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By M. C. RABBITT, V. L. SKITSKY, *and* S. T. VESSELOWSKY

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NOTE.—For a greater differentiation of contents section 8 of previous reports is replaced by section 0 and section 9, and the former section 9 is replaced by section 10 and 11. An additional section on drill-hole methods, section 8, is introduced. A double dagger (‡) after an entry indicates that the publication was reproduced by other means than ordinary printing.

GEOPHYSICAL ABSTRACTS 137, APRIL-JUNE 1949

By M. C. Rabbitt, V. L. Skitsky, and S. T. Vesselowsky

INTRODUCTION

Geophysical Abstracts are issued by the Geophysics Branch of the Geological Survey, United States Department of the Interior, as an aid to those engaged in geophysical research and exploration. The publication covers world literature on geophysics contained in periodicals, books, and patents. It deals with exploration by gravitational, magnetic, seismic, electrical, radioactive, geothermal, geochemical methods, and drill-hole methods, and with underlying geophysical theory, research, and related subjects.

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Acknowledgement.—Grateful acknowledgement is made of the advice and assistance received from various branches of the Geological Survey.

0. GENERAL GEOPHYSICAL SUBJECTS

11002. Dessau, G. Past and future of exploration geophysics in India: Min., Geol. and Met. Inst. India Trans., vol. 43, no. 1, pp. 41–66, 1947.

Geophysical exploration of India began early in the history of this science. A torsion-balance survey of the Indus Valley was made in 1923–24, before the first big success in the exploration of the Gulf Coast area of the United States. Electrical prospecting was started in 1936 in Assam by the Schlumberger organization, and seismic surveys in the Karachi region in 1939. Considerable geophysical exploration in India has been undertaken both by Government agencies and by private companies.

The author describes certain features of geophysical exploration peculiar to India and discusses questions such as the possibilities and limitations of geophysical methods in the exploration of geologic structures, in the investigation of dam foundations, and in prospecting for coal, ores, petroleum, and water.—*S. T. V.*

11003. Gutenberg, Beno. Earth physics: Physics Today, vol. 2, no. 2, pp. 14–18, 1949.

The author describes major problems of geophysics, emphasizes its strong relationship to physics, and expresses the hope that much greater cooperation between physicists and geophysicists will result in progress in this branch of science.—*S. T. V.*

11004. Kreiter, V. M. Searching and exploring for useful minerals [in Russian], 790 pp., Moscow, Gosgeolizdat, 1940.

This text on the geological and geophysical methods of exploration for minerals is written for students of the Moscow Geological Institute. The first section contains a description of ore types and associated geological features. A special chapter is devoted to methods employed in exploitation of coal mines and ore mines. A section on geophysical exploration written by A. I. Zaborovskii includes a detailed discussion of the geophysical methods best suited to prospecting for iron, manganese, chromite, nickel, copper, tin, molybdenum, mercury, aluminum, mica, sulfur, salts, coal, and petroleum. The last chapter describes methods of evaluating and assaying ore deposits.

A bibliography of more than 650 entries is appended.—*S. T. V.*

11005. Lalicker, C. G. Principles of petroleum geology, 377 pp., New York, Appleton-Century-Crofts, 1949.

The book deals with problems of the origin, accumulation, and migration of petroleum. The basic principles of gravitational, magnetic, seismic, and electrical methods of prospecting are described and illustrated in a special chapter.—*S. T. V.*

11006. Renner, Jean. La fondation et l'activité de l'Institut Géophysique Roland Eötvös de Hongrie [The founding and the activity of the Hungarian Roland Eötvös Institute for Geophysics]: Geofis. Pura e Appl., vol 13, nos. 1–2, pp. 6–10, 1948.

The Roland Eötvös Institute for Geophysics was founded by the Hungarian government in 1919, shortly after the death of Baron Eötvös, to carry on his scientific work. The main activity of the Institute has been concentrated on the development of instruments and methods of geophysical exploration and their practical application. As early as 1937 the Institute adopted the gravimeter, in addition to the torsion balance, as an instrument of exploration, and later extended its work into the fields of geomagnetic, seismic, and electrical methods of exploration.—*S. T. V.*

11007. Snarskii, A. N. The search and exploration of oil and gas deposits [in Russian], 168 pp., 120 figs., Baku, Azerbaydzhan S. S. R., 1940.

This text book for secondary technical schools gives general information about the genesis of oil and gas, the geologic conditions favorable to their accumulation, and methods of exploration. The principles of the gravimetric, magnetic, seismic, electrical, geothermal, geochemical, and logging methods are explained.—*V. S.*

11008. Vajk, Raoul. Geophysical developments in Europe during the war: Geophysics, vol. 14, no. 2, pp. 101–108, 1949.

The author has summarized geophysical exploration activity during World War II in Germany, the Netherlands, German-occupied U. S. S. R., Austria, Czechoslovakia, Hungary, Yugoslavia, Rumania, Poland, Italy, Switzerland, England, and France.—*M. C. R.*

1. GRAVITATIONAL METHODS

11009. Berroth, Alfred. Beitrag zu Bessel's Bestimmung der Gleichheit schwerer und traeger Masse [Contribution to Bessel's experiment to prove the equality of liquid and solid masses]: Geofis. Pura e Appl., vol. 13, no. 1–2, pp. 58–64, 1948.

The author repeated F. W. Bessel's 1832 experiments with solid and liquid-filled pendulum bobs to compare the effect of gravity on solid and liquid bodies. Bessel's results had shown differences in periods of oscillation of the two pendulums. The author proves that the liquid in the oscillating bob becomes turbulent, thus affecting the periods of vibration, and that by taking special precautions it is possible to eliminate eddies and obtain equality of the pendulum periods.—*S. T. V.*

11010. Berroth, Alfred. Über die geometrische und statische Abplattung der Erde aus den periodischen Gliedern der Mondbewegung [Geometric and static flattening of the earth derived from the periodic terms of the moon's motion]: Geofis. Pura e Appl., vol. 13, nos. 3–4, pp. 65–74, 1948.

The author recalculates the periodic terms of the equation of the motion of the moon derived by Hill from Delaunay's theory, using

the most recent values of the constants in this expression, and obtains a better agreement between the observed and the calculated values. From these elements of the orbit of the moon it is possible to compute values of the geometric and static flattening of the earth which are in close agreement with those derived from gravity measurements.—*S. T. V.*

11011. Bullerwell, W. A gravitational survey over a concealed portion of the Warburton fault, near Lymm, Cheshire [Abstract]: Internat. Geol. Cong., 18th sess., Great Britain, 1948, Titles and abstracts of papers, pp. 24–25, 1948.

The Warburton fault trends N. N. W. to S. S. E. from southwest of Leigh, Lancaster, across the northern Cheshire plain, England. In the area immediately north of Lymm the fault appears to have a throw of about 1,000 feet in Triassic strata, but the exact course of the fault is concealed below drift for several miles.

In September 1947, a gravitational survey was made over the conjectured fault line in the area northwest of Lymm. The instrument employed was a double-beam Eötvös-Suess small torsion balance. The gradient field was found to be complex, and a constant northerly regional gradient of considerable magnitude was revealed.

A reduction of data and a westerly swing in the gradient vectors indicated also a more local anomaly superimposed on the regional gradient. Further investigation of this local effect by both gradient and curvature values suggested that it was associated with a normal fault. Subtraction of the measured value of the regional gradient yielded maximum residual gradients showing linear continuity at small inclination to, and 100 yards to the southwest of, the conjectured line of the Warburton fault, previously shown on the geologic map.

11012. Cagniard, Louis, Gloden, Albert, Lucius, Michel. Sur la construction d'un reseau gravimetrique au Grand Duche de Luxembourg [On the construction of a gravimetric network of the Grand Duchy of Luxemburg]: Acad. Sci. Paris Comptes Rendus, vol. 227, no. 19, pp. 964–966, 1948.

Gravimetric measurements were made by the authors at 96 stations in Luxemburg, in October 1947, using a "North American" gravimeter and averaging one station per 26.9 sq. kilometers. The greatest anomalies were found in Bettendorf and Koetschette, +42.67 and −21.88 milligals respectively. The error of an individual measurement is estimated to be not more than a few hundredths of a milligal.

The new gravimetric network is based on the Belgian primary station of Bastogne. At this station g is 980.97198 gals in the French system and 980.97075 gals ±0.00035 in the Belgian. The difference between the values of g for Paris and Uccle is 1.23 ±0.45 milligal.—*S. T. V.*

11013. Facsinay, L. Isostatic anomalies of Transdanubia, Hungary, according to the gravity meter measurements: Geofis. Pura e Appl., vol. 13, nos. 1–2, pp. 28–42, 1948.

Gravity measurements were made between 1937–48 at 48 places in Transdanubia, Hungary, with a Boucher-Humble multiple gravimeter of

American make. The mean error of gravity meter measurements was ±0.15 milligal.

Isostatic reductions of these measurements and of 21 additional gravity-meter measurements made according to the Airy-Heiskanen hypothesis, using Heiskanen's tables, show that Transdanubia is characterized by positive isostatic anomalies of about 30 milligals (15 milligals higher than the mean value for Europe), and must be in isostatic equilibrium. The probable thickness of the earth's crust in this region is about 30 kilometers. There are some indications that the crust in Transdanubia does not move as a unit, but that Bakony Mountain is slowly rising and that Little Hungarian plain is sinking.

The article includes a map of the region. Numerical data and the results of calculations are given in several tables.—*S. T. V.*

11014. Galfi, John. Equalisation procedures in observations performed with Eötvös torsion balance: Geofis. Pura e Appl., vol. 13, nos. 1–2, pp. 43–52, 1948.

The author suggests a new procedure for adjustment of the several readings made at a given point with a torsion balance. This is based on the method of least squares, but also takes into account the drift of the instrument, which is assumed to vary quadratically with time. The complete mathematical exposition of the new procedure is given, as well as several practical examples.—*S. T. V.*

11015. Gulatee, B. L. Geophysical prospecting for manganese: Jour. Sci. Ind. Research, vol. 3, pp. 543–554, Delhi, 1945.

In 1940–41 a gravitational survey was made in Nagpur District, India, in exploration for manganese ores which are found in this region either in reefs or as boulders embedded in shallow alluvium.

Measurements were made with a gradiometer, a modification of the Eötvös torsion balance, at 40- to 50-foot intervals along four traverse lines spaced 120 feet apart, and disposed perpendicularly to the inferred strike of the reef. The main reef was successfully located close to the predicted position of the bed.—*S. T. V.*

11016. Hopfner, F. Das Problem des destanschliessenden Ellipsoids in der Geodesie [The problem of the best fitting ellipsoid in geodesy]: Österr. Akad. Wiss., Math-naturw. Kl., Anz., vol. 84, no. 6, pp. 19–20, 1947.

By considering a certain area on the geoid with a number of plumb-line deviations on it, it is possible to determine an ellipsoid best fitted to the surface of the geoid. By increasing the number of observation points it is possible again to find the best fitting ellipsoid. By continuing this process further a series of ellipsoids is obtained. The author proves that this sequence of ellipsoids is nonconverging and consequently that the notion of a limiting ellipsoid has no physical meaning.—*S. T. V.*

11017. Mader, Karl. Die Bestimmung einer Geoiderhebung aus Messungen mit der Drehwaage von Eötvös [Determination of the undulation of the geoid by measurements made with Eötvös torsion balance]: Geofis. Pura e Appl., vol. 13, nos. 1–2, pp. 53–57, 1949.

The author calculated the undulation of the geoid caused by the Hohe Wand, a peculiar mountainous stock that rises almost vertically to a

height of 550 meters above the plain near the town of Wiener Neustadt, Austria. Using the basic equations of potential theory and measurements of the gravitational field of the region made with a torsion balance, the calculations resulted in a value of 14 centimeters for the undulation at the top of the mountain, 11.5 centimeters over the sides, and 2.3 centimeters at a distance of 10 kilometers from the sides. Thus the variation of the shape of the geoid produced by this mountain is very smooth.—*S. T. V.*

11018. Morelli, Carlo. Nuovo contributo a favore di un sistema di riferimento "Internazionale" per le misure di gravitá relativa [Some new considerations in favor of an international reference system for measurements of relative gravity]: Ricerca Sci. Ricostruz., vol. 16, nos. 5–6, pp. 1–7, 1946.

The author mentions important errors in the Potsdam gravimetric system and discusses the necessity of its replacement by a new, internationally agreed upon reference system. The author cites the recent determinations of gravity made in Leningrad, Teddington, Washington, and Potsdam; he proposes the following formula for g as function of the geographic latitude of the point: $g=978.027\ (1+0.0052886\ \sin^2\varphi-0.0000059\ \sin^2\varphi)$.—*S. T. V.*

11019. Pekár, Desider. Die Verlässlichkeit der Eötvösschen Drehwage [The reliability of the Eötvös torsion balance]; Geofis. Pura e Appl., vol. 13, nos. 1–2, pp. 4–5, 1949.

The author discusses the drift of the Eötvös torsion balance, especially the changes in the readings caused by variations in temperature, and finds that temperature changes not only cause variation in the dimensions of the instruments but also produce air streams inside the instrument housing. Streamlining of certain parts of the instrument and introduction of special deflectors to minimize the effect of these eddies have reduced the dynamic drift of the torsion balance to a very low figure.—*S. T. V.*

11020. Tsuboi, Chuji. The density of the material underlying the earth's crust [in Japanese with abstract in German]: Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 22, pts. 2–4, pp. 105–109, 1944.

The explanation of Helmert's coastal effect on the gravity field, postulated by the Airy theory of isostasy, implies the gravitational action of the earth's crust and the subcrustal mass. Observational data on the gravity field do not make possible the determination of separate values of these two densities, but only their ratio.

The author assumed, on the basis of other geophysical considerations, that the probable thickness of the earth's crust is about 60 kilometers and concludes that, to satisfy the observed gravity values, the density of the subcrustal material must be 3.00.—*Author's abstract, translated by S. T. V.*

11021. Zahradnicek, J. Tvar a hmota zeme [The figure and the mass of the earth]: Univ. Masaryk Fac. sci., pub. no. 286, 1947.

On the basis of the results of recent gravimetric and astronomical measurements the flattening of the earth has been calculated as 1/297.3;

the gravitational constant as $(6.667 \pm 0.005) \times 10^{-8}$ (cm. g. sec.); average density of the earth as 5.519 ± 0.004 g./cm.^{3}; and the total mass as $(5.979 \pm 0.004) \times 10^{27}$ grams.—*S. T. V.*

2. MAGNETIC METHODS

11022. Jensen, Homer. Airborne magnetic profile above 40th parallel, eastern Colorado to western Indiana: Geophysics, vol. 14, no. 1, p. 57, 1949.

The Gulf airborne magnetometer was used in 1948 to record a 925-mile profile between Adena, Colorado, and New Ross, Indiana. Ground positions were established by means of a continuous-strip camera and local maps. The 1,300 to 4,400-foot flight altitudes had to be estimated from the barometric altimeter record, being mostly out of the range of the radio altimeter on the aircraft. The profile of total magnetic intensity is presented without correction for diurnal variation and instrumental drift, the latter having been less than 50 gammas for the entire flight. With the frequency-response characteristics and the noise level of the record, the magnetic trace can be accepted as valid within satisfactory limits.—*V. S.*

11023. Johnson, E. A. Pre-history of the earth's magnetic field [abstract]: Am. Geophys. Union Trans., vol. 30, no. 2, pp. 169–170, 1949.

The polarization of glacial clays and core samples of sediments from the Pacific have been investigated in a study of the history of the earth's magnetic field. Measurements of the glacial clays indicate that the earth's field has not changed substantially in direction or intensity during the last 15,000 years, and measurements of Pacific cores that the magnetic field has probably remained substantially constant during the last million years.—*M. C. R.*

11024. Kalashnikov, A. G., and Fonton, S. S. Experimental study of the topography of the anomalous magnetic field of geologic structures by means of models [in Russian]: Akad. Nauk SSSR Izv., Ser. Geog. i Geofiz., vol. 12, no. 6, pp. 536–548, 1948.

The magnetic field of a geologic fault was studied by means of models with the use of the magnetic field-meter previously developed by the senior author (*see* Geophys. Abstracts 114, no. 7020). The theoretical distribution of the field was calculated for a fault with infinitely extended surfaces by applying formulas based on Poisson's analysis. The models consisted of plastic material containing magnetic powder and had surfaces of adjustable dimensions. Measurements of the horizontal and the vertical magnetic components were made by the revolving coil of the apparatus as it was moved over a model placed between the two mutually perpendicular pairs of Helmholtz coils used to simulate the geomagnetic field.

The experimental results, plotted as magnetic profiles, showed a field distribution corresponding to that obtained by calculation. The limited dimensions of the models did not affect the configuration of the curves in the vicinity of the fault, but the experimental curves of the vertical magnetic component had none of the negative values characteristic of the theoretical curves. An increase of the amplitude of the fault

in the models resulted in an increase of the maximum value of the horizontal component and of the range of values of the vertical component. A change of magnetic concentration in the material of models showed that the ratio between the maximum values of the vertical and the horizontal components is proportional to the square of the relative magnetite content in the material.—*V. S.*

11025. **Kalinin, Iu. D.** Inhomogeneities at depth in the earth globe and geomagnetic variations [in Russian]: Akad. Nauk SSSR Izv., Ser. Geog. i Geofiz., vol. 12, no. 3, pp. 217–220, 1948.

