 are shown in graphs and a table.—*W. A.*

3380. Dmitriev, V. L., and Tolmachev, B. V., Tests of electrical prospecting for underground waters [in Russian]: Materialy po gidrogeologii i inzhenernoi geologii U. S. S. R., no. 1, pp. 99–104, Tashkent, 1935.

After a brief outline of the method of electrical prospecting and its application in hydrogeology the authors give a description of their work in the region of Kokand (Central Asia) in 1933.

A series of investigations by using point electrodes 3 to 600 meters apart was made. From the data obtained a map of resistance curves was drawn. The chemical composition of the ground waters is shown in another map.

The authors conclude that although no definite technical and economic data could be obtained by the method used, its application may be useful for some preliminary prospecting to depths from 30 to 100 meters.—*W. A.*

3381. Dolitsky, V. A., Electrical coring in the Kaganovich mine [in Russian]: Neftianoe khoziaistvo, vol. 17, no. 4, pp. 34–43, Moscow, April 1936.

From a series of diagrams produced by the results of electrical corings in the bore holes of the Kaganovich mine, the author traces the various layers and determines the changes in the resistance of these layers. By analyzing these resistances the author establishes some regularities and draws conclusions on the irregular saturation of the various parts of oil zones, thus raising the question of separate exploitation of these parts.—*W. A.*

3382. Fritsch, Volker, Mitteilungen über die Versuche bei Ostrov und Macochy (Prüfung der funkgeologischen Ergebnisse durch Schürfungen) [Information concerning the tests made near Ostrov and Macochy (Verification of radio-geological results by boring)]: Hochfrequenztechnik und Elektroakustik, vol. 46, no. 6, pp. 186–187, Leipzig, 1935.

The radio-geological results of the application of the capacity method near Ostrov and Macochy were verified by boring. It was proved that the Fochdome had a continuation in the eastern direction and was filled with clay and that at farther distances there were also empty cavities.—*W. A.*

3383. Fritsch, Volker, Dritte Mitteilung über die Bergradioversuche in Kotterbach [Third communication on the radio tests in mines in Kotterbach]: Hochfrequenztechnik und Elektroakustik, vol. 47, no. 6, pp. 190–195, Leipzig, June 1936. (See Geophys. Abstracts 83.)

Describes tests of receiving and tests of sending. The following results of practical importance were obtained:

(a) Indication of the existence of good geologic conductors, such as water channels or faults of great dimensions, is possible by the absorption method on a 25-meter strip.

(*b*) The radio in mines (Grubenfunk) on a 25-meter strip is, in case of small energies, possible only over short distances.

(*c*) The course of the absorption curve and especially the frequencies of the extreme absorptions depend on the electrical properties of the volume of rock penetrated, the latter being supposed as structures consisting of first- and second-order conductors with dielectric zones embedded in them. They can be explained by Debye's and Falkenhagen's theories. From the position of the absorption strip (Absorptionstreifen), which depends on the losses caused by conduction and dielectric bodies and can be determined by measurement, it is possible to draw conclusions on the composition of the space in question—for example, the existence of lodes. Thus a new method of radio prospecting could be created by which, under certain circumstances, more reliable data could be obtained than by the absolute measurements of the decrease of the intensity of field used at the present time.—*Author's abstract, translated by W. A.*

3384. Fritsch, V., Einige Grundzüge der Funkengeologie [Some characteristic features of spark geology]: Elektrotech. Zeitschr., vol. 57, no. 30, pp. 857–861, Berlin, 1936.

Radio-geologic work and its practical application in mining are described briefly. The possibility of geologic exploration by radio-technical measurements according to the principles of the absorption method and the capacity method is examined. Finally, the author discusses the principles for applying radio in mines (Grubenfunk) when wire communication of the underground with the surface of the earth is destroyed by a disaster.—*Author's abstract, translated by W. A.*

3385. Fritsch, Volker, Beitrag zur Anwendung der Funkmutung nach dem Absorptionsverfahren [Contribution to the application of spark prospecting (radio prospecting) according to the absorption method]: Elektrotech. Zeitschr., vol. 57, no. 42, pp. 1204–1205, Berlin, 1936.

By a method of spark prospecting (prospecting by radio) are drawn conclusions on the condition and composition of the mountain mass under investigation from the relation of frequency to the coefficient of extinction. This method, if compared with the usual absorption method, offers certain advantages. The author refers to his previous articles published in Elektrotech. Zeitschr., vol. 57, no. 30, p. 857, 1936, and Hochfrequenztechnik, vol. 47, p. 190, 1936. [See abstracts 3383 and 3384.]—*Author's abstract, translated by W. A.*

3386. Fritsch, Volker, Beiträge zu den Beziehungen zwischen Ausbreitung Hertzscher Wellen und geologischer Beschaffenheit des Untergrundes (Funkengeologie); Grundlage und Anwendung der Kapazitätsmethode [Contribution to the relationship between the propagation of Hertzian waves and geological structure of underground (radio geology); principles and application of the capacity method]: Beitr. angew. Geophysik, vol. 5, no. 4, pp. 375–395, Leipzig, 1936.

Discusses the principles of the "capacity method" and its application to geophysical exploration of the subsoil. First, he determines the electrical oscillatory circuit and especially the favorable ratio of firmly fixed capacities and self-induction. Then, a substitute for the geologic conductor under consideration is developed, and the conditions for making the necessary assumptions are investigated. From these considerations the minimum wave length and the length of the antenna are determined. Geologic conductors as a rule do not represent surfaces of separation well distinguished electrically; therefore a fictitious conductor is chosen

instead, the vertical distance of which from the surface of the ground is called the "fictitious depth." The author examines a series of simple cases involving one or several geologic media. The influence of the resistance loss upon the result of measurement is especially discussed. The two most important methods are examined at the end of the general part of the article. In the curve method the substitute capacity of the antenna C_a is represented as a function of the height of the antenna h_a above the ground, and from the course of the curve conclusions on the kind and composition of the subsoil are drawn. By using the other method the substitute capacity is determined from a great number of stations on the area of examination; then the points of equal substitute capacity are connected with one another by curves (C constants), and from their courses conclusions on their properties are drawn.

In the second part of the article (which will appear in a later issue) the author discusses the results of his experiments in the Moravian karst, near Brünn, and the Kotterbach sparry iron ore deposits, in Slovakia. The method was applied there above cavities and outcrop fissures, as well as in drifts. Its capability of reproduction and applicability for prospecting for the height is discussed, and a great number of typical C_a/h_a curves and C constants are presented.—*Author's abstract, translated by W. A.*

3387. Fritsch, Volker, Beiträge zur den Beziehungen zwischen Ausbreitung Herz'scher Wellen und geologischen Beschaffenheit des Untergrundes (Funkgeologie); Grundlagen und Anwendung der Kapazitäts Methode [Contribution to the relationship between the propagation of Hertzian waves and geologic structure of underground (radio geology); principles and application of the capacity method]: Beitr. angew. Geophysik, vol. 6, no. 1, pp. 100–119, Leipzig, 1936.

Continuation of a paper published in the Beiträge, volume 5, no. 4, 1936. (See abstract 3386.) This paper describes tests made by the author in Kotterbach and in Ostrov and Macochy, and problems of future investigations.

The author attempts to analyze some principles of the capacity method and to stimulate new measurements based on his own tests. This work cannot be considered as being accomplished, but in making further investigations with some new viewpoints a perfect method may be developed. Although theoretical foundations allow us to develop a suitable method, practical results can be attained by this method only after sufficient experiment.—*Author's abstract, translated by W. A.*

3388. Gish, O. H., Electrical messages from the earth; reception and interpretation: Washington Acad. Sci. Jour., vol. 26, no. 7, pp. 267–289, July 15, 1936.

The view may be tentatively entertained that earth currents are in the main induced by magnetic variations, but that their strength and duration depend upon the distribution and configuration of oceans and continents, as well as upon other structural features of the earth. Modifications produced in earth currents by the deep structure of the earth's crust may thus afford information about conditions in that little-known region. The magnetic forces which, on the view just outlined, influence the earth currents have their immediate origin in the high atmosphere in about the same region which reflects radio waves. One might expect to find in the earth a general system of electrical calculations related to that in the higher atmosphere. It has recently become possible to

construct, on the basis of observed data, a world picture of earth currents. A world view is summarized of the gross aspects of the quiet-period earth currents, comprehensively interpreting the tranquil electric messages from the earth.—*J. E. B., Sci. Abstracts, vol. 39, no. 466, 1936.*

3389. Hummel, J. N., and Rülke, O., Der scheinbare spezifische Widerstand in Bohrlöchern [The apparent specific resistance in bore holes]: Beitr. angew. Geophysik, vol. 6, no. 1, pp. 89–99, Leipzig, 1936.

In a vertical section of a group of strata with a constant measuring basis the apparent specific resistance ascertained by means of the Neumann-Wenner four-point method generally gives bizarre curves which are in no simple proportion to the actual specific resistances of the single layers. The apparent specific resistance is by no means an average value resulting from the actual resistances, it is even not always enclosed in their range, but the extreme values of the apparent specific resistance may be greater or less than the maximum or minimum actual specific resistances of the respective layers. If three base points are used the curves show an amount of edges which is three times that of layer limits crossed by the measuring base. Several special cases are dealt with, the values calculated being made up in the form of a diagram. Calculations of this kind are most important for utilizing the results of measurements obtained from electric bore-hole investigations.—*Authors' abstract.*

3390. Jakosky, J. J., and Wilson, C. H., Electrical mapping of oil structures: Mining and Metallurgy, vol. 17, no. 353, pp. 231-237, 1936.

Two years of intensive application of the electrical method described in this paper has given ample opportunity to evaluate its effectiveness. This work shows the method to be applicable under fairly wide geologic conditions, but to be limited to problems where the depths of penetration are less than 3,500 to 4,000 feet. The extreme detail obtained in normal field operation, with readings made at depth intervals of 15 to 20 feet, minimizes the possibility of errors in interpretation in areas of complicated stratigraphy. This method differs from previous electrical methods in maintaining an accuracy of measurement and interpretation consistent with the small changes in value introduced by the deeper subsurface stratigraphic changes, largely because of (1) minimizing the variation in apparent resistivity with time of current flow, by means of a constant time of measurement; (2) eliminating the variation in apparent resistivity with density of current flow by means of a constant time of measurement; (3) eliminating the variation in apparent resistivity with density of current flow by systematically increasing the total current flowing in the energizing circuit as the volume of earth increases with greater depths of penetration; (4) development of a graphic method of interpretation, based primarily on the depth-resistivity logs obtained from the surface measurements; and (5) multi-directional measurements, which allow evaluation of topographic and near-surface effects.

The method may be used as a supplement to other geophysical methods and, when operating as a constant-depth traverse system, may be employed as a rapid reconnaissance method for indicating structural changes and for the location of faults and fault zones.—*Authors' abstract.*

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3391. Jakosky, J. J., and Wilson, C. H., Electrical mapping of oil structures: California Oil World, vol. 29, no. 2, pp. 2–3, 14–16, July 30, 1936; vol. 29, no. 3, pp. 14–15, Aug. 6, 1936.

The same paper was published also in Mining and Metallurgy, volume 17, no. 353, pages 231–237, 1936. (See abstract 3390.)

3392. Jensen, Joseph, Recent developments related to petroleum engineering: Oil and Gas Jour., vol. 35, no. 31, pp. 44, 48, Tulsa, Okla., 1936; Petroleum World, vol. 33, no. 434, pp. 298–300, London, 1936.

This paper was delivered before the Pacific coast meeting of the Petroleum division, American Institute of Mining and Metallurgical Engineers, Los Angeles, October 1–2, 1936.

A new method for logging formations through casing, known as the "stratagraph", is based upon the electromotive series of metals. Two circuits are established and nearly balanced against each other, the difference between the two making a record which is interpreted. Each of these circuits is so regulated with resistance that it has about the same strength as the other, their variations being affected by the fluid in the formation, which serves as an electrolyte. The first circuit includes a zinc rod driven in the ground about 150 feet from the well. The current flows from the zinc rod through the earth to the casing of the well and is returned to the zinc rod from the casing through a wire in which the recording instrument and the resistance are placed. The second circuit includes a zinc plate suspended on an insulated wire line inside the casing. The fluid in the casing may be oil-field water, fresh water, salt water, or mud, but of the same consistency. This creates a constant electrolytic action between the zinc plate and the casing. The current flows from the zinc to the casing and from the casing through the earth to a copper ground located about 100 feet from the well. It returns from the copper ground through the recording instrument and the resistance down the cable to the zinc plate. These two currents flow in opposite directions. The only purpose of introducing the resistance in one of the circuits is to limit the swing of the needle of the recording device to the width of the paper on which the record is made. As the suspended zinc plate is raised or lowered in the well and comes opposite the different beds outside the casing containing fluids of different strength, currents of different magnitudes are set up. Thus the record is made. Where the record swings widely to the left it indicates shale, and where it swings widely to the right it indicates sand. The attached sketches are submitted in support of the foregoing explanation of the two circuits.—*Author's description.*

3393. Jensen, Joseph, Recent developments related to petroleum engineering: Petroleum World, vol. 33, no. 434, pp. 298–300, London, 1936.

The original paper under this title was delivered before the Pacific coast meeting, Petroleum division of the American Institute of Mining and Metallurgical Engineers. (See abstract 3392.)

3394. Johnson, E. A., Application of alternating-current methods of detection to earth inductors for marine and land observations: Terrestrial Magnetism and Atmospheric Electricity, vol. 41, no. 3, pp. 251–260, Baltimore, 1936.

The limiting sensitivity of earth inductors is discussed from a theoretical and experimental point of view for the case of direct-current and alternating-current methods of detecting the output. The effect of

parasitic voltages is discussed, and it is concluded that the alternating-current detector may be made as much as 1,000 times as sensitive as the direct-current detector. The particular advantage of alternating-current methods of detection for marine observations is pointed out, and it is shown that such observations can be made with greatly increased accuracy.—*Author's abstract.*

3395. Keeler, Ralph, Geophysical prospecting in the Philippines: Am. Chamber of Commerce Jour., vol. 16, no. 8, pp. 26–27, 29, Manila, August 1936.

Geophysical prospecting in the Philippines during the last 2 years by the Developments Co., Inc., is based on a high-frequency inductive method; an electro-magnetic field envelops the ground for a certain distance, and distortions or irregularities produced by the hidden mineral bodies are recorded and mapped. A small radio broadcasting station, of about 50-watt power, is used to set up the magnetic field, and a portable radio receiving set is set up combined with a direct finding coil for making readings. The distance over which the equipment is effective varies, but in the islands about 1,000 feet is the usual distance between broadcasting and receiving set. Mineral bodies can be located to a depth of several hundred feet. Properties on which the surveys were made are listed.—*W. A.*

3396. Khmelevsky, I. V., Application of electrical methods of prospecting for studying karst phenomena [in Russian]: Razvedka Nedr, no. 13, pp. 30–32, Moscow, 1936.

