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COMPILED BY

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NOTE.—Geophysical Abstracts 1–86 were issued in mimeographed form by the Bureau of Mines. No. 87, containing abstracts for the period July to December 1936 and an index to abstracts 81–87, January to December 1936, was published as Geological Survey Bulletin 887. Bulletin 895, containing abstracts for the year 1937, is being issued in 4 chapters, each covering 3 months.

Correction for Geophysical Abstracts 87, page 50

Under no. 3400, Loehnberg, A., and Loewenstein, A., Electrical prospecting for water, the last sentence of the abstract should be corrected to read as follows: The proportion of successful borings to the total number made with the aid of electrical methods is 85 percent. Without geoelectrical measurements the proportion of successful borings is estimated at not more than 30 to 40 percent.

GEOPHYSICAL ABSTRACTS 90, JULY-SEPTEMBER 1937

Compiled by W. AYVAZOGLOU

1. GRAVITATIONAL METHODS

3798. Boaga, G., Localization of a spherical body by the Eötvös balance: R. accad. naz. Lincei, Atti, Rend., Cl. sci. fis., mat. e nat., vol. 24, pp. 453–456, Dec. 6, 1936.

The problem of locating a spherical body by measurements with the Eötvös balance is generalized. It consists in determining the position from a series of measurements taken on lines north-south and east-west, whose vertical planes do not pass through the center of the mass.—*W. A. R., Sci. Abstracts, vol. 40, no. 473, 1937.*

3799. Goudey, Raoul, Mesures de l'intensité de la pesanteur en France pendant l'anneé 1936 [Measurements of the intensity of gravity in France during 1936]: Acad. Sci. Paris Comptes rendus, vol. 204, no. 20, pp. 1459–1460, 1937.

Values of the intensity of gravity at 50 stations measured during 1936 by using Holweck-Lejay's gravimeters nos. 52 and 518 are represented in a table. Topographic correction was not applied.—*W. A.*

3800. Gulatee, B. L., Gravity, geoid and plumb-line deflections in mountainous areas: Indian Acad. Sci., Sec. A, Proc., vol. 5, pp. 257–268, March 1937.

Gravity anomalies at stations in the Himalayan region have been determined with four more hypotheses besides the usual Hayford's. Results indicate that Hayford's hypothesis gives smaller residuals than the regional hypotheses of Vening Meinesz and Airy, although these latter hypotheses are more logical. It appears that departures in nature from any particular form of isostasy are much greater than the differences between the various systems. Some of the mountainous regions of the globe for which geoidal contours are known are considered to see if in any of them depressed geoid is associated with an elevated region. If the geoidal elevations are taken with reference to the spheroid fitting best the area in question, it is found that for the mountainous regions of the globe for which information is so far available, the geoid and topography go together.—*Author's abstract.*

3801. Heiskanen, W., Über die Isostasiefrage [On the question of isostasy]: Baltische geodät. Komm., 9th meeting, Helsingfors, 1936, Verh., pp. 152–163, 1937.

Report on the present state of the problem of isostasy. The smallness of isostatic anomalies in comparison with those of Bouguer shows that even in the tectonically active regions the isostasy hypothesis is very

close to the reality. Airy's theory agrees well with seismic investigations. The explanation of the great isostatic anomalies is given best by Vening Meinesz' theories. The isostatic anomalies are, on the average, negative in low latitudes and positive in high latitudes. This cannot be explained by correcting the formula for normal gravity, as it would result in a value of the oblateness (1/300.6) that is too small. In areas with positive isostatic anomaly the geoid rises above the reference ellipsoid and in areas with negative isostatic anomaly it sinks below this ellipsoid. Isostatic and free-air anomalies must be used for calculating geoid undulations. The present measurements are not sufficient for determining the three-axiality of the earth-ellipsoid. Great differences between the old and recent pendulum measurements are established (central stations up to 19 milligals, field stations up to 42). Further control measurements are necessary for the explanation of these contradictions. Considerable progress in gravimetric survey on the oceans was made during recent years.—*H. Jung's abstract in Zentralbl. Geophys., Meteor. u. Geod., vol. 1, no. 1, 1937, translated by W. A.*

3802. Hirvonen, R. A., Über die Genauigkeit der Mitschwingungskorrektion eines einsam schwingenden Pendels [On the accuracy of the correction for co-oscillation of a pendulum swinging separately]: Baltische geodät. Komm., 9th meeting, Helsingfors, 1936, Verh., pp. 164–171, 1937.

The accuracy of determining the correction of the time of oscillation of a pendulum swinging separately with regard to co-oscillation of pendulum support is investigated. The Borrass method is discussed. According to this method the amplitudes of a pendulum are compared with the amplitudes of another pendulum swinging in the same plane (the second pendulum having been originally at rest, and its motion having been caused by the elasticity of the pendulum support induced by the swinging of the first pendulum). Owing to the smallness of the amplitudes, the first observations are always less accurate than later observations. The two-pendulum method recently in general use, by which the co-oscillation of the pendulum support can be eliminated, is not discussed.—*Schmehl's abstract in Zentralbl. Geophys., Meteorol., u. Geod., vol. 1, no. 1, 1937, translated by W. A.*

3803. Hirvonen, R. A., Relative Bestimmungen der Schwerkraft in Finnland in den Jahren 1931, 1933 und 1935 [Relative determinations of gravity in Finland in 1931, 1933, and 1935]: Finn. geodät. Inst. Veröff., no. 23, 151 pp., Helsingfors, 1937.

Gravity determinations made by the author with the four-pendulum apparatus (Fechner, Potsdam) at 69 stations are described. The station net was extended to latitude 65° N. and to the eastern border of the country. Measurements were made under atmospheric pressure by optical methods; each pendulum swung separately. The accuracy of the gravity values was equal to ±1.3 milligal. According to new adjustments of measurements made by the Potsdam gravity system (Schmehl, Andersen, and Hirvonen), the gravity value of the Helsingfors reference station is about 5 milligals too small; thus the anomalies calculated for the other Finnish gravity stations are also too small, on an average 5 milligals. The recalculation of the values is suggested. The gravity anomalies as determined by Bouguer are within the range −35 to +33 milligals. A discussion of the anomalies is

not given.—*Schmehl's abstract in Zentralbl. Geophys., Meteorol., u. Geod., vol. 1, no. 1, 1937, translated by W. A.*

3804. Ising, Gustaf, Use of astatized pendulums for gravity measurements: Am. Inst. Min. Met. Eng. Tech. Pub. 828, 14 pp., 1937.

A description is given of the principle and technical development of an instrument, the essential part of which consists of a highly astatized, standing pendulum turning about a horizontal axis. A notable merit of this instrument is that when it is properly handled there is no secular wandering of the zero and no continuous change of the instrument constant; therefore it is a type suited for comparing gravity on stations at very great distances apart.

Recently, a new form of the instrument has been developed for use in field work. It is equipped for photographic recording (on film) as well as for visual observation and is fitted with optical arrangements for obtaining higher accuracy than the previous model.—*W. A.*

3805. Jung, Karl, Direkte Methoden zur Bestimmung von Störungsmassen aus Anomalien der Schwereintensität [Direct methods for determining disturbing masses from anomalies of the intensity of gravity]: Zeitschr. Geophysik, vol. 13, no. 2/3, pp. 45–67, Braunschweig, 1937.

Direct methods are derived for determining, from the distribution of gravity, symmetrical and antisymmetrical disturbing masses having simple forms. Notable characteristics of gravity anomaly such as extreme values, half-values, zero-values, gradients, and integrals are used. Detailed tables are given for practical application. The possibility of a sufficient control is especially taken into consideration. The application of the method is explained on two gravity profiles according to Vening Meinesz.—*Author's abstract, translated by W. A.*

3806. Lambert, W. D., The figure of the earth from gravity observations: Washington Acad. Sci. Jour., vol. 26, no. 12, pp. 491–506, 1936.

The article is mainly historical, giving some account of the work of three outstanding contributors to the theory. Sir Isaac Newton, in spite of lack of mathematical tools, which were a later development, correctly determined the flattening of a homogeneous spheroid of revolution rotating with the angular velocity of the earth. Alexis Claude Clairaut derived an important formula for the flattening of a level corresponding to the earth change of gravity between pole and equator. This formula looks paradoxical, but some illustrations are given to clear away the apparent paradox. Clairaut also did other work connected with the figure of the earth. Sir George Gabriel Stokes gave a method for determining the figure in detail, that is, the departures from a smooth mathematical spheroid. The method requires a knowledge of gravity all over the earth. The method devised by Vening Meinesz for determining gravity at sea enables us to look forward to the time when Stokes' method can be applied. The article also refers to Special Publication 199 of the U. S. Coast and Geodetic Survey (see Geophys. Abstracts 87, no. 3482), containing tables useful in connection with the figure of the earth.—*Author's abstract.*

3807. Mader, Karl, Gradient und Krümmungsgrösse des Segments eines unendlichen horizontalen Kreiszylinders [Gradient and curvature value of a segment of an infinite horizontal circular cylinder]: Gerlands Beitr. Geophysik, vol. 48, no. 4, pp. 417–427, Leipzig, 1936.

Although gradients and curvature values of large bodies of strata may be found by mechanical means or by calculations with the aid of graphic tables, the author considers it of interest to give a solution by using strictly mathematical methods. He discusses the cases of a segment of an infinite horizontal circular cylinder representing (1) an elevation, and (2) a depression of primitive rocks.—*W. A.*

3808. Mott-Smith, L. M., Gravitational surveying with the gravity-meter: Geophysics, vol. 2, no. 1, pp. 21–32, Houston, 1937.

The paper discusses briefly the history of gravity meters and the importance of gravity surveys for the prospector. The relative advantages claimed for the gravity meter over the torsion balance and pendulum, from the points of view of adaptability to field work, corrections, and accuracy, are brought out. The paper also discusses the methods of observation, particularly in regard to "drift."—*Author's abstract.*

3809. Nörgaard, G., Statischer Schweremesser [Statical gravity meter]: Baltische geodät. Komm., 6th meeting, Helsingfors, 1933, Verh., pp. 211–215, 1934.

The apparatus is characterized by the author as an inverse barometer (may be better called a kind of aerometer). It is a glass body filled with air under a mercury plug. The body is floating in oil. The height of floating serves as a direct measure of gravity. Temperature compensation may be secured easily and thoroughly by making the heat expansion of the float equal to that of the oil in which it is floating.—*Schwinner's abstract in Geol. Zentralblatt, vol. 58, no. 7, 1937, translated by W. A.*

3810. Nörgaard, G., Statische Schweremessungen auf See und Land [Statical gravity measurements on sea and land]: Baltische geodät. Komm., 7th meeting, Helsingfors, 1934, Verh., pp. 279–289, 1935.

Measurements were carried out with the improved statical gravity meter previously described (see abstract 3809). The accuracy attained on land was equal to 1.0 milligal. The average error of gravity measurements made during the sea trip between Copenhagen and Malmö and Bornholm did not exceed ±1.8 milligal.—*Schwinner's abstract in Geol. Zentralblatt, vol. 58, no. 7, 1937, translated by W. A.*

3811. Nörgaard, G., Statische Schweremessung auf See [Statical measurements on sea]: Baltische geodät. Komm., 8th meeting, Helsingfors, 1935, Verh., pp. 127–240, 1936.

The statical gravity meter previously described (see abstract 3809) was used during sea trips between Copenhagen and Aarhus (5 trips), Copenhagen and Aalborg, and trips across the Atlantic Ocean, Copenhagen-Oslo-New York and return. The mean error of measurements was between ±3 and ±4 milligals.—*Schwinner's abstract in Geol. Zentralblatt, vol. 58, no. 7, 1937, translated by W. A.*

3812. Prey, A., Über die Polfluchtkraft [On the force tending to move the continents towards the equator]: Gerlands Beitr. Geophysik, vol. 48, no. 4, pp. 349–387, Leipzig, 1936.

A continent of uniform density 2.7 (sial) extending in the form of a trapezoid between two meridians and two parallels, limited above and below by level surfaces and on the sides by plumb-line surfaces. is sup-

posed to float on the surface of the earth, the density of which decreases, according to a definite law, from the center to the periphery to a value of 3.0 (sima). The depth of the immersion depends greatly on the increase of density in the uppermost layers. The curvature of the earth and the variation of gravity are taken into consideration.

Gravitation, centrifugal force, and pressure are combined into a resultant force and a turning moment under the influence of which the continent is slightly shifted and tilted, if capable of moving at all; an equilibrium is thus attained at which all the forces and turning moments are balanced.

In the example computed ($Lat_1=25°$; $Lat_2=65°$; $L_2-L_1=40°$), the shifting was about 20 m north and tilting only 0.5″. The order of magnitude of the forces was about 10^{-6} of the weight of the continent. The shifting was so small that the continent probably did not move at all, and the small stresses were not balanced. There is no doubt that a "Polfluchkraft" capable of moving masses of the earth's crust over several thousands of kilometers toward the equator does not exist.—*Author's abstract, translated by W. A.*

3813. Sorokin, L. W., Ein optischer Koinzidenzapparat [An optical coincidence-apparatus]: Baltische geodät. Komm., 9th meeting, Helsingfors, 1936, Verh., pp. 249–256, 1937.

The electromagnetic coincidence apparatus in general use has two main disadvantages: 1, The rate of the chronometer influenced by the current may be different from that not influenced by the current; 2, The movement of the armature at the electromagnet shows irregular retardations in comparison with the current impulses. Both these defects can be eliminated by an optical arrangement in which a light ray is reflected from a polished screw of the chronometer balance and is projected through a slit upon the pendulum mirror only at a fixed position of the balance. The apparatus is described and its advantages in comparison with the electromagnetic coincidence apparatus are indicated. The new apparatus has been used with great success during the gravity measurements carried out in Russia.—*H. Jung's abstract in Zentralbl. Geophys., Meteor. u. Geod., vol. 1, no. 1, 1937, translated by W. A.*

3814. Sorokin, L. W., Ein visuelles Verfahren zum Empfang rhytmischer Zeitsignale bei Pendelbeobachtungen [Visual method for receiving rhythmical time signals during pendulum observations]: Baltische geodät. Komm., 9th meeting, Helsingfors, 1936, Verh., pp. 257–264, 1937.