The existence of extensive inhomogeneities of electrical conductivity in the interior of the earth at depths of the order of half its radius, previously suggested by the author, is investigated on the basis of data on diurnal geomagnetic variations of solar origin. It is shown that the main harmonic of the external part of the magnetic field of these variations must induce within the earth a series of secondary harmonics, because of the inhomogeneity of the earth's structure. Comparison of the theoretical results with the observational data strongly suggests that there are in the earth, at depths ranging from 0.3 to 0.6 of its radius, spherically shaped inhomogeneities which have thicknesses of of 0.1 to 0.2 of this radius and an electrical conductivity 10 to 100 times that of other parts of the earth.—*V. S.*

11026. **Kántás, Carlo.** Misure di magnetismo terrestre in Ungheria [Geomagnetic measurements in Hungary]: Geofis. Pura e Appl., vol. 13, nos. 1–2, pp. 11–19, 1948.

The first measurements of terrestrial magnetism in Hungary were made in 1696, but the first systematic geomagnetic survey of that country was made during the years 1843–58, with 52 stations occupied. The next surveys were made in 1869–79 and 1892–94. Under the leadership of Eötvös, during the years 1901–18 magnetic exploration progressed rapidly and about 6,275 stations were occupied. After his death the Roland Eötvös Geophysical Institute of Hungary continued his work and by 1947 the total number of stations was about 30,000. Other Hungarian governmental institutions participated in the magnetic exploration of the country, as well as the Hungarian-American Oil Company which, in prospecting for oil, made measurements of vertical intensity at more than 16,000 places. From these surveys formulas were derived for the normal values of the magnetic field vectors and for the secular and geographical variations of the geomagnetic field.

The article contains two magnetic maps of Hungary and several graphs of the regional magnetic field.—*S. T. V.*

11027. **Kendall, D. N.** The airborne magnetometer for mineral exploration: Inst. Petrol. Rev., vol. 3, no. 25, pp. 10–13, 1949.

During World War II the magnetic air detector (MAD) was developed by the U. S. Naval Ordnance Laboratory for detecting submarines. This was, in effect, an airborne magnetometer. The instrument consists of three mutually perpendicular coils. If the detector coil is oriented in the direction of the total geomagnetic field, there will be no component

through the other two coils. As soon as the first coil wanders slightly, these two coils will have small components through them, thereby activating an orienting mechanism which re-alines the detector in the direction of the field. The instrument is towed well behind the aircraft, to make it free from the aircraft's magnetic field.

The main advantages of aeromagnetic surveying are: elimination of ground interference; possibility of depth determination of the magnetic ore body by flying over the terrain at two different heights; high accuracy of the readings, reaching $\pm 1\gamma$; low cost, only one tenth of the ground cost; possibility of surveying inaccessible areas over forests, swamps, water. The author also points out difficulties and indicates that it is necessary to apply certain reductions to the profiles obtained.—*S. T. V.*

Koschmann, A. H. Addition to symposium on "Geophysics in mining." *See* Geophys. abstract 11144.

11028. Mercanton, P. L. Stabilité de l'aimantation rémanente des roches volcaniques, quelques faits nouveaux [Stability of the remanent magnetization of volcanic rocks, some new facts]: Soc. Vaudoise Sci. Natur. Bull., vol. 64, no. 271, pp. 69–71, 1948.

E. Thellier's 1937 experiments showed that the intensity and direction of remanent magnetization of basalt specimens changed when subjected to the weak magnetic field of the laboratory. This suggested that original remanent magnetization of lavas may be altered by the weak magnetic fields to which they are long subjected under natural conditions after cooling below the Curie temperature. Thus magnetic measurements for determination of the geomagnetic field of past epochs may be rendered invalid.

To check his data on magnetic declination in the past, the author sent basalt specimens which had been measured in 1932 and left packed next to each other to Thellier for measurement. Comparison of the original measurements and of the results of tests made in 1940, first after the specimens had been kept face up in the laboratory for 24 days, and second after they were kept in reversed position for 102 days, showed no change in the direction or intensity of magnetization in excess of the probable error of determination.—*V. S.*

11029. Minakami, Takeshi. Magnetization of the new lava flows of Miyakesima Island [in English]: Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 19, pt. 4, pp. 612–618, 1941.

Following the violent volcanic eruption on Miyakesima Island (Miyake-jima) on July 12, 1940, the author made magnetic measurements at forty stations in 1940–41 at different distances from the margin of lava flows. These show that the lava became magnetized in the direction of the earth's magnetic field. The magnetization was computed by the author as $I=1240\gamma$; and the components of the anomaly as $\Delta Z=-631\gamma$ and $\Delta H=+1350\gamma$. The mean intensity of magnetization determined by the author agrees sufficiently well with the value obtained by Nagata in his laboratory measurements.—*S. T. V.*

11030. Morelli, Carlo. Teoria e practica dei variometri magnetici da campagna [Theory and practice of magnetic field variometers]: Ist. Geofis. Trieste Publ. no. 223, 165 pp., 1947.

This is a handbook on magnetic field measurements. The introductory section contains a discussion on general theories of magnetism and on the terrestrial magnetic field, and a description of different methods of magnetic measurements with Thalen-Tiberg, Lloyd, De Collonge, Kohlrausch, Bildringmeier-Askania, La Cour, and other instruments. The next section is devoted exclusively to the Schmidt magnetic balance, including theory, operation and an analysis of possible errors in readings and corrections to be applied. In the last chapter the airborne magnetometer, developed in the United States during World War II, is described. An extensive bibliography is appended.—*S. T. V.*

11031. Nagata, Takeshi. A note on regional anomaly and secular variation in geomagnetism, part 1 [in English] and 2 [in Japanese with English summary]: Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 20, pt. 1, pp. 107–121, 1942, and vol. 21, pts. 3–4, pp. 367–375, 1944.

The distribution of the magnetically permeable subterranean mass that causes regional anomalies on the earth's surface was calculated by two methods on the general assumption that a centered dipole can be substituted for the primary geomagnetic field. In the first calculation the dipole was taken to be coaxial with the earth's rotation axis, and in the second calculation it was assumed to have a magnetizing direction characterized by certain specified ratios. The distribution of the permeable mass obtained by the second calculation is shown on a schematic map and is found to differ little from that obtained by the first calculation. On the basis of both results the value of the actual geomagnetic potential contains an increment not traceable to the subterranean mass. The magnitude of this increment was much smaller in the second calculation than in the first.—*V. S.*

11032. Petrova, G. N. Investigation of powdered magnetites [in Russian]: Akad. Nauk SSSR Izv., Ser. Geog. i Geofiz., vol. 12, no. 6, pp. 549–556, 1948.

The effects of magnetite concentration and grain size on the magnetic properties of rocks, and more particularly on their inner demagnetization factor, were studied by the use of powdered samples under conditions of both ideal (hysteresis-free) and natural magnetization to aid in the interpretation of magnetic data. Seven samples varying in magnetite content were compressed from mixtures consisting of known weights of river sand, bakelite, and powdered magnetite from the Gora Vysokaya deposits, in the Nizhniy Tagil district, U. S. S. R. Four other samples were prepared from powdered magnetite grain sizes and bakelite. Gypsum was substituted for bakelite in control samples.

The results showed that the inner demagnetization factor increases with a decrease of magnetite grain size and concentration in specimens. The demagnetization factor, depending on grain shape and on the surrounding medium, increases with a decrease of magnetite concentration. With a large concentration this factor is a linear function of the ratio

of intergrain distance to grain size. Grains of different size give almost identical hysteresis-free curves in weak fields but natural magnetization curves run higher in samples with larger grains.—*V. S.* (For previous paper *see* Geophys. Abstracts 136, 10799.)

11033. Pliner, Ia. G. The magnetic field of massive rotating bodies [in Russian]: Priroda, vol. 37, no. 7, pp. 16–24, 1948.

P. M. S. Blackett's paper showing that magnetism may be a universal property of rotating bodies is reviewed, and the underlying observations and calculations relative to the sun, the earth, and 78 Virginis are presented. Existing evidence is considered insufficient for the acceptance of this hypothesis, and astronomical, mathematical, nucleonic, and experimental methods of its verification are examined for cosmic bodies of various types, bodies rotating on the earth, and elementary physical particles.

An experimental investigation of the magnetic phenomena caused by the rotation of bodies was conducted beginning with 909 by P. N. Lebedev. He used rings 6 centimeters in diameter that made 35,000 revolutions per second, but obtained a null result because of insufficiently sensitive instruments. The magnetic field produced could have been only 8×10^{-10} gauss whereas the sensitivity of the magnetometer was 10^{-3}—10^{-4} gauss. His investigation was repeated 20 years later by Suonn and Longacre, again with an insufficiently sensitive magnetometer. The experiments are described and calculations are given to show that a slowly revolving large body is more suitable for observations because it should have a magnetic field of greater intensity than a rapidly revolving small body. As an eventual experimental possibility, use of a rocket-borne magnetometer equipped with a telemetering device is suggested for the measurement of the magnetic field of the moon.—*V. S.* (For Blackett's paper *see* Geophys. Abstracts 132, no. 9746.)

11034. Rikitake, Tsuneji. Notes on electromagnetic induction within the earth: Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 24, pts. 1–4, pp. 1–9, 1946.

The relation between the variation of the geomagnetic field and that of the earth current is analyzed mathematically for isotropic and anisotropic electrical conductivity, with the earth treated as a semi-infinite medium. The data employed are observations on diurnal variations made in 1947 at Ebro, Spain, where S. Chapman and T. Whitehead had made their investigation of the electromagnetic induction produced in the earth by diurnal geomagnetic variation.

The theoretical diurnal variation of the earth current for an isotropic earth is calculated from observations on the actual diurnal geomagnetic variation and the computation is reversed for an anisotropic earth. This is done by solving Maxwell's equation for the quasi-stationary state, with a consideration of the initial condition and the boundary condition at the surface of the earth where the observations were made. In each case the results of theoretical computations are further compared with actual observations of respective variations, averaged for the international calm days of the year 1927, and with the findings of the previous investigation.

It is found that the earth current calculated from the observed variation of the geomagnetic field agrees fairly well with that obtained by Chapman and Whitehead by means of a spherical harmonic analysis of the geomagnetic potential. The anisotropy of the electrical conductivity, found to be N. 18° W., is in close agreement with the direction of the diurnal variation of earth current at Ebro, which is nearly N. 20° W.—*V. S.*

11035. Schneider, E., Thellier, Émile, and Thellier, Odette. Contribution geophisique à l'étude du trias ophitique pyrénéen, 1 pt. [Geophysical contribution to the study of the ophitic Triassic in the Pyrenees, part 1]: Annales de Géophys., vol. 4, pt. 1, pp. 15–32, 1948.

A magnetic survey was made to determine the origin of the ophitic rocks found in the upper saliferous Triassic Keuper strata of the Pyrenees. The work included measuring the vertical geomagnetic component with a Schmidt balance over a net of stations in the region of Dax and Peyrehorade; tracing a magnetic profile across an elongated ophitic layer by measurements of the declination, the horizontal component, and the vertical component, with the instruments of Chasselon, La Cour, and Schmidt, respectively; and analyzing samples of several ophitic rocks. The techniques are described.

The preliminary results, illustrated by isoanomaly maps, show the magnetic properties of ophitic rock, the effectiveness of the magnetic method in detecting diapir folds in the Pyrenees, the size of magnetic anomalies in southwestern France, and the magnetic interference caused by electric railways and by metal wire supports used in vineyards. It is found that diapirs are revealed in the Pyrenees by strong positive anomalies caused by the ophitic rocks contained in them.—*V. S.*

11036. Schwartz, G. M. Report on magnetic work in St. Louis County in 1942: Office of Commissioner of Iron Range Resources and Rehabilitation, Rept. Inv. 1, 20 pp., St. Paul, Minn., June 1943.

In 1942 a magnetic survey was made in St. Louis County, Minnesota, northwest of Duluth, in search of mineral deposits. Measurements of vertical intensity, made with an Askania magnetometer, indicated promising zones of positive anomalies and defined the western boundary of the Duluth gabbro. The results are shown on maps and are discussed in relation to the local geology.—*V. S.*

11037. Slaucitajs, Leonīds. On anomalies in magnetic declination in Latvia: Baltic Univ. Contr.; no. 61, 3 pp., 1947.

The previously published values of geomagnetic declination on Latvian territory and the adjacent sea for epoch 1940.5 are plotted in the form of an isoanomaly map (for the values *see* Geophys. Abstracts 133, no. 10012). A close similarity is noted between this map and the isoanomaly maps of the horizontal and the vertical geomagnetic components presented earlier. (*See* Geophys. Abstracts 134, no. 10278.) Studies show that the central part of the country is the most disturbed magnetically. The distribution of positive anomalies on the western side and of negative anomalies on the eastern side of this zone is similar for both

declination and vertical component. The anomalies of declination deviate widely from their mean normal value of 2°, the extreme readings being +15.2° and −18.8° in the area of Subata-Garsene.—*V. S.*

11038. Smith, P. N. The towed bird, mechanical details: Columbia University, Airborne Instruments Laboratory Rept., 32 pp., New York, Feb. 1944. (Library of Congress, OTS PB Rept. 27556.)‡

The towed bird of the magnetic airborne detector (MAD) has been made aerodynamically stable by the addition of a tail of sufficient size and accurate construction and by proper suspension at the center of gravity of the streamlined housing. The design of the parallelogram bail which is used for the attachment to the cable reduces the transfer of motion from the cable to the bird and permits two degrees of freedom, pitch, and roll. Specifications and design drawings for the various parts of the bird are given. Photographs taken in flight show the extreme positions assumed by the bird during flight maneuvers, as well as its relation to the airplane during normal operation.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 110, Washington, D. C., 1946.*

11039. Toperczer, Max. Der Zustand des magnetischen Feldes in Österreich zur Epoche 1945.0 (Geomagnetic field of Austria at the epoch 1945.0) : Berg-u. Hüttenm. Monatsh., Jahrg. 93, Heft. 12, pp. 243–248, 1948.

The magnetic observations made in different regions of Austria before World War II were referred to the epoch of 1930. To recalculate these data to the 1945.0 epoch the author used two formulas, one for the geographical variation, the other for secular, both derived for central Europe from the measurements of the following observatories: Fürstenbruck, Vienna, Chambon-la-Fôret, De Bilt, Niemegk.

Using these formulas the author computed the values of the total magnetic vector, the horizontal component, and the declination for 110 points in Austria, referring them to the 1945.0 epoch.—*S. T. V.*

11040. U. S. Bureau of Aeronautics. Magnetic airborne detector – Handbook of operating instructions for AN/ASQ–3 equipment, installation reports, 682 pp., Washington D. C., July 1943–Jan. 1945. (Library of Congress OTS PB Rept. 30484.)‡

This microfilm report contains a brief handbook of operating instructions for AN/ASQ–3 equipment and its component parts and also a number of installation reports on various types of magnetic airborne detectors in different naval airplanes. The handbook gives a complete description of the equipment and detailed instructions for its installation, adjustment, operation, and emergency repairs. Illustrations show the appearance of the equipment and the location of controls; schematic block diagrams, assembly drawings, and photographs are included. The handbook also contains detailed instructions for the prototype installation of the AN/ASQ–2A on wing tips.

Appended installation reports deal with different types of magnetic compensators, give instructions for wing installations and trailing bird installations of MAD models in aircraft of various type, and describe

tests and other related procedure.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol 2, no. 8, p. 585, Washington, D. C., 1946, condensed by V. S.*

11041. U. S. Naval Ordnance Laboratory. A preliminary study of portable marine magnetometers: Mine Unit Rept. 165, 9 pp., Washington, D. C., Sept. 1940. (Library of Congress, OTS PB Rept. 33497.)‡

An instrument is needed to provide an accurate measure of the vertical, athwartship, and fore-and-aft component of the magnetic field around a ship. Several types of measuring instruments have been suggested. Two of them, adopted and used for thousands of measurements by the British Admiralty, were the fluxmeter and the pistol-type inductor. A third type, the earth inductor, was used by both the British and the French. Other types are in an experimental stage. Descriptions are given of the earth-inductor magnetometer, inductor-pistol magnetometer, permeability-type magnetometer, and gradiometer as a degaussing indicator. Included in the report are a schematic diagram of an earth-inductor magnetometer and a chart showing exploration of the vertical component of the magnetic field of the rigging of the U. S. S. *Cormorant.—U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 11, p. 805, Washington, D. C., 1946, condensed by V. S.*

11042. U. S. Navy Department. AN/ASQ-3 equipment; Installation specification: Navy Aeronautical Specifications M572 and EI-125, 4 pp. and 26 pp., Washington, D. C., Feb. 1943 and Nov. 1944. (Library of Congress, OTS PB Repts. 27322, 27324.)‡

The specification for the AN/ASQ-3 magnetic airborne detector (MAD) contains the requirements for the electronic detection equipment. As a part of the specification, certain Bell Telephone Laboratory specifications are listed and performance and construction standards are given.