Electrical methods of prospecting were tried by the author over a well-known karst area in the region of Chapaevka village, Saratov district, in order to establish the influence of karst phenomena on the results of measurements and on the interpretation of the data obtained. A very irregular curve was obtained from the electrical sounding over caverns, probably owing to tufa deposits there; the curve could not be interpreted by the usual methods of interpretation. The existence of the caverns could be clearly determined from the data obtained by electrical profiling, as low resistances were shown here in comparison with the high resistances produced by the surrounding limestone. The contours of the caverns could be well established and agreed with the slight subsidence of the ground observed by the eye. The determination of the depth of the caverns offered difficulties and could be made only very approximately.—*W. A.*

3397. Kupradze, V., Verbreitung der elektromagnetischen Wellen in nicht-homogenem Medium [Propagation of electromagnetic waves in a non-homogeneous medium]: Acad. sci. U. R. S. S. Comptes rendus, new ser., vol. 1, no. 1, pp. 7–9, Leningrad, 1936.

A mathematical discussion of the distribution of the electromagnetic waves in a layered medium. The integral equations obtained for this medium may be easily modified for a medium that contains a series of independent layers, each enclosed in the previous one of the series.—*W. A.*

3398. Kurdiukov, V. A., and Ryng, S. I., Prospecting for buried valleys by electrical methods [in Russian]: Razvedka Nedr, no. 14, pp. 12–14, Moscow, 1936.

Favorable results of electrical prospecting for water were obtained in 1935 in the arid regions of Karaganda-Balkhash (Kirghiz Republic). The depths of the three uppermost layers were determined by electrical

boring with an average error of a few meters. A bore hole was started at a place indicated by electrical prospecting, and water was found at a depth of 96 meters.—*W. A.*

3399. Lee, F. W., Geophysical prospecting for underground waters in desert areas: U. S. Bur. Mines Inf. Circ. 6899, 27 pp., August 1936.

A description of methods and results of geophysical prospecting for water in Nevada and adjacent States includes discussions of some of the associated problems relating to field technique and geologic interpretations, and some of the problems a field engineer encounters.

The author's conclusions may be summarized as follows:

Geophysical surveys in Nevada can help to determine underground water reserves. Enough water for moderate irrigation can be found in favorable districts. Sufficient differences exist in electrical conductivity between the gravel and clay beds to permit successful prospecting for water, especially at shallow depths. Where the water-bearing beds are as much as 350 feet deep, as in Bertine's artesian well, possible productive territory can be delineated. Considerable increase in speed of measurement and interpretation is possible with newer instruments. More experimental work relating to electrical conduction in the ground is desirable.

The paper is illustrated by 25 figures.—*W. A.*

3400. Loehnberg, A., and Loewenstein, A., Electrical prospecting for water: Mining Mag., vol. 55, no. 3, pp. 143–153, London, 1936.

In an account of geoelectrical work in Palestine involving boring operations for water a discussion of the general principles of geoelectric measurements and hydrologic underground prospecting is given. In the literature heretofore the questions treated were almost exclusively confined to the discovery of the first water horizon. There was rarely a discussion as to the quantity of water obtainable. To fill this gap the authors touch on the problem of water exploration in its general and most usual form, as follows:

1. All water-bearing strata are to be localized to a depth within economic limits.

2. The subterranean drainage area for the various water horizons is to be established and the yield of water to be estimated.

3. The probable quality of the subsoil water is to be found out.

4. Indications are desirable as to the difficulties encountered in the process of boring—that is, data as to the material of the various strata.

Before quoting examples illustrating a solution to these problems the authors discuss the obstacles that stand in the way of a hydrologic evaluation of geoelectric results.

Field diagrams of areas in which measurements were made are given, and their evaluation is discussed. The average measuring depth was 200 meters (minimum 50 meters, maximum 600 meters). The percentage of successful borings is estimated at not more than 30 to 40 percent.—*W. A.*

3401. Loehnberg, A., and Loewenstein, A., Die geoelektrische Hydrologie als Teilgebiet der Analyse des Untergrundes [Geoelectric hydrology as a special field in analyzing the underground]: Beitr. angew. Geophysik, vol. 6, no. 1, pp. 52–88, Leipzig, 1936.

For the solution of practical hydrologic problems (discovery of underground water), in addition to the first underground-water horizons, the deeper water resources must also be detected. The static and dynamic

conditions of the area to be investigated must be determined. To solve these questions the structure of the underground strata must be known in detail. This is possible by a new method of interpreting the curves of the apparent specific resistance (drawn according to Wenner); this method represents a modification and extension of Hummel's method by using flexible curves (Schmiegungskurven). The application of this method is described, and references justifying it are given. These interpretations, given in the form of vertical profiles beneath the points of measurement, result in cross sections of the underground showing the actual structure. From these pictures of the underground as developed by the geoelectric survey, conclusions on the hydrologic conditions may be drawn.

The necessary transformation of the results of geoelectric measurements into hydrologic or geologic facts requires a special complex kind of work.

Examples of geoelectric-hydrologic work in Palestine are described, and their practical results in connection with the discovery of water are mentioned.—*Authors' abstract, translated by W. A.*

3402. Löwy, H., Die Fizeaumethode und damit zusammenhängende Probleme der Geophysik und Hochfrequenztechnik [The Fizeau method and problems of geophysics and high-frequency technique connected with it]: Beitr. angew. Geophysik, vol. 6, no. 1, pp. 47–51, Leipzig, 1936.

In the Fizeau method intermittent waves are emitted from an antenna and, after reflection from a conducting surface, are received again by the same antenna at periodical intervals; after this they are transferred to an intermitting receiver having the same period but opposite phase. This method for measuring the distance of electrically conductive surfaces and connected geophysical and high-frequency problems are discussed.—*W. A.*

3403. Nippoldt, A., The secret of earth currents: Terrestrial Magnetism and Atmospheric Electricity, vol. 41, no. 3, pp. 261–263, Baltimore, 1936.

Observations on American telegraph lines and at individual stations during the last polar year, those made by Stenquist, by the Carnegie Institution of Washington at Huancayo and at Watheroo, by the Jesuits at Tortosa, Spain, and by many others lead to the inevitable impression that earth currents are primarily a local phenomenon but in addition have a universal character.

The distribution of land and water exerts an essential influence on the whole system of superficial currents, inasmuch as sea water is a much better conductor than land masses. The attention of geophysicists is directed to the geophysical aspect of earth-current curves and the distinction between superficial earth currents and those induced by the magnetic variation.—*W. A.*

3404. Earth-resistivity method of geophysical surveying [editorial note]: Petroleum Times, vol. 36, no. 916, pp. 151–152, London, Aug. 1, 1936.

Describes a method of geophysical surveying with the Megger earth tester based on measurements of the electrical resistivity or specific resistance of the earth. From variations in the resistivity it is possible to make accurate deductions as to the nature of the subsoil. The method is particularly applicable to such problems as determining the depth to bedrock for dams, buildings, highways, etc. The equipment, illustrated in two photographs, consists of two parts, one containing the hand generator and the other the necessary measuring instruments, connection

between the two being made by a special cable. There are five ranges—0–0.3, 0–1.0, 0–3.0, 0–10.0, and 0–30.0 ohms—and under normal conditions the instrument can be used for the determination of depths as great as 1,500 feet approximately.—*W. A.*

3405. Semenov, A. S., Method of electrical prospecting for hydraulic plants [in Russian]: Central Geol. and Prospecting Inst. Trans., no. 78, 64 pp., Leningrad, 1936.

A detailed description of field work by electrical prospecting in connection with the construction of large hydroelectric power stations. Conditions of the work in summer are examined especially. Experiments were made in tanks with the purpose of testing the effects of different factors on the character of the curves. A brief description of the method of interpreting the results is given. The article is illustrated by 47 figures.—*W. A.*

3406. Sen-Gupta, Bimalendu, and Khastgir, S. R., Direct determination of the electrical constants of soil at radio frequency: Philos. Mag., vol. 22, no. 146, pp. 265–273, London, August 1936.

The electrical conductivity σ and the dielectric constant ϵ of three different specimens of Dacca soil were directly determined by a resonance method for various values of moisture content from 0 to 40 percent, and for varying frequencies from 0.135×10^6 to 2.72×10^6 cycles a second. The values of σ and ϵ for the specimen of soil taken from a depth of 20 feet were decidedly lower than those for the surface soil Both σ and ϵ were found to increase with the moisture content, each tending toward a constant value for large values of the moisture content. The variation of σ and ϵ with frequency was also considerable.

Smith-Rose's direct determinations of σ and ϵ with specimens of English soil gave distinctly larger values, whereas Ratcliffe and White's values were of the same order as those obtained by us.

The values of the electrical constants of the soil obtained by direct experiments agreed in their order of magnitude with the values deduced from the attenuation measurements.—*Authors' summary and conclusion.*

3407. Geophysical prospecting for water [editorial note]: South African Min. and Eng. Jour., vol. 47, no. 2276, p. 44, Johannesburg, Sept. 12, 1936.

The striking success of the application of geophysical methods of prospecting for water (electrical methods) is mentioned in the annual report of the chief irrigation engineer for 1935. Drilling machines yielded the following results: With old-fashioned methods 29 bore holes were sunk, the footage drilled being 3,304; the total cost £4,147; the number of successful bore holes, 5; the percentage of successful holes about 17, and the average cost per useful supply over £800. On sites indicated as suitable after geophysical prospecting, 14 bore holes were sunk. The footage drilled was 2,412, at a total cost of £2,520, and the number of successful bore holes was 10. The percentage of successful bore holes was over 70, and the cost per useful supply £252.—*W. A.*

3408. Stefanescu, S. S., Sur les déformations d'un champ électromagnétique inductif provoquées par un sous-sol à stratification horizontale [On the deformations of an inductive electromagnetic field caused by the subsoil of horizontal stratification]: Soc. roumanienne phys. Bull., vol. 36, no. 63/64, pp. 169–179, 1934.

The electromagnetic field above the part of the earth's surface on which a straight-line current is induced is calculated. In one case the

ground is considered to consist of several homogeneous isotropic layers, and in another case of several layers of good conductivity, which are embedded in a nonconductive medium.—*Landhoff's abstract published in Zeitschr. Geophysik, vol. 12, no. 4, p. 100, 1936, translated by W. A.*

3409. Stepanov, G. I., On the question of the application of geophysical methods of prospecting in investigations connected with engineering and geology [in Russian]: Razvedka Nedr, no: 17, pp. 38–39, Moscow, 1936.

Briefly discusses the necessity for geophysical methods, in particular the electrical method, in connection with engineering work. The following questions are selected:

1. The elements of the flow of underground water (its amount, coefficient of filtration, velocity, and direction).

2. Phenomena of cracks and their intensity with depth and determinations of waterproof zones.

3. Determination of the magnitude of the weathered zones and of the depth of rocks unaffected by weather.

A few examples of this work carried out in Russia with good results are mentioned.—*W. A.*

3410. Stevenson, A. F., On the theoretical determination of earth resistance from surface potential measurements: Philos. Mag., vol. 21, no. 142, pp. 829–830, London, 1936.

This is a correction to Stevenson's paper of the same title published in Philos. Mag., vol. 19, no. 125, pp. 297–306, 1935. (See Geophys. Abstracts 73.) It reads as follows: "In a recent paper I attempted to give a solution of the problem (in the case where the conductivity is a function of depth only) in terms of Fourier series. Prof. R. E. Langer has, however, communicated to me a criticism of the paper which unfortunately invalidates much of the work."

The reason is briefly as follows: Equations (9) of the paper are an infinite set of linear equations for determining the Fourier coefficients of the potential from those of the conductivity. Groups of these equations were then summed in a certain way in order to obtain a direct relation between the Fourier coefficients of the surface potential and of the conductivity. But by a closer consideration of the structure of the original differential equation, Langer has shown that this process of summation leads merely to a series of identities 0 equals 0, and that, consequently, the subsequent work can have no real significance. The equations (9) still hold for the determination of the potential when the conductivity is an assigned Fourier series (and might be of a certain use in this connection), but this does not, of course, solve the converse problem of determining conductivity from surface potential, and this was the main object of the paper.—*Author.*

3411. Tagg, G. F., Earth-resistivity curves: Mining Mag., vol. 55, no. 1, pp. 28–31, London, 1936.

The empirical interpretation of earth-resistivity curves can be expected to give satisfactory results if the disturbing bed is thin and is of a resistivity differing considerably from its surroundings. A layer of water along an interface may appear as a thin bed of low resistivity and produce the desired effect on the resistivity curve. Where the beds are thick and of resistivities which do not differ greatly, however, it is doubtful whether an empirical rule will give satisfactory results.—*W. A.*

3412. Terada, K., Thunderstorms as a cause of earth currents: Geophys. Mag., vol. 9, pp. 269–278, Tokyo, December 1935.

Six different ways are stated by which electric charges may pass to the earth from the atmosphere; by three of these positive charges are brought, by the other three negative. The approximate times during which electricity is brought down by each of these methods are calculated. This calculation, along with the distribution of methods according to latitude, enables the quantity brought down in each latitude to be arrived at. At the poles the positive charge enters, at the Equator a much greater negative charge, the unequal distribution being mainly due, according to the author, to the point-discharge currents from thunderstorms. The actual value of earth current obtained from these charges, however, is very small, so that unsettled weather conditions do not account for the whole earth current. But over a region where the specific conductivity is high such conditions may contribute a fair proportion of the total.—*A. E. M. G., Sci. Abstracts, vol. 39, no. 461, 1936.*

3413. Walter, A. J. P., Earth-resistivity measurements: Mining Mag., vol. 54, no. 6, pp. 341–345, London, 1936.

Deals with the elimination of computations for stake resistances. The method used results in a considerable saving of time, for as many as 300 measurements can be taken with the instrument during an 8-hour day.—*W. A.*

5. RADIOACTIVE METHODS

3414. Belluigi, A., Giacimenti oleiferi ed elio [Oil-bearing deposits and helium]: Ind. mineraria, 2 pp., Rome, September–October, 1934.

Discusses the radioactivity of oil and of helium in oil-bearing deposits. The presence of helium in the gas accompanying the oil is interesting from two viewpoints—(1) utilization of the helium and (2) prospecting for oil by radioactive methods. Study of the radioactivity of cores extracted from the bore holes and of drawing geo-radio-electro-thermophysical profiles is recommended.—*W. A.*

3415. Ehrenberg, W., The connection between cosmic-ray showers and bursts: Royal Soc. London Proc., ser. A, vol. 155, no. 886, pp. 532–545, July 1, 1936.