The light ray used for observing pendulum oscillations strikes, in front of the pendulum, the mirror of an electromagnetic resonance relay through which the wireless time signals are transmitted. The oscillation of the pendulum is reflected in the observation telescope in the form of a vertical luminous line which expands during the time signal. The expanded part moves in the vertical direction along the luminous line, and its passage through the horizontal thread of the telescope marks the moment of coincidence of the oscillation of pendulum and time-signal. By making coincidence observations of the pendulum and chronometer before and after the reception of the time signal, the indication of the chronometer may be determined for every desired moment of time by means of simple interpolation. The method is demonstrated

by a numerical example taken from a series of observations.—*H. Jung's abstract in Zentralbl. Geophys., Meteorol. u. Geod., vol. 1, no. 1, 1937, translated by W. A.*

3815. Špaček, Vaclav, Die Quadratsummen der Lotabweichungen auf benachbarten Ellipsoiden und Gleichungen zur Berechnung des Erdellipsoids [The sum of the squares of the deviations of the plumb line upon adjacent ellipsoids, and equations for calculating the earth ellipsoid]: Gerlands Beitr. Geophysik, vol. 49, no. 3, pp. 277–295, Leipzig, 1937.

By means of the sum of the squares of the deviation of the plumb line upon a given ellipsoid of rotation, the formula $\Sigma\delta_2^2$ for the sum of the squares of the plumb-line deviations of an adjacent ellipsoid can be calculated. The equations contain the coordinates of the center of the second ellipsoid, the differences in the equatorial semi-axes, and the corrections of the supposed latitude and longitude of the original point of the trigonometric network.

In these equations, the coefficients contain only the latitudes and longitudes of stations for which δ was determined; they do not contain distances as do Hayford's equations.—*W. A.*

3816. von Thyssen, St., Spezialvermessung eines gravimetrisch gestörten Salzstockes [Special measurements of a salt dome disturbed gravimetrically]: Petroleum, vol. 33, no. 22, pp. 34–36, Berlin, 1937.

The description and general application of the Thyssen gravimeter were given in a previous article (Petroleum, vol. 32, no. 44, 1936; see Geophys. Abstracts 88, no. 3526). Here the author describes the results of a survey carried out with this instrument above a salt dome in North Hannover and examines the advantages of work with this gravimeter in comparison with the torsion balance in regions with great disturbances of the gradients and curvature values. Only a very irregular picture was obtained from 230 torsion-balance measurements, but the character of the salt dome could be firmly established from 38 measurements with the gravimeter. With an additional 18 stations a map of isogams of the region was drawn.—*W. A.*

3817. Tromp, S. W., Das Gesetz von Helmholtz und seine Anwendung auf Geotektonik [Helmholtz's law and its application to geotectonics]: Zeitschr. Geophysik, vol. 13, no. 2/3, pp. 78–87, Braunschweig, 1937.

A review is given of the various hypotheses by which the gravity anomalies in mountainous regions formed by folds may be explained. Objections to the theory of "roots of mountains" and the principal "laws" which must be observed by the forces forming the mountains are discussed. According to the author, these "laws" can be explained only by theories accepting the assumption that the thickness of the sial crust is constant, and that the equalization surface is undulating. The following theories are examined:

1. *Geodetic theories.*—A, Theories in which the anomalies are considered to be associated with the isostatic reduction methods; B, theories which assign one part of the anomalies to the form of the earth as an ellipsoid with three main axes.

2. *Geophysical theories.*—These theories associate the anomalies with the disturbances of the isostatic equilibrium: A, Theories by which

specific gravity of the sial crust is assumed to be constant and its thickness variable; B, Theories by which specific gravity of the sial crust is assumed to be variable.

The author's own theory is discussed in detail.

The article is followed by (1) H. Jung's "Bemerkungen zu den vorstehenden Ausführungen von S. W. Tromp (Remarks on the foregoing arguments of S. W. Tromp) and (2) Tromp's Antwort auf die kritischen Bemerkungen von H. Jung (Tromp's reply to the critical remarks made by H. Jung).—*W. A.*

3818. Wegener, K., Die absolute Schweremessung [Absolute gravity measurement]: Zeitschr. Geophysik, vol. 13, no. 2/3, pp. 68–71, Braunschweig, 1937.

The principle used so far in measuring absolute gravity is discussed, and a change in this principle is proposed.—*W. A.*

2. MAGNETIC METHODS

3819. Bahnemann, Fritz, Zur Einheitlichkeit der Darstellung magnetischer Messungen mit der Feldwaage [On the uniform representation of magnetic measurements made with the field-balance]: Beitr. angew. Geophysik, vol. 6, no. 4, pp. 413–416, Leipzig, 1937.

The suggestion is put forward that measurements made with the magnetic field balance should be plotted on a uniform basis. The physical definition of the direction of the earth's field should be taken as foundation. In the case of a body dipping parallel to the direction of the earth's field, a positive disturbance of magnetic vertical intensity would result to the north of the magnetic equator, and a negative disturbance south of the magnetic equator.—*Author's abstract.*

3820. Besairie, Henri, Contribution à l'étude de la déclinaison magnétique à Madagascar et de ses raports avec la géologie [Contribution to the study of magnetic declination in Madagascar and its relationship to geology]: Madagascar Service des Mines, Annales géol., no. 7, pp. 37–60, Tananarive, 1937.

From a study of the numerous measurements of magnetic declination, the values of which are represented in tables and maps, the conclusion is reached that the principal anomalies in Madagascar are due to purely local causes, in particular to the variations in the nature of the ground, and only rarely are they due to the structure of the earth's crust.—*W. A.*

3821. Burmeister, F., Die Säkularvariation der magnetischen Deklination in Bayern von 1850 bis 1935 [Secular variation of magnetic declination in Bavaria from 1850 to 1935]: Gerlands Beitr. Geophysik, vol. 49, no. 3, pp. 237–240, Leipzig, 1937.

Magnetic measurements were carried out in Bavaria in 1849–55 (273 station), 1908–11 (100 stations), and 1934–35 (87 stations). From these measurements are derived formulas for the change of secular variation by means of which the parallel displacement and the drift of the lines of equal secular variation are determined.—*W. A.*

3822. Dehalu, M., Les prospections géophysiques [Geophysical prospecting]: Rev. univ. mines, ser. 8, vol. 80, no. 5, pp. 193–201, Liége, 1937.

The magnetic method of prospecting is discussed. Magnetic susceptibilities of a series of rocks are given in a table. From a general survey in Belgium, the author established definitely one center of magnetic attraction to the south of Spa, and one center of repulsion to the north of Hasselt. From these two poles the lines of magnetic attraction and repulsion have a general east-west direction. This direction agrees well with the main tectonic lines of Belgium and with results of a detailed survey (distance between the points 1 to 4 km) in the region of Hautes Fagnes. The existence of the center of magnetic attraction to the south of Spa was confirmed, and also a local anomaly of a variable course was found. The anomaly was explained by the influence of eruptive rocks. Magnetic maps of Belgium and of the region of Hautes Fagnes are added.—*W. A.*

3823. Ein neuer Feldwaagentyp [A new type of field balance (editorial note)]: Bohrtech. Zeitung, vol. 55, no. 6, p. 165, Vienna, 1937.

The development by the Askania-Werke A. G., in Berlin-Friedenau, of a new type of vertical field balance, GF 7, is mentioned. The instrument is designed for use in regions with great anomalies, having a scale value of 25γ. It can be safely adjusted to ±1.5γ. A description of the balance is not given.—*W. A.*

3824. Hatakeyama, H., Preliminary investigation on the bay disturbance in the terrestrial magnetic field: Geophys. Mag., vol. 11, no. 1, pp. 1–10, Tokyo, 1937.

According to the definition of bay disturbance, which is a little different from that used so far (Wiechert, Steiner, Lubiger), 407 bay disturbances occurred from August 1, 1932, to August 31, 1935, in Toyohara. They are used for outlining a field of current and its dependence on place and time, which can be considered the cause of bay disturbances. Twelve observatories are used for investigating the relation of disturbance to distribution over the earth, and in four single cases the current fields are outlined for these observatories. The combination of the two results is expressed in lines of flow of current which represent the temporal and local dependence. These lines of flow of current resemble those of Chapman for the part of the day of the great earth-magnetic disturbances. The sole difference is a change in phase of one quarter of a day between the two systems of the current. The preliminary data are to be developed and completed by observations of earth currents and polar lights.—*G. Fanselau's abstract in Zentralbl. Geophys., Meteor. u. Geod., vol. 1, no. 1, 1937, translated by W. A.*

3825. Howe, H. H., On the theory of the unifilar variometer: Terres. Magn. and Atmos. Elec., vol. 42, no. 1, pp. 29–42, 1937.

Vectors are used in this treatment. Neglecting inhomogeneity of the field of control magnets, the following simple, inclusive equation is obtained: Scale-value per radian for changes normal to the magnetic axis $= (K+P)$, where K is ratio of torsion constant to magnetic moment and P is field parallel to axis. Some consequences are discussed, showing superiority over other scale-value equations. This equation is

adequate for the scale value of an H-variometer unless the readings are to be combined accurately with those of another variometer.

The subject is approached from a more general point of view. Horizontal intensity (H) is experimentally a function of ordinate (n), declination (D), and temperature (t). It is expressed by a Taylor series in those variables. The resulting analysis shows: (a) This method avoids mistakes frequently made when second-order effects are considered; (b) when properly defined in the most convenient way, the temperature coefficient is independent of ordinate and declination; (c) considerable error has resulted from the use of the wrong sign for the temperature coefficient of rigidity of quartz.

Consideration of variations of scale value shows: (a) Turning the torsion head affects the base-line scale value very little; (b) a simple formula for the effect of change of optical lever with ordinate results; (c) the principal part of the variation with ordinate is due to the fact that when the magnet turns, part of the earth's field acts parallel to its axis; (d) for a simple H-variometer the temperature coefficients of base-line value and base-line scale value are precisely the same; (e) a sensitivity-control magnet may cause a large temperature effect on scale value; (f) optical compensation produces an effect opposite in sign to the normal one, sometimes smaller, sometimes much larger; (g) the correction necessary to observed scale values is deduced. The effects of change of D are considered; these may be considerable even with a properly adjusted variometer, especially if it is uncompensated or has optical compensation.

A similar treatment for a D-variometer shows: (a) The scale-value may have considerable error unless corrected for the field of other magnets; (b) the effect of change of H is small and is wholly negligible if the variometer is properly adjusted, hence a D-variometer is more accurate than any intensity-variometer; (c) error in orientation may be detected and its magnitude may be estimated from the variometer's temperature coefficient.

Similar methods applied to the component in a fixed direction show that the formulas are somewhat simpler than for an H-variometer. Maladjustments are discussed, and it is shown that the formulas used for computing diurnal variations of X and Y from those of H and D are frequently incorrect. Certain possible improvements in instrument design and operation are suggested.—*Author's abstract.*

3826. Jenny, W. P., Oil and gas possibilities in northeastern Arkansas and western Tennessee: Oil Weekly, vol. 86, no. 4, pp. 26-32, Houston, 1937.

From magnetic investigations, which are to a great extent supported by surface geological considerations, it appears that a number of gentle folds may be found in northeastern Arkansas and western Tennessee which should be well worth testing for oil. The most likely producing formations are considered to be those of Pennsylvanian, Mississippian, Devonian, and Ordovician age, although Tertiary and Cretaceous sediments have a fair chance of having oil accumulations.

As an example of the type of local structure that may be expected in this general area, a magnetic and reflection picture of the Covington structure in Tipton County, western Tennessee, is given. The western high is magnetically expressed by a 1,200 gamma anomaly, the eastern high by a 750 gamma anomaly. In studying local structure it appears

logical to begin with geologic and magnetic investigations. Where these methods indicate favorable structural conditions it is advisable to survey the prospective areas by means of the reflection method. A regional magnetic map is added.—*W. A.*

3827. Jenny, W. P., Micromagnetic predictions are proven by drill: Oil Weekly, vol. 86, no. 1, pp. 110-111, Houston, 1937.

Accurate magnetic surveys on the Gulf Coast as an additional means for the determination of structure generally and especially of faults is advocated. In a previous paper on "Micromagnetic surveys" published in the Oil Weekly of April 27, 1936 (Geophys. Abstracts 87, no. 3276), the principles and obstacles of the new method were outlined. A map showing micromagnetic profiles across the northern extension of the recent Anahuac field drawn from the data obtained from micromagnetic surveys in 1936 is added. A comparison of these profiles with the present development of the field shows the correctness of the profiles. This verification shows the possibilities of micromagnetic surveys.—*W. A.*

3828. Keys, D. A., A survey of methods for determining depth of magnetic ore bodies: Am. Inst. Min. Met. Eng. Tech. Pub. 830, 8 pp., 1937.

A brief survey of practical methods of determining the depth of overburden above magnetic ore deposits is treated under the three following headings: When the magnetic anomalies arise from (1) a single pole, (2) a long narrow dike, and (3) a lens-shaped deposit. Three different field methods are described for the first case, four for the second, and one for the third. The results of applying field readings made on the Falconbridge ore body are given, which indicate that all methods give values of the depth of overburden in excellent agreement with that determined by diamond drilling.—*Author's abstract.*

3829. Koenigsberger, J. G., A comparison between absolute and variometric magnetic measurements: Terres. Magn. and Atmos. Elec., vol. 41, no. 4, pp. 353–354, 1936.

Measurements in 1931 of the absolute value of H and Z for eight stations in Switzerland were made by W. Bruckmann. In 1930 the author measured the H and Z components at these stations with a magnetic variometer, using one station as a base. Results at some stations were almost identical; at some, differences of over 50 gammas were noted. The differences in Z were within the limit of error of the instruments for about half the stations, with a closer agreement for H values for the others.—*D. W., Mines Mag., vol. 27, no. 5, 1937.*

3830. Kothny, G. L., Magnetic method of orienting cores: Petroleum Eng., vol. 8, no. 7, pp. 116–118, Dallas, 1937.

Attempts have been made to "orient" the core barrel out of the borehole, that is to determine its original position in the earth. When the core has been thus oriented the dip and strike of the strata intersecting the core may be determined. As most sedimentary rocks have a slight permanent magnetic polarity in the direction of the earth's magnetic field, a method is developed for determining the magnetic polarity of the core samples, for orienting the samples to correspond with the original position in the earth, and for measuring the dip and strike of the stratification in the core. This information

is obtained by means of a highly sensitive magnetometer that automatically and photographically records the polarity of the core samples. The examination should be made on three to five cores, preferably fresh, that show indications of a bedding plane and are not less than 2 inches in diameter and 3 inches long. Samples must be marked "top" and "bottom." Satisfactory determinations were made in more than 60 percent of the cores examined from all parts of the United States.