The installation specification for the same model describes in detail the location and mounting of all component parts of the MAD equipment. Mounting procedure, electrical bonding, and power requirements are given. A list of parts showing the quantity needed of each item is included. Assembly drawings, charts, and wiring diagrams illustrate the text.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 96, Washington, D. C., 1946, condensed by V. S.*

11043. U. S. Navy Department. AN/ASQ-3A equipment: Navy Aeronautical Specification M597, 7 pp., Washington, D. C., Nov. 1943. (Library of Congress, OTS PB Rept. 27323.)‡

This specification contains the requirements for the AN/ASQ-3A magnetic airborne detector (MAD), which is of the total-field type operating on a combination of vector summation and the oriented-detector principle. The detector element is oriented approximately by servomechanisms controlled by two other magnetic detectors which together with the detector are mutually perpendicular. The output of the detector plus the squared outputs of the orienting detectors are added to

approximate the total vector within the limits of the orienting mechanism. Three frequency responses corresponding to speed ranges of 0–20, 20–50, and 50–120 knots are available. The specification includes a list of the applicable Bell Telephone Laboratory specifications, a calibration curve, background noise and sensitivity data, a list of parts, and instructions for sampling, inspection, tests, packaging, packing, and marking of the equipment for shipment.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 96, Washington, D. C., 1946.*

11044. U. S. Navy Yard. Assembly of Mark 6, model 1 proving-ground magnetometers: Naval Ordnance Lab. Rept. 537, 40 pp., Washington, D. C., June 1942. (Library of Congress, OTS PB Rept. 31714.)‡

This report presents a complete discussion of the methods and materials used in the assembly of Mark 6, model 1 proving-ground magnetometers and cable waterstops. The information may be used as a basis for establishing a similar production assembly line. The text is illustrated by photographs, by blueprints of plan of assembly room and circuit for operation tester, and by a sample of permanent record. The following appendices are included: complete supply schedule; material used for the manufacturing of a proving-ground detector; fault locator and operation tester for proving-ground magnetometer; handling instructions for proving-ground magnetometer; recommendations for handling Mark 6, model 1 proving-ground detectors; proving-ground magnetometer inspection; and proving-ground detector records.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 11, p. 805, Washington, D. C., 1946.*

11045. U. S. Navy Yard. Calibration of the Mark 5, model 4 magnetometers (14B): Naval Ordnance Lab. Rept. 745, 29 pp., Washington, D. C., Sept. 1943. (Library of Congress, OTS PB Rept. 31727.)‡

The factors limiting the accuracy of magnetic measurements are summarized in a linear calibration relation. Each of the correction components is separately defined and evaluated. The operating procedure for calibration tests is discussed, and details of the circuits are given. A description of a test panel is included. An appendix contains the computation of standard solenoid constants. Schematic and wiring diagrams illustrate the text.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 11, p. 805, Washington D. C., 1946.*

11046. U. S. Navy Yard. Catalogue of magnetic measuring equipment: Naval Ordnance Lab. Rept. 663, 28 pp., Washington, D. C., Oct. 1942. (Library of Congress, OTS PB Rept. 31721.)‡

This catalogue lists the magnetic measuring equipment supplied by the Degaussing Material Unit of the Naval Ordnance Laboratory at the direction of Section Pr8 d, Bureau of Ordnance. Underwater and control units are included for the 4 types of stations for portable magnetometers and for universal accessories, the types being calibration and channel ranges, channel loops, magnetic proving grounds, and de-

perming stations. The items are arranged in the approximate order of their importance. Many service and maintenance units normally used together are listed as "kits" in an appendix.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 11, p. 805, Washington, D. C., 1946.*

11047. U. S. Navy Yard. Operating instructions for the portable magnetometer employing a Mark 5, model 4 detector unit and Mark 5, model 5 control box (13C): Naval Ordnance Lab. Rept. 551, 49 pp. Washington, D. C., June 1944. (Library of Congress, OTS PB Rept. 31715.)‡

The principle of operation and the constituent parts of the magnetometer are described. Detailed instructions for operating, calibrating, and making reading corrections are presented. Special precautions in the use of the instrument and directions for maintenance and repairs are given. Photographs, tables, schematic diagrams, and general service data are included.—*U. S. Dept. Commerce, Office of Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 11, p. 806, Washington, D. C., 1946.* (Supplementary data are given in Naval Ordnance Lab. Rept. 493, OTS PB Rept. 31712.)

11048. U. S. Navy Yard. Revised instructions for the use of inductor pistol magnetometers: Naval Ordnance Lab. Rept. 339, 18 pp., Washington, D. C., Feb. 1942. (Library of Congress, OTS PB Rept. 31705.)‡

Instructions are given for the care and use of the inductor-pistol magnetometer, Mark 1, model 3, a null-type instrument used to measure the vertical magnetic field under an iron ship. A photograph of the control box and of the disassembled parts of the detector unit and associated gear, a cross-section diagram of the assembled detector unit, and a wiring diagram of the control box are included. A table giving tilt and downstream displacement is shown.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 11, p. 806, Washington, D. C., 1946.* (These instructions supersede Naval Ordnance Lab. Mine Unit Rept. 169, OTS PB Rept. 31695.)

11049. U. S. War Department. Japanese type 2, Mark 4, magnetic detector: U. S. Enemy Equipment Intelligence Service, Signal Section, India-Burma, Prelim. Rept. 64, 5 pp., July 1945. (Library of Congress, OTS PB Rept. 53496.)‡

The Japanese magnetic detector, type 2, Mark 4, recovered by British forces in Burma, is described and illustrated by photographs and circuit drawings. It consists essentially of two vibrator packs, two relay boxes, and a loop control box. Its purpose is believed to be the detection and delineation of underwater ferrous metallic objects. It could have been intended for land use as well—*V. S.*

11050. U. S. War Department, U. S. Navy Department, and Air Council of the United Kingdom. Handbook of maintenance instructions for AN/ASQ-3 testing systems: Army-Navy 16-30ASQ3-3, 160 pp., Washington, D. C., Jan. 1944. (Library of Congress, OTS PB Rept. 27557.)‡

A description is given of the components and operation of the AN/ASQ-3 equipment for the magnetic detection of submarines from aircraft.

Brief instructions are included for its installation, adjustment, and operation, as well as full instructions for the maintenance of the system and its component units. A section on the mechanical and electrical features of the equipment describes its theory and operation. Labeled photographs, tables, diagrams, schematic drawings, assembly sketches, and list of parts are included.—*U. S. Dept. of Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 113, Washington, D. C., 1946.*

11051. U. S. War Department, U. S. Navy Department, and Air Council of the United Kingdom. Handbook of maintenance instructions for AN/ASQ–3A equipment: Army-Navy 08–20–14, 193 pp., Washington, D. C., June 1944. (Library of Congress, OTS PB Rept. 27560.)‡

This handbook contains general as well as detailed descriptions of the design, theory, and functioning of the AN/ASQ–3A equipment for the magnetic detection of submarines from airplanes. The equipment consists of several units connected by cables with one another and with the power supply of the aircraft. Some units are installed permanently in the airplane at the factory, whereas others, being portable, are installed at the operating base. Instructions are included for installation, operation, and maintenance of the system and its parts. Illustrations show the appearance of the units and the locations of controls. Photographs, diagrams, schematic drawings, tables, and lists of parts are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 113, Washington, D. C., 1946.*

Wantland, Dart. An example of a successful mining geophysical survey [abstract]. *See* Geophys. abstract 11111.

11052. White, R. F. Characteristics for some alloy magnets for geomagnetic instruments: Am. Geophys. Union Trans., vol. 29, no. 4, pp. 479–480, 1948.

Temperature coefficients and induction factors measured over a period of years show that cobalt steel has a smaller temperature coefficient and smaller induction factor and is capable of being more strongly magnetized than tungsten steel. Alnico II has a larger temperature coefficient and considerably smaller induction factor than cobalt steel, while Alnico VI has about the same temperature coefficient but an induction factor about half that of Alnico II.—*M. C. R.*

11053. Wiles, W. E. A modified Wild-pattern earth-inductor inclinometer: Am. Geophys. Union Trans., vol. 29, no. 4, pp. 476–478, 1948.

The U. S. Coast and Geodetic Survey has designed a modified Wild-pattern earth-inductor inclinometer, using the basic principles of the Wild design with commutator and brass ring but obtaining coil rotation by a horizontal drive shaft that activates the rotation axis of the coil by two quarter-sphere bevel gears. Tests of two instruments built by the U. S. Naval Observatory show that the new instrument gives results about as reliable as the old type and that changes in design have produced improved stability and absence of vibration and strain on the rotating coil.—*M. C. R.*

3. SEISMIC METHODS

11054. Buckner, H. M. Geophysical history of the Buckner field, Lafayette and Columbia Counties, Arkansas, in Geophysical case histories, vol. 1, 1948, pp. 429–442, Menasha, Wis., Soc. Expl. Geophys., 1949.

The presence of a structural feature at Buckner, Ark., was first indicated by a reconnaissance seismic survey in the fall of 1936, at which time reflections from the Nacatoch (Gulf Cretaceous) were mapped. The area was resurveyed in more detail early in 1937 and reflections from Glen Rose horizons and from the top of the Smackover limestone were mapped. Following this survey the prospect was leased and drilled, resulting in the discovery of the first Smackover producing area of commercial importance in Arkansas. Development of the western part of the field proceeded rapidly. A detailed seismic survey conducted in the fall of 1938 to evaluate acreage east of the eastern limits of production at that time resulted in the drilling of the discovery well for the eastern portion of the field.—*V. S.*

11055. Caloi, Pietro, and Lo Surdo, Antonino. Nuovo smorzatore per i sismografi tipo Wiechert [A new damping mechanism for seismographs of the Wiechert type]: Annali Geofis., vol. 1, no. 2, pp. 203–205, 1948.

Wiechert's original damping mechanism which consisted of a piston suspended on four springs and oscillating in a cylindrical chamber with very small clearance was difficult to adjust. A new design is proposed in which the piston is rigidly fixed on the first lever of the magnification mechanism, and the necessity of its adjustment as well as any reaction of the piston on the movement of the pendular mass are thus eliminated. The damping action can also be varied by changing the air openings of the chamber. Several drawings and photographs illustrate the construction of the new damping mechanism which has replaced the old on Wiechert seismographs in many Italian seismological observatories.—*S. T. V.*

11056. Coryn, F. R. Geophysical history of the Apache pool, Caddo County, Oklahoma, in Geophysical case histories, vol. 1, 1948, pp. 312–318, Menasha, Wis., Soc. Expl. Geophys., 1949.

Information obtained from a reconnaissance reflection seismic survey of the Apache pool area late in 1936 served as a basis for leasing. A detailed reflection survey was made in 1937, as well as some refraction shooting and a limited amount of magnetometer work. A test drilled on the basis of the reflection data was unsuccessful. A supplementary detailed survey was made in 1940, and a second test was drilled which resulted in the discovery of the Apache pool.—*V. S.*

11057. Cram, I. H. Case history, Pauls Valley field, Garvin County, Oklahoma, in Geophysical case histories, vol. 1, 1948, pp. 319–326, Menasha, Wis., Soc. Expl. Geophys., 1949.

As early as 1928 available subsurface data indicated that the Pauls Valley district in Oklahoma possessed promising Ordovician beds and would provide reasonably good drilling prospects if sizable closures

could be detected. As a magnetic survey failed to give structural information and torsion balance work was unsuccessful elsewhere in Oklahoma, a correlation-reflection reconnaissance survey was made in 1933–35. However, the 13 holes drilled in accordance with its findings proved dry. In 1938 another reflection survey was made by continuous profiling. The results, together with the evidence from the dry holes, made it possible to interpret correctly more than 150 feet of closure on top of the Ordovician limestone at the base of Pennsylvanian beds and approximately 300 feet of closure beneath the Bromide sand of Ordovician age. The discovery well was located on the basis of this information. Contours subsequently plotted from drilling showed somewhat larger closures than those inferred from seismic findings. Maps of the successive stages of interpretation and of drilling data are given.—*V. S.*

11058. Dix, C. H. On the minimum oscillatory character of spherical seismic pulses: Geophysics, vol. 14, no. 1, pp. 17–20, 1949.

The oscillatory character of seismograms has sometimes been considered due to departures from the simple spherical wave equation or to the character of the source. Treatments of the latter have not been satisfactory because they neglect the probable major effects of nonlinearity, such as heating, fracturing, and other departures from Hooke's Law, which arise near the source. The present paper considers a pulse of finite length from front to back, supposing that the media in front of and in back of the pulse remain quiet, and shows that such a pulse is not as arbitrary as the general solution of the spherical wave equation would indicate, but that the dilation must change algebraic sign at least twice within the pulse. Thus in all practical cases were energy is supplied for only a limited time interval, a spherical seismic pulse of the compressional type must have a minimal oscillatory character and the dilatation must show 1.5 oscillations at least.—*M. C. R.*

Ewing, Maurice. Structure of the Mid-Atlantic ridge [Abstract]. *See* Geophys. Abstract 11140.

11059. Gilmore, M. H. Relation of microseisms to meteorology: Am. Geophys. Union Trans., vol. 30, no. 2, pp. 165–169, 1949.

The author reviews the work of the Naval Aerological Service in developing the microseismic method of storm detection in the Caribbean and western Pacific regions. Seven tripartite stations and three single-instrument stations have been operated in this project. (For details *see* Geophys. Abstracts 126, nos. 8681, 8682.) Present data leave no doubt of the direct relationship between microseism storms and severe tropical disturbances. Energy of the disturbance is partly changed to strong vibrations of the earth's crust which travel outward in more or less concentric circles. With concentrated storms as hurricanes and typhoons, microseisms seem to come from the area of greatest turbulence. Microseisms are apparently not produced by storms over land and are greatly reduced in amplitude when storms pass over water less than 20 feet deep. Amplitudes are also affected by the intensity of the storm, the distance from the recording station, and "microseismic barriers" (certain

zones, the exact nature of which is not known, which limit or prevent the free passage of microseisms).—*M. C. R.*

11060. Handley, E. J. Notes on the migration of steep dips with special reference to curved paths [abstract]: Geophysics, vol. 13, no. 2, p. 300, 1948.

Computing procedures are outlined for areas of steep dips. Some practical procedures are suggested to be used in areas of steep dips where a linear increase of "instantaneous" or true velocity with depth holds to an acceptable approximation.

11061. Heinrich, R. R. Three Ozark earthquakes: Seismol. Soc. America Bull., vol. 39, no. 1, pp. 1–8, 1949.

Seismographic and macroseismic data have been used to determine the epicenters of the earthquakes of January 15, 1945, May 15, 1946, and December 1, 1947, in Missouri. The epicenter of the 1945 earthquake is related to the St. Genevieve fault zone. Epicenters of the other shocks are near the boundary between the Ozarks and the Gulf Coastal Plain and suggest faulting in the basement at the southeastern margin of the Ozarks.—*M. C. R.*

11062. Hersey, J. B., and Ewing, Maurice. Seismic reflections from beneath the ocean floor: Am. Geophys. Union Trans., vol. 30, no. 1, pp. 5–14, 1949.

Apparatus and procedures are described with which seismic reflections have been obtained from the ocean bottom and from deeper horizons. The area surveyed lies between Bermuda, the Greater Antilles, and the United States. All records obtained in an east-west strip 70 to 80 miles wide—extending from 61° W. longitude south of Bermuda to 71° W. longitude and thence southward as a strip 200 to 300 miles wide to about 23° N. latitude—show a single prominent reflecting horizon at depths exceeding 500 feet below the bottom (assuming the seismic velocity in the bottom sediment to be equal to or greater than that of sea water).

In this area the bathymetric data indicate that the bottom is either flat or relatively smooth. The records from other parts of the area are, with few exceptions, more complicated, correlating with bathymetric evidence of a rougher bottom there. A system is outlined for classifying reflection records obtained in deep water with suggested geologic significance of the various record types.—*Authors' abstract.*

11063. Hersey, J. B., and Press, Frank. Seismic studies of geologic structure of the ocean floor [abstract]: Am. Geophys. Union Trans., vol. 30, no. 2, p. 171, 1949.

Between 1946 and 1948 significant advances have been made in the study of the structure of ocean basins by seismic reflection methods. Reflection records have been made at approximately 1,500 stations in the north Atlantic by groups from Woods Hole Oceanographic Institute and Columbia University (For preliminary results *see* Geophys. Abstract 11062). Analysis of records to date indicates thicknesses of material above the principal reflecting horizon in the deep ocean that range from a negligible cover in some parts to as much as several thousand feet in other parts.—*M. C. R.*

11064. Hughes, J. W. Seismic exploration in Mississippi [abstract]: Geophysics, vol. 13, no. 3, p. 493, 1948.

. The paper presents a concise history of seismic work in Mississippi, discusses the problems encountered, reviews the results obtained, and submits the writer's recommendations for more effective exploration.

11065. Hunzicker, A. A. Geophysical history of the Salem oil field, Marion County, Illinois: Geophysical case histories, vol. 1, 1948, pp. 471–480, Menasha, Wis., Soc. Expl. Geophysicists, 1949.

This paper presents the discovery history of the Salem oil field in Illinois. Seismic reflection reconnaissance and detailed surveys, which disclosed the Salem structure, were conducted in late 1936 and in 1937. Structural maps of these surveys are included, as are the geologic structural maps prepared from subsequent Devonian and Trenton oil development. Departures between seismic and geologic delineations of structure are compared in 81 instances. Of these, 63 percent showed differences in average interval of 20 feet or less. Production was established on July 1, 1938.—*Author's abstract.*

11066. Inglada Ors, Vicente. Contribucion de la investigaciones sismicas al estudio de la figura de la terra, part I [Contribution of seismic investigations to the study of the shape of the earth]: Rev. Geofis., vol. 7, no. 26, pp. 109–124, 1948.

Recent data on the shape of the earth determined by different investigators in connection with the recommendations of the Second Congress of the International Union of Geodesy and Geophysics held in Madrid in September 1924 are summarized. The adoption of the international ellipsoid of Hayford and the Helmert formula for the value of gravity as a function of the geographical coordinates are discussed. Recent precise triangulation and gravitational surveys made in different countries have revealed important deviations from values given by these formulas.