Recording of the ionization current in a cosmic-ray ionization chamber is controlled by triple coincidences of Geiger-Müller counters, so that knowledge of the variation of the number of showers with their size is obtained. The majority of showers produced in a lead shield consist of far more particles than are necessary to operate a triple coincidence set. The results of these experiments lead to the conclusion that bursts are showers measured by the ionization they produce.—*Author's abstract.*

3416. Follett, D. H., and Crawshaw, J. D., Cosmic-ray measurements under 30 meters of clay: Royal Soc. London Proc., ser. A, vol. 155, no. 886, pp. 546–558, July 1936.

The authors show that the shower producing radiation penetrates 30 meters of clay, and that the ratio (shower-rate) ÷ (vertical intensity) at that depth is not very different from that at ground level. The authors conclude from these results that a considerable part of the radiation which penetrates 30 meters of clay must consist of positive or negative electrons. The zenith angle distribution of cosmic rays at ground level

has been shown to be the same as under 30 meters of clay, a result which is consistent with the conclusion that the intensity of radiation varies inversely as the square of the path length traversed.—*Author's abstract.*

3417. Israël-Köhler, H., and Becker, F., Proportion of emanation in ground air: Gerlands Beitr. Geophysik, vol. 48, no. 1, pp. 13–58, Leipzig, 1936.

Theoretical speculation and experimental determinations are given of the condition of emanations in air obtained from the ground, and from the dependency of the pressure of Rn at different depths, the existence, form, and depth of the tectonic heterogeneity can be predicted. Such experiments form a supplementary method of geophysical survey, which can be further augmented by measuring gases (CO_2; CH_2) which do not dissociate. The depth for which geological heterogeneity is perceptible by emanation at the surface is limited by the "prolificness" of the source of interruption. The most reliable analysis is the one based upon the distribution of atmospheric pressure in a relatively short depth. A review of the methods of determining the Th emanation in the ground air and some results of orientating surveys are given.—*H. M. B., Sci. Abstracts, vol. 39, no. 465, 1936.*

3418. Jeffreys, Harold, On the radioactivity of rocks: Gerlands Beitr. Geophysik, vol. 47, no. 1/2, pp. 149–171, Leipzig, 1936.

Statistical comparison of experimental determinations of radium and thorium in rocks is given. The purpose of the paper is to show what differences are adequately supported by the observations. Some of the differences are capable of more than one interpretation; suggestions are made for further investigation.

The author gives comparative values for the following rock types in different regions: (1) Granites; (2) granodiorites, granitites, hornblende granites, quartz trachytes; (3) gneisses; (4) syenites and trachytes; (5) diorites, andesites, dacites; (6) basalts, dolorites, diabases, norites, gabbros; (7) plateau basalts; (8) eclogites, poole; (9) peridotites, etc.; (10) dunites.—*W. A.*

3419. Montgomery, C. G., and Montgomery, D.D., The absorption of cosmic-ray showers by lead: Phys. Rev., vol. 49, no. 10, pp. 705–711, 1936.

The absorption in lead of the shower rays which produce the bursts of cosmic-ray ionization is measured by two methods. The first method consists in observing the ionization produced above and below a lead absorber placed across the center of an ionization chamber; the second is to observe the probability that a burst of ionization in a chamber is accompanied by a simultaneous discharge of three Geiger-Müller counters over one of which has been placed an absorber. The results of the two methods are in good accord and may be stated in the form that the probability that a ray of a shower will penetrate a thickness of lead decreases linearly with the thickness, becoming zero at approximately 11 centimeters. The experiments serve to emphasize again the high energies that are involved in a large shower. The results are applied to observations on the effect of shielding on the ionization observed in the stratosphere.—*Author's abstract.*

3420. Growth of knowledge of the ionosphere [editorial note]: Nature, vol. 137, no. 3475, p. 956, London, 1936.

Mentions Prof. S. K. Mitra's "Report on the present state of our knowledge of the ionosphere" appearing in the Proceedings of the National Institute of Sciences of India, 1935. This report presents the

main results of both theoretical and experimental investigations on the ionosphere during the last 12 years.—*W. A.*

3421. Neuberger, H., Bemerkungen zu der Abhandlung von Herrn M. Bossolasco, Turin, "Über die Anzahl der Kondensationskerne in Mogadischu" [Remarks on M. Bossolasco's work "On the number of condensation nuclei in Mogadischu"]; Bossolasco, Mario, Erwiderung auf die Bemerkungen von Herrn H. Neuberger zu meiner Arbeit "Über die Anzahl der Kondensationskerne in Mogadischu" [Answer to the remarks of H. Neuberger concerning my work "On the number of condensation nuclei in Mogadischu"]: Gerlands Beitr. Geophysik, vol. 46, no. 1/2, 1935, pp. 208–217, Leipzig, 1935.

Bossolasco's article which caused the exchange of opinions indicated above was published in Gerlands Beitr. Geophysik, vol. 44, no. 1, pp. 1–15, 1935. (See Geophys. Abstracts 78.) The question concerned the correctness of the measurements of the nuclei of condensation made by Bossolasco on the North Sea (Island of Sylt) during the international polar year.—*W. A.*

3422. Nishina, Y., and Ishii, C., A cosmic-ray burst at a depth equivalent to 800 meters of water: Nature, vol. 138, no. 3495, pp. 721–722, London, Oct. 24, 1936.

Dr. Y. Nishina and C. Ishii have recently made measurements of cosmic-rays intensities in a railway tunnel under a vertical thickness of rock (diorite) varying from 1,230 to 120 meters, water equivalent about 3,400 and 340 meters, respectively. At a vertical thickness of 325 meters (minimum thickness 290 meters) a burst of 107 ions was observed, which proves the presence of cosmic rays after passing through rock the absorption of which is equivalent to that of more than 800 meters of water.—*Editor's abstract, p. 724.*

3423. Rothé, E., and Arlette, Hée, Étude d'une zone de contact de granite-gneiss par l'observation des rayons pénétrants [Study of a granite-gneiss contact by observation of penetrating radiation]: Acad. sci. Paris Comptes rendus, vol. 203, no. 3, pp. 268–270, July 20, 1936.

The great difference in the radioactivity of the granite of Bressoir with two micas (practically nil) and that of the porphyroid granite of the central Vosges (practically double that of any neighboring rock), usually containing much amphibole, affords a useful method for determining the zone of contact. Thus, within a short distance along the footpath from Brifosse to Chaumes de Lusse, the radioactivity falls by over 50 percent.—*C. A. S., Sci. Abstracts, vol. 39, no. 465, 1936.*

3424. Satterly, J., Age of the earth: Devonshire Assoc. Trans. 67, pp. 35–73, 1935.

After a brief account of the astronomical and geological methods of deducing limits to the age of the earth, a detailed account is given of the radioactive method of determining the age of rocks, as deduced from the amounts of U and Th, and the amount and atomic weight of Pb present therein, with examples worked out in full.—*C. A. S., Sci. Abstracts, vol. 39, no. 463, 1936.*

3425. Snarsky, A., Determination of the gas content of horizons by the radioactivity of the minerals: Azerbaidzhanskoe Neftianoe Khoziaistvo, no. 11/12, pp. 28–34, Baku, 1934.

On the basis of some experiments reported in the paper, the following conclusions were reached:

1. The radioactivity of minerals containing crude oil is of a sedimentary character.

2. Minerals of increased radioactivity may be considered indicators for the presence of gas.

3. Activity of individual mineral samples is possible, but it is due to enclosures of radioactive elements.

4. An increase in the activity of water-containing horizons is possible, and such horizons, if they contain gas, can be determined by means of prospecting, being characterized by their electrical resistance.

5. In the absence of suitable apparatus for determining the α-emanation, the soil will show a blurred maximum (by the Schlumberger method).

6. Because of diffusion properties of the gas through the minerals, and in the case of its activity and an accumulation in the upper mineral layers, the air will be activated, and the latter fact can be utilized for investigating the presence of gas and oil.—*Abstract in Inst. Petroleum Technologists Jour., vol. 22, no. 149, 1936.*

3426. Spicer, B. A., Emanation electroscope: Jour. Sci. Instruments, vol. 13, pp. 263–267, London, August 1936.

Describes an instrument for the estimation of quantities of Rn in the range of activities not covered by the existing emanation or γ-ray electroscopes. The sensitivity is controlled by a variable capacity.—*Author's abstract.*

3427. Ziemecki, St., and Narkiewicz-Jodko, K., Variation of cosmic-ray intensity with height in the atmosphere: Nature, vol. 137, no. 3475, p. 944, London, 1936.

Measurements of cosmic-ray intensity at points between 6,000 and 10,000 meters gave a smooth curve, the deviations from it not exceeding 5 percent and being in general less than 2 percent, contrary to the results obtained by Suckstorff, who found especially great discontinuities in higher regions between 7,000 and 9,700 meters. The discontinuities observed by Suckstorff were due to the irregularity of the movement of the electrometer tread, the Kolhörster apparatus not being sensitive enough for measurements of short duration. The curves showing Kolhörster measurements, those obtained by Suckstorff, and those obtained by the authors are given in a figure for comparison.—*W. A.*

6. GEOTHERMAL METHODS

3428. DeLury, J. S., and Lane, A. C., Radioactivity and geothermal gradients: Pan Am. Geologist, vol. 64, pp. 99–105, September 1935.

The main sources of earth heat are the relatively hot interior of the earth and the radioactive elements, which are commonly considered to be concentrated largely in the outermost shell. Geothermal gradients are very diverse largely because radioactive materials are very diverse in their concentration, and therefore radioactive materials are the dominant source of heat in outer shells of the earth.—*W. A.*

3429. DeLury, J. S., and Spivak, Joseph, Concomitants of diverse geothermal gradients: Pan Am. Geologist, vol. 64, pp. 185–192, October 1935.

Theories of intrusion and diastrophism must have cognizance of the limitations which are placed on them by physical conditions within the earth. The dominating factor in determining these conditions is heat, but thermal evidence has been interpreted in widely different ways in attempts to arrive at temperatures existing at various depths. Many

hypotheses are built on assumptions of delicate adjustment of thermal conditions, which are vital to each particular hypothesis. It appears, therefore, that a solution of the geothermal problem is necessary in order that untenable hypotheses may be discarded, and to point the way to the correct diagnosis of the causes of earth movements. Interpretations of geothermal data are so diverse, however, that a solution may well appear to be hopeless. Nevertheless, the writers venture to approach the geothermal problem with the view that the evidence has so far been misused and that there are sufficient data to permit correct interpretation.—*Authors' introduction.*

3430. DeLury, J. S., Geological deductions from a thermal equation: Jour. Geology, vol. 44, no. 4, pp. 479–495, 1936.

A thermal source is indicated for the energy of earth distortion and deformation of the outer lithosphere. Heat is available and effective for these purposes in direct proportion to the unevenness of its distribution. Radioactive elements, which are considered to be the most important source of heat in outer shells, migrate extensively in geologic time through erosion and movements of magma. An investigation of the interplay in time of the factors of thermal conductivity and vertical horizontal distributions of radioactive elements seems to show that small fractional differences in each of these factors may decree important differences in geothermal history. Predictable effects of diversity of geothermal conditions, such as thermal distortion, magma generation, magma migration, and forced intrusion followed by deformation, are indicated. In addition some conclusions are drawn concerning the origin of batholiths and of certain types of extrusives.—*Author's abstract.*

3431. Wegener, Kurt, Die Temperatur am Boden des Grönländischen Inlandeises [The temperature at the bottom of the Greenland inland ice]: Zeitschr. Geophysik, vol. 12, no. 4, pp. 166–172, Braunschweig, 1936.

The temperature at the bottom of the inland ice is limited in the downward direction by the temperature of the ice surface, the thickness of the ice, and the heat current; in the upward direction by the melting temperature. Melting temperature prevails at the bottom of the inland ice.—*Author's abstract, translated by W. A.*

7. UNCLASSIFIED METHODS

3432. Antonov, P. L., On a variant of gas survey [in Russian]: Neftianoe Khoziaistvo, vol. 17, no. 8, pp. 27–29, Moscow, 1936.

Gas survey is, in general, based on the analysis of samples of soil air from depths of 1 to 1.5 meters. From the qualitative and quantitative results of the analysis conclusions on the existence of a deposit of gas or oil are drawn. The character of the distribution of the hydrocarbon gases diffusing from the various parts of a productive layer is shown in a figure. The results of the analyses of samples of the soil air are represented graphically in the form of a profile. The obtained minimum coincides with the position of the dome of the structure. The contours of the cap containing gas are determined by the positions of the points of the inflections of the curve. A few profiles obtained from preliminary measurements over known deposits are given.—*W. A.*

3433. Antonov, P. L., On the evaluation of the productive strata by the method of gas survey [in Russian]: Neftianoe Khoziaistvo, vol. 17, no. 8, pp. 29–31, Moscow, 1936.

A mathematical discussion of the approximate determination of the order of the pressure in the strata. The solution of the problem is based on the theory of the distribution of hydrocarbon gases in the intermediate layers. A long deposit of a small width is examined.—*W. A.*

3434. Bartels, J., Geophysical time functions: Preuss. Akad. Wiss. Ber. 30, pp. 504–522, Berlin, 1935.

A statistical theory of geophysical successions is worked out, which can be applied to arrays with a probability after-effect, especially to time series in geophysics. The tendency to conservation and quasi-persistence causes a considerable diminution of the observed material and changes in the usual statistical treatment, especially in proving the presence of periods. Examples are given.—*W. A. R., Sci. Abstracts, vol. 39, no. 463, 1936.*

3435. Bartels, J., Geophysical cycles: Washington Acad. Sci. Jour., vol. 26, pp. 195–199, May 15, 1936.

The author recommends statistical methods "not only for detecting significant cycles, but even more for checking the exuberant production of cycles".—*W. A. R., Sci. Abstracts, vol. 39, no. 463, 1936.*

3436. Bowie, William, Vertical movements of earth's crust as determined by leveling: Jour. Geology, vol. 44, no. 3, pp. 387–395, 1936.

The leveling net which has been extended over the country to serve many engineering purposes is used also to detect vertical movements in the earth's crust by re-running, at intervals, the lines in the net and comparing the results of the different runnings. In certain critical areas in California a number of the lines have been re-run, but so far the only area in which large changes have been found is in San Jose and vicinity.—*Author's abstract.*

3437. Charrin, P., La géophysique en Gulf coast en 1935 [Geophysics on the Gulf coast in 1935]: Rev. pétrolifère, no. 678, pp. 549–550, Paris, April 11, 1936.