The value of a knowledge of the direction of dip is evident, as it not only discloses structure in wildcat wells but can also be used in proved areas to determine when wells have passed through faults or crossed the axes of anticlines into areas from which they should be deflected.—*W. A.*

3831. Ljungdahl, G. S., Magnetic secular change in Sweden, 1929–36: Terres. Magn. and Atmos. Elec., vol. 42, no. 2, pp. 127–128, 1937.

Preliminary values of the average secular change of declination, inclination, and horizontal intensity from 46 remeasured field stations are given as functions of geographic latitude and longitude.—*W. A.*

3832. Logachev, A. A., Magnetic survey from an airplane in the western region of U. S. S. R. [in Russian]: Razvedka Nedr., vol. 7, no. 5, pp. 34–37, Moscow, 1937.

In a previous paper (Geophys. Abstracts 87, no. 3282) the author described his tests for determining magnetic anomalies from an airplane made with the aid of apparatus developed by him. In this paper he describes tests continued with slightly improved apparatus (friction and air resistance of the rotating frame were minimized and the total weight reduced from 72 kg to 30 kg) in the region of Smolensk. The survey was made over the known Rogneda anomaly, about 130 km from Smolensk. Six profiles taken at various altitudes from 200 to 300 m are given. The results show that anomalies of an intensity of 2,000 γ or more may be determined from an airplane in any weather it which the airplane can fly. Anomalies of about 1,000 γ may be determined during quiet, clear days.—*W. A.*

3833. MacCarthy, G. R., and Straley, H. W., Magnetic anomalies near Wilmington, N. C.: Science, new ser., vol. 85, no. 2206, pp. 362–364, 1937.

The results of a reconnaissance survey of the magnetic anomalies in a part of the Coastal Plain of North and South Carolina have already been given by MacCarthy (Jour. Geology, vol. 44, no. 3, 1936; see Geophys. Abstracts 87, no. 3283). The present paper describes the extension of the previous survey to the region immediately east, north, and northwest of Wilmington, N. C.

An Askania vertical field balance, Schmidt type, was used. The accompanying isogamic or magnetic contour map is based upon about 550 observations. The trend of the magnetic structures outlined by these isogams is, roughly, northeast-southwest.

The authors' interpretation of the anomalies shown by the map is that they are the reflection of structure and perhaps of topography in the pre-Cretaceous rocks that are buried beneath the sediments of the Coastal Plain. The anomalies of the region are considered to be of scientific as well as practical interest. Noticeable compass deflections have been observed in this area, and judging by the observed

effect of similar deflections associated with equally intense anomalies elsewhere, local interference with radio reception might be expected.—*W. A.*

3834. Maurain, Charles, Influence possible des actions méchaniques (vibrations) et des perturbations magnétiques sur le champ magnétique terrestre et ses anomalies [Probable influence of mechanical action (vibrations) and magnetic disturbance upon the terrestrial magnetic field and its anomalies]: Acad. sci. Paris, Comptes rendus, vol. 204, no. 15, pp. 1095–1097, 1937.

From the studies conducted by the author, Eblé, Coulomb, and others in various regions, it was established that changes in magnetization, both induced and remanent, may be caused by mechanical actions such as vibration, torsion, tension, etc., thus also by earthquakes, as well as under the influence of microseismic perturbations. The instability of magnetization of basalts established by Thellier (Geophys. Abstracts 89, no. 3696) gives further evidence on the probable role of mechanical vibrations and magnetic perturbations upon the conditions of the magnetization of materials forming the earth's crust, thus also on the distribution of the terrestrial magnetic field.—*W. A.*

3835. McNish, A. G., Terrestrial-magnetic and ionospheric effects associated with bright chromospheric eruptions: Terres. Magn. and Atmos. Elec., vol. 42, no. 2, pp. 109–122, 1937.

Magnetic changes occurring at a large number of stations simultaneously with bright chromospheric eruptions reveal that the effect is an augmentation of the normal diurnal variation supposedly due to increased atmospheric ionization by ultraviolet light from the eruption. Radio fade-outs occurring at the same time indicate that this increase of ionization takes place at the base of or below the E-layer while the upper layers are unaffected. These facts are adduced in support of the Stewart-Schuster theory, which attributes the diurnal variations to dynamo currents in the ionosphere, since the lower ionosphere is the region in which these currents are likely to flow. The upper regions of the ionosphere are most favorable for the operation of the drift-current and diamagnetic theories. Absence of typical features of magnetic disturbance immediately after and for several days following the more intense eruptions is contrary to the effects predicted by the ultra-violet theory of magnetic storms.

Examination of the processes of ionization indicates that the solar eruptions are adequate causes of the effects observed. These eruptions must produce very large increases in ionizing radiation. It is suggested that normal radiation from the sun in the extreme ultra-violet is much greater than that calculated on the assumption that the sun is a black-body radiator at a temperature between 6,000° and 7,000° K.

Statistical examination of the phenomena suggests that differences in intensity may be adequate explanation for the production of magnetic effects and radio fade-outs by some eruptions, only fade-outs by others, and absence of noticeable terrestrial effects in numerous others. Fade-outs reported when no eruptions occurred seem attributable to causes of a different nature.—*Author's abstract.*

3836. Meyer, G., Erdmagnetische. Untersuchungen im Hegau [Investigations of terrestrial magnetism in Hegau]: Naturf. Gesell. Freiburg Berichte, vol. 34, pp. 359–397, 1935.

The earth-magnetic disturbances in Hegau are attributed to permanent magnetism of the basalts that form the mountains of that country. These mountain tops are always magnetic south poles. The magnetism is induced from the earth, and its existence in the basalts is explained by their content of minerals rich in iron, especially magnetite. Mountains formed of phonolite do not produce any magnetic disturbances.

Rocks having a magnetic direction opposite to that of the inducing earth effect were not observed here (the contrary of observations made in Kaiserstuhl near Freiburg). The basalts remain at the present time in the same magnetic condition which they acquired at the time of their hardening.—*Sindowski's abstract in Geol. Zentralblatt, vol. 58, no. 6, 1937, translated by W. A.*

3837. Schlomka, Teodor, Zur neuen Haalckschen Theorie des Erdmagnetismus [Concerning the new Haalck's theory of terrestrial magnetism]: Zeitschr. Geophysik, vol. 13, no. 2/3, pp. 126–131, Braunschweig, 1937.

After a brief outline of the present state of physical theories of terrestrial magnetism it is shown that Haalck's new theory does not give satisfactory quantitative results, and that the conclusions drawn by Haalck are not correct.—*Author's abstract, translated by W. A.*

3838. Schwinner, Robert, Säkulare Änderung der Vertikalintensität und Gebirgsbau in Österreich [Secular variation of vertical intensity and formation of mountains in Austria]: Gerlands Beitr. Geophysik, vol. 48, no. 4, pp. 388–416, Leipsig, 1936.

Magnetic measurements were made in Austria in 1850, 1890, and 1930. Secular variations of Z and T resulting from these measurements are shown by isoporic lines (lines of equal annual change) on maps that show also the principal features of geologic structure. The picture of these isoporic lines has proved that they depend on the formation of mountains similarly to the Z-anomalies of the same measurement, which were derived from the isodynamic maps of 1850, 1890, and 1930. The different geotectonic features may be accordingly distinguished as (1) geoanticlines with old crystalline rocks and zones of geosynclinal character and (2) accumulations of sediments which have been folded into the crystalline rocks during later periods. This is best confirmed by the observations of Reich concerning the dependence of the magnetic secular variation on the geological mass-structure. The map of isoporic lines of Germany compiled by Reich for the years 1901 to 1931 is also completed and extended as far as the southern Alps.—*Author's abstract, translated by W. A.*

3839. Vacquier, Victor, Short-time magnetic fluctuations of local character: Terres. Magn. and Atmos. Elec., vol. 42, no. 1, pp. 17–29, 1937.

The comparison of the short-time fluctuations of the earth's vertical magnetic intensity afforded by data taken during the daylight hours by the exploration corps of the Gulf Research & Development Co. indicates that at points separated by 800 miles, 58 percent of the fluctuations are of local origin. It is found that on a few magnetically quiet

days the time variations of the vertical magnetic intensity are locally so different in magnitude and in phase as to disprove the theories of magnetic variations that are based solely upon the difference between night and day ionization of the upper atmosphere. The observed irregularities are independent of magnetic activity. They can be accounted for only by the dynamo theory and indicate the presence of local air circulations in the ionosphere. It is suggested that simultaneous registration of the magnetic elements at points spaced about five times the ionospheric height might delineate the circulation of the upper air and perhaps thus provide information useful to meteorology.—*Author's abstract.*

3840. Waters, K. H., A magnetometric survey in the Lincolnshire iron field: Mining Mag., vol. 56, no. 6, pp. 341–345, London, 1937.

The survey was undertaken to determine the limitations of the vertical magnetometer as a prospecting instrument and to discover what would be revealed by a survey in a rather densely populated area in which iron objects are plentiful and scattered irregularly. A particular object of the survey was to find out whether any use could be made of the vertical variometer if the ore sought were not ferromagnetic but paramagnetic. The survey was carried out over the beds of Northamptonshire ironstone, east of Lincoln. Schmidt's vertical field magnetometer without temperature compensation was used. The present survey shows what care must be taken in any survey conducted in a region where steel objects abound.

The susceptibility of the ore was found by means of an instrument designed by Rankine, and an average of three values gave the susceptibility as 50×10^{-6}. This low value shows that the ore is a true paramagnetic substance and explains the small value of the anomaly obtained.—*W. A.*

3. SEISMIC METHODS

3841. An introduction to the seismograph for the amateur [editorial note]: Earthquake Notes, vol. 8, no. 4, pp. 1–6, 1937.

The article covers the more important principles of the seismograph. An attempt is made to give a general idea of some of the methods employed without going into details and specifications. A detailed consideration would have involved, among other things, the formula for the time or period of oscillation of a simple pendulum in which T (time of one oscillation) is equal to 2π times the square root of L (length of pendulum) over g (force of gravity), $T=2\pi\sqrt{L/g}$. It would have involved the explanation of the application of this formula to the horizontal pendulum because of the reduction in the effective force of gravity on the pendulum. The portion of gravity force which can act to make the horizontal pendulum oscillate is directly proportional to the sine of the angle of inclination "i" of the plane of oscillation as shown in a figure.—*Author's summary.*

3842. Barab, J., and Martin, J. M., Explosives for seismic exploration: Explosives Engineer, vol. 15, no. 7, pp. 201–204, 216–218, Wilmington, Del., 1937.

Development of suitable explosives to meet the demands of seismic shooting and a brief general discussion of the various types of explosives are given. The vibrogels, as these explosives are designated by manu-

facturers, represent certain modifications of the regular gelatin formulas and are packed to meet the requirements of geophysicists. The explosive which is used most extensively in seismic shooting at present is 60 percent L. F. extra gelatin (the letters L. F. mean "low freezing" and indicate that the liquid ingredients are designed to resist low temperatures to prevent freezing during cold weather). The results of tests made with vibrogels A, B, and C, which are all 60 percent ammonia gelatins with similar explosive characteristics and differ principally in their hardness and consistency, are shown in three charts.—*W. A.*

3843. Berroth, A., Geometrische Lösung der Grundaufgaben der in der Geologie angewandten Seismik [Geometrical solution of the fundamental problems of seismics applied in geology]: Zeitschr. Geophysik, vol. 13, no. 2/3, pp. 87–106, Braunschweig, 1937.

Fundamental rules of applied seismics (reflection and refraction methods) are examined from the uniform geometrical viewpoints for both one-layer and several-layers problems, as practically all the geologic cases may be included in these two problems.—*Author's abstract, translated by W. A.*

3844. Bois, Charles, Sur la détermination de la profondeur focale des séismes très éloignés [On the determination of focal depths of very distant quakes]: Acad. sci. Paris Comptes rendus, vol. 204, no. 20, pp. 1493–1495, 1937.

Deep-focus earthquakes recorded in Strasbourg from 1923 to 1935 were studied. Only 12 earthquakes could be interpreted satisfactorily by using Brunner's curves, as these curves are drawn only for a small number of phases. Better possibilities were offered by analyzing most distant quakes by the use of Gutenberg's tables, as the latter were compiled for a greater number of phases.

The values of the focal depths of the 12 earthquakes, given in a table, are compared, and it is found that the values calculated by using Brunner's curves are equal to or greater than those calculated with the aid of Gutenberg's tables, the average difference being 10 km.

In applying Brunner's curves and Wadati's tables for calculating focal depths the author, in a previous work (see Geophys. Abstracts 89, no. 3700), established an average difference of 25 km.—*W. A.*

3845. Bois, C., Détermination de la distance épicentrale d'un séisme à foyer profound à l'aide des tables dressées pour les tremblements de terre normaux [Determination of epicentral distance of a deep-focus earthquake with the aid of tables prepared for normal earthquakes]: Ann. physique globe France Outre-Mer, vol. 4, pp. 3–4, 1937.

F. W. Sohon had shown that it is possible to calculate with sufficient accuracy from the initial times of phases P, pP, S, and sS of a deep-focus earthquake the difference of the initial times of S and P of an imaginary earthquake with the same distance of focus and normal focal depth by using the formula

$$(S-P)_o=(S-P)+\tfrac{1}{2}((sS-S)-(pP-P))$$

and, therefore, it is possible to determine the epicentrum of a deep-focus earthquake from the travel-time tables prepared for normal

earthquakes. The author refers to the fact that in many earthquakes it would be very difficult to discover the sS-phase. But this may be disregarded because a constant value equal to 1.80 can be assigned to the ratio

$$\frac{sS-S}{pP-P}$$

with a sufficient approximation, and Sohon's formula may be changed into the simpler one

$$(S-P)_o=(S-P)+0.40(pP-P).$$

Formulas for applying other phases (sP, pPP, PR) are given. The results from a few deep-focus earthquakes with depth of focus from 140 to 620 km are compared with the evaluations given in the International Seismological Summary. The mean variation of the focal distance is 0.5°, and the maximum is not over 1°.—*H. Jung's abstract in Zentralbl. Geophys., Meteor. u. Geod., vol. 1, no. 1, 1937, translated by W. A.*

3846. Conrad, V., Erdbeben und Luftdruckänderung [Earthquakes and changes in atmospheric pressure]: Gerlands Beitr. Geophysik, vol. 48, no. 2/3, pp. 239–253, Leipzig, 1936.