The author expects seismic investigations to yield more precise answers to these questions of geodesy. Reflection of seismic waves from the lower boundary of the earth's crust should give an accurate value of the depth of isostatic compensation, and computation of the Bouguer reduction, important in gravitational surveys, should be made more reliable by seismological observations.—*S. T. V.*

11067. Kunz, Bruno. Refraction oder Reflexion [Refraction or reflection]: Bergbau, Bohrtechn. und Erdöl Zeitung, vol. 65, no. 1, pp. 6–9, 1949.

In the United States seismic prospecting by the reflection method is used more often than in Europe where the higher cost of this method makes it prohibitive, and the refraction method is preferred. The latter is especially convenient when the velocity of seismic waves in deeper strata is substantially greater than that in the upper layer. In Austria, as in some other Alpine countries, this favorable ratio of velocities does not exist. Here the upper stratum can have a velocity as high as 4,000 meters per second. According to the author both methods have their place in exploration, supplementing each other. For shallow exploration,

as in engineering structures, elastic vibrations can be produced by mechanical vibrators. As a potential competitor to the seismic methods the author considers the electric-resistivity method and mentions the survey, recently carried out in the Caucasus, where an electrode spread of 8,000 meters positively identified layers at a depth of 2,200 meters.—*S. T. V.*

11068. Landsberg, H. E. Note on deep focus earthquakes, pressure changes, and pole motion: Geofis. Pura e Appl., vol. 12, no. 5–6, pp. 177–180, 1948.

The hypothesis that a major part of the annual pole motion is caused by the seasonal transport of air masses and that these pole motions in turn can act as trigger forces on earthquakes is tested by comparing observations of northern hemisphere pressures, pole motion, and occurrence of deep-focus earthquakes during the interval 1922–1935. The author believes the correspondence of a maximum of deep-focus earthquakes during June and a minimum during July to a main maximum and a secondary minimum in rate of change of pole position is significant, but that other variations of the deep-focus earthquake frequency curve could be attributed to random variations.—*M. C. R.*

11069. Lee, S. P. Seismological work in China: Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp. 88–91, 1948.

A brief account is given of the founding, instrumental equipment, operation, and publications of the Chinese seismic stations of Zi-Ka-Wei, Chiu-feng, Pei-Chi-Kou, Tsingtao, Tientsin, and Taiwan, as well as of the disruption of their activities by the Sino-Japanese war. Progress in the rehabilitation of these stations is reported, and new stations are proposed at Peking (Pei-p'ing) and Lan-chou by the National Geological Survey—*V. S.*

11070. Leet, L.D. Vibrations from delay blasting: Seismol. Soc. America Bull., vol. 39, no. 1, pp. 9–20, 1949.

Systems of delay blasting are discussed with reference to their effectiveness in reducing vibrations. Standard-delay (long-delay) blasting by caps detonating at intervals of 1 to 6 seconds effects no fundamental reduction of vibration because the vibration pattern from each set of explosives is completed before the next begins. The method devised by the U. S. Bureau of Mines of simultaneously detonating charges spaced about half a wave length apart achieved cancellation of one peak but did not reduce the maximum amplitude. Results of experiments with short delays were so erratic that Bureau of Mines' investigators concluded such shooting was not practical. Renewed attempts since 1945 to reduce vibration by short-delay firing, using either caps or a switch applying current to standard caps at predetermined delay intervals, have been more successful, although the mechanism by which the reduction was achieved was not well enough understood to permit application with equal success under a variety of conditions. The character of vibration records in controlled comparison tests indicates that reduction of vibration occurs at the source. The author suggests two factors which may produce the observed effects by reducing the amount of vibration in the solid face, a decoupling coefficient based on the fact that gases

from delay holes move through rock already partially shattered and decoupled from the solid face by the instantaneous shot, and an interference coefficient, or interference and cancellation of waves in the zone of shattering.—*M. C. R.*

11071. Macelwane, J. B., and Heinrich, R. R. Progress report of the Jesuit Seismological Association for the year 1947: Am. Geophys. Union Trans., vol. 30, no. 1, pp. 127–130, 1949.

During 1947 the member stations of the Jesuit Seismological Association resumed their normal activities, disrupted by the war, and introduced improvements in their work. Installations of new equipment and operation of previous instruments are reported, and preliminary epicenters located by the Association during the year are tabulated, with their geographic positions shown on a sketch map. The two deepest earthquakes of the year were in South America, one on January 29 in northern Argentina, the other on August 6 in western Brazil, both of which had a focal depth of 600 kilometers. An earthquake of 400-kilometer depth occurred on July 25 in northern Argentina, and another of 450-kilometer depth occurred on February 18 in the Pacific Ocean south of the main island of Japan.—*V. S.*

11072. Military Land Survey. Results of revisions of triangulation and levelling in the neighborhood of Ogashima, Akita-ken [in Japanese, with English summary]: Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 19, pt. 4, pp. 671–682, 1941.

The region around Ogashima, Japan, was remarkably deformed by the destructive earthquake of May 1, 1939. Triangulation of this region was repeated in 1940 and displacements of 39 triangulation points were measured with reference to base points outside of the affected region. The results of these measurements are presented in a table and on two maps of the region. They show horizontal displacements up to 60 centimeters and vertical displacements from —16.8 to +65.0 millimeters.—*S. T. V.*

11073. Milne, W. G. The earthquake in Montmorency County, Quebec, on January 1, 1948: Dominion Observatory Ottawa Pubs., vol. 7, no. 8, pp. 337–344,, 1948.

The epicenter of the earthquake of January 1, 1948, has been located at 47°20′ N., 70°55′ W., or 3 to 5 kilometers northeast of that point, from the analyses of the seismograms of six Canadian stations and Weston College. This epicenter is on the eastern boundary of Montmorency County, about 60 kilometers west of and possibly on the same fault plane as that of the St. Lawrence earthquake of March 1, 1925.—*M. C. R.*

11074. Milne, W. G. The location of the Cornwall-Massena earthquake, September 5, 1944: Dominion Observatory Ottawa Pubs., vol. 7, no. 9, pp. 345–362, 1949.

All available seismograms and reports of field observations have been assembled and analyzed to determine the most probable epicenter of the

Cornwall-Massena earthquake of September 5, 1944, in Canada and New York State. The evidence accumulated is described, and the foreshocks and aftershocks are listed. A preliminary epicenter was determined by stereographic projection methods, and a more precise location was established with the use of only *P*-phase arrival times and a least squares solution. The final epicenter was found to be at 44°58.5′ N. latitude, and 74°53.9′ W. longitude, and the depth of focus of the order of 25 kilometers. This point is located slightly north of a line joining Massena and Massena Center in New York State.—*V. S.*

11075. Minakami, Takeshi, and Uchibori, Sadao. The To-Nan-Kai earthquake, damage and aftershocks [in Japanese, with English summary]: Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 24, pt. 1–4, pp. 19–30, 1946.

A strong earthquake on December 7, 1943, at To-Nan-Kai, Japan, shook the islands of Honshū, Shikoku, and Kyūshū, killed about 1,000 persons, and destroyed 54,000 houses. To study its aftershocks, temporary seismograph stations were established at Okazaki, Toyohashi, Yokkaichi, and Uziyamada. Observations on the duration of preliminary microtremors made possible the determination of the hypocenters of 40 aftershocks that occurred between February 14 and March 20, 1944. The distribution of these epicenters, shown on sketch maps, the position of the Fukozu fault formed by the violent Mikawa earthquake of January 13, 1945, and the related evidence led the authors to conclude that the Mikawa earthquake was an aftershock of the To-Nan-Kai earthquake. The relation between the destruction of houses and the character of the ground is discussed. Damage is especially high on alluvial ground.—*V. S.*

11076. Mintrop, Ludger. 100 Jahre physilkalische Erdbebenforshung und Sprengseismik [One hundred years of seismology and seismic methods of exploration]: Die Naturwissenschaften, vol. 34, no. 9, pp. 257–262, no. 10, 289–295, 1947.

The achievements of seismology since the initiation of this branch of science one hundred years ago are impressive. Seismologists are now in a position to study deep layers of the earth which for a long time seemed to be beyond reach of observation. The starting point in the history of seismology was the study published in 1948 by William Hopkins, on the propagation of seismic waves, in which he followed the recently discovered theories of physical optics. The progress of seismology was paced by the development of seismometers and by the establishment of a sufficient number of seismic stations. The advent of radio communication which made possible an exact measurement of time and a precise synchronization of events in distant points, contributed to the progress of seismology. In 1846 Robert Mallet suggested the study of geological properties of a region by artificially produced seismic waves. A great step forward was made by Wiechert in 1906, when he built his seismograph with a magnification of 50,000. The author describes his own experiments with seismic waves produced by a falling weight. He also discusses the patterns of seismic waves around a salt dome, over a fault, and over stratified ground. Valuable information on the struc-

ture of the earth's crust was obtained from seismic observations made in connection with the Helgoland explosion, when it was possible to determine the sequence of layers that underlie the European area to a depth of over 600 kilometers.—*S. T. V.*

11077. Miyamura, Setsumi. The two faults caused by the Tottori earthquake of September 10, 1943 [in Japanese with German summary]: Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 22, pt. 1, pp. 49–59, Tokyo, 1944.

The destructive earthquake which occurred in the Tottori-ken, Japan, on September 10, 1943, produced two almost parallel fault escarpments trending in a west-southwest direction. At the eastern end of one fault, the northern side was uplifted, at the western end, this side subsided and was displaced westward in relation to the southern flank. On the contrary, the other fault line showed everywhere a lowering of the northern side. The vertical displacement in both faults was greater than the horizontal, and at some places reached 4 to 5 meters. Repeated measurements showed that the disturbed ground has a slight tendency to return to its initial position.—*S. T. V.*

11078. Morelli, Carlo. Problemi di sismologia moderna [Problems of modern seismology] Scienza e Tecnica, vol. 7, no. 7–8, pp. 284–294, Rome, 1943.

The author describes various kinds of earthquakes, and the laws of propagation and methods for investigation of seismic waves. The contributions of seismology to the knowledge of the earth's structure, and the causes of normal, intermediate, and deep-focus earthquakes are discussed. On the basis of seismological evidence the author suggests the following structure of the earth: an outer layer, about 900 kilometers thick, characterized by an increase of velocity of seismic waves with depth; beneath this an intermediate layer in which the velocity of seismic waves either remains constant or increases very slowly; and finally in the center of the earth, a core.—*S. T. V.*

11079. Nasu, Nobuji. A note on seismic prospecting in coal fields. Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 20, pt. 1, pp. 229–236, 1942.

No geophysical method exists for directly detecting coal or oil deposits. Geophysical methods can only indicate geological formations ordinarily associated with those minerals. In most of the coal fields explored by the author the coal-bearing strata underlie superficial low-speed layers of a young geologic formation. The author discusses such a formation of several horizontal layers and the travel-time curve of a refracted wave for it. From the derived equations the thickness of the individual layers can be obtained. More than three layers need seldom be considered. The derived formulas are applied to several practical examples with wave velocities ranging from 1,500 to 5,400 meters per second. In placing the geophones care must be taken that no reflected wave from any layer is lost, as this would vitiate the findings of the survey.—*S. T. V.*

11080. Nasu, Nobuji. Seismic exploration of river deposits. Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 20, pt. 1, pp. 225–228, 1942.

The ground around the sites where bridges were to be constructed over the Huzi (Fuji-kawa), Ooi, and Tenryu (Tenryū-gawa) in Japan were explored by the seismic reflection method. Numerous preliminary measurements of the surface velocity were made because it was found that river valleys usually have considerable anisotropy in the uppermost layer of the ground. The instruments used were mechano-optical detectors with a magnification of 40,000.

Velocities ranged from 300 to 600 meters per second in the uppermost layer. Velocities in deeper layers ranged from 700 to 3,100 meters per second. The author recommends placing foundations of heavy structures in underlying layer because the uppermost layer has not sufficient "bearing power."—*S. T. V.*

11081. Neumann, Frank. What everyone should know about earthquake risk: Earthquake Notes, vol. 20, no. 1, pp. 1–3, 1948.

The author discusses the dangers from earthquakes to which structures in different regions of the United States may be exposed and suggests some precautions to be observed in construction work. A map based on the history of destructive earthquakes shows the seismic probability in various regions in the United States.—*S. T. V.*

11082. Olson, W. S. Geophysical history of the Tucupita oil field, Venezuela, in Geophysical case histories, vol. 1, 1948, pp. 611–618, Menasha, Wis., Soc. Expl. Geophysicists, 1949.

The Tucupita oil field in the Orinoco delta was discovered as a result of a regional seismic reflection survey. Because the delta is a swamp traversed by a network of river distributaries, the equipment consisted of a fleet of 35 vessels, including a house boat and a shop barge. Continuous profiling was employed with the aid of cross-spreads in some areas and of spot correlations across gaps caused by lack of data and across fault zones. Problems of weathered layers constituted major obstacles, and some areas proved refractory to all methods.

The results showed a zone of no reflection about 500 meters thick, representing the Freites shale section at depths of 1,200 to 1,650 meters. Below it were reflection horizons representing the combined Oficina and Temblador formations 500 meters thick, consisting of an alternating sandstone and shale series resting on basement rock. These zones permitted good determinations of the direction and magnitude of fault displacement, so that the depth of 5,600 feet for the top of Oficina sands, calculated from reflection tops, compared well with the actual figure of 5,509 feet. Oil accumulation is considered due to a fault which interrupts the regional monoclinal dip.—*V. S.*

11083. Oulianoff, Nicolas. Analyse séismique des noyaux basiques des massifs granitiques Mont Blanc-Vosges et Aar-Fôret Noire [Seismic analysis of the basic cores of the granitic massifs Mont Blanc-Vosges and Aar-Black

Forest]: Soc. Vaudoise Sci. Natur. Bull., vol. 64, no. 272, pp. 117–131, 1948.

Previous research on the deep structure of the Alps, based on seismic records of the earthquake of January 25, 1946, in Switzerland, is continued by an analysis of additional seismic evidence, gravitational data on the Alps, and tectonic information. Four profiles passing from the epicenter near Montana Vermala to the stations of Neuchâtel, Basel, Zürich, and Chur, situated at approximately the same altitude, are studied on the basis of the localization of the hypocenter at a depth of about 10 kilometers and of observations on P_2 phases as well as on P_1 phases supposed to be longitudinal waves of the P_n type partly refracted through the deeper crustal layer.

Determination of the thickness of the sial and sima crustal zones by a graphic method, assuming wave velocities of 5.78 km./sec. and 8 km./sec. and considering the gravitational data of W. Heiskanen and E. Salonen, leads to the conclusion that there is in this region an intermediate layer between the granitic layer and the sima, characterized by the phase P^*, and that the thickness of the granitic layer varies from one profile to another. Granitic thickness for each profile is determined on two assumptions, of horizontal and of sloping boundaries of the sima and the intermediate layer. The different results are correlated in a schematic geologic section through three profiles, showing the approximate ratios of granitic and of intermediary thicknesses in the entire Alpine area of the Mont Blanc-Vosges and Aar-Black Forest.—*V. S.* (For previous study *see* Geophys. Abstracts 131, no. 9581.)

11084. Palmer, R. L. Field techniques in marine seismic exploration [abstract]: Geophysics, vol. 13, no. 3, pp. 493–494, 1948.

This paper presents a brief history of marine seismic exploration accomplished in submerged areas prior to 1944. This exploration covered inland or protected waters, but only a few offshore explorations. The increased demand for oil and the diminishing returns from land exploration gave the impetus required to start marine research and exploration in the Gulf of Mexico and other large areas of shallow water. The paper also gives a brief history of the refraction method as a means of reconnaissance exploration, with its merits and limitations. Several illustrations show line layouts and buoys adaptable to this type of exploration.

The detailed discussion that follows deals primarily with five phases of field operations, namely surveying, sizes and types of boats most suitable for work, placing of shots in water, line layouts for reconnaissance and detailed surveys, and methods of placing geophones in water. Numerous illustrations show the history of reflection marine technicques and equipment developed since 1944. The approximate acreage already leased in the Gulf of Mexico from Brownsville, Tex., to Mobile, Ala., is given.—*V. S.*

11085. Peterschmitt, Elie. Sur la détermination rapide des épicentres approchés des séismes éloignés [On the rapid determination of approximate

epicenters of distant earthquakes]: Inst. Phys. du Globe Strasbourg Ann., new ser., vol. 4, pt. 3, pp. 106–107, 1948.

The approximate epicenter of earthquakes may be determined quickly by using data from two stations within 150 to 400 kilometers of each other and at epicentral distances greater than 1,000 kilometers. The azimuth of the epicenter from one of the stations may be expressed as a function of the epicentral distance and the difference in epicentral distances of the two stations, the latter being determined from the difference in arrival times of one or several waves. To simplify calculation, it is convenient to make nomograms for each pair of stations.—*V. S.*

11086. Petroleum World. Dr. Poulter develops new method of seismic exploration: vol. 35, no. 12, pp. 32–33, 1948.

This new method of seismic exploration permits greater speed and economy by eliminating the drilling of shot holes. According to the author, when explosives are fired in a shot hole, a spherical wave is formed and a major portion of the energy is absorbed within one or two feet from the point of explosion. Such an explosion also generates a surface wave or ground roll, often injurious to surrounding buildings. Using several specially shaped small charges distributed in a certain pattern over the ground, an essentially flat wave of low amplitude is produced which spreads over a larger area, producing clear reflection even under difficult geological conditions.—*S. T. V.*

11087. Ramirez, J. E. The Pasto, Colombia, earthquake of July 14, 1947: Seismol. Soc. America Bull., vol. 38, no. 4, pp. 247–256, 1948.