A summary of the results of geophysical work in the Gulf coast region in 1935 is given. A comparison is made with the work in 1934 (Geophys. Abstracts 85, p. 1820). Seventeen new discoveries made in Texas and Louisiana and the amount of oil produced by them in 1935 are given in tables. The fields are grouped into three categories—those producing over 100,000 barrels a year, those producing less than 100,000, and unproductive fields.

An increase of about 21,000,000 barrels in comparison with 1934 is calculated. This increase is due mainly to the new geophysical discoveries; therefore, by estimating the expense for geophysical work during 1935 at about $7,000,000 or $8,000,000 the conclusion is drawn that these expenses were already covered three times by the increased production only (at $1 a barrel).—*W. A.*

3438. Geological and geophysical survey [editorial note]: Chem. Eng. and Min. Rev., vol. 28, no. 332, pp. 267–268, Melbourne, 1936.

In reviewing the geophysical work in northern Australia the author mentions the magnetic surveys made in the Tennant Creek region, where a number of magnetic anomalies that may prove to be of con-

siderable importance were disclosed. Electromagnetic indications that may correspond to auriferous copper ore bodies were obtained in the Trekelano and Dobbyn areas. Electromagnetic indications were obtained also in the Mount Freda and Canteen areas.—*W. A.*

3439. DeLury, J. S., Magmas from subsidence: Am. Jour. Sci., 5th ser., vol. 23, pp. 357–368, April 1932.

The writer presents in this paper a hypothesis that seems to eliminate some of the difficulties which are inherent to current hypotheses of magma formation, magma intrusion, and explanations of the occurrence and association of divergent rock types. The hypothesis, moreover, besides seeming to meet the demands of igneous geology, appears to lead to a logical inter-relation of all crustal phenomena.

The present paper is written primarily to point out the probable importance of subsidence in the problems of magma formation and igneous intrusion. Certain inferences will be drawn concerning the bearing of the hypothesis on the questions of differentiation and assimilation. The strength of the conception as a whole, however, lies in its broad correlation of all crustal phenomena, so that its implications in other directions will be briefly indicated.—*Author's summary.*

3440. DeLury, J. S., Locus of magma formation: 5th Pacific Sci. Cong., A7, pp. 2285–2289, 1934.

An investigation of the evidence of horizontal variations in the crust leads to a mechanism of horizontal sheet flow in crust or subcrust, a mechanism which has already been deduced from the requirements of crustal structures (DeLury, The auto-traction hypothesis of crustal evolution: Univ. Manitoba, Dept. Geology and Mineralogy, Contr., 1931). The horizontal migration of magma on a broad scale permits an explanation of thermal conditions and thermal history which are anomalous under assumption of vertical adjustments. Even if the conclusions of the writer concerning thermal conditions in crust and earth are only approximately correct, their bearing on the major problems of the crust cannot be ignored. Generally speaking, strength increases with depth. There is no universal asthenosphere, but isostasy is disturbed and corrected locally by the same mechanism which operates in an earth that is only locally weak. Thermal distortion of the body of the earth leads to crustal distortion, which, in turn, leads to migration of magma in horizontal sheets, igneous intrusion, and accompanying crustal deformation. Present-day phenomena, such as changes of level, earthquakes, and volcanism, are effects which might be anticipated in all of their bearings from the thermal conditions of the crust and the crustal mechanism which these conditions seem to require.—*Author's abstract.*

3441. DeLury, J. S., Causes of crustal elevation and depression: Pan Am. Geologist, vol. 63, pp. 81–89, March 1935.

Unless the earth, as a whole, is weak, or there is a continuous shell of weakness, astronomic forces can have little or no effect in distorting the body of the earth. The author concludes that the earth has no weak shell, and that heat is very definitely the source of energy which eclipses all others in providing the forces for distortion.—*W. A.*

3442. Eve, A. S., Northern lights: Nature, vol. 137, no. 3472, Suppl., pp. 813–820, London, May 16, 1936.

The phenomenon of the "northern lights" is described under the following headings: (1) The upper air, (2) Sound of auroras, (3) Spectroscopic evidence, (4) Aurora and magnetism, (5) Aurora and the weather, (6) Exploring the upper atmosphere, (7) Radio waves, (8) Sunspots, (9) Meteors, and (10) Mother-of-pearl and noctilucent clouds.

The study of the northern lights is bound up with other physical phenomena in the upper regions of our atmosphere, and progress can best be made, as in other branches of science, by advance on a broad front.—*W. A.*

3443. Grenet, G., Revue de physique du globe [Review of the constitution of the earth]: Rev. gén. sci. pures et appl., vol. 27, no. 14, pp. 421–424, Paris, July 31, 1936.

Examines the electric phenomena of storms, terrestrial magnetism, and geophysical phenomena in connection with the activity of the sun, such as diurnal and accidental variations of the magnetic field, the polar lights, propagation of radio-electric waves, telluric currents, and theories of the influence of the sun upon the geophysical phenomena.—*W. A.*

3444. Hales, A. L., Convection currents in the earth: Royal Astron. Soc. Monthly Notices, Geophys. Suppl., vol. 3, pp. 372–379, April 1936.

The idea of convection currents in the outer shell of the earth is investigated, and it is found that currents sufficient to give the stress differences required by the gravity anomalies are possible.—*Author's abstract.*

3445. Heiland, C. A., Suggestions for an expansion of Mines Geophysics Department: Mines Mag., vol. 26, no. 9, pp. 33–37, Denver, 1936.

The importance of geophysical training and research is emphasized. Discusses the development of geophysics in the United States and other countries, geophysics and the mineral industries in Colorado, equipment for geophysics instruction and research, suggestions for teaching and research personnel, for addition to equipment, and for additional offices, lecture rooms, and laboratory space, and research problems for the immediate future.

Heiland mentions especially the following main problems on which the geophysicist's attention will be focused: (*a*) Locating oil directly by geophysical measurements; (*b*) adaptation of electrical methods to the direct location of gold in place and in placer gravels; (*c*) systematic investigation of abandoned mines with a view to locating extensions of ore bodies; and (*d*) systematic study and perfection of methods for the location of ground water.—*W. A.*

3446. Herrman, H., Stöcke, K., and Udluft, H., Ground pressure and plate statics; tests on the elastic properties of coal-measure rocks from Upper Silesian mines: Beitr. angew. Geophysik, vol. 5, no. 4, pp. 396–424, Leipzig, 1936.

This article, which was originally published in the Zeitschr. Berg-, Hütten- und Salinenwesen, vol. 82, no. 6, 1934 (see Geophys. Abstracts 74), is given here in English.

The authors' idea is that in the working of seams the rock layers are bent, and therefore pressure and stress effects are caused. The first part of this article deals with the laws of plates. Points of discussion are the distribution of the abutment pressure along plate edges on small

nonelastic supports, the stresses and cracks in bent elastic plates, the influence of end conditions, more especially the difference between perfect and imperfect restraint. Examples from mining experiences follow which deal with the so-called Abdruck (pressure relief) as a consequence of plate laws, measurements of bends along the working face, pressure and stress effects beyond the working face in the intact area. An experiment made in a Lower Silesian coal mine shows the effects which the form of working-face line has in relation to the distribution of ground pressure. The mining conditions of the Andreasflöz 3, of the pit Königin Luise Westfield near Hindenburg (Upper Silesia) show that, owing to the working method here used, the pressure relief appears. Level subsidences in a higher situated main road explain the bending curves of the roof strata.—*Authors' abstract.*

3447. Jameson, M. H., Geophysical prospecting in the Witwatersrand gold fields: Mines Mag., vol. 26, no. 8, pp. 7–8, 29, Denver, August 1936.

The Witwatersrand system is divided into Upper and Lower groups, as follows: Upper, Kimberly-Elsburg series, Main Bird series; Lower, Jeppeston series, Government Reef series, Hospital Hill series.

The use of magnetic instruments to measure magnetic anomalies is confined to investigations of structural and stratigraphic conditions, and they are merely auxiliary aids to prospecting. The magnetic method has met with considerable success in the location of post-Karoo dikes and in determining the approximate location of the suboutcrops of three very strongly magnetic shale beds of the Lower Witwatersrand system. This method cannot, however, detect the Main Reef itself and cannot furnish reliable information as to the depth and dips of the Witwatersrand beds. Seismic reflection methods might be of considerable importance in this area in determining the thickness of the dolomites and Ventersdorp lavas. Dolomite basins could in all probability be mapped and avoided in mining operations; faults could be located and their throw measured.

Objections have been made to the use of seismic methods in determining the thickness of the dolomite because of its many cavities. In the region of the Venterspost Gold Mining Co., a shaft has proved the compactness of the dolomite of that area.

It is to be noted that the application of other geophysical methods would not eliminate the use of the magnetic method. Only through further experiments can the true scope of these methods be determined and their possibilities in the Witwatersrand area be established.—*Author's conclusion.*

3448. Judson, E. B., Comparison of data on the ionosphere, sun spots, and terrestrial magnetism: Nat. Bur. Standards Jour. Research, vol. 17, no. 3, pp. 323–330, 1936.

Ionosphere data of the National Bureau of Standards from 1930 to 1935 are compared with data on the earth's magnetic-field intensity and sunspot numbers. Seasonal variations of F_2 critical frequency and virtual height are compared with sunspot numbers and magnetic activity. Correlation of annual averages of the ionosphere critical frequencies with sunspot numbers is shown. Variations of midnight F_2 critical frequencies are compared with variations of sunspot numbers and magnetic activity.—*Author's abstract.*

3449. Jung, Karl, Geophysikalische Methoden zum Aufsuchen wichtiger Rohstofflager [Geophysical methods of prospecting for important raw-material deposits]: Chem. Zeitung, vol. 59, no. 42, pp. 425–427, 1935.

A general review of the most important geophysical methods of prospecting.—*W. A.*

3450. Kornfeld, J. H., Review of petroleum development in Texas: Petroleum Eng., vol. 7, no. 10, pp. 31–141, July 1936.

This long article is divided into eight parts, dealing divisionally with coastal Texas, east-central Texas, east Texas, north Texas, Texas Panhandle, southwest Texas, west-central Texas, and west Texas. In coastal Texas the Tomball field was a monument to geophysical exploration and was found by torsion balance. The Anhuae deep-seated salt-dome discovery was due to reflection-seismograph and torsion-balance methods and has proved the largest producer of the deep salt domes. The Schlumberger electrical surveying method is also largely used. Exploration of more than 60,000 acres has begun in Galveston Bay, with a fleet of 10 boats carrying seismic operators and apparatus. Gravel beds to a depth of 100 feet cause distortion velocities to the recording instruments unless shot points are drilled across a profile line and cased with 3-inch pipe. Routine practice utilizes shot points 40 feet in depth. Deep tests drilled in exploration work have been useful recently for geophone tests to determine wave velocities. The geophone is lowered to the bottom of the hole, and a charge of dynamite detonated at the surface. Correlation of unusual seismic pictures with those of known deep-seated domes is improving interpretation technique in recognizing anomalies of deep-seated domes, aided by correlation with regional minima as shown by torsion-balance work.

The Van oil field, a so-called ideal oil field, was indicated by the irregular dip at the surface of the lower Claiborne strata, and was checked by the core drill and reflection seismograph. The Buffalo oil field after the structure had been checked with geophysical instruments. Reflection-seismograph work revealed the "high" in the Long Lake oil field. Cayuga was discovered by reflection-seismograph surveys. The Red Lake structure was shown on torsion-balance evidence.

Major faults in the Balcones fault system are associated with masses of serpentine which represent peaks of weakness along regional fault displacements, occurring predominatingly on the upthrown side of local faults. Many of the larger plugs were successfully outlined by the magnetometer. Not all serpentine plugs were proved to be productive, although local uplift in association with a serpentine plug intrusion may be responsible for oil in overlying formations—for example, in the Chacon Lake oil field. Up to January 1, 1934, a total production of 15,700,400 barrels was recorded from 15 fields in serpentine or altered igneous material.

The existence of favorable structure near Lodi, Marion County, proved by intensive seismograph geophysical surveys, led to the extension westward from Caddo, La., of the large Rodessa oil field into Cass County, Tex.

Seismograph exploration by obtaining anomalies of the salt-dome type and a shallow sulphur dome seem to prove the existence of a salt-dome basin like the Texas and Louisiana coastal portions of the Gulf of Mexico embayment, the indications being that a huge basin exists in northern Mexico and that large oil reservoirs will have accumulated at the edge lines of the numerous sands in the Eocene, Oligocene, and

Miocene series. Owing to the great thickness of gravel beds in the Rio Grande extension of the Reynosa escarpment, which will be a hindrance to the reflection seismograph, the torsion balance, magnetometer, and other geophysical methods will be more extensively used. Lack of surface mounds, although salt deposits exist, renders detection of structure by surface geology almost impossible. After a reflection-seismograph survey disclosed the structure, the Mercedes oil field was discovered.—*Adapted from B. F. N. M., Inst. Petroleum Technologists Jour., vol. 22, no. 155, 1936.*

3451. Krahmann, R., Geophysical investigations upon mineral deposits in southern Africa: Beitr. angew. Geophysik, vol. 5, no. 4, pp. 425–450, Leipzig, 1936.

This is the second compilation, the first having been completed up to the end of June 1933 (see Geophys. Abstracts 61, p. 1145), and this one to end of June 1934.

The various geophysical investigations in the tables are classified according to the different physical methods employed.

The literature index has been divided into different groups according to the classification as given in the tables.—*W. A.*

3452. McFadyen, A. D., Science versus magic: Sci. Am., vol. 92, pp. 212–215, October 1936.

A popular description of various methods of geophysical prospecting for oil, accompanied by 10 figures.—*W. A.*

3453. Permiakov, J. G., Conditions favorable for oil deposits and the further direction for prospecting in the region of Emba [in Russian]: Neftianoe Khoziaistvo, vol. 17, no. 4, pp. 26–33, Moscow, April 1936.

Discusses characteristics of the region of the outcrops of oil-bearing beds, formation of salt domes in the Emba region, classification of salt domes, interdome structures, favorable conditions for the formation of oil deposits in the zones of salt domes, and types of deposits connected with salt domes, including contact deposits, deep structures, and buried structures. The article is illustrated by 21 figures.—*W. A.*

3454. Principles and practical results of geophysics [editorial note]: Petroleum Times, vol. 36, no. 916, pp. 141, i–xlviii, London, Aug. 1, 1936.