The hypothesis of Nopcsa that earthquakes may be released by a certain effect of atmospheric pressure does not hold for all earthquake regions, as has been proved in the case of two Scottish epicentres. On the other hand, the behavior of the Hungarian earthquakes is such that it is not possible to deny the reaction of the quakes in this region to the effect of atmospheric pressure. It is certainly not to be overlooked that the Hungarian material studied here does not suffice to establish definite results. If the observations are correct, the following conclusion must be drawn: The effect of the air pressure must be considered a secondary releasing cause of earthquakes if, according to its direction, it reinforces the effect produced by the geologic movements.—*Author's abstract.*

3847. Dobberstein, Heinz, Ein photoelektrischer Schwingungsmesser [A photoelectric vibration indicator]: Zeitschr. Geophysik, vol. 13, no. 2/3, pp. 123–126, Braunschweig, 1937.

The principle and construction of a photoelectric vibration indicator by which the travel-time curve may be directly recorded is described. In this apparatus the so-called "stationary mass" regulates the light ray, which strikes a photocell in rhythm with oscillations, thus producing the electrical oscillations, which are recorded photographically by means of a galvanometer or oscillograph. A few resonance curves are shown.—*W. A.*

3848. Farren, W. R., and White, H. H., Recent developments in explosives for seismograph prospecting: Geophysics, vol. 2, no. 2, pp. 114–118, Houston, 1937.

Types of dynamite selected from numerous field tests conducted in cooperation with explosives manufacturers are briefly described.—*W. A.*

3849. Freeman, L. J., The seismograph an aid to the geologist in Arkansas: Mines Mag., vol. 27, no. 5, pp. 19–21, 37, Denver, 1937.

Seismographic survey was called upon in 1935 to determine structural conditions below the Cretaceous at Smackover, Ark., on Norphlet dome.

It was determined by seismographic tests that reflections could be obtained deeper than the Cretaceous, and thus a structural picture of the region could be furnished. An exploration program described in this article was carried out. Time was allotted for regional studies after the seismograph had found certain conditions to prevail over the area. The most promising folds were mapped. The seismograph has demonstrated that it can be of value not only in revealing local structure but also in furnishing data for regional studies by the geologist.—*W. A.*

3850. Frost, D. V., Seismic method of prospecting for ores [in Serbian]: Rudarski i Topionicki Vesnik, vol. 9, no. 2, pp. 11–12, and no. 5, pp. 46–47, Belgrade, 1937.

Review of theoretical principles of seismic method. Mathematical theory for determining the depth of horizontal and inclined layers is given. This work is compiled and issued by Gorsky from the manuscripts of the deceased Professor Frost.—*V. Gorsky.*

3851. Hagiwara, Takahiro, Report on the work of the Earthquake Research Institute, Tokyo Imperial University, during the year 1933–34: Gerlands Beitr. Geophysik, vol. 48, no. 1, pp. 94–108, Leipzig, 1936.

Studies of earthquakes, elastic waves, tunamies, crustal deformations, effects of earthquakes on engineering work, construction and improvements of seismographs, etc., carried on by a number of Japanese seismologists, are described.—*W. A.*

3852. Jeffreys, Harold, The Italian earthquake of July 23, 1930: Gerlands Beitr. Geophysik, vol. 49, no. 4, pp. 393–401, Leipzig, 1937.

The nature of the inconsistent readings given as S between 10° and 20° has been investigated by means of the records of an earthquake so situated that the SH and SV waves would be recorded on different horizontal components. It is found that the earlier readings are clearest on the component that should show SH, and presumably are the true S. The later movement is larger and has a longer period. Various suggestions are made to explain it, but none appears wholly satisfactory.—*Author's abstract.*

3853. Landsberg, H., Note on earthquake intensities on different floors of houses: Gerlands Beitr. Geophysik, vol. 48, no. 1, pp. 84–85, Leipzig, 1936.

Observations of the Canadian earthquake of November 1, 1935, made in central Pennsylvania showed that in the higher floors of houses the intensity increased by ½ degree of the modified Mercalli-Sieberg scale.—*Author's abstract.*

3854. Nopcsa, F. B., On connections existing between earthquakes and atmospheric pressure: Gerlands Beitr. Geophysik, vol. 48, no. 2/3, pp. 229–238, Leipzig, 1936.

Regarding the relations between earthquakes and the changes of atmospheric pressure it seems that among the regions of shallow-focus earthquakes four types can be distinguished:

1. A type due to loading by sedimentary accumulation of overthrust. Plus reaction.

2. A type due to unloading by erosion or by the melting of glacial caps. Minus reaction.

3. A type due to the thinning out of sial as a first effect of continental drift. Plus reaction.

4. A type due to the rise of sima as a last effect of continental drift. Minus reaction.

Perhaps it will be found that the earthquakes of the types 3 and 4 have a somewhat deeper focus than those of the types 1 and 2.

It is by no means thought that earthquakes can be released only by a change of the atmospheric pressure, for they can just as well be released by any of the factors that diminish the friction on the surfaces of faults. Among others, Conrad found that the changing position of the poles is such a factor, but this factor naturally works otherwise in folded regions where the trend is more or less parallel to the equator (Alps) than in the regions where the trend is more nearly at right angles (Dinaric Ranges, Appenines). Convincing details are given in Conrad's paper "Schwankungen der seismischen Aktivität in verschiedenen Faltungsgebieten" (Fluctuations of seismic activity in various folded regions, published in Mitt. Erdbeben-Komm. Akad. Wiss. Wien, neue Folge, no. 63, 1926); here it is enough to mention that the maximum of seismic activity in the Dinaric Ranges and the Appenines corresponds to a minimum in the Alps. Naomi Miyabe claims to have found similar connections existing between the earthquakes of the Pacific Ocean (On the fluctuation of the zone of macroseismic activity in the Pacific Ocean; Imp. Acad. Tokyo, Proc., vol. 5, 1929).—*Author's abstract.*

3855. Pirson, S. J., Continuous-profiling method of seismographing for oil structures: Am. Inst. Min. Met. Eng. Tech. Pub. 833, 9 pp., 1937.

The continuous-profiling method of prospecting has been in great favor for the past few years in detailing subsurface structure suitable for oil and gas accumulation. It practically reduces the interpretation and correlation of seismic reflection records to a mechanical routine, with the result that errors are less likely to creep into the final results. The field procedure, computation of the records, and weathering corrections, as well as the correlation procedure, are explained in detail.—*Author's abstract.*

3856. Pirson, S. J., Practical graphical and approximation methods for dip-shooting calculations: Oil Weekly, vol. 85, no. 7, pp. 22–34, 1937.

Correlation-reflection shooting consists in obtaining records of identified characteristic reflections in an area where the formations are well stratified and show but little or gradual convergence. Dip-reflection shooting consists in obtaining records showing reflections which are unidentified but from the configuration of which it is possible to compute the dip of the subsurface formations. The second method forms the subject of this article.

The method itself is divided into the following different field procedures—(1) straight dip shooting, (2) correlation dip shooting, and (3) continuous profiling. General subsurface condition suitable for dip work is shown in a figure. The graphic calculation and the nomographic method used in straight dip shooting are explained in detail. The correlation dip shooting may be applied when the subsurface slopes are considerable and it is necessary to take into account the side-swipe effect, that is, to compute the depth and location of the reflection points as well as the dip of the formations themselves. This can be

achieved by shooting in three directions from a shot hole, assuming that correlation between the three records is possible. An example of such computation is given.

In continuous profiling the dips of the subsurface formations can be obtained by continuous development of the geophones in straight or curved lines on the surface of the ground with one or two reflection points overlapping in each spread. The procedure is explained by the use of a figure.—*W. A.*

3857. Rieber, Frank, Complex reflection patterns and their geologic sources: Geophysics, vol. 2, no. 2, pp. 132–160, Houston, 1937.

A technique is shown for producing synthetic records corresponding to assumed ideal structural conditions, the resulting records being reproduced in the usual visual form and also in the form of directionally analyzed records. Examples of folding, faulting, and irregular sedimentation are given.—*Author's abstract.*

3858. Rolland, G. F., and White, H. H., Developments of essential characteristics in electric blasting caps for seismograph prospecting: Geophysics, vol. 2, no. 2, pp. 119–126, Houston, 1937.

Two characteristics are essential in electric blasting caps—uniformity and safety. These requirements are discussed, and the steps involved in producing an improved product are outlined. Various technical methods for evaluating the essential characteristics are given in some detail. Special developments in accessories tending towards greater efficiency and safety in seismographic practice are described.—*W. A.*

3859. Rosaire, E. E., Exploration by the reflection seismograph in the Gulf Coast of Texas and Louisiana: Oil Weekly, vol. 86, no. 1, pp. 70–82, 1937.

This is a reprint from the Journal of the Institution of Petroleum Technologists, London, vol. 23, no. 159, pp. 40–56, 1937 (see Geophys. Abstracts 88, no. 3595).—*W. A.*

3860. Seismic survey program extended into Montana [editorial note]: Eng. News-Record, vol. 118, no. 3, pp. 89, 1937.

Strong-motion accelerographs of improved design were recently installed in Montana as part of the seismic survey program of the U. S. Coast and Geodetic Survey. The essential function of the instrument is to make three records on sensitized paper mounted on a drum, which is housed in a lightproof case. Each record indicates the extent of earth movement in a different plane. The record is made by a pin point of light whose fluctuations are controlled by the three accelerometers, one for each plane, mounted in the center of the panel assembly. The instrument is not operative until a shock occurs heavy enough to jolt it into action. A picture of the installation is given.—*W. A.*

3861. Siñeriz, J. G., La investigación sísmica en el estrecho de Gibraltar [Seismic investigation of the Strait of Gibraltar]: Acad. cien. Madrid Rev., vol. 32, pp. 431–476, 1935.

In this investigation to determine the possibility of building a tunnel under the Strait of Gibraltar, the seismic method was applied, and it was found that the impervious layers along the shore line have a thickness of more than 1,000 meters, thus the drilling of a tunnel inside of these rocks is possible. The maximum depth of the strait, as established by the measurements made by the Oceanographic Institute, did not ex-

ceed 400 m. Tables showing the results of seismic exploration are added.—*W. A.*

3862. Smith, A. L., and Wilson, J. H., Abnormal velocities in sedimentary beds in eastern Utah: Geophysics, vol. 2, no. 1, pp. 56–62, Houston, 1937.

Velocity determinations at wells and refraction shooting in the area indicate abnormally high velocities in Utah. The following conclusions are reached: (1) These high velocities are related to hardening due to incipient metamorphism after deposition; (2) this condition has an adverse effect on the quality of reflections; (3) it interferes with interpretation of refraction data; (4) it may be an index of unfavorable conditions for accumulation of oil or gas.—*Authors' abstract.*

3863. Sponheuer, W., Gebäudeschwingungen beim Erdbebenstoss [Oscillation of buildings during an earthquake shock]: Zeitschr. Geophysik, vol. 13, no. 2/3, pp. 106–111, Braunschweig, 1937.

For the explanation of the form of oscillation and of the stress of buildings, bending curves and stretching curves were determined for a rod having uniform cross section and one end fixed to the shaking table. The results show that the bending and stretching curves were composed of two portions corresponding to the two frequencies of the shock movements (of a coupled oscillation).—*Author's abstract translated by W. A.*

3864. Stöcke, K., Herrmann, H., and Udluft, H., Gebirgsdruck und Plattenstatik, Teil 2: Elastizitätsversuche an Gesteinen aus Niederschlesien und Westfalen [Ground pressure and plate statics, part 2, Tests on elastic properties of rocks from Lower Silesia and Westphalia]: Zeitschr. Berg- Hütten- u. Salinenwesen Deutsch. Reich, vol. 84, no. 11, pp. 467–503, Berlin, 1937.

This article is the continuation of the research on "ground pressure and plate statics" previously published by the same authors (see Geophys. Abstracts 74, no. 2516; 87, no. 3446). In this paper the authors give the results of tests made on pressure and bending of rocks from Lower Silesia and Westphalia. The modulus of bending and the values of bending and of elasticity of 91 samples are studied.

The rocks examined are classified according to a new nomenclature, and their petrographic properties are compared with technical qualities.

The results obtained in the laboratory are discussed with respect to geology, geophysics, and mining. The following conclusions relate to geophysics:

1. An important fact to be considered in gravity measurements is that the volumetric weight of rocks within a special class may vary considerably.

2. In making seismic observations it is necessary to keep in mind that great difference may occur in the E-modulus of rocks belonging to similar types and that the E-modulus generally accepted for various sediments, such as argillaceous slate, sand-slate, and sandstone, should be used conditionally only.

3. The anisotropic behavior of rocks must be taken into consideration, the results depending on whether the stress works perpendicular or parallel to stratification.

4. The value of the E-modulus depends also on the degree of tension to which the layer is subjected, and in making calculations it is not the same if the tension is between 0 and 100, or up to 500 kg/cm^3.

5. Tests made by Heinrich show that there are contraditions in the values of E as obtained by mechanical methods and by seismic methods.—*W. A.*

3865. Taylor, J., Intensive seismic exploration in north Louisiana: Oil and Gas Jour., vol. 35, no. 22, pp. 79–82, 1936.

A discussion of seismic prospecting in the area named. This activity was started largely by the discovery of oil in the Trinity group at Rodessa. The peak of activity came in July, 1936, with 40 crews active and has simmered down to a present level of 20 crews. Seismic equipment is described and spreads used; reflection horizons found are discussed.—*D. W., Mines Magazine, vol. 27, no. 5, 1937.*

3866. Visser, S. W., Some remarks on the deep-focus earthquakes in the International Seismological Summary, second paper: Gerlands Beitr. Geophysik, vol. 48, no. 2/3, pp. 254–267, Leipzig, 1936.