On July 14, 1947, the city of Pasto, Colombia, was shaken by an earthquake of intensity IX, Modified Mercalli scale, followed by 3 less severe shocks on the same day. Pasto is situated on the lower eastern slopes of the semidormant Andean volcano El Galeras (Volcán de Galeras) in the seismically active region of Nariño. The earthquake was registered in Bogotá at the Instituto Geofísico de los Andes Colombianos, 510 kilometers from Pasto, but not at Balboa, San Juan, or Tucson. Additional information was gathered by the author through questionnaires. The study made from these data, primarily of macroseismic effects, is reported together with an isoseismal map of the area.

The evidence shows that the waves were propogated more easily along the mountain chains than in other directions and that the depth of the focus may have been less than 10 kilometers. Though there are no known faults in the epicentral region, the earthquake is considered likely to be of tectonic origin because the nearby volcano El Galeras showed no activity.—*V. S.*

11088. Ramirez, J. E. Preliminary report concerning the research on short-period microseisms at Saint Louis University: Am. Geophys. Union Trans., vol. 29, no. 4, pp. 570–574, 1948.

Investigations of microseisms of various periods from one minute to thousandths of a second are summarized briefly. As part of the present

study on the nature and origin of microseisms with periods of 0.2 to 0.5 second, a tripartite station has been set up on the grounds of the Florissant seismograph station. Each station is equipped with three components of capacity type seismographs and two microbaragraphs.—*M. C. R.*

11089. Review of Scientific Instruments. Vol. 20, no. 1, p. 90, 1949.

An instrument for measuring the intensity of seismic waves propagated through the earth during seismic explosions has been developed by the General Electric Company. It can register shocks of an intensity up to 1,500 *g*, and of frequency up to 10,000 hertz. It operates as a crystal detector. Indications can be amplified and registered.

Such an instrument called "earth shock acceleraton detector" was used by the Tennessee Valley Authority during construction work of the Watauga Dam.—*S. T. V.*

11090. Rice, R. B. A discussion of steep-dip seismic computing methods: Geophysics, vol. 14, no. 2, pp. 109–122, 1949.

Several standard computing techniques commonly used in steep-dip areas are compared. Formulas for the horizontal displacements and depths of reflection points are derived for the curved-path, straight-path, modified wave-ray, and depth-displacement methods, assuming a parabolic increase of velocity with depth, and the results obtained for a typical velocity function are compared graphically. The over-all results of applying these methods to computation of asymmetric structural profile are also compared graphically.—*M. C. R.*

11091. Richter, C. F. and Nordquist, J. M. Minimal recorded earthquakes: Seismol. Soc. America Bull., vol. 38, no. 4, pp. 257–261, 1948.

The magnitude of an earthquake was originally defined by Richter as the common logarithm of the maximum displacement expressed in microns, of the trace written by a standard torsion seismometer at an epicentral distance of 100 kilometers. A group of shocks near Riverside, California, February 18 and 19, 1948, afforded opportunities for studies of small magnitudes. The magnitude of the principal shock was determined by the usual method and magnitudes of the smaller shocks by comparison of amplitudes. Magnitudes as low as 0.4 were identified. The increase in number of earthquakes with decrease in magnitude continues at least to magnitude 0.4 The energy of these minimal shocks is calculated as 2×10^{12} ergs. A note added in proof states shocks of magnitudes down to 0.0 were observed near the Haiwee station on June 10, 1948.—*M. C. R.*

11092. Rothé, J. P. La séismicité des Alpes occidentales, compléments [The seismicity of western Alps, supplement]: Inst. Phys. du Globe Strasbourg Ann., new ser., vol. 4, no. 3, pp. 88–105, 1948.

Supplementary information is given on the seismicity of western Alps to complete, detail, and in some cases correct data previously published by the author (*see* Geophys. Abstracts 124, no. 8383). Seismic arcs of Piedmont and Briançon and epicenters in Haute Vesubie are discussed.

The general nature of seismic disturbances in the Alps is examined, and earthquake movements are classed as ground lifting, lowering, and shearing. The previous chronologic list of principal earthquakes is expanded to a total of 876 entries by the addition of 220 shocks. A bibliography is appended.—*V. S.*

11093. Snedden, L. B. Geophysical history of Gill Ranch gas field, in Geophysical case histories, vol. 1, 1948, pp. 596–601, Menasha, Wis., Soc. Expl. Geophys., 1949.

The Gill Ranch gas field, Madera County, California, is an example of the type of reflection prospecting which was successful in developing several gas and oil fields on low amplitude structures in the northern part of the San Joaquin Valley. A detailed reflection survey was carried out in 1940–41 by using continuous subsurface coverage technique with a gridwork of lines spaced approximately 4,000 feet apart and with a shot-point spacing of 1,200 feet. Contour maps were constructed on the top of the Kreyenhagen, base of Second Panoche sand, and on the basement rocks. There are at present nine producing wells in the field.—*V. S.*

11094. Stoneley, Robert. The continental layers of Europe, introduction and résumé of earlier estimates: Seismol. Soc. America Bull., vol. 38, no. 4, pp. 263–274, 1948.

The observed periods and group velocities of Love waves propagated across Eurasia indicate that the thicknesses T_1 and T_2 of the granitic and intermediate layers of Eurasia satisfy the approximate equation $2T_1+T_2=65.5\pm6$ km. If the equation obtained by Jeffreys from Japanese deep-focus earthquakes, $T_1+0.85\ T_2=30.3\pm1.3$ km., is accepted, we find $T_1=32.2\pm7.4$ km. and $T_2=-6.8\pm9.4$ km., implying that the thickness of the intermediate layer is not significantly different from zero. Taking $T_2=0$ would then give $T_1=33\pm3$ km.

This value does not seem compatible with the observed rate of outflow of heat; but the data concerning the rate of generation of heat through radioactive disintegration are very uncertain. Combined with the Love-wave equation, the isostatic equation indicates a thickness of about 30 kilometers for the floor of the Pacific Ocean; this is in general agreement with the work of Byerly and Vening Meinesz.

The deep-focus earthquake equation then indicates that the base of the granitic continent, without any "intermediate layer," should be at about the same level as the lower surface of the basalt layer under the Pacific Ocean, both continent and ocean floor resting on the horizontal surface of ultrabasic material. The need for further investigations into the propagation of surface elastic waves is manifest.—*Author's summary.*

11095. Stulken, E. J. Computation aids for solving refractions [abstract]: Geophysics, vol. 13, no. 3, p. 498, 1948.

A discussion is given of the following four cases: Multilayered section of constant velocities; velocity of the type $v=v_0+Az$; velocity of the type $v=v_0\sqrt{1+Az}$; and velocity of the general type $v=v_0(1+Az)^{1/n}$.

For each case mention is made of a means of identifying the velocity function and of depth computation methods. The construction and use of new computational charts is described.

11096. Treskov, A. A. Determination of principal discontinuities in the earth's structure by the method of fictitious waves [in Russian]: Akad. Nauk SSSR Izv., Ser. Geog. i Geofiz., vol. 12, no. 5, pp. 463–473, 1948.

The author uses for the investigation of the earth's structure "fictitious waves" which have a travel time equal to the difference between the travel times of transverse and longitudinal waves. By this means the principal discontinuities in the earth's interior have been located at depths of about 900 and 1,800 kilometers, and the boundary of the earth's core has been placed at a depth of 3,720 kilometers, on the assumption that *S* waves propagate to an epicentral distance of 105°.

The first discontinuity is found at a somewhat shallower depth than the depth of 1,000 to 1,200 kilometers assigned to it by other investigators, whereas the second discontinuity is at about the same depth as that determined by others. The theoretical calculations are presented, and the data computed on the basis of A. Sieberg's tables, 1923, and those of Jeffreys and Bullen, 1940, are tabulated and plotted in graphs.—*V. S.* (*See* also Geophys. abstracts 121, no. 7982.)

11097. Tsuboi, Chuji. Secular deformations of the base line rhombus at Mitaka in relation to seismic activities in the vicinity: Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 19, pt. 4, pp. 559–578, 1941.

In 1916 the Japanese Geodetic Commission established a set of five geodetic base lines in the compound of the Tokyo Astronomical Observatory at Mitaka. Each of these lines is approximately one hundred meters in length. The lines form two equilateral triangles. Measurements of the lines have been repeated twenty-five times between 1916 and 1939 with the utmost care and precision. Variations in length of the base lines between successive measurements were usually only a few tenths of a millimeter, but occasionally amounted to a millimeter or more. The author investigated the relationship between the length variation of these lines and the action of 230 earthquakes which occurred in this region since the first measurement. He concludes that the presence of the mechanical stresses, once generated in the ground, has an important bearing on the particular ways in which the consecutive earthquakes differ from each other, especially in their first shocks.—*S. T. V.*

11098. Tuve, M. A., Goranson, R. W., Greig, J. W., Rooney, W. J., Doak, J. B., and England, J. L. Studies of deep crustal layers by explosive shots: Am. Geophys. Union Trans. vol. 29, no. 6, p. 772, 1948.

As part of a study of the nature of the earth's crust, undertaken as a cooperative venture between the Department of Terrestrial Magnetism and the Geophysical Laboratory of the Carnegie Institution of Washington, an attempt has been made to determine the layering of the crust underlying the region around Washington, D. C., and the Appalachian highlands using the best combination of refraction, and vertical- and

critical-angle reflection of seismic waves resulting from controlled detonations of high explosives. From time distance curves of refraction observations made to distances of 350 kilometers from exploding charges of 600 to 4,000 pounds, the following layering and compressional wave velocities have been found in the vicinity of Washington: 0–10 km., 6.0–6.17 km./sec.; 10–24 km., 6.7 km./sec.; 24–42 km., 7.05 km./sec.; 42–? km., 8.15 km./sec.—*M. C. R.*

11099. Ulrich, F. P. Progress report of seismological work by the United States Coast and Geodetic Survey in the western United States during 1947: Seismol. Soc. America Bull., vol. 38, no. 4, pp. 275–288, 1948.

During 1947 the Coast and Geodetic Survey continued its seismological activities in the western United States, placing increased emphasis on the development of cooperative investigations. Data on the observed earthquakes of intensity V or greater are tabulated, principal earthquakes are described, epicentral distribution is shown on a sketch map, and isoseismic contours for the earthquakes of April 10 and November 23, 1947, are plotted. A brief outline is given of the work on the questionnaire program, strong motion, vibration, tiltmeter and teleseismic registration, instrumental development, cooperative projects with the U. S. Bureau of Reclamation, and the American Republics program. The activities of the Washington office are listed.—*V. S.*

4. ELECTRICAL METHODS

11100. Belluigi, Arnoldo. L'impiego della "Geofisica Applicata" in miniera [Use of applied geophysics in mining]: Experientia, vol. 5, no. 3, pp. 111–112, 1949.

The author points to the necessity of establishing a new branch of geophysics which can be applied to exploration of metalliferous mines. Electrical inductive methods can be used in such cases with certain modifications imposed by specific conditions found in the mines. In mines, objects experimented upon, such as ore bodies or galleries, are always of finite dimensions and do not permit the use of infinite limits of integration.

As an example the author calculates Foucault currents generated in a rectagular prismatic body of given electromagnetic properties and shows that the problem can be reduced to an integral equation of the second kind, which can be solved by Neumann's method.—*S. T. V.*

11101. Cagniard, Louis. Importance des phénomènes d' anisotropie dans le problème de l' interprétation des données d' un sondage électrique, conséquences pratiques [Importance of the phenomena of anisotropy in the problem of interpretation of data of electrical sounding and practical consequences]: Inst. Phys. du Globe Strasbourg Ann., new ser., vol. 4, pt. 3, pp. 3–28, 1948.

Theoretical considerations underlying electrical exploration by continuous currents are summarized to aid in the interpretation of electrical data by geophysicists, geologists, and engineers. The exposition deals mainly with a generalized application of principles of electrical conductivity in isotropic media to anisotropic media, especially in cases

characterized by uni-axial anisotropy. The equivalence between the two types of media is analyzed mathematically for the general application, for 2 thin layers, and for pseudo-anisotropy.

General equations are deduced for the distribution of electric current in any subsurface medium having a stratification parallel to the ground surface and either satisfying, or not, conditions of homogeneity, isotropy, and continuity. Practical application to electrical exploration is envisaged as, first, the finding of a hypothetical isotropic medium corresponding to the field data obtained and, second, as the determination of the actual equivalent medium by the introduction of corrections for anisotropy. Coring data on anisotropy can aid in estimating these corrections.—*V. S.*

11102. Chao, J. S., and Kao, S. K. The field test of the potential gradient method: Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp. 56–58, 1948.

The potential-gradient method of electrical prospecting developed by W. P. Weng was tested over two known geologic structures in China. In a survey of the Shih You Kou anticline in Szechwan use was made of a direct current of 1 ampere supplied by a 220-volt generator through two current-electrodes spaced 3,000 meters apart. The change of potential between receiving electrodes set 100 meters apart was measured by means of a vacuum-tube voltmeter, with a D'Arsonval galvanometer as an indicator. The skewed curve of apparent resistivity plotted from the results showed close correspondence with the geology of the asymmetrical anticline which had been surveyed in 1937 by electrical logging of a test hole and was found to contain highly resistive strata of Jurassic sandstone and Triassic limestone. The curve flattened as soon as the depth of the limestone exceeded the penetrating depth of the current.

At the Kan You Chuan anticlinal dome in Kansu the electrode spacings employed were half as large as in the first survey, and a micro-ammeter was used with the voltmeter as an indicator. The apparent resistivity curves again reflected the configuration of the structure. It is concluded that the potential-gradient method can be employed in areas of favorable geology, but that its application is handicapped by the necessary use of long cable lines and of a highly sensitive instrument.—*V. S.* (For a description of the method *see* Geophys. abstract 11112).

11103. Enenstein, B. S. Electrical sounding with a single pole [in Russian]: Akad. Nauk SSSR Izo., Ser. Geog. i Geofiz., vol. 12, no. 3, pp. 221–230, 1948.

Single-pole electrical sounding, in which the difference of potential is affected practically by only one of the feeding electrodes, was demonstrated by A. N. Tikhonov to possess a greater resolving power in the exploration of subsurface structures than dipole sounding. The author has studied various techniques of such sounding and concludes that at present the workable solution is to remove one of the feeding electrodes along the cable line (drawn perpendicularly from the middle of the receiving line) to such a distance that it would cease to exert an influence on the measured potential. He investigated the length of this distance by field experiments made over stratified media, with the nearer feeding electrode placed in various positions. The tests, which

are described, showed the necessary distance was generally 3 to 5 times the length of the receiving line.

In the method developed in the course of this investigation a T-shaped electrode configuration, which has one of its feeding electrodes grounded at the lower end of the T-base, is used. Two converging single-pole soundings are made, simultaneously with two other electrodes disposed on opposite extensions of the receiving line at the T-head. The results obtained in the region of the Volga, which are outlined, have shown that it is possible to determine the presence of a gently sloping reference horizon and the orientation of its axis of inclination even under the geologically and electrically complex local conditions.—*V. S.*

11104. Fritsch, Volker. Die Ausbreitung hochfrequenter Hertzscher Felder in Kalilagerstätten [Propagation of Hertzian fields of high frequency through potassium deposits]: Geofis. Pura e Appl., vol 12, no. 1–2, pp. 23–52, 1948.

During World War II the author made extensive experiments on the propagation of radio waves through potassium deposits, to test the possibility of applying radio waves to exploration for minerals, especially potassium, and of using radio communciation methods in the mining industry particularly in cases of disasters when telephone lines are destroyed.

A geologic structure typical of the potassium deposit explored consists of 5 to 10 meters of humus, a layer of sandstone or clay 400 to 600 meters thick, a similar layer of gypsum, and, at the depth of some 1,000 meters, a rich layer of potassium salt. Potassium salts are very poor conductors of electricity, as are most of the overlying formations.

The author established the possibility of employing radio waves for exploration and for wireless communication over distances of several kilometers between points on the surface and in the mines. Experiments were carried out with various frequencies and varying emission power. German Army Signal Corps instruments were used.—*S. T. V.*

11105. Gabelman, J. W. A preliminary report of a self-potential survey of the Anglo-Saxon vein, Georgetown, Colorado [abstract]: Colorado-Wyoming Acad. Sci. Jour., vol. 3, no. 5, pp. 38–39, 1948.

In 1946 an electrical self-potential survey was conducted at the Anglo-Saxon mine, Georgetown, Colo., to test indications that the Anglo-Saxon vein projects into the vicinity of the old Anglo-Saxon Extension workings. Exploration was confined to an area 100 by 250 feet, where the two veins were believed to be about 75 feet apart and converging. The equipment consisted of a potentiometer, porous pot-electrodes, and 300 feet of wire. Ground potentials, measured every 25 feet, roughly outlined the Extension vein and indicated the presence of the Anglo-Saxon vein. Anomalies were of the order of 30 to 100 millivolts.

Methods of the equipotential line, Gish-Rooney resistivity, potential drop ratio, and Metallascope were also tested but were unsuccessful because of difficulties with equipment and unexpected terrain conditions. It is believed that the self-potential is the simplest, most economical,

and most successful method for this district. The other methods may be used if changes are made in equipment and procedure.—*V. S.*

11106. Ku, K. G. On some new anomalous results of earth current investigations in mountainous areas of southwest China: Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp. 30–39, 1948.