The article is divided into six main sections:

1. History of geophysics (magnetism; electrical methods; gravimetric methods; seismic methods). After a brief historical outline of the search for minerals the author concludes that the industrial use of geophysics began about 1920. A table outlining the development of geophysics as it appeared in December 1935 is given, though the author does not guarantee the strict accuracy of the figures. The number of geophysical parties working with all methods is estimated as follows: United States, 172; U. S. S. R., 84; Central America, 16; Argentina, 4; Canada, 6; Africa, 7; Rumania, 6; Europe (except U. S. S. R. and Rumania), 14; Asia (except U. S. S. R.), East Indies, Oceania, 13; total, 332.

2. Present position as to geophysical methods surveyed (gravimetric methods, magnetometry, seismic prospecting, electrical prospecting, future of geophysics, economic aspects of geophysics). The methods are summarized in two tables. The first, which corresponds to the "tools" used by the geophysicist, indicates the various techniques utilized, with their essential characteristics. The second table enumerates the practical "problems" which may be met, and gives for each one the most suitable method to apply.

3. Electrical exploration of drill holes (electrical resistivities of rocks, measurement of electrical resistivities, spontaneous currents inside drill holes, measurement of spontaneous potentials, application of electrical logs). Schlumberger's "electrical coring" method is described in detail.

4. Geophysical prospecting technique (static methods, electrical methods, seismic methods). The methods are described in detail.

5. World-wide geophysical operations and results (Canada, United States, U. S. S. R., France, North Africa, Rumania, Germany, Spain, Poland, Austria and Czechoslovakia, Italy, the Balkans, Africa, Venezuela and Trinidad, Argentina, Brazil, Chile, Asia (except U. S. S. R.), Malay Archipelago, Australia, New Zealand). A brief outline of the geophysical work carried out in these countries, with the essential results obtained.

6. World geophysical organizations.—Principal companies carrying out geophysical work (except oil companies that have their own geophysical departments) in the United States, France, Italy, Germany, Poland, Sweden, and United Kingdom are mentioned.

The article is illustrated by a great number of photographs, maps, and graphs.—*W. A.*

3455. Liogenky, S., Application of geophysical methods in searching for pegmatite veins in northern Karelia: Leningrad Geol. Trust Bull. 1, pp. 37–57, 1936.

The possibility of applying geophysical methods for detecting pegmatite veins was tested in the region of the Samoilovich mine, in northern Karelia. The operations were limited by drawing several profiles of well-known deposits. Electrical, radioactive, and magnetic methods were applied. Characteristic anomalies were detected by all the methods, except that of precise magnetometry. The results obtained are represented in a series of profiles. The practical problems of detecting pegmatite deposits can be solved best by the electrical methods. For checking anomalies to determine the attitude of pegmatite veins, their thickness, etc., the gravity and emanation methods should be used.—*W. A.*

3456. Northern Australian aerial and geological survey [editorial note]: Queensland Govt. Min. Jour., vol. 37, no. 432, pp. 160–161, Brisbane, 1936.

A brief summary of the report of the Committee of Direction and Control of the Northern Australia Survey for the half year ended December 31, 1935. Geophysical surveys included (1) a magnetic survey of the Tennant Creek gold field, where several magnetic anomalies were discovered. An exceptionally large magnetic anomaly indicated a large body of magnetic iron ore lying at a depth of about 300 feet. (2) Electromagnetic indications that may correspond to auriferous copper ore bodies were obtained in the Trekelano and Dobbyn areas. (3) Electromagnetic indications were also obtained in the Mount Freda and Canteen areas (Soldier's Cap).—*W. A.*

3457. Rosaire, E. E., Geophysical prospecting for petroleum: Military Eng., vol. 28, no. 161, pp. 351–354, Washington, 1936.

Shows in two maps proved domes of fields discovered nongeophysically in 36 years, and proved domes of fields discovered geophysically in 12 years, in Texas and Louisiana. The last section of the article deals with possible military adaptations. Should another war occur in which the opponents are comparably equipped with modern weapons, it is inevitable that sound-ranging methods will again be used.—*W. A.*

3458. Safronov, N. I., On the "aureoles of dissemination" of mineral deposits and their use in prospecting [in Russian]: Problems of Soviet Geology, vol. 6, no. 4, pp. 302–323, Moscow, 1936.

Outcrops of primary deposits are regularly connected with zones of accumulation of products of disintegration resting more or less in place, rich in characteristic or useful elements of the deposit in different phases.

For these zones the author proposes the name "aureoles of dissemination" and divides them according to the state of the contained characteristic or useful element into "salt", "mechanical", and "gaseous" aureoles. In the "salt aureoles" the characteristic or useful element is presented in liquid state (as easily soluble salt), in mechanical aureoles in the shape of stable minerals, and in gaseous aureoles in the form of gas.

The search for aureoles is made by means of the physico-chemical method of prospecting based upon a testing of surface formations on a large scale by means of the exact methods of physico-chemical analysis.

For the search for salt aureoles of dissemination is recommended the use of selective electrodes and a polarographic analysis on the basis of an electro-analysis; for mechanical aureoles, spectro-metallometrical surveys.

In order to corroborate his conclusion on methods, the author quotes several examples from the work done successfully in 1935 by the geophysical department of the Central Scientific Geological and Prospecting Institute on very different deposits (polymetallic, borate, tin deposits).—*Adapted from author's abstract.*

3459. Sawtelle, George, Salt-dome statistics: Am. Assoc. Petroleum Geologists Bull., vol. 20, no. 6, pp. 726–735, 1936.

Data on discovery, geology, and production of the Gulf coast salt domes. The locations of the 141 salt domes known in the Texas-Louisiana Gulf coast area are shown on a map.—*W. A.*

3460. Schleusener, Alfred, Über Deformationen der Niveauflächen durch bergmännischen Abbau und andere künstliche Massenbewegungen (Deformation of level surfaces caused by mining and other artificial mass movements): Beitr. angew. Geophysik, vol. 5, no. 4, pp. 480–518, Leipzig, 1936.

From the works of Galle and Helmert it is well known that equipotential surfaces of the earth are considerably influenced by hills and mountains. This treatise considers whether large deformations of equipotential surfaces are caused also by artificial mass movements.

Calculations of the changes of the level surfaces caused by the change of the distribution of masses, and calculations of plumb-line deviations are given. The measurements made at the Oldau Lock serve as a proof of the applicability of the conclusive formulas. They may also be applied for artificial mass movements.

The influence of the extraction of 1 milliard tons of hard coal is shown in a figure. The example as applied to Upper Silesia shows that the equipotential surface subsidence occasioned by 40 years of mining amounts to about only 1 millimeter. In the Ruhr district the change in the equipotential surfaces by mining is probably about 3 millimeters. A few other examples are discussed.

The conclusion drawn is that precise levels in special cases may be influenced by reason of artificial mass movements, but in general these changes are very slight only.—*W. A.*

3461. Sineritz, J. de, Geophysical studies in Spain: Rev. pétrolifère, no. 681, p. 643, 1936.

An account of geophysical work (electric, gravimetric, magnetic, and seismic methods) by the Spanish Government since 1927. Successful discoveries of faults, artesian-water sources, salt formations, etc., are mentioned.—*W. A.*

3462. Sokolov, V. A., La prospection gazeuse [The gas survey]: Rev. pétrolifère, no. 700, pp. 1381–1385, Paris, Sept. 12, 1936.

Owing to the fact that geophysical methods of prospecting give only information on underground structure without disclosing the location and contours of oil and gas deposits, the author proposes a new method of prospecting for oil and gas, called the "gas survey." This method consists of taking samples of soil air at depths of 2 to 10 meters and analyzing these samples with regard to their content of hydrocarbons. The main conditions necessary for the accumulation of oil and gas deposits, such as the existence of mother rock, of reservoirs in which oil and gas may accumulate, of structure favorable for deposits of industrial value, and of a roof sufficient for protecting the deposit from dispersion into the atmosphere, must, of course, be fulfilled. These conditions can be determined by the usual geophysical methods. The principle of the gas survey, apparatus, and the interpretation of the results are briefly described, based on the work done over well-known deposits in the region of Baku. Profiles showing the content of heavy hydrocarbons and methane are given, and the locations of productive and unproductive deposits are determined.

From the comparison of the data obtained by the gas survey with the real productivity of oil and gas in this region, the author concluded that high concentrations, as a rule, corresponded to the productive zones as established by drilling.

The applicability of gas survey in practice is considered to be possible after some further development of the methods of work.—*W. A.*

3463. Sokolov, V. A., On the methods of the interpretation of gas surveys: Neftianoe Khoziaistvo, vol. 17, no. 5, pp. 18–23, Moscow, 1936.

The following factors may aid in the interpretation of gas surveys and in the location of oil or gas: (1) The absolute value of the content of hydrocarbons, (2) the content of hydrocarbons according to the profiles, (3) the isolines of the content of hydrocarbons, and (4) the qualitative composition of hydrocarbons.—*W. A.*

3464. An Institute of Geophysics [editorial note]: South African Min. and Eng. Jour., vol. 47, no. 2257, p. 291, Johannesburg, 1936.

The establishment of an institute to be named "The Bernard Price Institute for Geophysical Research" is announced in this note. In addition to developing the work carried on at the University of Cape Town on lightning and cosmic-ray problems, the institute will deal with problems connected with meteorology, applied geology, geophysical prospecting, and radio communication as applied to the location of atmospheric depressions and temperature gradients in the earth's crust. Geophysical prospecting in connection with the exploration and development of new mining areas, particularly on the extensions of the Witwatersrand gold field, will receive special attention.—*A. E.*

3465. Stechhöfer, Stephan, Erdstrahlungsmessungen mit dem Geiger-Müller-Zählrohr und elektrische Feldstärkenmessungen im Gelände [Earth radiation measurements with the Geiger-Müller counter tube and electrical-field intensity measurements in the field: Zeitschr. Geophysik, vol. 12, no. 2/3, pp. 68–86, Braunschweig, 1936.

The author draws from his measurements the conclusion that the divining-rod effect was not caused either by the penetrating radiation or by a disturbance of the electrical field.—*W. A.*

3466. Tucker, Mitchell, Extensive leasing follows discovery of Smackover Permian production: Oil and Gas Jour., vol. 35, no. 8, pp. 25–26, Tulsa, Okla., 1936.

Active search for favorable structural traps and points of oil accumulation continues throughout the "Permian basin" of Arkansas and Louisiana. At present there are 20 seismograph, 2 magnetometer, and 1 torsion-balance crews actively engaged in this search. Extensive exploratory work in this territory must, according to the author, be done by geophysical means. In a résumé of geology and the occurrence of petroleum made in 1934 by the United States Geological Survey, the following was said in this regard: "Although the surface geology of the Arkansas Coastal Plain cannot be ignored as an essential preparatory basis for other types of exploration, virtually all of the future exploration will be guided primarily by geophysical investigations, subsurface studies, and actual drilling, with surface indications of minor importance."—*W. A.*

3467. Whipple, F. J. W., Strains in an elastic solid: Royal Astron. Soc. Monthly Notices, Geophys. Suppl., vol. 3, pp. 380–388, April 1936.

The distribution of strain in a semi-infinite solid is discussed on the supposition that the solid is homogeneous, that there are no external forces, and that the strains in the immediate neighborhood of an internal nucleus are of a specific type. Formulas are given for the displacements of the surface. It is found that elevation of the surface is associated with radial displacement outward from a central point, and depression with displacement inward. The bearing of this theory on seismology is briefly discussed.—*Author's abstract.*

3468. Williams, Neil, 260 geophysical crews active in field exploration work: Oil and Gas Jour., vol. 35, no. 18, p. 25, Tulsa, Okla., 1936.

There are now more than 260 geophysical crews at work, an increase between 50 and 60 within 6 months. The crews are distributed as follows: Texas Gulf coast, 50; Louisiana Gulf coast, 33; north Louisiana, Arkansas, and northeast Texas, 27; Oklahoma and Kansas, 50; California, 27; Wyoming, 6; Illinois, 7. This check does not show any crews operating in Nebraska, New York, and other Eastern States.

The industry is spending about $14,000,000 annually on geophysical exploration. This figure is based on an estimated average monthly cost of $4,500 to $5,000 per crew. It is figured that the discovery of one or two good fields each year repays the cost many times over. On the Gulf coast alone 15 fields whose discovery is directly attributed to geophysics have been opened this year. Since the introduction of geophysics 97 fields, exclusive of those in the lower Gulf coast district and southwest Texas, have been opened as a result of geophysics. Altogether, 154 fields and domes have been found on the Gulf coast. Most of the geophysical exploration now under way is being done by

shooting crews. Of the total of 260 crews now active, 210 are using the seismograph, 36 are operating torsion balances, and 14 magnetometer, pendulum, gravitometer or one of the various electrical instruments. Reflection shooting is most prevalent.—*W. A.*

3469. Wyszynski, O. V., Die Erforschungsarbeiten in Polen, ausgeführt durch die "Pionier" A. G. [Prospecting work in Poland carried on by the "Pioneer" Co.]: Petroleum Zeitschr., vol. 32, no. 23, pp. 31–34, Berlin, 1936.

The Pioneer Co. is organized and supported by all the large companies in Poland for the purpose of exploration of new oil regions and for the adaptation of new methods of prospecting to the geologic conditions of Poland. The regions in which geophysical work (magnetic, gravimetrical, and seismic methods) has been done since 1929 are mentioned, and the results obtained are briefly described.—*W. A.*

8. GEOLOGY

3470. Halbouty, M. T., Geology and geophysics showing cap rock and salt overhang of High Island dome, Galveston County, Tex.: Am. Assoc. Petroleum Geologists Bull., vol. 20, no. 5, pp. 560–611, 1936.

The High Island dome was first drilled for oil in 1901; the first production was obtained from the porous cap rock in 1922, on the superdome structure. The Yount-Lee Oil Co. in 1931 proved the existence of an overhang at High Island and has since developed the field from the northwest flank to the southeast flank. The development at present is toward the east flank.

The cap rock at High Island is divided into a false cap rock and a true cap rock. The false cap rock is a hard sand and lime rock ranging in thickness from 200 to 1,300 feet. The true cap rock lies underneath the false cap rock and consists of a series of caps. At the base of the series is anhydrite, which grades upward into gypsum and a calcite cap above the gypsum.

The overhang has so far been proved to exist on all flanks that have been drilled. There is a cap-rock overhang as well as a salt overhang; the cap-rock overhang extends outward and away from the salt. Production is just as abundant under the cap-rock overhang as under the salt overhang. The dome is somewhat lopsided in that the southeast flank is about 1,500 feet higher than the northwest flank. Faults have been detected on the south and southeast flanks. A theoretical peripheral fault is mapped from the northwest to the southwest flank. Oil has been produced in commercial quantities from the cap rock, Pliocene formation, Miocene formation, M Dv zone, *Discorbis* zone, and *Marginulina* zone. The *Heterosteyina* zone at High Island has not yet been penetrated or encountered. The Pliocene and Miocene production is very small, and practically all the sands in these two formations contain water.