In a previous paper (Geophys. Abstracts 87, no. 3369) the author considered the long-wave records in the International Seismological Summary and suggested that the number of such records may serve as a means of deducing the focal depth of earthquakes. In this paper further remarks are added and the geographical distribution of deep-focus earthquakes is discussed in detail.

Abnormally situated deep foci are reclassified. Methods of control are suggested.—*W. A.*

3867. Yosimatu, T., On the regional and local factors of earth currents at the Kakioka magnetic observatory, part 1 [in Japanese]: Meteorol. Soc. Japan Jour., vol. 15, pp. 145–158, 1937.

Earth current and earthquake. Eliminating the so-called universal factors of earth current with two independent E-W components, 1.5 km and 0.1 km long, respectively, we find the following results: Earthquakes, especially larger-scale ones, frequently occur near the maximum or minimum points of the special variation of the above-eliminated curves, which have usually no appreciable change except the anomalous electrode change. This variation begins to occur some hours before the earthquakes. The earthquakes are classified in three types, I, D, and M type, according to the increasing, decreasing, and mixed variation of the eliminated potential difference, in which case the potential is taken as positive when west high. The geographical distribution of the three types is illustrated in a figure, showing some intimate relation to the topography, or gravitational anomaly near the island. The amplitude $A\frac{mV}{100m}$ and period T in hours of variation before the earthquake occurrence is approximately expressed by the following empirical formulas in which

$$\Delta \geqq 1, A = \alpha \frac{\Delta + \epsilon}{(\Delta^2 + b^2)^m}; \quad T = C(1 - \epsilon^{-\alpha A})$$

where Δ is the distance from the observatory to the epicenter, and ϵ and A, etc., are some constants. Some possible considerations regarding this variation are proposed.—*Author's English abstract.*

3868. Yosimatu, T., On the earth-currents variations accompanied with the remarkable earthquakes, "Nijima," Nov. 27, 1936, and "Nojimazaki," Oct. 26, 1936 [in Japanese]: Meteorol. Soc. Japan Jour., vol. 15, pp. 158–160, 1937.

Eliminating the so-called universal variations with two independent base lines, we find that earth currents vary in some manner with the activity of the earthquakes and their after-shocks. The relation between the mode of the variation of earth currents and mechanism of earthquake is not clear at the present time.—*Author's English abstract.*

4. ELECTRICAL METHODS

3869. Andrianov, P. J., The dilatograph with photoregistrator [in Russian]: Jour. Geophysics, vol. 6, no. 6, pp. 546–557, Moscow, 1936.

The description of a "dilatograph," an apparatus for determining the change in volume of rock samples is given. The principle of the apparatus is as follows: The sample is inserted into a cylindrical cast-iron receptacle and covered with quicksilver. Along the axis of the receptacle a platinum-iridium wire is fixed. When the wire touches the surface of the quicksilver a circuit is closed. The surface of quicksilver rises or sinks with the change of volume of the rock sample, thus making the end of the wire shorter or longer. This produces a change in the resistance and current intensity, which is registered photographically by means of a mirror galvanometer. Diagrams representing the volume curves for several rock samples are added.—*W. A.*

3870. Brown, J. G., The effect of overcast sky upon the local diurnal variation of the earth's electric field: Terres. Magn. and Atmos. Elec., vol. 42, no. 2, pp. 163–164, 1937.

A method of obtaining the local diurnal variation of the earth's electric field and a theory to account for the local variation were discussed in a previous paper (Geophys. Abstracts 83, no. 3067). In another paper (Geophys. Abstracts 87, no. 3377) it was shown that the greatest amplitudes of the local variation occur in clear weather with calm nights and only gentle variable winds during the daytime. The author states that continuous wind, due to its turbulent action at the surface, keeps the nuclei stirred up to such an extent that the effect of turbulence and convection caused by surface heating during the daytime and the effect of subsidence at night are very much reduced. If the theory of the local variation is correct, it seems probable that anything which reduces the amount of heating at the surface will reduce the amplitude still more. To test this conclusion a comparison of the local variation during clear weather with that during weather with overcast sky, for both quiet and windy days, was made by using the records of the Ebso Observatory at Tortosa, Spain. The forms of the curves obtained for days with light winds were quite similar, but the mean amplitude on overcast days was only about half of that on clear days. On overcast days with strong continuous wind, the amplitude was only about two-thirds of that on clear days. This result indicates that wind is the main factor in reducing the amplitude of the local variation, but even with wind of considerable velocity the effect of overcast sky is still noticeable.—*W. A.*

3871. Card, R. H., Correlation of earth resistivity with geological structure and age: Am. Inst. Min. Met. Eng. Tech. Pub. 829, 19 pp., 1937.

Experimental data on the resistivity of the earth's crust have been obtained at many points. These have been derived largely from meas-

urements of the low-frequency mutual impedances of generally paralleling lines. This type of measurement is such as to give a figure in the nature of an average or "effective" resistivity of the crust to a considerable depth. These data are compared with those on the age and other characteristics of the geologic formations composing the crust.

In general, increasing effective resistivity corresponds to increasing age of the formations involved, though the relation is a highly irregular one. There are some outstanding exceptions—for instance, the presence of volcanic rocks in young sedimentary formations or of alluvial soils overlying old rock formations may alter this relation greatly.—*Author's abstract.*

3872. Fritsch, Volker, Untersuchung des Untergrundes mit funktechnischen Mitteln (Funkmutung) [Investigation of the underground by means of radio (radio-prospecting)]: Elektrotechnik u. Maschinenbau, vol. 54, no. 52, pp. 621–625, 1936.

Propositions made by Löwy, Leimbach, and Kröncke about 25 years ago to use radiotechnical methods of measurement for investigating the underground, and the progress of applied geophysics made by works of Koenigsberger, Reich, Hummel, Petrovsky, and many other scientists resulted in the development of the so-called "radiogeology." An account of some important methods of radiogeology and of tests made by the author is given. The capacity and absorption methods are examined in detail through numerous practical examples. Other methods are discussed briefly. It is indicated that the fundamental advantage of radiogeology in comparison with other geophysical methods consists in the fact that as a greater number of different kinds of objects are capable of being determined by measurements, the adjustment to the given conditions of work is much more favorable than by the use of galvanic methods.—*W. Geyger's abstract in Zeitschr. Geophysik, vol. 13, no. 2/3, 1937, translated by W. A.*

3873. Fritsch, Volker, Möglichkeiten einer Funkmutung auf Erdöl [Possibilities of radio prospecting for oil]: Bohrtech. Zeitung, vol. 55, no. 5, pp. 117–119, Vienna, 1937.

Principles of radio prospecting for oil are examined, also the difficulties arising (1) from the fact that only deposits at shallow depth can be disclosed, and (2) from the interference of the uppermost layer, which is usually a good conductor.

The absorption method and the capacity method are studied theoretically and explained schematically by figures.—*W. A.*

3874. Fritsch, Volker, Beiträge zur Funkgeologie, 4, Darstellung der Eigenschaften geologischer Leiter [Contribution to radiogeology, 4, Representation of the properties of geologic conductors]: Beitr. angew. Geophysik, vol. 6, no. 4, pp. 407–412, Leipzig, 1937.

The properties of geologic conductors are represented by stereometric diagrams, the specific inductive capacity, the conductivity, and the frequency being used as rectangular coordinates. Any geologic conductor may thus be represented by a certain three-dimensional diagram. Geologic conductors may be distinguished by wireless prospecting methods (Funkmutung) only when their diagrams differ. The in-

fluence of structure, moisture, and salinity upon conductivity and field losses are illustrated by diagrams.—*Author's abstract.*

3875. Fritsch, Volker, Neuere Forschungen auf dem Gebiete der Funkgeologie [Recent investigations on radiogeology]: Petroleum Zeitschr., vol. 33, no. 13, pp. 14–16, Berlin, 1937.

The problem of radiogeology requires the study of the relationship between high-frequency Hertz's field and a geologic conductor—that is, a geologic formation through which a current or a field may pass. The importance of a geologic conductor depends mainly on water solutions contained in it, therefore the study of geologic conductors is the starting point in radiogeologic investigations.

Experiments described in this article, as well as in a series of previous articles, enable the author to draw conclusions on the applicability of the theories derived to radiogeology.

From experiments, assumptions for determining a geologic conductor may be made, and the possible practical application of the theoretical principles is discussed.—*W. A.*

3876. Fritsch, Volker, Der Einfluss des Wassergehaltes auf den Widerstand geologischer Leiter [Influence of the content of water on the resistance of geologic conductors]: Elektrotech. Zeitschr., vol. 58, no. 12, Berlin, 1937.

1. The resistance of solid constituents of geologic conductors is, with a few exceptions, so high that the currents flowing through them can be neglected. The effective resistance is determined almost exclusively by the liquid constituents.

2. The relationship between the resistance and the content of water is very complicated and depends on many other conditions.

3. Rocks of poor conductivity which electrically do not differ greatly from the surrounding medium may be sometimes disclosed electrically by the solutions in which they are constituents.—*Author's abstract, translated by W. A.*

3877. Gassmann, Fritz, Ein geoelektrischer Widerstandsmesser [A geoelectric resistance meter]: Schweizer naturf. Gesell. Verh., 117. Jahresvers., Solothurn, pp. 269–270, Aarau, 1936.

Apparatus for measuring differences of potential on the surface of the earth is described. The apparatus is arranged especially for the Wenner's four-point method with the additional fifth central electrode. A picture of the apparatus is given and the four-point method is briefly discussed.—*Author's abstract, translated by W. A.*

3878. Hedstrom, Helmer, Phase measurements in electrical prospecting: Am. Inst. Min. Met. Eng. Tech. Pub. 827, 18 pp., 1937.

Attention is directed to the importance and usefulness of phase measurements in electrical prospecting for ore. The paper describes a new field method for ore prospecting, the "Turam" method, which makes use of phase measurements. The apparatus (shown in a figure) consists of two induction coils; by means of insulated two-conductor cables these induction coils are connected to the Turam, a simple bridge arrangement made up of variable resistances. The Turam, through a three-stage amplifier of special design, is connected to a telephone, which serves as a null instrument for adjustment of the Turam. For the taking of a reading the two coils are placed, for instance, 60 feet apart and held horizontal, while the observer adjusts the two dials

on the Turam until no sound is heard in the telephone. The right-hand dial on the Turam then shows directly the phase difference between the fields affecting the two coils, while the reading on the left-hand dial gives the ratio between the strength or amplitude of the two fields. The instrument can, without change in the position of the two coils, take in phase differences from +25° to −25° and amplitude ratios from 0.6 up to about 10.00.

Field procedure, calculation work, and advantages of the Turam method are discussed in detail.—*W. A.*

3879. Jakosky, J. J., and Hopper, R. H., The effect of moisture on the direct-current resistivities of oils, sands, and rocks: Geophysics, vol. 2, no. 1, pp. 33-53, Houston, 1937.

This paper contains the results of detailed research study to determine the factors which govern the electrical conductivities of oil sands and rocks. The experimental work shows the electrical resistivity to be an inverse function of the percentage of conductive water present in any rock type. It was found that the resistivity-moisture curves of both petroliferous and nonpetroliferous rock are of a general hyperbolic form. For the higher values of moisture content, the curves rapidly approached the conductivity of the electrolyte contained within the rock or oil sands, while for the lower values of moisture content the resistivity values are high and governed by the properties of the rock. Rocks containing soluble salts have critical points on their resistivity-moisture curves, with the greatest change occurring in the neighborhood of 10 percent moisture content. Rocks containing fresh water have relatively high resistance values, which change fairly uniformly with the variations in moisture content. The research work indicates that the presence of oil does not appreciably affect electrical resistance of the rock. Since the resistivity values are dependent upon the electrolytic effect, the work indicates that resistivity values alone are not a reliable criterion for predicting the presence or absence of an oil sand. The work explains further why high electrical resistivity values are not to be expected when applying electrical geophysical methods for mapping subsurface structure.—*Authors' abstract.*

3880. Novitchenko, V. N., Preliminary results of electrical coring in the Don Basin [in Russian]: Razvedka Nedr., vol. 7, no. 6, pp. 27–34, Moscow, 1937.

The distribution of deposits of soft coal and anthracite in the basin of the Don is shown on a map. The purpose of the electrical coring was to locate the strata missed by previous investigations and to determine their magnitude. Schlumberger's method applied in a series of bore holes showed that electrical coring can be used to determine the presence, magnitude, and depth of coal layers. In addition to this, the coring could be correlated with the measurements of temperature. The resistivity method was found to be more applicable for determining soft coal layers and the spontaneous polarization method for anthracite layers.—*W. A.*

3881. Ostermeier, J. B., Tektonische Forschung durch quantitative Elektroden-verfahren [Tectonic investigation by quantitative electrode-methods]: Bohrtech. Zeitung, vol. 55, no. 6, pp. 158–164, Vienna, 1937.

In case of subsoil of homogeneous structure the resistance of rocks determined by quantitative electrical methods of measurement as function of depth is constant for all depths and corresponds to the specific

resistance of the rocks; in case of stratified subsoil the measured resistance value becomes an integral value, the representation of which as a function of depth makes it possible to determiue the borders of the strata as well as their depths. The principal methods of measurement and the manner of their practical application are described, and the relationship between the resistance diagram and the structure is explained. The resistances measured are correct within 1 to 3 percent for depths not greater than 1,000 m; this accuracy increases considerably if measurements are made along the extensions of conductive layers. The borders of the layers can be determined with an accuracy of 3 to 5 percent of the depth. The tectonic details can be disclosed along the profiles by using quantitative methods; by widening the net of measurements it is possible to obtain information concerning the subsoil adjoining the profiles.

The methods can be successfully applied for discovering salt domes, structural lines, faults, etc. Investigation along the extensions of the discovered conductive layers is an especially valuable form of application of the method. Sufficient accuracy of measurements may be obtained for all depths attainable by boring.—*Author's abstract, translated by W. A.*

3882. Pylaev, A. M., On the interpretation of the curves obtained from electrical investigation of three layers for the case of a high resistance of the third layer [in Russian]: Jour. Geophysics, vol. 6, no. 6, pp. 526–535, Moscow, 1936.