Spontaneous polarization surveys were made with non-polarizable electrodes and potentiometers at several mining localities in the mountainous areas of southwestern China. The results revealed additional features of earth currents in mountainous regions observed by a number of authors in Europe and elsewhere. The difference of potential between points situated about 500 meters apart along a mountain slope was as large as 0.8 volts. Contrary to the published findings, there were many cases in tunnels or on steadily rising slopes where the current flow changed its direction along traverses, forming "negative centers." The possible relation of the current to oxidation of mineral deposits or to other electrochemical processes in the earth is discussed, but no conclusions are reached on the causes of the current flow.—*V. S.*

11107. Levin, M. L. Propagation of a plane electromagnetic wave in a medium of periodically recurring layers [in Russian]: Zhur. Tekh. Fiz., vol. 18, no. 11, pp. 1399–1404, 1948.

The author considers that the effect of periodically recurring dielectric layers on the propagation of electromagnetic waves is not correctly determined by the usual method of taking into account the coefficient of their reflection from a single layer because of the dispersion of the recorded impulse and interruptions in the spectrum of frequencies. He analyzes the propagation of a primary plane transverse electromagnetic wave in a medium comprising within its stratification periodically recurring dielectric layers extending infinitely in the direction of the wave's motion. As the local geometry of all primary waves is the same, the study deals only with a homogeneous plane wave. A dispersion equation is deduced and is applied to the cases of long and short waves. The generalized character of the results makes them applicable to waves other than electromagnetic ones.—*V. S.*

Magnée, Ivan de. Geophysical prospecting in the Belgian Congo. *See* Geophys. abstract 11137.

11108. Mironov, A. T. A survey of electrical current in the Black Sea near the southern coast of the Crimea from May 1946 to March 1947 [in Russian]: Akad. Nauk SSSR Izv., Ser. Geog. i Geofiz., vol. 12, no. 2, pp. 89–97, 1948.

For nearly a year differences of natural electric potential were observed on two electrodes immersed in the waters of the Black Sea 250 meters apart along the southern coast of the Crimea. These observations are compared with records of the geomagnetic field and records of telluric currents published for the same period by the Institute of Terrestrial Magnetism, Moscow. The data, presented in tables and graphs, show a greater correspondence between magnetic and local electric variations than between magnetic and telluric variations.

The analysis suggests a close relationship between the natural electric current in the sea and the intensity of the geomagnetic field. It tends to confirm the author's view that the phenomena of terrestrial electricity can be studied better at sea than on land because they are less affected by local factors. A correspondence is also noted between the times of increased amplitudes of the electric current in the sea and the times of the passing of the spots and floccula over the sun and the appearances of aurora, both connected with solar corpuscular activity.—*V. S.*

11109. Niessen, K. F. The earth's constants from combined electric and magnetic measurements partly in the vicinity of the transmitter: Zeitschr. Naturf., vol. 3a, no. 8–11, pp. 552–558, 1948.

The author suggests a new method of determining of the dielectric constant and the electric conductivity of the ground from measurements of electric and magnetic fields around a radio transmitter. The method is based on different laws of variation of the electric and magnetic fields with distance from the transmitter. The results are presented in a set of master curves constructed for different directions.—*S. T. V.*

11110. Rikitake, Tsuneji. Measurement of earth current in Sakura-jima after the eruption [in Japanese, with English summary]: Tokyo Imp. Univ. Earthquake Res. Inst. Bull., vol. 24, pts. 1–4, pp. 217–220, 1946.

Variations in the north and east components of the earth current were measured at Furusato near the southern coast of Sakura-jima, from March 27 to April 11, 1946, to determine the effects of the eruption of March 9, 1946. The technique of measurements was the same as that used at the time of the Tottori earthquake of 1943.

During the observations the earth potential changed gradually in both components about 100 mv./km. Diurnal and short-period variations were noted, which could be attributed to electromagnetic induction caused by variation in the geomagnetic field. On April 5, between 16 hours and 18 hours, the earth current varied anomalously, especially in the north component, but there were no changes in volcanic activity either before or after this variation. It is concluded that the evidence has shown no relation between the variation of earth current and that of volcanic activity.—*V. S.*

11111. Wantland, Dart. An example of a successful mining geophysical survey [abstract]: Colorado-Wyoming Acad. Sci. Jour., vol. 3, no. 5, pp. 36–37, 1948.

The geologic problems, technical procedures, and ultimate results of magnetic and self-potential surveys are illustrated by the exploration at the Malachite mine near Morrison, Colorado, in 1937–39. A zone of sulfide deposits occurs here in an amphibolite belt between the gneiss and the schist of the Idaho Springs formation. The survey showed that magnetic "highs" were associated with magnetite in the wall rock and with pyrrhotite in lenticular zones, and that a pronounced self-potential minimum was related to chalcocite in such zones. A prospect tunnel driven to test the self-potential "low" uncovered a new ore body.

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The possibilities of geophysics in mining and of accessory geologic surveying in Colorado are discussed on the basis of these results and of a memorandum dating back to 1934, and one of the projects of this memorandum, considered to have current possibilities, is outlined.—*V. S.* (*See* also Geophys. Abstracts 128, no. 9040.)

11112. Weng, W. P. A potential-gradient method for electrical survey: Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp. 51–55, 1948.

A new potential-gradient method of electrical prospecting is advanced as a modification of the resistivity method of F. Wenner. It consists of applying a direct current through two widely spaced electrodes and measuring the potential gradient at points between them. The gradient is determined by observing potential change at successive pairs of closely spaced points by means of receiving electrodes, as the current is switched on and off to eliminate the residual, stray contact, and other undesirable potentials. A sensitive potentiometer must be used so that it can measure sudden changes of potential difference.

The apparent resistivity is computed from the potential gradient, and the values are plotted along the line of measurement. Definite interpretation of results is not possible unless the survey is made over a small area where the distance of the measured points from the center of the line between the current electrodes is short. Otherwise the same curve can be obtained both from level layer of highly resistive material or from a syncline or anticline, as is shown by a mathematical analysis of the two-layer problems.—*V. S.*

5. RADIOACTIVE METHODS

11113. Chalard, Jacques. Application du compteur de Geiger-Müller à la stratigraphie, dans le bassin houiller du nord de la France [Application of the Geiger-Müller counter to stratigraphy in the coal basin of northern France]: Acad. Sci. Paris Comptes Rendus, vol. 222, no. 9, pp. 506–508, 1946.

Application was made of the Geiger-Müller counter to stratigraphy in the coal basin of northern France. In searching for radioactive elements in the springs of northern France a shale horizon in the coal basin was found to possess a high radioactivity. Subsequently, good results were obtained by using the counter to trace other horizons. Doubtless it could give good results on reconnaissance work.—*Annot. Bibl. Econ. Geol. 1947, vol. 20, no. 2, p. 121, 1948.*

11114. Commonwealth of Australia. Radioactive mineral deposits, Bureau of mineral resources, geology and geophysics, Pamphlet no. 3, 36 pp., 1948.

This collection of notes for the guidance of uranium and thorium prospectors in Australia, contains a summary of the physical properties such as color, streak, luster, hardness, fracture, and specific gravity, of the minerals bearing uranium and thorium and lists the most important minerals with general comments on their deposits. This is followed by a description of different methods of detecting these minerals using Geiger-Müller counters, ultra-violet lamps, electroscopes, spinthariscopes, or a photographic procedure. Two colored plates show samples of the

most important minerals: pitchblende (uraninite), autunite, carnotite. monazite and others.—*S. T. V.*

11115. Curran, S. C., and Baker, W. R. Photoelectric alpha-particle detector: Rev. Sci. Instruments, vol. 19, no. 2, p. 116, 1948.

An alpha-particle detector of high sensitivity and short resolving time can be produced with the aid of a photoelectric multiplier as a detector of scintillations. An alpha-particle of 2×10^6 electron-volts energy releases about 1.1×10^5 quanta per scintillation, assuming a wave length of 4,500 A°. The sensitivity of the photoelectric multiplier is 5.1×10^{-15} coulombs/quantum. An anode resistance of 0.5×10^9 ohm was used. The background rate of counting was 0.5 pulse/minute. The most suitable screen material was found to be a blue phosphor of zinc sulfide. The screen recorded between 80 and 100 percent of the particles falling upon it. The apparatus is simple, sturdy, and free from difficulties caused by microphony.—*S. T. V.*

11116. Frongia, G. Contributo alla conoscenza della radioattività dei giacimenti metalliferi della Sardegna [Contribution to the knowledge of radioactivity of metalliferous ore deposits of the island of Sardinia]: Univ. Cagliari Fac. Sci. Rend., vol. 9, no. 2, pp. 1–20, 1938.

Sixty samples of different minerals typical of the island of Sardinia were tested for radioactivity, using a Geiger-Müller counter filled with rarified air operating with 1,000 volts tension. No important radioactivity was found in any of the minerals tested. The most active were some samples of granite with an equivalent radioactivity of 188×10^{-6} grams uranium per gram weight of the sample.—*S. T. V.*

11117. Hée, Arlette. Le thorium dans les substances faiblement radioactives et dans les roches [Thorium in weakly radioactive substances and rocks]: Inst. Phys. Globe Strasbourg Ann., new ser., vol. 4, pt. 3, pp. 30–59, 1948.

Previous studies have shown that the ionization produced by substances containing thorium is a function of the thickness and sometimes the age of the specimen, as well as of the nature of the substance, and thus cannot be used for estimating the amount of thorium present. The present investigation was aimed at determinating the role of thorium in weakly radioactive substances and rocks and the variation, if any, produced by thorium in their radiation. The samples used had equal surfaces but different thicknesses. Measurements were made with an electrometer equipped with a condenser of total radiation but known to register, by virtue of its dimensions, ionization attributable almost exclusively to alpha rays. The method consisted in compensating the ionization current with that of a standard condenser, so that the measured values were obtained directly in electrostatic units.

The results showed that in weakly radioactive substances the apparent effect of thickness is due to the liberation of thoron which depends on the permeability of the medium to gases, as is also the case with thorium minerals. When $Fe(OH)_3$, which facilitates the diffusion of thorium emanation was added to the powdered sample of rocks the

previous observation that the effect of thickness is not proportional to the amount of thorium was confirmed. The rocks studied included travertines and arkoses. Results suggested that radioactive prospecting would be aided by a knowledge of the permeability of rocks to radioactive gases.—*V. S.*

11118. Joyet, G., and Simon, M. Origine de l'effet de température sur le tube de Geiger-Müller à alcool-argon [Origin of the effect of temperature on the alcohol-argon Geiger-Müller tube] : Helv. Phys. Acta, vol. 21, pp. 180–183, 1948.

By preparing several Geiger-Müller tubes from different materials the authors investigated the cause of the effect of temperature on operating characteristics. Temperatures ranged between 4.9° C. and 45° C. It is concluded from the experimental results and theoretical considerations that the temperature effect is due not to alcohol-vapor dissociation but to the absorption of the alcohol vapor by certain materials in the walls of the tube. The most active materials are, in the order of their importance, cibanite, picene, and anticorodal. Pyrex, electrolytic copper, Aplezon *W* wax, and polystyrene do not provoke a temperature effect.—*Nucl. Sci. Abstracts, vol. 1, no. 8, p. 379, Oak Ridge, Tenn., 1948.*

11119. Lang, A. H. Notes on prospecting for uranium in Canada: Geol. Surv. Canada, Paper 49–4, 22 pp. 1949. ‡

In response to questions on prospecting for uranium in Canada, information is published on the general features of native uranium deposits, methods of finding them, and local characteristics of the country's principal districts favorable to uranium occurrence.—*V. S.*

11120. Marble, J. P. Some applications of autoradiography [abstract] : Internat. Geol. Cong., 18th Sess., Great Britain, 1948; Titles and abstracts of papers, pp. 6–7, 1948.

A properly prepared surface of a radioactive mineral, when placed in direct contact with a photographic plate or film for an optimum time, will yield valuable information as to relative radioactive content of different parts of the specimen, leaching, infiltration of radioactive matter, movements, subsequent to original crystallization, and other points. In some cases the existence of the metamict condition can be determined. By exposing for the same length of time chips of an unknown mineral with others whose $U+Th$ content is known, a semiquantitative estimate of the $U+Th$ content of the unanalyzed mineral can be quickly made.

11121. Schafer, W. D. The use of standard broadcast receivers as radiation indicators: U. S. Atomic Energy Comm. Doc. 2310 (LADC–554), 4 pp., Oak Ridge, Tenn., n. d., declassified Sept. 21, 1948.

By connecting a Geiger Müller tube to a standard home or automobile radio, an instrument is obtained which will indicate the presence of radioactivity and roughly measure its amount. Diagrams of the connection are given.—*Nucl. Sci. Abstracts, vol. 1, no. 8, p. 378, Oak Ridge, Tenn., 1948.*

11122. Smith, P. B. Dead-time reduction in self-quenching counters: Rev. Sci. Instruments, vol. 19. no. 7, pp. 453–457, 1948.

The various methods of dead-time reduction are investigated and discussed. The application of a large negative voltage pulse to the center wire, just after the discharge starts, reduces the dead time. This effect is due to a combination of stopping the propagation of the ion sheath, ion neutralization, and ion multiplication. In the most favorable case found, the dead time of a Geiger tube having a normal dead time of 160 microseconds is reduced to 80 microseconds by this means. Increasing the gain of the detecting circuit without a negative pulse does not reduce the dead time more than a factor of two, unless the counting rate is greatly increased so that all pulses are small. Operation with high gain just below the Geiger threshold shows efficiency of the order of 50 percent for beta particles, and no measurable dead time.—*Author's abstract.*

11123. Urry, W. D. The radium content of varved clay and a possible age of the Hartford, Connecticut, deposits: Am. Jour. Sci., vol. 246, no. 11, pp. 689–700, 1948.

The radium content of the summer and winter portions of the varves in the clay deposits at Hartford, Connecticut, vary rhythmically. When the radium contents of the summer and of the winter portions are plottted against time as measured by the varve count, the curves exhibit slopes of opposite sign, although the total radium content of any varve, is practically constant.

These phenomena may be due to a disturbance of the radioactive equilibrium but this hypothesis, while plausible, is far from proven. A greater concentration of the uranium relative to ionium in the winter clay than in the summer clay would also explain these phenomena. Such a disturbance of the equilibrium provides a means of determining the age of the deposits. On this basis one derives a tentative figure for the age of the Hartford clay (varve 3,700) of 18,000 years. The hypothesis of a disturbance of radioactive equilibrium is supported by the fact that the analyses of the summer and winter curves, which are completely independent, give very nearly the same age.—*Author's abstract.*

Wilson, J. Tuzo. Thermal and radioactive studies, 1947–48. *See* Geophys. abstract 11130.

11124. Wu, C. S., and Rainwater, L. J. Portable alpha-activity measuring instrument: U. S. Atomic Energy Comm. Doc. 2051 (DR–288), 20 pp., Oak Ridge, Tenn., May 25, 1945.

A portable sensitive alpha-particle detector has been developed for scanning and surveying small amounts of uranium metal on various surfaces. For the sake of simplicity and serviceability the method of an ionization chamber has been employed with a portable electrometer circuit. Units built in the laboratory have proved very satisfactory. The high sensitivity that has been achieved with these instruments approximates counter sensitivities. It is rather easy to detect 0.10 milligrams of normal uranium oxide. Circuit diagrams are given.—*Nucl. Sci. Abstracts, vol. 1, no. 1, p. 34, Oak Ridge, Tenn., 1948, condensed by V. S.*

6. GEOTHERMAL METHODS

11125. Beliakov, M. F. On the relation of geoisotherms to the pre-Cambrian relief of the Russian platform [in Russian]: Akad. Nauk SSSR Doklady, vol. 64, no. 2, pp. 225–228, 1949.

Temperatures in deep wells in the region of the middle Volga were studied to determine their relation to the local pre-Cambrian relief. The measurements were made with an electric-resistance thermometer principally in the areas of the Samarskaya Luka and of Buguruslan, situated about 235 kilometers apart, where the crystalline basement is known to slope from depths of about 1,500 to 3,000 meters. The results indicated a corresponding sloping in the profile of the geoisotherm of 25° C. from a depth of 1,000 meters at Samarskaya Luka to a depth of 1,500 meters at Buguruslan, and showed respective geothermal gradients of 49 and 72 m./C.°, exceeding the normal value of 33 m./C.°.

Though the configuration of the basement and of the geoisotherms in the section intervening between the investigated areas was not known, it is believed general parallelism between the geoisothermal contours and the structure of the Russian platform has been demonstrated for this region. The less reliable data for Tuymazy, 135 kilometers to the northeast from Buguruslan, showed a similar relationship. If substantiated, this parallelism would make possible a prediction of the configuration of the pre-Cambrian relief from shallower geothermal data.—*V. S.*

11126. Birch, Francis. The effects of Pleistocene climatic variations upon geothermal gradients: Am. Jour. Sci., vol. 246, no. 12, pp. 729–760, 1948.