The M Dv zone is a new paleontologic zone of lower Miocene age mapped by the writer as lying immediately above the true *Discorbis* zone of the middle Oligocene. This new zone is characterized by both lower Miocene and true *Discorbis* fauna. The name M Dv has been chosen to represent the zone because of the occurrence of a Miocene fauna associated with *Discorbis* cf. *D. vilardeboana* and its fauna.

The M Dv zone has so far proved to be the most productive of all the zones. Sands at six different horizons have been found in it. The

production of the *Discorbis* zone has been slight, but some of the company's latest and best wells are producing from this zone. Only one sand has been found in the *Marginulina* zone. The oil at High Island is divided into three types, ranging from 24° to 44° A. P. I. gravity.

The seismograph survey of the flanks of the High Island dome was made in October 1934, by the McCollum Exploration Co.—*Adapted from author's abstract.*

3471. Kelley, V. C., and Soske, J. L., Origin of the Salton volcanic domes, Salton Sea, California: Jour. Geology, vol. 44, no. 4, pp. 496–509, 1936.

The location of the Salton volcanic domes and the alinement of the associated mud volcanoes strongly suggest their affiliation with the buried extensions of the San Andreas fault. Two surface trends are evident—the northeastward locus of the volcanoes, and the northwestward line of mud geysers. The latter coincides almost exactly with a southeastward extension of the San Andreas fault from 15 miles to the northwest. A detailed magnetic survey indicates that the subsurface material is not confined to the immediate vicinity of the domes. Steep magnetic gradients observed over the flats some distance from the line of volcanic hills are interpreted as the magnetic effect of the sloping surface of the underground igneous mass. In consequence of wind-directed wave attack during the presence of Lake Cahuilla and Salton Sea the lighter pumiceous materials have been concentrated to the lee of the hills in wave-built terraces or "tails," which at the southernmost volcano have accumulated in sufficient quantities to be of commercial importance. At this same volcano a peripheral distribution of obsidian with relation to pumice leads to a unique interpretation of its structure and origin. Fumarolic carbon dioxide gas trapped in the valley sediments to the northeast of the domes has been recently exploited for the manufacture of "dry ice."—*Authors' abstract.*

9. NEW BOOKS

3472. Amaral, I. C. do, and Souza, H. C. A., Prospecção geophysica em São Paulo [Geophysical prospecting in São Paulo]: Ministerio da agricultura, Departamento nacional da producção mineral, Brazil, Bull. 10, 1936, 100 pp., 28 figures and 8 maps, Rio de Janeiro, 1936.

Contains three articles: (1) Detailed magnetic survey of the areas of São Pedro-Xarqueada, by I. C. do Amaral and D. S. Oddone; (2) Gravimetrical survey of the São Pedro area, by H. C. A. de Souza and M. Y. dos Guaranys; and (3) Magnetic survey of elevated places ("elevações") of Pitanga and Páu d' Lho.—*W. A.*

3473. Année polaire internationale, 1932–33: Participation française, vol. 1, Introduction, terrestrial magnetism, polar auroras, atmospheric ozone, cosmic rays, 413 pp., Paris, Gauthier-Villars, 1936.

The present publication constitutes the first volume of results obtained by the French expedition to Scoresby Sound during the second international polar year 1932–33 and is issued by the French commission for the polar year. The first section of the present volume, by J. P. Rothé, deals with the magnetic data obtained at Scoresby Sound from November 24, 1932, to August 14, 1933. The following subjects are discussed: Instruments employed, absolute measurements, polar auroras and magnetism, diurnal and annual variation of the magnetic field, solar and magnetic activity.—*W. A.*

3474. Bellamy, E. F., Index catalogue of epicenters for 1913–30, 40 pp., Isle of Wight, County Press, Newport, 1936.

In the University Observatory at Oxford two catalogs of epicenters are kept, one arranged in order of latitude, the other in that of longitude, with the dates on which the corresponding foci have been in action since 1913. This book is a reproduction of both these catalogs.—*W. A.*

3475. Bergtechnisches Taschenwörterbuch [Technical-mining pocket dictionary] part 2, German-English, Essen, Verlag Glückauf G. m. b. H., 1936. Price, RM. 4.20.

3476. Bowie, William, Geodetic operations in the United States, January 1, 1933 to December 31, 1935: U. S. Coast and Geodetic Survey Special Pub. 207, 25 pp., 1936.

Contents: General statement; Triangulation and leveling nets; Statistical data for triangulation executed; Triangulation methods; Measurements of base lines; Theodolite tests; Plane-coordinate systems; Local control surveys; Topographic mapping; Special geodetic work in California; Triangulation adjustments; Geodetic publications issued since January 1, 1933; Gravity determinations; Tidal stations and observations; Isostasy; Federal Board of Surveys and Maps; Section of Geodesy, American Geophysical Union; Surveying and mapping division, American Society of Civil Engineers.

Special articles: (1) Geodetic operations, Corps of Engineers, United States Army, by F. S. Besson; (2) Geodetic operations of the United States Geological Survey, by W. C. Mendenhall; (3) Adjustment of the triangulation on the North American datum of 1927, by Walter F. Reynolds; (4) Projections and plane-coordinate system, by O. S. Adams; (5) Local control surveys, by H. W. Hemple; (6) The United States Naval Observatory time service and variation of latitude work, by Paul Sollenberger; (7) Gravity and geodetic astronomy, by C. H. Swick; (8) Variations in yearly sea level, by Paul Schuremann.

3477. Brown, E. G., A determination of the relative values of gravity at Potsdam and Washington: U. S. Coast and Geodetic Survey Special Pub. 204, 15 pp., 1936. Price 10 cents.

The present publication is an account of the new gravity connection by the relative method between Washington, D. C., and the world gravity base station at Potsdam, Germany, made by E. G. Brown, of the Coast and Geodetic Survey, in the winter of 1932–33. Contents: Historical introduction; Program of observations; Apparatus and observing methods; Locations and elevations of stations; Chronology; Results of observations.

3478. Brunner, G. J., Chart of depth, time, and distance for deep-focus earthquakes, accompanied by a booklet: The Brunner focal depth-time-distance chart, by G. J. Brunner and J. B. Macelwane, New York, John Wiley & Sons, Inc., 1935.

The booklet describes the construction of the curves, which were based on several special studies by Brunner, Stechschulte, Scrase, and Wadati. Rules for use of the chart are presented.

3479. Information book on terrestrial magnetism and electricity, edited by N. W. Pushkow, 69 pp., Sloutzk (near Leningrad), Central Magnetic Observatory, 1936. Price, rubles 3.00.

The book contains the following articles (in Russian): (1) General magnetic survey of U. S. S. R., 1931–35, by N. N. Trubiachinski; (2) The Warsaw meeting of the Commission of Terrestrial Magnetism and Atmospheric Electricity, September 1935; (3) Some data of researches in terrestrial magnetism and atmospheric electricity during the international polar year, by N. W. Pushkow; (4) Communication on the work carried out on terrestrial magnetism and atmospheric electricity in the U. S. S. R. during the period from 1931 to 1935, by N. W. Pushkow; (5) The new magnetic laboratory at Sloutzk, by B. M. Janowski; (6) Magnetic laboratory of the geophysical station in Kawgolowo, by A. A. Logachew; (7) The new magnetic observatory in Nijnedevitzk, by P. J. Gusew; (8) Temperature changes in the higher atmosphere (translation) by E. V. Appleton; (9) Radioactivity of the atmosphere and aerial masses, by E. J. Merkulowa; (10) On the principle of magnetic cartography, by B. Weinberg; (11) The apparatus for direct determinations of vertical component of terrestrial magnetic field, by B. E. Brunneli; (12) On the question of the accuracy of determination of the inclination by Lamont's method, by N. P. Benkowa; (13) Micromagnetic survey of the molybdenum deposits at Parandova and Pjaavara, by J. M. Pudowkin; (14) Terrestrial magnetism work carried out by the expedition in 1935 on the "Malygin" by P. E. Fedulow; (15) New type of the magnetometric balance B. M. (La balance magnétométrique, designed by de LaCour), by N. W. Pushkow; (16) A new type of Z-variometer (designed by the Carnegie Institution, Department of Terrestrial Magnetism and Atmospheric Electricity), by N. W. Pushkow; (17) Apparatus registering the conductivity of the air in the stratosphere, by M. J. Bobarykowa; (18) Comparison of the observatory's standards by apparatus sent by post, by N. W. Pushkow; (19) Net of stations with rapid registration, by N. W. Pushkow; (20) Review of the Sun's activity, by E. T. Perepelkin; (21) Review of the terrestrial magnetic activity, by G. N. Kalitina; (22) Review of the conditions of broadcasting, by B. F. Arkhangelski and N. J. Lenshin. In addition to these articles the book contains notes and communications, reviews and abstracts, and a list of foreign and Russian publications.

3480. Chapman, S., The earth's magnetism, 112 pp., London, Methuen & Co., Ltd., 1936.

The brief but fairly comprehensive monograph by Dr. Chapman is very welcome, especially since it serves as a forerunner of a much more extensive and detailed treatment of the subject which the author hopes to publish shortly in collaboration with Prof. J. Bartels.—*Review by H. D. Harradon, Terrestrial Magnetism, vol. 41, no. 3, p. 264, 1936.*

3481. Cloos, H., Einführung in die Geologie; ein Lehrbuch der inneren Dynamik [Introduction in geology; handbook of interior dynamics], 503 pp., 356 figs., 3 tables, Berlin, Gebrüder Borntraeger, 1936. Price, RM. 24.

Part 3 of the book deals with the interior of the earth, discussing (1) physical methods for investigating the subsoil; (2) subsoil and the interior of the earth; (3) conditions and causes of the formation of the earth's crust.

3482. Coast and Geodetic Survey, Tables for determining the form of the geoid and its indirect effect on gravity: Special Pub. 199, issue of 1936. Price, 15 cents.

Contents: Part 1, Fundamental tables; part 2, Density of compensation for computing special Bowie tables; part 3, Bowie isostatic reduction tables; part 4, Determination of the geoid from gravity anomalies. In addition there is an appendix containing a number of miscellaneous tables. The present publication is intended to facilitate the solution of problems involving the deviation of the geoid from the spheroid of reference, with especial reference to the intensity of gravity.

3483. Coast and Geodetic Survey, Earthquake investigations in California, 1934–35: Special Pub. 201, 231 pp., 124 figs., 1936. Price, 35 cents.

Contains the following articles: (1) Field parties and problems, by F. P. Ulrich; (2) Strong-motion program and tiltmeters, by N. H. Heck, H. E. McComb, and F. P. Ulrich; (3) The analysis of records, by F. Neumann; (4) The questionnaire program for collecting earthquake data, by P. Byerly and H. Dyk; (5) Vibration observations, by D. S. Carder, with introduction by L. S. Jacobsen; (6) Vibration studies, by R. S. McLean and W. W. Moore; (7) The building and ground vibrator, by J. A. Blume, with introduction by L. S. Jacobsen; (8) A report on earthquake damage to type 3 buildings in Long Beach, by R. R. Martel; (9) Periods of the ground in southern California earthquakes, by B. Gutenberg; (10) Preliminary report on four-unit portable seismograph, by H. Benioff; (11) Geodetic work in earthquake regions in California, by W. F. Reynolds and H. S. Rappleye.

3484. Dominion Observatory, Wellington, New Zealand, Dept. Sci. and Ind. Research, Bulls. E51 and E52, 1936.

Seismologic reports from New Zealand stations.

3485. Efimov, I. E., and Rusakov, V. P., Geophysics, collection of articles in connection with the study of western region, 148 pp., with figures and maps, 1935. Smolensk, U. S. S. R., no. 3. Price, rubles 4.65.

Contents: (1) Isotopes of radioactive elements and the determination of the geological age of rocks, by V. P. Rusakov; (2) Methods of determining the content of radium and of the radioactivity of phosphorites, by V. P. Rusakov and A. G. Pogrebov; (3) Preliminary magnetic surveys in the region of the lakes Divo and Svadetskoe, western region; (4) On the temperature of trees, by I. Efimov; (5) Microclimate in the region of the Kardymovo station, western region, by I. Efimov; (6) Results of the actinometric observations in the region of the Kardymovo station, by I. Efimov; (7) Radioactivity of the water sources in the region of the Kardymovo station, by A. Pogrebov; (8) Sun radiation and the transparency of the earth's atmosphere in Smolensk during 1932, by O. M. Davidovich; (9) On the technique of the working out of actinometric and meteorological material, by O. M. Davidovich; (10) Detailed magnetic survey of one part of the Plokhinsk anomaly in the western region, by A. M. Berezkin and A. Virin; (11) Radioactivity of phosphorites in the region of the Volga River, by P. M. Anokhin and Ch. A. Mozolensky.

3486. Forberger, Karl, Magnetische Bodenforschungen im ausseralpinen Wiener Becken und am Alpenrand bei Wien [Magnetic prospecting in the outer Alpine Vienna Basin and on the border of the Alps near Vienna], with introduction by W. Petrascheck, 4 maps and profiles of Austria, Petroleum Inst., Vienna 1, Eschenbachgasse 9, Verlag für Fachliteratur Ges. m. b. H., Vienna 19, Vegegasse 4, 1935. Price, 6 shillings=3 marks.

3487. Geophysical prospecting in the Ukraine [in Ukrainian], vol. 1, 216 pp., Kiev., 1936. Price, 6 rubles.

This symposium contains the following articles: (1) Geophysical prospecting in the Ukraine, by D. V. Babienko, pp. 5–27; (2) Twenty years of magnetometric work in the S. R. S. R., by A. A. Strona, pp. 28–43; (3) Magnetic anomalies of the Pobuzhie (area along the river of Bug), by D. V. Babienko, pp. 44–126; (4) On the study of magnetic anomalies, by K. G. Bronstein, pp. 127–133; (5) Magnetic surveys in the region of Zhitomir-Korosten-Radomishl, by T. T. Miloshevich, pp. 134–146; (6) Results of magnetic surveys in the regions of Melitopol-Berdiansk and Orekhovo-Pavlograd, by P. P. Kuznetzov, pp. 147–164; (7) Determination of the subterranean relief by electrical profiling, by A. S. Glusbar, pp. 165–190; (8) Seismic prospecting in the Ukraine up to 1935, by P. M. Karatygin, pp. 191–194; (9) Seismic prospecting in the Ukraine in 1935, by V. S. Zavistovsky and T. A. Balabushevich, pp. 195–200; (10) Gravimetrical measurements in the region of Romni, by T. S. Subotin, pp. 201–205. Pages 206–216 contain notes, reviews, and chronologic records.