Curves obtained from the data of field observations made by direct-current electrical prospecting are interpreted by means of three superimposed graduated plates (pallets). The method described was successfully applied in Karelia and on the Peninsula of Kola.—*W. A.*

3883. Riznichenko, G., Determination of depths by electroprofiling [in Russian]: Jour. Geophysics, vol. 7, no. 1, pp. 105–128, Moscow, 1937.

Mathematical discussion of the method and of its accuracy for determining the depth of the second layer in a two-layer problem is given. Graphical method and limits for using the analytical method are considered. Nomograms for calculating depths are drawn. Conditions for the application of the method of electroprofiling for more than two layers are examined.—*W. A.*

3884. Rooney, W. J., Earth-current variations with periods longer than one day: Terres. Magn. and Atmos. Elec., vol. 42, no. 2, pp. 165–172, 1937.

Examination of the earth-current records from Tucson and Huancayo shows that the daily mean values recorded on characteristically disturbed and calm days differ consistently by a small amount. This suggests that a part of the current flowing during disturbances or magnetic storms is unidirectional for the day or longer and is the first definite indication of a component in earth currents with period greater than one day. The magnitude of the effect is small, not more than a few percent of the range of diurnal variation at a given station. The direction of flow indicated is to the north and east at Tucson and to the south and east at Huancayo. These directions are consistent with those noted in the diurnal variations but they may be modified by local geologic features. The reversal of direction of the northward component is also a feature of the diurnal variations when the stations

considered are on opposite sides of the equator. The potential gradient due to earth-current flow is so small at Watheroo, in proportion to the large and irregular contact potentials occurring there, that the Watheroo records are not conclusive on this point. Insofar as they have any significance, the results are in agreement with those at Huancayo and consistent with the preferred direction of current flow found in the diurnal-variation records. A wider distribution of stations and a more accurate quantitative measure of the effect is necessary before attempting to suggest a system of current circulation consistent with these results.—*Author's abstract.*

3885. Rossmann, F., Über die Funkschwierigkeiten bei den Gronau-Flügen über Grönland [On the radio difficulties during the Gronau flights over Greenland]: Zeitschr. Geophysik, vol. 13, no. 23, pp. 71–78, Braunschweig, 1937.

Weakening and breaking of radio signals noticed during the flights of W. von Gronau in the region of the Greenland inland ice (1930–32) may be explained by the refraction of the long radio waves (600 m) in the ice. Similar processes play an important role also in disturbances of sound caused by ice. Considerations connected with this phenomenon are discussed.—*Author's abstract, translated by W. A.*

3886. Semenov, A. S., The accuracy of apparent resistivity measurements [in Russian]: Central Geol. and Prosp. Inst. Materials, Geophysic, no. 3, pp. 26–43, Leningrad, 1937.

The accuracy of measurements of apparent resistivity depends on a great number of various factors. Those considered to be of greatest importance are (1) sensitivity of the galvanometer; (2) resistivity of the earth connections and of the wires of the receiving circuit; (3) inconstancy of the polarization of the receiving electrodes; (4) influence of migrating currents and telluric currents; (5) inaccurate compensation of induction; (6) influence of the skin effect; (7) influence of the wind; (8) inconstancy in the intensity of the element of the polarization compensator; (9) inconstancy of the intensity of the element of the potentiometer; (10) inconstancy in the resistance of the potentiometer element; (11) inaccuracy in the potentiometer resistivity; and (12) inaccuracy in measuring distances.

Means for reducing the harmful influence of some of these factors are suggested.—*W. A.*

3887. Sergeev, E., and Azo, U., The "loop" method in tectonic geophysical prospecting [in Russian]: Central Geol. and Prosp. Inst. Materials, Geophysic, no. 3, pp. 43–54, Leningrad, 1937.

A brief description of the physical principles of the method of determining the strike in rocks is given. Detailed laboratory investigations relating to this method are demonstrated. The method is based on the principle of using the anisotropic electrical properties of rocks—that is, their unequal electrical conductivity in different directions (along the strike, across the strike, and down the dip)—and in observing the mutual action of the two contours, the first composed of the closed loop with the feeding source and the second composed of a section of the conductor with two earth connections at the ends.

Laboratory experiments on different anisotropic media at different angles of dip of the layers and with different thicknesses of isotropic deposits overlying the anisotropic medium proved the possibility of applying the method to the solution of technical prospecting problems.

A brief account is given of the results obtained by this method in the U. S. S. R. by which the theoretical foundations and laboratory experiments were confirmed.—*W. A.*

3888. Shaw, S. H., Geoelectrical measurements in drill holes: Mining Mag., vol. 56, no. 4, pp. 201–208, 1937.

Supplementary information regarding the method of logging drill holes by electrical measurements described in the January issue of the Mining Magazine (see Geophys. Abstracts 89, no. 3752) is furnished. Tables showing the results of logging obtained in a series of holes through rocks of different types are given.

The possibility of measurements inside cased holes is discussed. The results of experiments made by the author do not uphold Schlumberger's statement that electrical measurements can only be made in the uncased part of the hole because the casing acts as a screen that completely masks the properties of the surrounding rocks and that inside the casing the resistivities are equal to zero. Satisfactory resistance measurements were taken inside the casing. The following precautions, however, should be adopted: (1) The casing itself should not be used as the upper or surface electrode for passing current into the ground, but a separate stake should be placed at some distance from the collar of the hole to insure a distribution of the current to the ground and minimize any short-circuiting effect the casing might have; (2) precautions should be taken to prevent any of the three electrodes inside the hole from coming into actual contact with the casing. An alternating current instrument such as the Megger should be used in preference to a potentiometer because large and erratic polarization potentials may be caused by the casing and these might interfere with, or even prevent, the reading of the potentiometer.

The important part played by natural potentials in the logging and interpretation of the records of deep drill holes is discussed.—*W. A.*

3889. Shpak, V., Application of the resistivity method to the search for steeply dipping lenses [in Russian]: Central Geol. and Prosp. Inst. Materials, Geophysic, no. 3, pp. 11–26, Leningrad, 1937.

The results of the resistivity work over the sulphide ores in Bliava (Southern Ural) and in the Altai Mountains are summed up briefly. The results obtained by the field parties differ greatly from the theoretical curves.

Some directions are given for the interpretation of steeply dipping lenses; these are based on laboratory tests of copper models having a form as similar as possible to the deposits in question. A series of figures showing the results of the tests is given.—*W. A.*

3890. Smith, H. I., Electric methods of geophysics and application: California Min. Jour., vol. 6, no. 9, p. 3, Auburn, 1937.

The article describes briefly the fundamental principles of the electrical methods of geophysics, their application to mining and mining problems, and the possible results to be hoped for and expected.

The uses and purposes and the methods best suited and most commonly used in mining are mentioned.—*W. A.*

3891. von Thyssen, St., Hummel, J. N., and Rülke, O., Die Ursachen des seismisch-elektrischen Effektes [The causes of the seismic-electrical effect]: Zeitschr. Geophysik, vol. 13, no. 2/3, pp. 112–119, Braunschweig, 1937.

The seismic-electrical effect observed during field work may be easily proved in the laboratory in an electrolytic trough. The electrochemical processes on the surface of electrodes are evidently influenced by elastic deformations. Information concerning this fact may be found in electrochemical literature.—*Author's abstract, translated by W. A.*

5. RADIOACTIVE METHODS

3892. Aeckerlein, G., Die Erforschung des Erdinnern durch Emanationsmessung [Exploration of the interior of the earth by measuring emanation]: Phys. Zeitschr., vol. 38, no. 10, pp. 362–370, Leipzig, 1937.

The method of measuring the emanation absorbed by water in boreholes proved to be more efficient for determining depth profiles than the old method of measuring this emanation in the soil air on the surface of the ground. Tables showing radioactivity of water and of rock at various depths down to 120 m are given. Radioactive profiles drawn from the measurements in boreholes and a diagram showing the dependence of the content of Ra in rocks on the depth are presented.—*W. A.*

3893. Dubey, V. S., and Bajpai, M. P., Radioactivity of the Deccan traps, part 1, Basalts: Am. Jour. Sci., vol. 34, no. 199, pp. 24–29, New Haven, 1937.

This paper contains the results of radioactive determinations of eight specimens of Deccan basalts from western India by the "solution method." A brief field study and microscope description of these rocks and chemical analyses of some of them have also been included. The values of radioactive contents of the Deccan basalts have been compared with those found in some basic English and Indian rocks. It has been found that the "fusion method" as followed by Joly and other workers gives slightly higher values for radium and lower values for thorium than the solution method. The results indicate that the radioactive contents have not varied much in the successive lava flows and younger dykes of the Deccan trap period.—*Authors' abstract.*

3894. Gorshkov, G. V., and Kurbatov, L. M., An attempt to determine geological structure from the intensity of γ-emanation in boreholes [in Russian]: Jour. Geophysics, vol. 7, no. 1, pp. 90–104, Moscow, 1937.

Successful application of Schlumberger's electrical coring is not possible, for example, in tubed holes, frozen soil, salt beds, etc. The authors therefore propose to complete the electrical coring by the γ-method. Gamma measurements may be made inside of boreholes under very favorable conditions because the absorbing of γ-rays by the overburden is eliminated and thus the apparatus will be under the direct effect of the γ-emanation from the rocks under investigation.

Influences on the readings of the γ-apparatus caused by the presence in the hole of water and air, as well as by the absorption of γ-rays by the water, the pipes, and the apparatus are studied theoretically. Data obtained from experimental measurements are compared with

those derived theoretically. Conclusion is drawn that measurements of the intensity of γ-emanation in boreholes give valuable information concerning geological structure.—*W. A.*

3895. Grammakov, A. G., Starovatov, N. P., and Tverskoy, P. N., On the method for determining radioactivity from the ionization effect of β-emanation [in Russian]: Jour. Geophysics, vol. 6, no. 6, pp. 487–510, Moscow, 1936.

The apparatus and method applied are described. Waxed paper 6.10^{-3} cm in thickness can be successfully used as a filter for absorbing α-rays. Formulas are derived expressing the absorption of β-emanation in the substance of the emanating body according to the data obtained for uranium ore (density 1.3) and for its mixtures with chalk and lead monoxide (densities 0.7 and 1.7).

The method may be applied to samples containing 0.01 percent or more of U_3O_8. If the activity is less than 0.01 percent more sensitive electrometers and electron recorders must be used.—*W. A.*

3896. Israel-Köhler, H., and Becker, F., Die Emanationsverhältnisse in der Bodenluft [Conditions of emanation in the ground air]: Gerlands Beitr. Geophysik, vol. 48, no. 1, pp. 13–58, Leipzig, 1936.

The following statements are made from comparison of the theoretical considerations with the results of measurements carried out by the author and other investigators:

1. Surveys of emanations in the ground air in connection with the geotectonic structure of the subsoil are examined theoretically and experimentally. From the form of the horizontal and vertical profiles of Ra emanation and from the dependence of concentration on the pressure at various depths conclusions are drawn on the existence, form, and depth of tectonic inhomogeneities.

2. The depth to the layer from which the emanation arises can not be determined definitely, as the emanation changes according to the productiveness of the assumed source.

3. The quantitative conclusions on the depth of the disturbing zone, which are possible theoretically, are greatly limited in practice, owing to the fact that the measurements made close to the surface of the ground are influenced by the inhomogeneities in the upper layer. Most reliable results may be obtained from the analysis of the dependence of the concentration on the air pressure at a depth of a few meters.

In conclusion the methods for determining Th emanation in the ground air are discussed and a few measurements which may serve for orientation are quoted.—*Authors' abstract, translated by W. A.*

3897. Rothé, Edmond, and Hée, Arlette, Prospection de la carrière de trapp et de granit de Raon-l'Étape par les radiations pénétrantes [Prospecting by penetrating radiation in the Raon l'Étape trap and granite quarry]; Acad. sci. Paris Comptes rendus, vol. 204, no. 24, pp. 1835–1837, June 14, 1937.

Proceeding with the investigation on the application of penetrating radiation for prospecting (see Geophys. Abstracts 83, no. 3070; and 87, no. 3423) the authors describe their observations made in trap and granite quarry of Raon-L'Étape.

Data showing the ionization of various kinds of trap and granite are given, showing the important difference between various layers in

ionization by penetrating radiation, as well as the difference in the effect due to the distance, depth, and distribution of active layers.

Similar measurements in other quarries of the region showed that the ionization above the trap was very weak, even zero. On the contrary, some kinds of granite produced a very strong ionization due partly to the presence of zircons and other minerals containing rare earths.—*W. A.*

3898. Urondo, F. E., Die Radioaktivität des Untergrundes [Radioactivity of the subsoil]: Santa Fé [Argentina] Univ. Nac. Litoral, Fac. Quím. Ind. y Agr. Rev., vol. 4, pp. 112–125, 1936.

A review based on literature published during the past several years is given, including the content of radioactive matter in the earth's crust, the relationship between the radioactivity of the earth's crust and geologic time, radioactivity and the earth's heat, radioactivity and mining, radioactivity of the earth's crust and ionization of the air, and measurements of the radioactivity of air in the subsoil.—*Müller's abstract in Zeitschr. Geophysik, vol. 13, no. 2/3, 1937, translated by W. A.*

6. GEOTHERMAL METHODS

3899. Deussen, Alexander, and Guyod, Hubert, Use of temperature measurements for cementation control and correlations in drill holes: Am. Assoc. Petroleum Geologists Bull., vol. 21, no. 6, pp. 789–805, 1937.

After comparing the early and the modern methods of temperature investigations in drill holes, the authors review briefly the main applications of these measurements to oil wells.

The possibilities and limitations of two specific techniques are discussed—location of cemented zones and correlation between different wells.

The location of the cement behind the casing by thermometric measurements is quite feasible and commercially successful, provided such measurements are made immediately after the completion of the cementing job and preferably before any circulation of mud has taken place.

Although temperature measurements cannot be expected to replace the electrical methods of logging wells, they may be used successfully under some conditions to correlate wells already cased where no other method of investigation can be applied.—*Authors' abstract.*

3900. Korytnikova, N. N., Influence of heat conductivity of rocks on geoisotherms [in Russian]: Jour. Geophysics, vol. 7, no. 1, pp. 62–89, Moscow, 1937.