The solution for the effect of variation of surface temperature upon the internal temperature of a semi-infinite conducting solid is arranged for convenient application to the problem of finding the disturbance of temperature in the earth resulting from climatic fluctuations. Numerical estimates for any specified climatic history are easily found by the use of tables of coefficients of "recollection." A schematic history, generalized from the work of several authorities, serves as a basis for calculating the disturbance of temperature down to 3 kilometers. It is shown that, in practice, the effects of very different climatic histories will be indistinguishable except under unusually favorable conditions. When the fluctuations of the Pleistocene and the warmer pre-Pleistocene climates are considered, the net disturbances are much smaller than when all time before some 20,000 years ago is treated as "glacial," as in former studies. A review of the observations of underground temperatures supports the conclusions of the analysis that the climatic correction to the geothermal gradient may never exceed 3° C./km., with a still smaller maximum correction more probable.—*Author's abstract.*

11127. Kovner, S. S. Thermal anomalies of the Ishimbay deposits [in Russian]: Akad. Nauk SSSR Doklady, vol. 64, no. 3, pp. 329–332, 1949.

A comprehensive geothermal investigation to test the author's techniques was made of the Ishimbay oil district, U. S. S. R., in the past several years. Assumed anomalies were first determined theoretically

by methods developed by the author for estimating the effects of geologic structures on the geothermal field. Calculations for each geologic section consisted in integrating by a specially simplified procedure a system of differential equations of thermal conductivity which took into consideration the coefficient of conductivity of the local rocks, the configuration of geologic boundaries, and the continuity of temperature and of heat flow. The results indicated the existence of anomalies that could be detected by thermal measurements of an accuracy of 0.1 degree.

To test these findings, temperatures were measured in 109 bore holes with mercury thermometers housed in special containers and lowered usually to depths of 100 and 200 meters, and occasionally to 50 and 300 meters. The local geology is outlined, and ratios of coefficients of rock conductivities are indicated. The anomalies detected coincided closely with the predicted ones, as appears from the tabulated values of theoretical and observed temperatures. Measurements at depths of 50 and 100 meters proved most reliable. It is concluded that calculations based on subsurface geologic configuration and on differences in the thermal conductivity of local rocks can be used to predict geothermal anomalies.—*V. S.*

11128. Noble, J. A. Evidence for a steepening of geothermal gradients in some deep mines and drill holes: Am Jour. Sci., vol. 246, no. 7, pp. 426–440, 1948.

Direct readings of rock temperatures taken along the line of the new Yates shaft of the Homestake mine, South Dakota, disclose a geothermal gradient that steepens notably in depth. Comparison of these results with those from several other deep mines and deep drill holes suggests that this steepening may be a general effect at the depths penetrated by those mines and drill holes. A possible cause is a gradual decrease in the thermal conductivity of rocks in depth due to a gradual decrease in the amount of intergranular moisture in the rocks.—*Author's abstract.*

11129. Verhoogen, Jean. Von Zeipel's theorem and convection in the earth: Am. Geophys. Union Trans., vol. 29, no. 3, pp. 361–365, 1948.

A theorem of astrophysics may be applied to the Earth and leads to conclusion that the distribution of radioactive matter is probably such that the temperature is not the same at all points on a level surface inside the Earth. These differences in temperature might give rise to convection currents that circulate in meridional planes. The velocity of these currents cannot be estimated for want of data on the actual distribution of temperature, but it may be a few centimeters per year.—*Author's abstract.*

11130. Wilson, J. Tuzo. Thermal and radioactive studies, 1947–48, Research Council of Ontario Progress Rept. no. 8–1–48, 1948. ‡

Progress made in geothermometry and radioactivity at the University of Toronto during 1947–48 is reported. A. D. Misener conducted geothermal measurements underground in seven Canadian mines. Readings in the drill holes of Tech-Hughes, Lake Shore, and Wright-Hargreaves mines gave a three-dimensional view of temperature distribution to 7,200-foot depth in the Kirkland Lake area. Measurements in the

Hollinger and McIntyre mines at Porcupine and in the Creighton and Murray mines at Sudbury established geothermal gradients in these districts. Rock specimens were collected for determinations of coefficients of thermal conductivity.

N. B. Keevil measured the alpha radioactivity of 6,000 specimens of North American rocks. Counters are now being used to study the distribution of radioactivity in the batholiths of Round Lake and Red Lake and in the Sudbury district. A mass spectrometer is being rebuilt for investigations of geological age.—*Canadian Geophys. Bull., vol 2, no. 3, pp. 35, 38, 1948, condensed by V. S.*

7. GEOCHEMICAL METHODS

11131. Kotiakhov, F. I. On the content of chlorides in oil-bearing strata [in Russian]: Neftianoe Khoziaistvo, vol. 26, no. 10, pp. 16–18, 1948.

As the composition of the interstitial water remaining in petroliferous strata can be related to the composition of the oil which supplanted it for the most part, the water from 70 drill-hole cores taken from Groznyy oil wells, in the Caucasus, was analyzed for its chloride content. Determinations were based on a titration of interstitial water extracts by the Winkler method after the surface layer of the cores had been shaved off to eliminate traces of drill-hole fluid. The results are plotted on graphs, and discussed in the light of local geology.

It is found that chloride content varies from one layer to another and also within the same layer. For example, in the Tashkala oil field the average chloride content in one layer was 4.8 grams per liter of interstitial water and 0.117 grams per kilograms of rock, while the chloride content on the periphery of the layer was only 0.575 grams per liter. In the Malgobek oil field, one layer had an average chloride content of 27 grams per liter of interstitial water and 0.187 grams per kilogram of rock, but an average chloride content of 12 grams per liter was found in the water on the periphery of this layer. No relation was observed between the chloride contents of interstitial water and the penetrability and particle diameter of the rock that contained it.—*V. S.*

11132. Vogt, Thorolf, and Bergh, H. Geokjemisk og geobotanisk malmleting—11, Sink og bly i jordprøver [Geochemical and geobotanical ore prospecting—11, zinc and lead in soil]: Kon. Norske Vidensk. Selsk. Forh., 1947, vol. 20, no. 26, pp. 100–105, 1948.

Results of 134 determinations of zinc and lead, made in 1942 and 1943 in soil samples from the outcrop of the southern Lossius sulfide deposit near Røros are given. The content of zinc varies from 4 to 7,500 milligrams Zn per kilogram of water-free soil, as shown in a tabulation of the distribution of the metal in different groups of results. As the zinc content in normal soil may be about 100×(50–200) milligrams per kilogram, the concentration factor near the ore deposits lies between 5 and 50. The content of lead ranges from 0 to 440 milligrams per kilogram of water-free soil, as shown in the same tabulation. The concentration factor may be of the same order for zinc and copper. The present method seems to be very useful for geochemical studies of deposits containing Cu, Zn, and Pb, and probably also for other heavy metals.—*Authors' abstract.*

11133. Vogt, Thorolf, and Bergh, H: Geokjemisk og geobotanisk malmleting—12, Bestemmelse av jern og mangan i jordprøver [Geochemical and geobotanical ore prospecting—12, Iron and manganese in soil] : Kon. Norske Vidensk. Selsk. Forh. 1947, vol. 20, no. 27, pp. 106–111, 1948.

The results of 72 determinations of iron and manganese in soil samples taken from the outcrop of the southern Lossius sulfide deposit near Røros are given. These data should be compared with the previous results presented in communications 10 and 11 of this series (*see* Geophys. abstracts nos. 10904 and 11132). The contents of iron versus manganese are found to vary between 100 to 45,000 milligrams versus 1 to 3,500 milligrams per kilogram of water-free, fine soil, as shown in tabulations and sketch maps. An additional sketch presents the regional distribution of the loss of ignition in water-free, fine soil, giving a rough expression of the contents of humus. These findings may lead to the utilization of concentrations of iron and manganese in soil ("bog ore") as diagnostic guides in geochemical prospecting for deposits containing iron sulfides.—*Authors' abstract.*

8. DRILL-HOLE METHODS

11134. Dakhnov, V. N. Geophysics of an oil field [in Russian], 424 pp., Moscow, Gostoptekhizdat, 1947.

A treatise is presented on physical methods of exploration of drill holes and oil fields. In the first chapter the author discusses the physical properties of different zones, analyzes the process of electrical conduction through a geologic formation, discusses the influence of porosity, chemical composition and water saturation. Several formulas are given for use in calculations, as well as numerous tables of physical characteristics of minerals. Electrical resistivity, dielectric constant, magnetic susceptibility, heat conductivity and heat capacity, mechanical strength, velocity of propagation of elastic waves, porosity and radioactivity are given for seventy minerals.

The possibility of using different physical properties for diagnostic purposes is emphasized. For instance, well logging can be based on measurements of dielectric constant because the contrast between an oil bearing horizon and a water reservoir is very great.

Well logging by the methods of resistivity and of natural potentials is discussed in detail. Many questions are treated mathematically, and a great number of diagrams and master charts are given. One of the special examples treated is the problem of a well with an artificially increased pressure of mud, making possible the detection of the effect of mud penetration into the formation.

Separate chapters describe instrumental equipment, measuring techniques, sources of errors and their correction.

Thermal, magnetic, and radioactive methods are covered in special chapters. Methods of mechanical coring are also discussed as well as the interpretation of results obtained.—*S. T. V.* (A review by A. G. Ivanov appeared in Sovetskaia Kniga, no. 4, pp. 17–20, Moscow, 1948).

9. UNCLASSIFIED GEOPHYSICAL SUBJECTS

11135. Brant, A. A. Some limiting factors and problems of mining geophysics: Geophysics, vol. 13, no. 4, pp. 556–581, 1948.

The force-field methods—magnetic, electrical resistivity, equipotential, self-potential, electromagnetic, gravimetric, and geothermal—where the forces observed result from the action of a natural or artificial field, are all limited by the decrease in anomaly according to an inverse power law with the depth of the anomalous body. Furthermore, large physical-property contrasts frequently occur in the surface material, making the detection and interpretation of subsurface conditions difficult. The structures controlling ore deposition are small, measuring the order of a few feet to hundreds of feet and are manifold in number. The direct detection of ore is seldom possible.

A more accurate assessing of the limitations and scope of existing methods to know the extent of their application, more rigorous mathematical interpretation procedures, development of methods for the detection of scattered sulfides, and drill-hole and underground exploration techniques are suggested as worthy of study.—*Author's abstract.*

11136. Ferris, J. G. Ground water hydraulics as a geophysical aid: Michigan Geol. Survey Division, Tech. Rep. no. 1, 15 pp., Lansing, Michigan, 1948. ‡

This is an analytical study of the conditions controlling the flow of a liquid through a porous underground formation when the efflux is from a central point. Problems of this kind are often met in hydrology and in studies of oil fields. The analysis is based upon the equation derived by C. V. Theis for the nonuniform flow of liquid through a formation. In the subsequent analytical development the method of images is used. The results of computations are presented in formulas as well as in graphs, convenient for numerical work. An experimental verification of the derived theory was made on an artesian well in Flint, Michigan. The results of the measurements were in satisfactory agreement with the developed theory.—*S. T. V.*

11137. Magnée, Ivan de. La prospection géophysique au Congo Belge [Geophysical prospecting in the Belgian Congo]: Centenaire de l'Assoc. Ing. Liège Cong. 1947, Sec. Coloniale, pp. 295–299, 1948 (?).

An account is given of geophysical exploration in the Belgian Congo since 1925. The local geology is not favorable to the accumulation of petroleum but indicates the presence of copper, cobalt, diamonds, gold, and tin. Electrical resistivity, spontaneous polarization, ratiometric, and magnetic methods were applied in various localities, mostly in Katanga.

Copper in Katanga occurs in dolomitic zones in complex structures. Resistivity surveys are useful in detecting carbonate rocks characterized by high resistivity, and spontaneous-polarization surveys help in indicating associated horizons of graphitic schists. These surveys were applied extensively in the cupriferous zone around Kambova-Kamoya and Luishia in conjunction with drilling. Ratiometric surveys by alter-

nating current, made by M. A. Nordström in Busanga and Lubembe in 1935 to investigate mineral deposits in local quartzites, proved less successful because of difficulties in interpretating the complex local geology.

The gold region of Kilo-Moto was explored by P. Duhoux with the vertical Askania magnetometer, the Gish-Rooney potentiometer, and the ratiometer of P. Fourmarier, Jr. This region presents difficulties because the surficial cover is over 30 meters thick and of variable composition whereas the quartz auriferous veins in the subsurface are small. The ratiometric method proved to be most effective. Diamond deposits in the region of Tshikapa and Bakwanga were explored by electrical methods. Other surveys are mentioned. M. Dehalu detected with a pendulum a very strong gravity anomaly in the region of lakes and volcanos in the eastern Congo.—*V. S.* (*See* also Geophys. Abstracts 123, no. 8270.)

11138. Thomsen, H. L., and Burton, G. A. Winter operation of geophysical equipment: Geophysics, vol. 14, no. 1, pp. 10–16, 1949.

This is the full text of the paper. For advance abstract, *see* Geophys. Abstracts 129, no. 9269.

10. RELATED GEOLOGICAL SUBJECTS

11139. Carder, D. S. and Small, J. B. Level divergences, seismic activity, and reservoir loading in the Lake Mead area, Nevada and Arizona: Am. Geophys. Union Trans., vol. 29, no. 6, pp. 767–771, 1948.

A net of first-order levels established in the Lake Mead area in 1935 by the U. S. Coast and Geodetic Survey was resurveyed in 1940–41 during the period of high water, thus affording comparison of levels under conditions of near minimum and near maximum reservoir load. In each case leveling was done more accurately than the specifications of the Board of Survey and Maps for first-order leveling. The extreme divergence between the two surveys was eight inches. In general, areas underlain by sedimentary rocks appear to be settling relative to areas of granites and pre-Cambrian gneisses. This supports the conclusion in an earlier report (*see* Geophys. Abstracts 125, no. 8522), based on studies of seismic activity in the area, that the crustal block occupied by the lower lobe of Lake Mead is downfaulting against the granitic masses to the southeast and southwest in a renewal of pre-Pleistocene activity under the stimulus of the added load of 12 billion tons of water.—*M. C. R.*

11140. Ewing, Maurice. Structure of the mid-Atlantic ridge [abstract]: Am. Geophys. Union Trans., vol. 30, no. 2, p. 170, 1949.

A study of the mid-Atlantic ridge by continuous depth sounding, bottom sampling, core sampling, seismic records, and bottom photography was made during a two-months cruise in 1947. The ridge between the Azores and latitude 29° N. appears to consist of a rugged central highland 60 to 200 miles wide almost entirely above 1,600 fathoms, flanked on both sides by broad terrace-like features from 1,600 to 2,500 fathoms

deep. West of the terraces there is a gradual descent to the western Atlantic basin at a depth of 2,900 fathoms. Seismic reflections show the depth of the principal buried horizon is 3,000 feet on the flanks, and only 100 feet on the central highland and in the western basin. S. J. Shand has identified the rocks dredged from the central highland as predominantly basalt with an abundance of serpentine and a mylonitized anorthositic gabbro.—*M. C. R.*

11141. Grigor'ev, I. F. The relationship between ore formation and intrusive rocks [in Russian]: Akad. Nauk SSSR Izv., Ser. Geol., 1948, no. 6, pp. 3–8, 1948.

The author outlines briefly existing views on the relationship between ore formation and intrusive rocks and illustrates them by examples showing that the connection between hydrothermal solutions and erupted magmatic bodies is closer than is usually believed. Some examples refer to ore deposits related to small porphyry intrusives, such as the silver-tin ores of Bolivia, tin-copper ores of Tasmania, gold-scheelite ores of Ontario, gold ores of Australia, Canada, and the Ural Mountains, copper ores of Spain, Chile, California, and Nevada, and lead-zinc ores of Germany, Colorado, and the Altai Mountains in Siberia. Other examples deal with ore deposits related to small intrusives located on the periphery of large granitoid massives but independent of them, as well as with various types of the initial hydrothermal modification of the enclosing rocks.—*V. S.*

11142. Harshman, E. N. Structural control of some Philippine ore deposits [abstract]: Colorado-Wyoming Acad. Sci. Jour., vol. 3, no. 5, pp. 37–38, 1948.

Rock structures have been dominant in the control of deposition of many Philippine ore bodies. The copper-gold veins of the Lepanto Consolidated Mining Co., Mountain Province, and the lead-zinc-gold veins of the Paracale Gumans Consolidated Mining Co., Camarines Norte, both in Luzon, are good examples of mineralization in which an impervious blanket or capping was responsible for the tenor and position of the ore.

In the Lepanto Mine, ore deposition was limited to 80 feet of brecciated footwall along a 600-foot-wide silicified shear zone. Enargite, gold, and chalcopyrite were deposited by the ore-bearing solutions. At the Paracale Gumans, ore was deposited in a number of parallel fractures in a granitic stock that intruded peridotite. Fractures were open and well defined in the granite, but were tight and poorly defined in the overlying peridotite. Details are given of structural control in both mineralized areas.—*V. S.*

11143. Hsieh, C. Y. Paleogeography as a guide to mineral exploration: Geol. Soc. China Bull., vol. 28, nos. 1–2, pp. 1–11, 1948.

The author describes the paleogeographic conditions of the formation of sedimentary mineral deposits in China with a view to suggesting clues useful for their exploration. Attention is given to the origin, distribution and varieties of deposits of coal, bauxite, phosphates, iron, and copper found in the various provinces. The text is illustrated by sketch maps of the principal zones of the deposits.—*V. S.*

11144. Koschmann, A. H. Addition to symposium on "Geophysics in mining:" Geophysics, vol. 14, no. 1, pp. 67–69, 1949.

Recent evidence on the distribution of ore in definite belts related to deep-seated structures increases opportunities for exploration by geophysical methods. Several features of a known mineralized belt in Colorado are as follows: the most productive deposits lie in a relatively straight and narrow zone; the belt trends transversely to the mountain ranges and intersects several of them; the ore occurs in rocks of diverse types and of all geologic ages; the belt of deposits coincides with a belt of intrusive and extrusive igneous rocks; and the belt is broken by a barren gap. As the mineralization apparently was not controlled by any surficial features, it must have depended primarily on a deep structure in the basement rocks. To the extent that this is generally true of ore deposits, geophysical measurements of the anomalies produced by such structures could aid in detecting the belts associated with them.