3488. Hazard, D. L., Results of observations made at the United States Coast and Geodetic Survey magnetic observatory near Tucson, Ariz., in 1927 and 1928, 114 pp., U. S. Coast and Geodetic Survey, 1935.

Contents: (1) Introduction; (2) Instruments; (3) Constants of magnetograph; (4) Absolute observations and base-line values; (5) Diurnal variations; (6) Summary of monthly and annual means; (7) Hourly values of declination, 1927; (8) Hourly values of vertical intensity, 1927; (9) Hourly values of declination, 1928; (10) Hourly values of horizontal intensity, 1928; (11) Hourly values of vertical intensity, 1928; (12) Magnetic storms. Contains 14 figures, reproductions of magnetograms showing the principal magnetic storms.

3489. Heck, N. H., Earthquakes, 230 pp., Princeton Univ. Press, 1936. Price, $3.50.

The book begins with a brief description of the vibrations that originate within the earth. Effects of earth tremors, cause of earthquakes, modern methods of studying earthquakes, analysis and interpretation of earthquake records, the process of locating earthquake epicenters and foci are described and explained.

3490. Institution of Petroleum Technologists, Petroleum—Twenty-five years' retrospect, by twenty-five authors, 219 pp., 42 illus., London, 1935. Price, $2.

The general theme of the book is briefly to record the progress of all phases of the petroleum industry from 1910 to 1935.

3491. Kohlrausch, F., and others, Praktische Physik zum Gebrauch für Unterricht, Forschung und Technik [Practical physics for use in teaching, research, and technics], 958 pp., 512 figures, 73 tables, Leipzig, B. G. Teubner, 1936. Price, RM. 32.

Consists of six main parts—(1) General remarks on measurements; (2) Mechanics; (3) Heat; (4) Optics; (5) Electricity and magnetism; (6) Corpuscles and energy-quanta.

3492. Macelwane, J. B., and Sohon, F. W., Introduction to theoretical seismology, Part 1, Geodynamics, by J. B. Macelwane, 366 pp., 67 figures, 15 plates, tables, New York, John Wiley & Sons, Inc.; London, Chapman & Hall, Ltd., 1936. Price, $6.

Contents: (1) Stresses in an elastic solid; (2) Elastic strain; (3) Relations between stress and strain; (4) Elastic body waves: 1, Waves in the interior of an isotropic elastic solid; 2, Waves in a gravitating, compressible planet; (5) Surface waves on the plane boundary of an isotropic elastic solid: 1, Rayleigh waves; 2, Love waves; (6) Vector treatment of elastic waves; (7) Reflection and refraction of elastic waves; (8) Paths of seismic rays; (9) Interpretation of seismograms; (10) Determination of epicenters; (11) Depth of focus; Appendix 1; Appendix 2; List of symbols; Index.

In concluding the introduction the author writes:

"The study of the underlying theory of seismology will benefit the geologist, for it will give him new methods of dealing with a whole class of important phenomena relative to faulting, mountain-building diastrophism, and regional distortion and will acquaint him with structural features of the earth, both in the crust and deep in the interior, which otherwise would be unknown. The physicist will find it of interest for the study of mechanics and especially of elasticity, for it will put him in possession of methods applicable in a laboratory in which are available forces and distances of such magnitude as otherwise to be totally beyond his reach. He can thus deal with short and long elastic waves and with paths through the earth much as he deals with all forms of electromagnetic waves in space. The mining engineer will find in this study enlightenment on the behavior of active faults that traverse his workings and assistance in taking proper precautions. The civil engineer will see its immediate application to the location and design of bridges, dams, and pipe lines, and to nearly all structures for which he is responsible. The architect and the structural engineer will derive from theoretical seismology principles and methods that will aid them greatly in securing the information they need for the design of buildings least liable to damage by earthquake vibrations. To the geophysicist the study of theoretical seismology is indispensable.

"Since seismology embraces the underlying principles of both the geological and physical branches of the science, it is a border-line subject. Either aspect may therefore be emphasized. In the present volume the stress is placed on the mathematical and physical theory."

3493. National Research Council, Transactions of the American Geophysical Union, 17th annual meeting, April 30, May 1, 2, 1936.

Part 1 (pp. 1–260): Introduction, by Jno. A. Fleming, pp. 3–5; General assembly, pp. 8–34, Reports of committees; Symposium on recent trends in geophysical research; Resolutions adopted.

Section of geodesy, pp. 35–74, Reports and papers: (1) State geodetic control surveys, by H. W. Hemple; (2) Guatemala-Honduras boundary, by J. P. Lustene; (3) Use of color filters on geodetic instruments, by H. C. Warwick; (4) Report on absolute value of gravity at Washington, by P. R. Heyl; (5) Recent developments in gravity instruments, by A. J. Hoskinson; (6) The Hawaiian Island arc, by Paul

Bartsch; (7) Study of earth tides by gravitational measurements, by R. D. Wyckoff; (8) Field operations of the Geodetic Survey of Canada for 1935, by N. J. Ogilvie; (9) Progress of the geodetic work of the Coast and Geodetic Survey during the past year, by C. L. Garner; (10) Geodetic work in Mexico during the year 1935, by Manuel Medina; (11) An interpretation of gravity anomalies in terms of local and regional geologic structures, by G. P. Woollard.

Section of seismology, pp. 75–116, reports and papers: (1) Progress report on a three-component seismometer and tiltmeter, by L. B. Slichter; (2) Progress report on the research connected with the Timiskaming earthquake of November 1, 1935, by Ernest A. Hodgson; (3) Current geophysical activity in Texas and Louisiana, by Donald C. Barton; (4) Progress report in seismology for the United States Coast and Geodetic Survey, by E. W. Eickelberg; (5) Geological implications of deep-focus earthquakes, by V. C. Stechschulte; (6) Progress in engineering-seismology research at Massachusetts Institute of Technology, by Arthur C. Ruge; (7) Improvements in strong-motion seismographic equipment, by R. E. Gebhardt; (8) Sand craters and their possible significance, by P. O. Macqueen; (9) A genetic system of earthquake origin, by H. Landsberg; (10) Relation of earthquake belts of the Pacific and Indian Oceans to submarine topography, by N. H. Heck; (11) Review of earthquakes for the past year, by E. W. Eickelberg; (12) Reflection dip-shooting methods in seismic prospecting, by H. M. Rutherford; (13) Transforming the stereographic map, by F. W. Sohon; (14) The determination of ground motion from seismograms, by A. Blake; (15) Seismographic tilt measurements at Buffalo, by John P. Delaney; (16) Local earthquakes in New England, 1934–35, by M. P. Collins; (17) The new seismic vault at Fordham, by J. J. Lynch; (18) Correlations between tilting of the ground and the tides in Chesapeake Bay, by George Merritt; (19) A discussion of some problems in epicenter work, by R. R. Bodle; (20) Deep-focus earthquakes from a geologist's point of view, by W. T. Thom, Jr.; (21) A mechanical method of analyzing accelerograms, by Frank Neumann; (22) Comment on F. W. Sohon's paper, Transforming the stereographic map, by W. L. G. Joerg.

Section of meteorology, pp. 117–157, reports and papers: (1) Symmetry-points in the air pressure, by B. Haurwitz; (2) An example of long-range forecasting of precipitation on a drainage area, by Samuel Shulits; (3) The 9-month period in the variations of solar and meteorological phenomena, by H. W. Clough; (4) Statistical aspects of long-range weather forecasting, by A. G. McNish; (5) Eclipse meteorology, with special reference to the total solar eclipse of 1932, by S. P. Fergusson, C. F. Brooks, and B. Haurwitz; (6) Measurements with a climatological ultraviolet dosimeter in central Pennsylvania, by H. Landsberg; (7) Pilot-balloon observations at sea, by A. R. Stickley; (8) A preliminary summary of the Multanovski school of long-range weather forecasting, by Irving I. Schell; (9) Meteorological features indicated by air-conductivity measurements made on flight of Explorer II, by O. H. Gish and K. L. Sherman.

Section of terrestrial magnetism and electricity, pp. 157–192, reports and papers: (1) Magnetic work of the Dominion Observatory during 1935, by R. M. Stewart; (2) Magnetic work of the United States Coast and Geodetic Survey, April 1935 to March 1936, by R. S. Patton; (3) Recent progress in the laboratory investigations of the aurora and light of the night sky, by Joseph Kaplan; (4) Magnetic and electric investigations of the Department of Terrestrial Magnetism of the Carnegie

Institution of Washington, April 1935 to March 1936, by J. A. Fleming; (5) Research in atmospheric electricity at Stanford University, by N. E. Bradbury; (6) Report of the magnetic work at the Astronomical Observatory of Mexico during the year 1935, by Joaquín Gallo; (7) Work in geophysics of the Colorado School of Mines during 1935, by D. Wantland; (8) Researches related to terrestrial magnetism and electricity of the United States Naval Research Laboratory, by H. M. Cooley; (9) Research at Mount Wilson Observatory of the Carnegie Institution of Washington, relating to terrestrial magnetism, by S. B. Nicholson; (10) Auroral and ionospheric station at the University of Alaska, by E. H. Bramhall; (11) Ionosphere researches of the National Bureau of Standards, by J. H. Dellinger; (12) Progress report on the investigations of magnetic bays, by A. G. McNish; (13) Improved instruments and methods for magnetic measurements, by H. E. McComb; (14) Sunspot activity and radio transmission fade-outs, by R. S. Richardson; (15) Some observations on the diurnal variation of the vertical intensity of the earth's magnetic field, by Victor Vacquier; (16) Magnetic anomalies in the Carolina Coastal Plain, by G. R. MacCarthy; (17) Application of alternating-current methods of detection to earth inductors for marine and land observations, by E. A. Johnson; (18) Undirectional cosmic-ray intensities and their variation with latitude, by T. H. Johnson; (19) New factors in investigation of the ionosphere, by L. V. Berkner, H. W. Wells, and S. L. Seaton; (20) On the effective group velocities of low-frequency radio time signals and the apparent variability of velocity with the region of the earth traversed, by H. T. Stetson; (21) Potential distribution about a leaky cylinder, by L. B. Slichter; (22) Actual and potential results from electrical exploration of the atmosphere, by O. H. Gish; (23) Magnetic survey in the Lehigh Valley, by Maurice Ewing and H. H. Pentz.

Section of oceanography, pp. 193–232. Ten reports and papers.

Section of volcanology, pp. 233–259. Nine reports and papers.

Part 2 (pp. 261–563): Reports and papers, Section of hydrology and Western interstate snow-survey conference. Contains 37 reports and papers.

Copies of the Transactions may be purchased by nonmembers of the Union at the following postpaid prices: Part 1, $1.50; part 2, $2. Orders, with checks payable to American Geophysical Union, should be addressed to the general secretary, American Geophysical Union, 5241 Broad Branch Road NW., Washington, D. C., U. S. A.

3494. Neumann, Frank, United States earthquakes, 1934: U. S. Coast and Geodetic Survey Serial 593, 1936. Price, 15 cents.

This publication is a summary of earthquake activity in the United States and the regions under its jurisdiction for the calendar year 1934. Contents: (1) Introduction; (2) Noninstrumental results; (3) The Utah earthquake of March 12, 1934; (4) The Parkfield earthquake of June 7, 1934; (5) The Panama earthquakes of July and August 1934; (6) Seismological observatory results; (7) Strong-motion seismograph results; (7) Tilt observations; (8) Additions and corrections to previous publications. Contains 27 illustrations.

3495. Reich, Prof. Dr. H., Angewandte Geophysik für Bergleute und Geologen [Applied geophysics for mining engineers and geologists], vol. 1, 151 pp., 74 figs., Leipzig, Akademische Verlagsgesellschaft m. b. H. 1933; vol. 2, 153 pp., 73 figs., 1934.

Contents, volume 1: (A) General remarks on geophysical methods; (B) Geophysical investigation of areas for exploration of the structure

of the earth in general: (1) Geological and physical foundations; (2) Gravity measurements; (3) Magnetic measurements; (4) Earthquake measurements; (C) Geophysical exploration of ore deposits: (I) Sedimentary ore deposits: (1) Physical properties of sedimentary rocks; (2) Methods of investigation; (3) Results; volume 2: (II) Magmatic deposits: (1) Physical properties of eruptive rocks, crystalline slates, and mineral lodes; (2) Methods of investigation; (3) Results; (D) Geophysical investigations in connection with other technical purposes such as discovery of useful minerals, providing with water, in construction work.

3496. Schmidt, Adolf, Tafeln der normierten Kugelfunktionen [Tables of normalized spherical harmonics], 52 pp., Gotha, Engelhard-Reyher Verlag, 1935. Price, RM.6.60.

A review of this book is given by J. Bartels in Terrestrial Magnetism and Atmospheric Electricity, vol. 41, no. 3, p. 264, 1936. According to Bartels, these tables should be in the hands of every geophysicist whose work deals with the earth as a whole. It would be desirable if the normalization, as introduced by Schmidt, could find general recognition and application.

3497. Schultz, W., Louis, H., and Goethe, E., Bergtechnisches Taschenwörterbuch [Technical mining pocket dictionary], part 2, German-English, 76 pp., Essen, Verlag Glückauf G. m. b. H. Price, RM.4.20.

3498. von Srbik, Robert, Geologische Bibliographie der Ostalpen von Graubünden bis Kärnten [Geologic bibliography of the East Alps from Graubünden to Kärnten], vol. 1, pp. 1–687; vol. 2, pp. 688–1412, issued by the Deutscher und österreichischer Alpenverein [German and Austrian Alpine Society], Munich and Berlin, R. Oldenbourg, 1935.

More than 50,000 works written by more than 3,600 authors are collated. The material is arranged in 54 groups according to regions and in 17 groups according to the subject-matter. Of special interest for geophysicists are the groups dealing with earthquakes, gravity, glaciology, etc.

3499. Stocks, Theodor, and Wüst, Georg, Die Tiefenverhältnisse des offenen Atlantischen Ozeans [Depth conditions of the open Atlantic Ocean], explanatory remarks to the outline map 1/20 millions, reprint from the "Wissenschaftliche Ergebnisse der Deutschen atlantischen Expedition auf dem Forschungs und Vermessungs Schiff *Meteor*, 1925–27" [Scientific results of the German Atlantic Expedition on the discovery and measurement ship *Meteor* in 1925–27], vol. 3, part 1, 32 pp., with 11 figs. in text, 3 figs. on 2 plates, and 1 supplement in colors, Berlin and Leipzig, Verlag von Walter de Gruyter & Co., 1935. Price, RM.6.