The problem of the distribution of temperature around a buried body the heat conductivity of which differs from that of the surrounding medium is discussed mathematically, and the possibility of applying the results to the solution of geothermic problems is studied theoretically. Practical verification could not be made, owing to the lack of necessary observations in the U. S. S. R.

In order to simplify the mathematical study it is assumed that (1) the temperature distribution does not depend on time; (2) only one body of different temperature is present within the homogeneous infinite medium; (3) if no such a body is present the isothermal surfaces are horizontal planes.—*W. A.*

3901. Lovering, T. S., Heat conduction in dissimilar rocks and the use of thermal models: Geol. Soc. America Bull., vol. 47, no. 1, pp. 87–100, 1936.

Formulas are derived to find values for the geothermal gradient within the earth. It is assumed that the interior of the earth forms a metallic core, surrounded by a mafic silicate shell. If the conductivities in the metallic core and the silicate shell are approximately those of steel and basalt, the calculations show that the steepest gradient within the metallic core is probably only a fiftieth of that existing on the surrounding silicate shell. This conclusion strongly suggests that the geothermal gradient within the metallic core of the earth must be very flat at the present time. Gradients in the silicic rocks with low conductivities nearer the surface would have a low gradient in equilibrium with a steeper gradient in the substratum. Geothermal measurements in regions of old, little-disturbed, mafic rocks should give the most useful information on the problem of deep internal temperatures.—*W. A.*

3902. Quiring, Heinrich, Recent geothermal investigations: Research and Progress, vol. 3, no. 4, pp. 195–198, Berlin, 1937.

The mean value of the geothermal temperature gradient in Europe is approximately 3° C. per 100 m increase in depth; in America it is 2.4° C. per 100 m. Tables showing the results of temperature measurements in various German mines of the Rhine slate mountains were given in "Glückauf," 1936, pp. 57–62 (Geophys. Abstracts 83, no. 3072). Some of the general results of the investigation as given in this paper are as follows: (1) Temperature measurements show that the temperature gradient in Devonian rocks in mines not thermally influenced varies between 2.9° and 1.26° C., with an average of 2.2° C.; (2) the heat conductivity of natural rocks is, in general, dependent upon the bulk density of the rocks; (3) the mean temperature gradient in the Rhine slate mountains (2.2° C.) is approximately the same as that observed when driving tunnels through pre-Cambrian rock (Mount Cenis 2° C., Albula 2.04° C., Gotthard 2.27° C., Simplon 2.30° C.); (4) the temperature measurements in the mines of the Rhine region give a much more correct picture of the thermal conditions in the deeper portion of the earth's crust than measurements resulting from borings in post-Devonian rocks; (5) in the deeper parts of the earth's crust the conductivity of rocks increases, in general, at higher temperatures; (6) there are considerable variations from the theoretical values in certain parts of the earth's crust due to the thermal, magmatic, chemical, and radioactive processes.—*W. A.*

7. UNCLASSIFIED METHODS

3903. Blau, L. W., The interpretation of geophysical data: Geophysics, vol. 2, no. 2, pp. 95–112, Houston, 1937.

Geophysical data result from measurements of physical properties. The geophysicist postulates certain possible physical causes of the observed effects. The geologist reasons from observed geologic effects to geologic causes. The difficulties of interpreting physical effects as reflected in geophysical data in terms of geologic causes are pointed out. The author takes the position that geophysical data must be worked up independently. A competent geophysicist-geologist may then combine the

geophysical and geologic information. Only when this procedure is followed will a report include all available knowledge of the area under investigation.

The requirement that geophysical data be immediately translatable into geologic language and furnish material for drawing geologic contour maps is shown to be incompatible with the nature of geophysical data. Attention is drawn to the changing geophysical scene and to the tendency to use geophysical methods after they have ceased to be adequate for the solution of prospecting problems.

It is suggested that geology can aid geophysics principally through library reconnaissance and advance surface mapping. Geophysics has become a serious competitor of geology in search for oil, and the geophysical-geological ecotone has advanced steadily into geologic territory.—*Author's abstract.*

The paper is followed by discussions by A. Deussen, O. L. Brace, and D. C. Barton.

3904. Brace, O. L., Interrelationship of geology and geophysics: Oil Weekly, vol. 85, no. 7, pp. 35–44, 1937.

This article is reprinted from the Bull. Am. Assoc. Petroleum Geologists, vol. 21, no. 2, 1937 (see Geophys. Abstracts 89, no. 3627). The author summarizes as follows suggested procedure that will enable both geologist and geophysicist to benefit most effectively: (1) The general direction of any oil-prospecting campaign should be placed in charge of a competent geologist; (2) each geophysical field party should be accompanied by a competent field geologist; (3) an office geologist should be detailed to work side by side with the geophysicist who makes interpretative maps.—*W. A.*

3905. Eby, J. B., Progress of Geophysics: Petroleum Engineer, vol. 8, no. 10, pp. 66–75, Dallas, 1937.

A review of the present status of geophysics in oil exploration is given. It is shown that the use of the reflection seismograph is still the dominant method. New developments, both with regard to instruments and technique, are discussed. The recently constructed seismometer, or detector, which has a weight of less than 8 ounces and the size of an ordinary flashlight battery is mentioned. The demand for more refined information resulted in a steady development toward improved methods and led to the system of continuous profiling. By this method the seismometers are in line, spaced 150 or 250 feet apart. The shot is either along the same line or at right angles to it and usually 2,500 feet distant. The planting of the dynamite charge has been studied, and now it is customary to plant the charge at depths of from 100 to 250 feet. Methods of interpretation of the results have improved.

The introduction of the new inclined beam torsion balance by which the time for making an ordinary field observation was reduced from several hours to approximately an hour and a half, resulted in an increased use of the torsion balance.

Considerable work is being done on the examination of subsoil gases.

The article is illustrated by a series of pictures showing the instruments and methods of the latest type.—*W. A.*

3906. Forbush, S. E., On diurnal variation in cosmic-ray intensity: Terres. Magn. and Atmos. Elec., vol. 42, no. 1, pp. 1–16, 1937.

Cosmic-ray data from precision cosmic-ray meter records obtained at Cheltenham, Md., for 273 complete days during April 1935 to October 1936 are subjected to rigorous statistical analysis. The results indicate that the real barometric coefficient does not change from hour to hour or from month to month. It is shown that the barometric coefficient obtained at this station is in good agreement with certain results obtained from altitude-intensity curves. It is furthermore shown, in two independent ways, that there is no indication of any external air-temperature effect upon the recorded intensity. Finally, the data have been subjected to modern statistical methods which provide an objective measure for the probability that the observed diurnal variation is real. The results indicate, for the period covered by this analysis, a physically significant 24-hour wave in apparent cosmic-ray intensity, with an amplitude of 0.17 percent of the total intensity having its maximum at about 11^h, 75° west meridian mean time.—*Author's abstract.*

3907. Hosi, T., On some similarities between the variation of the terrestrial magnetism and the atmospheric electricity [in Japanese]: Meteorol. Soc. Japan Jour., vol. 15, pp. 204–207, 1937.

The author investigated the variations of the terrestrial magnetism, the atmospheric electricity and the earth current, using the data obtained at the Kakioka and the Toyohara magnetic observatories. The diurnal variation of the atmospheric potential gradient indicates the existence of the longitudinal current flow in the lower strata of the atmosphere, and the variations in this current system may cause the induction current in the earth's crust. The existence of this induction effect was verified with magnetic records. From the short period variation, we can also deduce some similarities between the variation of the terrestrial magnetism and the earth current. The author attacked this problem in the case of the bay disturbance in the terrestrial magnetic field with sufficiently good results.—*Author's abstract.*

3908. Howell, L. G., Atmospheric potential gradient measurements: Geophysics, vol. 2, no. 2, pp. 161–165, Houston, 1937.

Relative atmospheric potential gradient measurements were made in the neighborhood of a salt dome. Two sets of measurements were made simultaneously at two different points. Wulf-type electrometers were used with thorium ionium nitrate collectors insulated with sulphur. A number of set-ups were made, and no significant variations in potential gradient were found.—*Author's abstract.*

3909. Johnson, W. R., Jr., MacCarthy, G. R., McCampbell, J. C., and Straley, H. W., Tracing a basic dike near Chapel Hill, N. C., by geoelectrical and geomagnetic methods: Am. Inst. Min. Met. Eng. Contrib. 106, 7 pp., 1937.

This is a report of a geophysical survey made to compare constant-depth earth resistivity and vertical field-balance magnetometer methods. Magnetic and resistivity values of stations on a grid, laid out over and around a dike cutting Triassic and older rocks, were determined. The magnetometer is favored by the writers for use in an initial survey because it is more rapid than the electrical method. The resistivity

method is advantageous (1) as a means of checking a magnetic survey, and (2) in securing additional information at critical points. The electrical method is recommended for reconnaissance purposes only in exceptional cases.—*Authors' abstract.*

3910. Landsberg, H., Geophysics versus geology is an educational problem: Oil Weekly, vol. 86, no. 1, pp. 127–128, Houston, 1937.

The author discusses the interrelationship between geophysics and geology as presented in some recent issues published in the Oil Weekly (L. W. Blau, March 29, 1937, and O. L. Brace, April 26 and May 10, 1937; see Geophys. Abstracts 89, no. 5763, and 90, no. 3904). Necessary courses for training "combination" men are outlined.—*W. A.*

3911. Liddle, R. A., The Van oilfield, Van Zandt County, Texas: Texas Univ. Bull. 3601, 79 pp., 27 pls., January 1937.

An interesting series of geophysical maps—seismic, torsion balance, and magnetometer—are presented, together with maps based on the results of the extensive subsequent drilling. Van is a rich oil field on a very deep salt dome, the presence of whose salt core is known only from the torsion-balance data. Attention was first called to the Van prospect by erratic dips, surface faulting, abnormal drainage, and topography. A refraction seismic survey indicated the presence of a dome and gave a good outline of it. Many seemingly unexplainable irregularities in the seismic data now are known to be the effect of the complicated faulting of the dome. The presence of the salt is indicated by a broad gravity minimum, which contrasts with the shallower minimum and sharp maximum of the shallow Grand Saline salt dome not far to the northwest. The position of the Van dome and oil field is indicated with good accuracy by the residual minimum after the elimination of a regional anomaly. A faint magnetic minimum seems associated with the dome. The details of the structure were worked out by detailed surface mapping and by an east-west and a north-south series of core holes. This report presents one of the most detailed series of structure-contour maps which have been published on any structure.—*D. C. Barton, Geophysics, vol. 2, no. 1, 1937.*

3912. Macelwane, J. B., A research library in the geophysical field: Geophysics, vol. 2, no. 1, pp. 17–20, Houston, 1937.

The author points out the problem arising from the rapid accumulation of geophysical data in large amounts in the various companies. Much of this material is obsolete or is such that making it available to the research worker would entail no loss to the owners. The author suggests that a library, suitably staffed with competent scientists, might be set up, in a centrally located institution, where the material might be made available to the proper workers. This library might also be equipped with vaults for such data as the owners wish to be kept confidential for an indefinite period of time, and in that way, function also as a depository as well as a working library.—*Author's abstract.*

3913. Malamphy, M. C., Geophysical prospecting for petroleum structures in Alagoas [Prospecção geophysica para estructuras petroliferas em Alagôas]: Mineração e Metallurgia no. 5, pp. 193–202 [English], and no. 6, pp. 281–291 [Portuguese], 1937.

After a brief critical examination of the survey carried out by the Elbof Division of Piepmeyer and Co. on an area bounded by the Atlantic

Ocean, Garça Torta, Rio Pratagy, and a line approximately parallel to the coast and distant from it approximately 3 kilometers, the author describes the survey conducted by the engineers of the Serviço de Fomento da Producção Mineral, which covered an area of approximately 1,250 km^2, including that investigated by the Elbof Co., required 6 months for its completion, and cost the Federal Government $18,000. The magnetic, torsion balance, and seismic methods were used.

The results indicate the possibility that conditions in past geologic time may have been favorable for the generation of petroleum and that structural conditions are sufficiently favorable to facilitate the accumulation of petroleum in commercial quantities in case it actually does exist in the subsurface formations; locations for a number of drill tests are suggested to prove or to disprove the petroliferous character of such structures.—*W. A.*

3914. Mogilevsky, G. A., Recent developments in the field methods of gas survey [in Russian]: Neftianoe Khoziaistvo, vol. 18, no. 4/5, pp. 29–36, Moscow, 1937.

Two main questions of gas survey are discussed, (1) influence of meteorological factors on the records showing the content of hydrocarbons in soil air and (2) variation of these records caused by the method of taking samples.

Two bore holes were investigated and experimental curves showing the influence of meteorological factors on the concentration of hydrocarbons are drawn.

The technique of taking samples and possibilities for improving the method are discussed in detail.

Profiles and schematic designs of isolines of the gas survey carried out over the Khadyjinsk oil-bearing region and the region of Asphalt Mountain are given. From the data obtained by the survey the existence of several single lenses between these two regions was established, and in one place commercial oil was found by boring.

Practical and theoretical questions of gas survey may be successfully solved by further improvement of field methods.—*W. A.*

3915. Pratt, W. E., Discovery rates in oil finding: Am. Assoc. Petroleum Geologists Bull., vol. 21, no. 6, pp. 679–705, 1937.

A statistical review of oil-field discoveries by periods, the progressive accumulation of petroleum reserves, and the classification of discoveries according to method by which discovery was made, indicate a decreased discovery rate in recent years. Possible explanations for this decreased rate are discussed.—*Author's abstract.*

3916. Rosaire, E. E., and Ransone, K., The amount and distribution of seismic and gravity exploration in the Gulf Coast through 1936: Geophysics, vol. 2, no. 1, pp. 1–16, Houston, 1937.

Maps are presented to show the accumulated density of exploration by the reflection seismograph and the torsion balance for 114 counties and parishes comprising the Gulf coastal areas of Texas and Louisiana.