3500. Vasiliev, A. A., and Katiaiev, V. A., Geophysical methods of prospecting in western Siberia [in Russian], 259 pp., figures, maps, Tomsk, West Siberian Geological, Hydrological, and Geodetical Trust, 1935. Price, 10 rubles.

This is a collection of articles on geophysics: (1) Geophysical methods of prospecting in western Siberia, by A. A. Vasiliev and V. A. Katiaiev; (2) Contribution to the question of solving the reverse geophysical problem by using magnetic fields, by J. N. Lapinsky; (3) Table of values of Va and ha for an infinitely long elliptical cylinder, by J. N. Lapinsky; (4) On the determination of a most favorable net for discovering ferromagnetic ores on the Shoria table-land, by J. N. Lapinsky; (5) Absolute survey of the Tashtagol iron-ore deposit, by A. T. Perezhogin; (6) The

resistance method in solving the problems of structural geology, by V. A. Katiaiev; (7) Contribution to the question of calculating the geometrical net for magnetic surveys, by M. A. Zablotskaia; (8) On the determination of magnetic properties and species of rock by the deviation apparatus, by N. J. Zakharenko; (9) Electrical prospecting on the Berikulsk gold-bearing deposits, by V. V. Borodin; (10) Radiometric investigations in western Siberia, by O. V. Udodova; (11) Seismic prospecting in Kuznetsk Basin, by M. A. Baldin; (12) Results of observations with the gravitational variometer in the Kulundinsk Steppe in the summers of 1932 and 1933, by S. N. Bazhenov; (13) On corrections in interpreting seismic materials, by G. D. Legeza; (14) Schemes of an additional lever for the vertical mechanical seismograph and schemes of a horizontal direction seismograph, by G. D. Legeza; (15) On the arrangement of seismic survey in the Kuznetsk Basin, by G. D. Legeza; (16) Application of the horizontal seismograph for determining the direction of the explosion, by G. D. Legeza.

3501. Willis, Bailey, The east African plateaus and rift valleys—Studies in comparative seismology: Carnegie Inst., Washington, Pub. 470, 358 pp., 16 figs., 1936.

An extensive description of African rift valleys and plateaus, with the author's hypothesis of their origin. Earthquakes, gravity tests, and volcanism are briefly mentioned.

10. PATENTS

3502. Method and apparatus for seismic prospecting; Ludwig W. Blau and Louis Statham, Houston, Tex., assignors to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2046104, issued June 30, 1936.

This invention relates to an apparatus for recording seismic disturbances, comprising a seismograph, means of greater conductivity than the surface layer of the ground for simultaneously collecting over an area larger than the base of the seismograph all the energy arriving through the ground by different paths and for conducting the collected energy to the seismograph to cause the direct waves to actuate the seismograph at successive intervals of time while the reflected waves received at the area actuate the seismograph simultaneously. Claims allowed, 17.

3503. Method and apparatus for seismic-electric prospecting; Ludwig W. Blau and Louis Statham, Houston, Tex., assignors to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2054067, issued September 15, 1936.

This invention relates to the method of geophysical exploration which comprises receiving over a continuous extended volume of the ground, including subsurface strata, wave energy arriving throughout the volume from a source of propagation of seismic waves, and obtaining an indication due to the effect of this wave energy on the electrical properties of the volume of ground. Claims allowed, 28.

3504. Seismic prospecting; Ludwig W. Blau, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2055476, issued September 29, 1936.

This invention relates to a seismic measuring system including a source of direct and reflected seismic waves, apparatus for differentiating between a reflected mechanical wave having small horizontal components and a direct mechanical wave having large horizontal components, each

in comparison with their vertical component, which comprises means for separately transforming the vertical and horizontal components of the waves into electric currents, means for adjusting the amplitude of the horizontal components against the vertical, and means for opposing the electric current of the horizontal components against the current of the vertical component whereby the total current is greatly reduced for direct waves and the current for reflected waves is substantially unaffected. Claims allowed, 10.

3505. Electrical circuits for seismic prospecting; Ludwig W. Blau, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2055477, issued September 29, 1936.

This invention relates to seismic prospecting in which earth vibrations are produced, the first cycles of each of which are smaller than the later cycles; apparatus for recording the beginning of the vibrations, which comprises means for transforming the vibrations into electric pulsations, means for transmitting the pulsations along an electric circuit, means for turning the circuit to the frequency of the particular electric pulsations caused by the portion of the earth vibrations of predominant frequency, means for damping the circuit more than critically whereby the ratio of first-cycle amplitude to second-cycle amplitude of the particular electric pulsations is increased, and means for recording the amplified first cycle. Claims allowed, 11.

3506. Tamping for explosives; Ludwig W. Blau, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2055618, issued September 29, 1936.

This invention relates to an apparatus for directing explosive energy in a given direction, which comprises means for confining an explosive charge against a surface to be blasted, the means comprising magnesium oxychloride which when set has a density greater than 2.5 and a velocity of sound through it greater than 2,500 meters per second. Claims allowed, 2.

3507. Reflection-shooting procedure for the accurate determination of dip; Ludwig W. Blau, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2058764, issued October 27, 1936.

This invention relates to the method of determining the dip of a given subsurface stratum, the steps which comprise successively creating seismic waves at a plurality of spaced shot points, and in turn simultaneously receiving the waves from each shot point at a plurality of receivers disposed on lines between the shot points. Claims allowed, 22.

3508. Apparatus for determining subsurface tectonics of the earth; John C. Karcher, Dallas, Tex.: U. S. patent 2044079, issued June 16, 1936.

This invention relates to apparatus for determining the difference in the gravitational constant between a plurality of spaced points comprising a plurality of similarly constructed Kelvin balances disposed at said points and electrically connected in series whereby to obtain a uniform magnetic flux in the coils of said balances, and means for indicating any difference of equilibrium between the several balances at said several points. Claims allowed, 5.

3509. Apparatus for determining well temperatures; Ernest N. Merrill and George A. Young, Long Beach, Calif., assignors to Shell Development Co., San Francisco, Calif., a corporation of Delaware: U. S. patent 2053967, issued September 8, 1936.

This invention relates to a temperature-indicating device for boreholes, comprising a sealed metallic casing substantially filled with liquid and adapted to be placed in a borehole, and a plurality of solid fragments having calibrated melting points, said fragments being spaced from each other within the casing and immersed in the liquid filling said casing. Claims allowed, 5.

3510. Subsurface surveying; Willard North, Los Baños, Calif., assignor to Geophysical Research Corporation, New York, N. Y., a corporation of New Jersey: U. S. patent 2059018, issued October 27, 1936.

This invention relates to the method of exploring geologic formations which comprises producing a source of artificial seismic waves, receiving said waves by detectors arranged at progressively greater distances from the wave source, and impressing the output of each detector upon a plurality of recorders, one or more of said recorders being arranged to record the combined output of several detectors. Claims allowed, 23.

3511. Method of making geophysical explorations; Harold R. Prescott and Frank L. Searcy, Ponca City, Okla., assignors to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2046843, issued July 7, 1936.

This invention relates to an electrical circuit for detonating an explosive charge in the making of geophysical explorations, comprising a bridge wire of a detonator, a source of potential, and a resistance connected in series; a shunt circuit for said resistance, and means for recording fluctuations of current in said shunt circuit. Claim allowed, 1.

3512. Method of geological exploration; Harold R. Prescott and Frank L. Searcy, Ponca City, Okla., assignors to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2049724, issued August 4, 1936.

This invention relates to a method of geologic exploration, including the steps of creating elastic waves at or near the earth's surface, generating varying electromotive forces in sympathy with the waves produced and resulting from various subsurface geologic formations, selecting an electromotive force of a desired frequency range, and recording the voltage variation thereof. Claims allowed, 4.

3513. Method and apparatus for making geophysical explorations; Harold R. Prescott, Ponca City, Okla., assignor to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2053841, issued September 8, 1936.

This invention relates to a method of making geophysical explorations, including the steps of creating elastic waves at or near the earth's surface, converting said waves and reflections thereof from geologic strata into varying electromotive forces in sympathy with said waves, selecting electromotive forces of a desired frequency range, and varying said selecting step as a function of the potential of the electromotive forces selected, and recording the voltage variations in the selected electromotive forces. Claims allowed, 7.

3514. Method and apparatus for recording elastic waves; Frank Rieber, Los Angeles, Calif.: U. S. patent 2051153, issued August 18, 1936.

This invention relates to a method of geophysical survey which comprises creating a localized disturbance in the earth, translating the vibrations resulting from said disturbance into electrical impulses at a point apart from said disturbance, and recording said impulses as a reproducible phonographic record. Claims allowed, 15.

3515. Apparatus for measuring depths; Edwin E. Turner, Jr., West Roxbury, Mass., assignor to Submarine Signal Co., Boston, Mass., a corporation of Maine: U. S. patent 2044820, issued June 23, 1936.

This invention relates to a system for measuring depths in which a sound-producing mechanism disposed to impart a sound wave to a ship's skin comprising a striking body, means for operating said striker, a diaphragm having a central boss upon which the striker strikes, an extension of said boss on the other side of said diaphragm, and nonyielding metallic means disposed between and loosely contacting with said second boss and said ship's skin. Claims allowed, 6.

3516. Surveying underground structures; Benjamin B. Weatherby, Tulsa, Okla., assignor to Geophysical Research Corporation, New York, N. Y., a corporation of New Jersey: U. S. patent 2049236, issued July 28, 1936.

This invention relates to the method of creating artificial seismic waves for use in subsurface surveying which comprises drilling a hole, filling the lower portion of said hole with solid material different from that in which the hole is drilled, drilling a hole in the filled-in material, and detonating an explosive charge in said last-named hole. Claims allowed, 9.

3517. A new or improved method of an apparatus for investigating geological structure; Dr. Ludwig Machts, of Marburga, Lahn, Germany, and Bernard Rehder, of Marburga, Lahn, Germany: British patent 433450, issued August 12, 1935.

This invention relates to a method of investigating irregularities existing below the surface of the ground, wherein a detection apparatus having an antenna is moved over a chosen path and is adapted to give substantially continuous indications in the form of oscillograph diagrams of the intensity and/or direction of the local electric fields, and means being arranged to record automatically such indications when desired, further means being also arranged for indication simultaneously of the position of the apparatus on the chosen path when such records are being made, the results of such records affording an indication of the position and nature of a local disturbance in the electric field and therefore of the position of a local subterranean irregularity. Claims allowed, 14.

3518. Improvements in apparatus for locating deposits of oil, gas, and other dielectric subterranean bodies; Sir George Croydon Marks, a member of the firm of Marks & Clerk, of 57 and 58, Lincoln's Inn Fields, London, W. C. 2, a British subject: British patent 330876, issued June 16, 1930.

This invention relates to a system for detecting the presence of oil or other dielectric deposits below the surface of the earth, and to an improved apparatus comprising a source of high-frequency alternating current, means for transmitting current from said source through relatively short and relatively long paths below the earth's surface, and means for indicating differences of characteristics between the paths. Claims allowed, 7.

3519. Pendelgerat [pendulum apparatus]; Josef André, Rochester, U. S. A.: German patent 623034, issued February 6, 1936.

This invention relates to a pendulum apparatus assigned for geophysical purposes, comprising a hollow pendulum adapted to have light rays pass through it, and an optical system below the pendulum by means of which these light rays are directed to a reading device, graduation scale, etc., or these light rays are deviated to a photographic recording device. Claim allowed, 1.

3520. Einrichtung zum Messen von Entfernungen mit Hilfe von Echos electromagnetischer Impulse [Method of measuring distances by means of the echoes of electromagnetic impulses]; Submarine Signal Co. of Boston, Mass., U. S. A.: German patent 623005, issued February 6, 1936.

This invention relates to a method of measuring distances by means of electromagnetic impulses or waves emitted periodically and received after their reflection from the object to be determined. The time interval between the direct and reflected impulses is utilized for the measurement. The method is characterized by the fact that time intervals between the impulses emitted regularly are small in comparison with the time intervals of the pauses between the emitted impulses; the measuring is made by producing phase coincidence between the direct impulses and their appropriate reflected impulses. Claim allowed, 1.

3521. Perfectionnements aux appareils pour l'exploration électrique des sondages [Improvements in the apparatus for electrical exploration of bore holes]; Conrad Schlumberger, of France (Seine); French patent 788352, issued October 9, 1935.

This invention relates to the improvements made in the apparatus described in French patent 678113. (See Geophys. Abstracts 81, p. 1695.) The new apparatus designed for measuring the electrical resistivity of rocks traversed by drilling is characterized by the fact that the three electrodes are attached to one single cable. This makes it possible to obtain precise data even at greater depths. Claim allowed, 1.

3522. Perfectionnement aux procédés et aux dispositifs pour la reconnaissance électrique des terrains recoupés par un sondage [Improvements of the methods and apparatus for electrical prospecting of the ground traversed by boring]; Conrad Schlumberger, of France (Seine): French patent 790904, issued November 29, 1935.

This invention relates to a method of measuring the resistivity of the ground at the walls of the uncased part of the hole, filled for this purpose with water. According to this method a current is sent into the ground at the levels to be investigated, by means of two electrodes connected to a source of current; the difference of potentials produced at this level is measured by means of two other electrodes. The method requires the sending of a direct current of high intensity, and that at least one of these electrodes is placed at a relatively small distance from one of the electrodes of measurement so that the difference of potentials produced between the two electrodes of measurement by passing of the current through the soil is great; this will make it possible to neglect the differences of the disturbing spontaneous potential. Claims allowed, 5.

3523. Procédé et dispositifs pour la reconnaissance électrique des terrains recoupés par un sondage [Method and apparatus for electrical prospecting of the ground traversed by boring]; Conrad Schlumberger, of France (Seine): French patent 791227, issued December 6, 1935.

This invention relates to a method for electrical prospecting of the ground traversed by drilling, according to which a current is sent into the ground by means of two electrodes connected electrically to a source of current and the difference of potentials produced between the two other electrodes is measured. All the four electrodes may be lowered into the hole to the level to be studied, or one of the sending electrodes and (or) one of the measuring electrodes may be placed on the surface of the ground. Claims allowed, 5.

3524. Method of geophysical investigations and prospecting; N. I. Sofronov and A. P. Soloviev, Geophysical Section of the Scientific Geological Research Institute: Russian patent 46313, issued March 31, 1936.

This invention relates to a method of geophysical investigations and prospecting characterized by the fact that for the purpose of making observations on the value of the polarization potentials of the electrodes, such electrodes are used the potential of which is determined, depending on concentration of electrolytes in the ground and on underground waters. Claim allowed, 1.

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