The conclusion is drawn that the conspicuous overruns of exploration for these two methods indicated by this survey are a natural consequence of complete surveys for this area by the companies exploring on a coast-wide scale. These coast-wide coverages represent prospect discovery by these methods and are considered to be good practice in

view of the probable introduction of new methods of higher finding power.—*Authors' abstract.*

3917. Sergeev, E., and Solovov, A., The ion method of geophysical prospecting [in Russian]: Central Geol. and Prosp. Inst. Materials, Geophysic, no. 3, pp. 1–10, Leningrad, 1937.

The principles of the new method, called by the authors the "ion method," consist of examining the process of modifications taking place in the upper parts of deposits and resulting in the appearance of a circle around the outcrop of useful minerals produced by mechanical transportation of substances, by mineralized waters, or by gas formations.

The oxidation of sulphide deposits is characterized by the typical appearance in ground waters of free sulphuric acid (H_2SO_4) and different soluble sulphates. As the result of diffusion and capillarity, the products of oxidation of sulphide minerals propagate in the soil, and according to observations the greatest concentration corresponds to the epicenter of the deposit. Specially selected electrodes are used for determining these concentrations. As such electrodes, the authors tested the lead-sulphate electrode for the determination of the anion concentration of SO_4 and the neutral sulphate solutions and a platinum-lead-oxide electrode for the determination of the concentration of the free sulphuric acid, the polarization potential of which is determined by the concentration of corresponding ions.

The value of the electromotive force of the polarization of the electrode is measured by a potentiometer as compared with a normal electrode.

The ion method may, according to the authors, be applied as an auxiliary means for the search of sulphide deposits.—*W. A.*

3918. Tucker, Mitchell, Geophysical crews busy in Mississippi, Alabama, and Florida: Oil and Gas Jour., vol. 36, no. 3, pp. 20–21 and 36, Tulsa, 1937.

Fourteen crews are at the present time mapping structures in the southern states of Mississippi, Alabama, and Florida in searching for oil. The companies carrying on the surveys (seismic, gravimetric, torsion balance) and the locations involved are enumerated.—*W. A.*

3919. Williams, Neil, Geophysical results spur to further exploration: Oil and Gas Jour., vol. 36, no. 9, pp. 36–37, 49, Tulsa, 1937.

The increasing number of fields in the Permian basin of western Texas and southeastern New Mexico whose discovery can be attributed directly to geophysics resulted in more intensive geophysical exploration. According to recent reports 30 geophysical crews with various types of instruments are active in the district, the largest number ever reported. They include seismographs, 17; torsion balance, 6; gravitometer, 4; electrical, 2; and magnetometer, 1. A number of recent discoveries and the methods applied in each case are briefly described.

The unusual difficulties encountered in carrying on seismic exploration make the cost of maintaining a shooting crew in the district run at about $13,000 a month, which is in contrast to a cost of from $7,900 to $8,200 on the Gulf Coast. Torsion balance, gravitometer, and magnetic findings have been misleading in many places, owing to the influence of regional features over local structure.—*W. A.*

3920. von Zwerger, R., Die neuere Entwicklung der Geophysik in den Vereinigten Staaten, insbesondere an der Golfküste von Texas und Louisiana [Recent development of geophysics in the United States, especially in the Gulf Coast of Texas and Louisiana]: Oel und Kohle, vol. 13, no. 16, pp. 373–380, Berlin, 1937.

This detailed account of the development of the geophysical work in the United States since 1925 comprises the following items:

1. *Participation of geophysics in the detection of new fields, 1925–35.*—Figures are given showing the increase in the discovery of new fields due to the introduction of the geophysical methods of prospecting.

2. *Present state of geophysical activity and fears concerning the future.*—The number of geophysical crews increased in the United States to about 200 seismic-reflection crews and 50 torsion-balance crews. The constantly increasing depth of new productive fields (2,000 to 3,000 m) offers difficulties in operation resulting in excessive cost, which must be taken into consideration.

3. *New geologic course and the answer of geophysics.*—Search for new "stratigraphic oil traps" and deposits formed by favorable paleogeographic conditions resulted in the increased use of electrical methods of prospecting.

4. *Development of geophysical problems and methods on the Gulf Coast, 1925–35.*—This development is shown by means of a series of examples.

5. *Technical improvements in reflection seismics.*—Introduction of special equipment for drilling deeper holes for shooting charges; improvements in using explosives; introduction of the semiautomatic amplitude control, etc.

6. *Regional gravity measurements made by pendulum and gravimeter.*—Ten pendulum apparatuses were at work in 1935 in the Gulf Coast, the results being then used for detailed investigations by torsion balances and gravimeters.

7. *Geophysics outside of the Gulf Coast.*—Reflection seismograph is method most used in Midcontinent field.

Total crews working in the United States: Magnetometer, 10; gravimeter, 9; electrical, 5; torsion balance, 50; seismic reflection, 200; and seismic refraction, a few. Number of oil and gas fields discovered in 1936: In California, 1 oil field and 2 gas fields; in southern Arkansas and northern Louisiana, 2 oil fields and 2 gas fields; in Oklahoma and Kansas, several small oil and gas fields; and on the Gulf Coast, 12 oil fields (Texas, 9, and Louisiana, 3).

8. *Future of geophysics in the United States.*—Application of new methods with higher efficiency in the same fields; application of old methods in new regions; and application of old methods in known regions but for solving new problems.

The author suggests that the highly developed geophysical work in the United States should serve as a lesson for the development of this work in Germany on two lines: (1) Efforts must be made to develop new geophysical methods technically and scientifically; (2) The reflection-seismic method, which is so successful in the United States, should be applied for solving similar geologic problems in Germany.—*W. A.*

8. GEOLOGY

3921. Boon, J. D., and Albritton, C. C., Jr., Meteorite scars in ancient rocks: Field and Laboratory, vol. 5, no. 2, pp. 53–64, 1937.

In a previous paper (Meteorite craters and their possible relationship to "cryptovolcanic structures," Field and Laboratory, vol. 5, pp. 1–9, 1936; see Geophys. Abstracts 88, no. 3636) the writers suggested that some explosion features currently attributed to volcanism may actually record impacts of giant meteorites which fell during the geological past. It is the purpose of this article to show how meteorite craters and their underlying structure might be preserved and to evaluate the meteoritic hypothesis as an explanation for three craters which tentatively have been ascribed to other origins.

Methods of study for recognizing meteorite scars in ancient rocks are suggested.

Geological results of meteorite impacts, aspects and preservation of meteorite scars, possible examples of meteorite scars, Flynn Creek structure, Sierra Madera, and Vredeford dome, are discussed.—*W. A.*

3922. Gelletich, Hans, Über magnetitführende eruptive Gänge und Gangsysteme im mittleren Teil des südlichen Transvaals [On igneous magnetite-bearing dikes and the systems of dikes in the central part of southern Transvaal]: Beitr. angew. Geophysik, vol. 6, no. 4, pp. 337–406, Leipzig, 1937.

An area bounded on the north by the Witwatersrand and Krugersdorp-Zeerust Railway, on the west by the Mooi River, on the south by the Vaal River, and on the east by the line drawn through Springs-Nigel-Heidelberg and Koppiesfontein was systematically explored for magnetite-bearing igneous dikes. It was established that in the surveyed area there are 14 dikes of the same dike system, which, together with the dikes surveyed in the Rustenburg district by the Geological Survey of the Union of South Africa, was called the Pilansberg dike system. This system of dikes, which strikes NW. and SE. from the Pilansberg, and in the area more to the south spreads in a fan-shaped manner is, as to the extension of the system and the length of the single dikes, the biggest dike system ever described.

In the area of the Bushveld complex the dykes are generally alkali-syenitic, and outside the Bushveld (with one single exception) doleritic, or they are compounds (with dioritic middle portions and doleritic marginal portions). Otherwise their mineral composition is very similar. The dikes are more or less vertical and their thickness varies from 20 to 100 m (65 to 328 feet).

The magnetization of the dikes in this system is, as far as the direction is concerned, everywhere opposite to the actual earth's magnetic field. This dike system is considered the most remarkable example of such an abnormal magnetization, for which there is no satisfactory explanation.

The existence of another dike system consisting of four great dikes, temporarily called the Post Karoo dike system of the East Rand, was established also. The direction of magnetization of these dikes is in accordance with that of the earth's magnetic field.

Some other magnetite-bearing dikes of this area which do not belong to the above-mentioned systems are described.—*Author's abstract.*

3923. Haskell, N. A., On the possibility of viscous behavior in crystalline rocks under dynamo-metamorphic conditions: Gerlands Beitr. Geophysik, vol. 49, no. 4, pp. 387–392, Leipzig, 1937.

In the absence of definite experimental data, a certain linear relationship is assumed to hold between the rate of recrystallization and the stress in a polycrystalline body undergoing recrystallization under stress in the presence of a liquid phase. It is shown that this leads to a relationship between stress and strain of the same form as the Maxwell law of elastico-viscosity. This suggests that the theory of viscous fluid motion may be applicable to the deformation of deep-seated rocks during dynamic metamorphism in an orogenic zone of the earth's crust.—*Author's abstract.*

9. NEW BOOKS

3924. Nippoldt, A., Erdmagnetism, Erdstrom, und Polarlicht [Terrestrial magnetism, earth's current, and aurora borealis], 128 pp., 13 figs., 9 tables, (Sammlung Göschen, Bd. 175), Berlin, Verlag Walter de Gruyter & Co., 1937. Price, RM. 1.62.

The main chapters of this new edition deal with elements of the earth's magnetism; the remanent magnetism of the earth and the sun; the variations of the earth's magnetism; the earth's current; aurora borealis; magnetic and electrical forces in the universe.—*W. A.*

3925. Tromp, S. W., On the mechanism of the geological undulation phenomena in general and of folding in particular and their application to the problem of the "roots of mountains" theory: A. W. Sijthoff's Uitgeversmaatschappij N. V. Leiden, 184 pp., 89 figs. Price, fl. 6.90; bound, fl. 8.40.

The author reviews all the geologic phenomena that can be grouped together as "undulations" and discusses the many different types of geological folds, their genesis and relations, giving illustrations. In chapter 2 he considers critically the "roots of mountains" theory, and in chapter 3 the various classes of theories that may be used to explain gravity anomalies and the genesis of mountain folds. A bibliography of tectonic literature consisting of 273 titles is added.—*W. A.*

10. PATENTS

3926. Frequency comparing device for determining the force of gravity; Blau, Ludwig W., Houston, Tex., assignor to Standard Oil Development Co., a Corporation of Delaware; U. S. patent 2,077,390, issued April 20, 1937.

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

3927. Electromagnetic prospecting method; Melton, Benjamin Starr, Houston, Tex.: U. S. patent 2,077,707, issued April 20, 1937.

This invention relates to a method of electrically locating buried geologic formations, including passing into the earth a series of independent periodic electrical impulses to indicate electrical earth waves that may be detected at points in the area under observation, timing such impulses to occur at a minimum rate of 16 times per second so as to create visual patterns of the reflected and refracted impulses which will lie within the normal persistence of vision, and receiving and forming visual patterns of the reflected and refracted earth waves at a point of observation, whereby the time of travel of said waves may be visually obtained. Claims allowed, 3.

3928. Torsion balance; Rainbow, Henry, The Hague, Netherlands, assignor to Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij, The Hague, Netherlands, a Dutch Company: U. S. patent 2,080,062, issued May 11, 1937.

This invention relates to a torsion balance comprising a balance beam, a torsion suspension for said beam, a couple of weights carried by said beam, a substantially cylindrical housing for said beam, and a cylindrical member carried by said beam, the relation between the outer diameter of the said member and the inner diameter of said housing being such that the cylindrical member is adapted to move with little play in the cylindrical housing. Claims allowed, 8.

3929. Seismophone; Prescott, Harold R., and Woodyard, Kenneth C., Ponca City, Okla., assignors to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2,084,561, issued June 22, 1937.

This invention relates to a seismophone consisting of a housing, a mass, elastic means for mounting said mass for vibration within said housing, a damping fluid in said housing, means actuated by vibration of said mass for moving said damping fluid and means responsive to temperature for varying the resistance to fluid movement inversely as the temperature. Claims allowed, 3.

3930. Vorrichtung zur Messung von Radium-Emanationen, vorzugsweise des Emanationsgehaltes der Bodenluft [Arrangement for measuring radium emanation, especially the content of emanation of the ground air]; Dr. Edward Lorenser, "Erda" Akt.-Ges. of Göttingen: German patent 420,511, issued October 29, 1925.

This invention relates to an arrangement in which the ionization chamber connected with the electrometer is closed on one side by means of a movable, airtight piston, by the movements of which the ground air to be investigated may be sucked in. Claim allowed, 1.

3931. Verfahren zur elektrischen Untersuchung des Untergrundes mittels der in diesem vorhandenen Erdströme [Method for electrical prospecting of the subsoil by means of terrestrial currents contained in it]; Compagnie Générale de Géophysique of Paris: German patent 639,046, issued Nov. 27, 1936.

This invention relates to the method of electrical investigation of the soil by means of terrestrial currents flowing in the form of an extended network and having at any moment almost the same direction. The

method consists of measuring the potential differences produced on the surface of the earth by the terrestrial currents at moments at which the component of the terrestrial current measured on a control line with a fixed direction has the same value. Claims allowed, 4.

3932. Verfahren und Anordnung zum Erkennen der von einen Bohrloch durchsunkenen Gebirgsschichten [Method and apparatus for determining the structure of the layers of the rocks penetrated by boreholes]; Société de prospection électriques (Procédés Schlumberger) of Paris: German patent 644,899, issued May 15, 1937.

This invention relates to the method of prospecting by means of sound distribution in layers penetrated by boring. It is characterized by the fact that measurements of the local velocities of propagation and of damping of the sound during its passage through the earth's layers at various depths may be carried out, and, accordingly, the tonality of the kind and volume of the transferred sound may be determined. From the variations of these characteristic features information on the petrographic properties of the earth's layers penetrated by boring may be derived. Claims allowed, 4.

3933. Balance de torsion [Torsion balance]; Elwerath Gewerkschaft of Germany: French patent 809,690, issued March 8, 1937.

This invention relates to an improvement in the torsion balance in which the suspension of the system is arranged in a metallic housing having a thickness of wall about as great as, or greater than, the diameter of the oscillation space; the housing is formed of several metallic tubes which slide into one another; the housing is made of aluminum. Claims allowed, 3.

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