On the other hand, the application of the magnetic method in areas of pyrrhotite bodies has been proved ineffective in the Kokomo district, Colorado. Two reconnaissance transverses were recently run by J. H. Swartz for the U. S. Bureau of Mines across one of the known bodies, and no correlation was found between the deposit and the magnetic data.—*V. S.*

11145. Kosygin, Iu. A., and Magnitskii, V. A. On possible forms of a geometric and mechanical relation between primary vertical movements, magmas, and folding [in Russian]: Moskov, Obshch. Ispyt. Prirody Biull., Otd. Geol., vol. 23, no. 2, pp. 3–15, 1948.

The origin of structures and magmas in geosynclinal areas is tentatively explained in terms of deep primary vertical movements. Consideration is limited in particular to gradually developing displacements, and it is pointed out that, whatever their direction and extent, they cause a condensation or a stretching of strata necessarily accompanied by modification of their inner structure. These modifications consist essentially of processes of folding, cracking, and penetration of magma, which form geosynclines or platforms and which preclude the reversibility of deep primary vertical movements. Accordingly, such movements can be considered to have a dominant role in the formation of the earth's crust, not excluding horizontal movements and sudden vertical movements fully compatible with them. The suggested mechanism has been verified quantitatively for the geologic structure of the Donbass, U. S. S. R.—*V. S.*

11146. Maksimovich, G. A. New data on the porosity of superficial geospheres [in Russian]: Akad. Nauk SSSR Doklady, vol. 61, no. 5, pp. 829–832, 1948.

The author has revised and amplified his previous data on the porosity of various rocks as a result of 4,000 new measurements, increasing to 14,000 the total number of his porosity determinations. The average porosity of the lower part of the zone of weathering is found to be 35.13 percent, computed on the assumption that it is composed of equal amounts of sand and clay. Based on data from plateaus of the U. S. S. R. the aver-

age porosity of the rocks underlying plateaus is 14.15 percent. As indicated by data from the Ural Mountains, the average porosity of the rocks in folded areas is 12.8 percent. These figures are based on the most recent estimates of the relative volumes of the constituent rocks. Data on the porosities of specific rock types, as well as of the earth's zones or geospheres, are presented in tabular form.—*V. S.*

11147. Molengraaff, G. Y. H.—Repaling van de stand van het gedeelte van een laag, dat door een roterende verschuiving is verschoven [Determination of the position of the part of a stratum displaced by a rotating fault]: Geol. Mijnb., vol. 10, no. 12, pp. 317–320, 1948.

In many problems of geophysics it is important to determine the position of a stratum which has been displaced by a rotary fault. The solution of this problem has been given by M. D. Haddock. The author deals with this problem following Haddock's method with certain modifications. The method is illustrated by three drawings, one perspective and two traced by the methods of descriptive geometry. Application of the procedure to several special examples is given.—*S. T. V.*

11148. Rich, J. L. Submarine sedimentary features on Bahama banks and their bearing on distribution patterns of lenticular oil sands: Am. Assoc. Petroleum Geologists Bull., vol. 32, no. 5, pp. 767–779, 1948.

While flying from Miami to eastern Cuba, the author obtained a photographic record, from an altitude of 11,000 feet, of the Bahama banks, as the sea bottom was visible through the water for a distance of 208 miles. The features of greatest interest were mapped by photogrammetric methods to determine their topographic relationship and approximate dimensions. This revealed a striking pattern of bars and giant ripples which may aid in explaining the distribution of certain lenticular oil and gas sands such as the Clinton sand of Ohio, apparently deposited at considerable distance offshore. Details of subaqueous features are shown on photographs and sketch maps.

The pattern revealed on the Bahama banks exhibits a remarkable similarity to that of the oil and gas sands in part of the Clinton sand area of Ohio, although the scale of the features of the Bahama banks is considerably smaller.—*V. S.*

11149. Rittmann, Alfred. Le temperature nella crosta terrestre e l'orogenesi (Temperature distribution in the terrestrial crust and orogenic processes): Univ. Napoli Ist. Geol. Applic. Memorie e note, vol. 1, pp. 21–38, 1948.

The author analyzes critically numerical data presented by geophysical and geologic investigations of the thermal state of the terrestrial crust. On the basis of physico-chemical relations he establishes the approximate variation of temperature in the crust to a depth of about 100 kilometers. Having established the thermal state of the crust, he discusses the influence of the assumed pattern of the thermal field on the genesis of subcortical magmatic currents and on the development of subsequent geotectonic displacements.—*S. T. V.*

11150. Shepard, F. P. Submarine geology, 348 pp., 106 figs., 11 tables, 1 map, New York, Harper and Brothers, 1948.

This textbook is a compilation of current data on the geology of ocean basins. It deals with waves, currents, shoreline phenomena, continental shelves and slopes, submarine canyons, coral reefs, the deep-ocean floor, and economic applications of submarine geology. The information on continental shelves covers their origin, history, topography, sediments, oil possibilities, and the mapping of oil structures. The following methods of exploring the ocean floor are treated briefly: radar, loran, echo sounding, sampling, coring, dredging, bottom photography, sediment traps, and geophysical prospecting. Bibliographic references accompany chapters, and a bathymetric chart of the world is appended.—*V. S.* (A review appeared in Geophysics, vol. 14, no. 1, p. 86, 1949.)

11151. Shneerson, B. L. Certain cases of deformation of rock layers in a plastic state [in Russian]: Akad. Nauk SSSR Izv., Ser. Geog. i Geofiz, vol. 12, no. 4, pp. 336–348, 1948.

A mathematical analysis is made of the mechanism of deformation of rock layers in a plastic state, such as salt layers. Either a horizontal layer is subjected to lateral forces only or to forces acting both laterally and from above, or a layer or lens with a curvilinear upper surface is subjected to constant force applied laterally. It is shown that the increase in the thickness of a layer subjected to a lateral pressure is governed by complex laws, and the tentative conclusion is advanced that a primary factor in the formation of salt domes must be an uneven pressure from above, created by the existence of local zones of unconformity or by an excess load on the wing of the salt formation. Theoretical deductions are verified by comparisons with geologic evidence on the formation of salt domes in the Emba region of the U.S.S.R.—*V. S.*

11152. Tsytovich, N. A. Soil mechanics [in Russian], 2nd edition, 388 pp., Gosizdat, Moscow, 1940.

This treatise is written primarily for civil engineers, but certain sections of the book are also of interest to geophysicists, for example the chapter on kinds of soil and their physical characteristics, granular composition, porosity, permeability, density, and fluidity. A separate chapter deals with permanently frozen ground and observable phenomena in connection with its thawing and freezing.

The last chapter deals with different methods of soil investigation for engineering purposes, procedure of sampling, laboratory testing, interpretation of the results obtained, and application of data obtained to field work.—*S. T. V.*

11153. Umbgrove, J. H. F. The pulse of the earth, 2nd edition, 358 pp., The Hague, M. Nijhoff, 1947.

The second edition of Umbgrove's "The pulse of the earth" is extended to twice its original size. In twelve chapters the author deals with the physical evolution of the earth and discusses the following problems of geophysics: space and time, structural history of conti-

nents and the regional distribution of the mountain chains developed during the various orogenic cycles, basins and troughs of the continents genetically classified, the earth's crust and its substratum, Vening Meinesz' theory of crustal buckling, the formation of the continental shelf, problems connected with island arcs, the floor of the oceans and the formation of the continents, inadequacy of Wegener's theory to explain former climates and especially the Permian ice ages, physiography of the earth's crust, processes of mountain building, and the formation of dome-shaped elevations.—*S. T. V.* A review by Ph. H. K., appeared in Geol. Mijnb., vol. 11, no. 2, pp. 105–106, 1949.

11. TECHNICAL AIDS TO EXPLORATION

11154. Bousquet, A. G. Counting-rate meters versus scalers: Nucleonics, vol. 4, no. 2, pp. 67–76, 1949.

In the various instruments used for detecting radioactivity—Geiger tubes, ionization chambers, scintillation counters, and others—radiation impinges on the detector, and the electric pulses produced in it are counted by accessory equipment indicating the rate per minute. The most reliable types of accessory equipment are the counting-rate meter and the scaling circuit system. These are described, and a comparison is made of their advantages and limitations as to sources of error, statistical effects, and equilibrium time. It is found that the scaling circuit performs only the function of counting pulses but it counts them accurately; the counting rate may be determined from the results. The rate meter indicates the rate directly with moderate accuracy. It also shows up variations in rate and, when used with a recorder, provides a permanent record.—*V. S.*

11155. Brown, D. R., Galloway, W. C., Robertson, J. R., and Silvey, G. A. A self-contained recording pressure gage: Rev. Sci. Instruments, vol. 20, no. 1, pp. 27–30, 1949.

The instrument described can measure pressures as much as 1,200 pounds per square inch at frequencies from 0 to 200 hertz. The pressure-sensitive element is a circular diaphragm. The gage is self-contained and is not dependent upon auxiliary starting devices. It is triggered by blast pressure which simultaneously starts the motion of a recording plunger which is in operation for five seconds. The damping is achieved by a liquid flowing through an orifice.

The pressure gage can be used in liquids or gases.—*S. T. V.*

11156. Dix, C. H. Microcards, a new method of publication: Geophysics, vol. 14, no. 1, pp. 1–5, 1949.

The reprinting of selected extracts from books and articles on microcards, now undertaken in several fields of knowledge, is discussed as an aid to research. A microcard is the ordinary 3×5-inch library catalogue card bearing the regular author-title-source entry, in normal-size print and below it a photographic copy of 50 to 100 pages of selected, consecutively arranged passages from the text, reproduced on a greatly reduced scale of about 1:20. Such cards are filed in a catalogue index for reference and are read with the use of a magnifying apparatus,

which projects enlarged images of parts of the text on a ground-glass screen. Because of the moderate cost of microcards and the limited space required for their filing and storing, this method of publication can make accessible to research institutions and individual investigators literature in specialized fields now available only in very large libraries.—*V. S.*

11157. Electrotechnic Engineering Co. Geiger-Müller counters: Nucleonics, vol. 4, no. 2, p. 85, 1949.

A simplified Geiger-Müller counter is said to have been developed by the Electrotechnic Engineering Co., Lidcombe, New South Wales. The instrument is contained, complete with batteries, in a welded aluminum case, 11⅛ by 7½ by 8¾ inches, and weighs 23½ pounds. For prospecting work a special attachment is provided, by means of which the tube can be carried close to the ground. It can also be lowered into boreholes and used in other locations difficult of access. The sensitivity of the tube contained in the case is reportedly such as to enable detection of ½ millicurie of radon at 20 feet. Higher counts can be read directly from a dial whereas an earphone is required for the lower counts.—*V. S.*

11158. Higgs, P. M. A recording mechanical pressure gage of high range: Rev. Sci. Instruments, vol. 20, no. 1, pp. 23–26, 1949.

This instrument was designed to measure fluctuating pressures as much as 1,000 pounds per square inch at frequencies to 500 hertz as they are met in seismic experiments. The measuring element is a diaphragm 10 inches in diameter. Three thicknesses of diaphragms were used to give a wider range of sensitivity. The pressure versus time record is recorded in polar coordinates upon the surface of a disk rotated by a motor powered by dry batteries. Indications of the instruments are only approximate, the error of the measuring diaphragm alone being of the order of about five percent.—*S. T. V.*

11159. Hinch, William. Instruments for measuring radioactivity [abstract]: Colorado-Wyoming Acad. Sci. Jour., vol. 3, no. 5, p. 44, 1948.

Two general types of instruments for measuring radioactive emanations are counting-rate meters and high-input impedance D. C. amplifiers. The former is generally used for amplifying and integrating the pulses from detectors such as Geiger-Müller counters, the latter for amplifying currents from ionization chambers. Special circuits of both types are discussed, the variations used in particular applications are indicated, and the limitations of both instruments are outlined.—*V. S.*

11160. Kroll, C. W. A rigorous method for computing geodetic distance from shoran observations: Am. Geophys. Union Trans., vol. 30, no. 1, pp. 1–4, 1949.

A theoretically accurate method is given for computing geodetic distances from shoran observations on the assumptions that the figure of the earth is represented by the international sphere, that the shoran ray lies in a plane passing through the center of the earth and is governed by the laws of geometric optics, and that the velocity of light is

299,776 km./sec. This method is very laborious but useful as a check on a simpler method of numerical integration which is also presented. In the simpler method the time of propagation of the shoran ray is divided into small intervals, and calculation involves determining the change in the distance from the center of the earth to a point on the ray's path during each of these intervals, and hence the total change during the time of propagation. The mathematical derivation is given. Although this method is not as short as the approximate shoran reduction formula usually used, it consists almost entirely of an iteration process that can be carried out on electronic computing equipment in a very short time and is more accurate, especially for long lines where unfavorable atmospheres are encountered.—*V. S.*

11161. Thomas, C. D. Counter pulse shape: Rev. Sci. Instruments, vol. 20, no. 3, pp. 147–149, 1949.

The shape of the decay pulse from a self-quenching counter depends on the circuit constants as well as on the motion of the positive ion sheath. This dependence is considered mathematically, and a formula is developed to take account of these factors in determining pulse height and form. In order to check this relation experimentally, data obtained from photographed single pulses are presented and compared with the calculated values. The curves given cover a wide range of values of circuit resistance and capacity.—*Author's abstract.*

12. PATENTS

[The figure in parentheses indicates the classification of the entry; see table of contents]

11162. (1) Einrichtung and Verfahren zur Bestimmung des vertikalen Schweregradienten [Device and method for determining the vertical gradient of gravity]. Kunz, Bruno, Vienna: Austrian patent 162,358, issued Feb. 25, 1949.

Device for determining the vertical gradient of gravity, consisting of a springlike elastic body loaded with weights and characterized by the feature of two effective masses attached to it at different levels that divide the body into an upper and a lower part in such a manner that the local change of the vertical gradient of gravity is proportional to the change in the ratio of deformation of the upper part to the lower part of the body. Claims allowed, 4.

11163. (2) Magnetic field strength indicator. Edwin P. Felch, Jr., Chatham, N. J., and Thaddeus Slonczewski, Glenwood Landing, N. Y., assignors to Bell Telephone Laboratories, Inc., New York, N. Y., a corporation of New York: U. S. patent 2,468,968, issued May 3, 1949.

A magnetic field strength measuring system comprising in combination three magnetometers having their principal magnetic axes mutually perpendicular, each magnetometer comprising a length of magnetic material with electric windings thereon which are energized with an alternating current of fundamental frequency to generate a voltage of second harmonic frequency therein proportional to the product of the field

strength and the direction cosine of the angle formed by the principal magnetic axis of each magnetometer with the direction of the magnetic field to be measured, an electromechanical orienting system therefor comprising two reversible electric motors one for each of two of said magnetometers, a mechanical linkage from each of said motors to its associated magnetometer whereby the motors may rotate their associated magnetometers around mutually perpendicular axes, an electric circuit coupling each of said two magnetometers to its associated electric motor whereby each motor is caused to rotate in response to the magnitude and phase of the second harmonic voltage generated in its associated magnetometer to maintain the principal axes of said two magnetometers substantially normal to the direction of the magnetic field, and the principal axis of the third magnetometer in substantial alignment with said field, and an electric squaring means for squaring the amplitudes of the second harmonic voltages generated in the three magnetometers, a separate rectifier for each of the squared voltages, a circuit combining into one current the direct current from each of said rectifiers, and an indicator responsive to the combined direct current. Claims allowed, 12.

11164. (3) Interference eliminator for seismic recording systems. R. P. Gilmore, Fulton, Mo., assignor to Shell Development Co., San Francisco, Calif., a corporation of Delaware: U. S. patent 2,456,401, issued Dec. 14, 1948.

In a system for neutralizing interfering signals induced in a seismic recording network by outside magnetic field oscillations, electronic circuit means for converting said oscillations into an alternating current, means for passing a portion of this current through a circuit comprising in series a set of Helmholtz coils and an inductive reactance, means for passing another portion of this current through a second circuit comprising in series a set of Helmholtz coils and a capacitive reactance, said sets of Helmholtz coils being arranged so that their magnetic fields intersect at right angles, a coil rotatably positioned at the intersection of said magnetic fields, means for adjusting the phase of the current induced in said coil when said alternating current is passed through said Helmholtz coil circuits, means for amplifying said induced current, and means for introducing said amplified current into said seismic recording network to neutralize said interfering signals. Claims allowed, 3.

11165. (3) Seismic surveying. J. O. Parr, Jr., San Antonio, Tex., assignor to O. S. Petty, San Antonio, Tex.: U. S. patent 2,461,173, issued Feb. 8, 1949.

In apparatus for use in seismic surveying, the combination with a plurality of seismometers, of a plurality of recording devices, compositing means for combining signal energy derived from at least two of said seismometers and delivering such combined energy to one of said recording devices, and an automatic volume control circuit interposed between each of said last named seismometers and said compositing means and responsive to the arrival at the associated seismometer of energy of undesired frequencies in excess of a predetermined energy level for reducing the total energy transmitted to such compositing means from such seismometer, whereby the level of energy of undesired frequencies so combined by said compositing means is rendered more nearly equal and

out of phase energy of undesired frequencies is more completely cancelled. Claims allowed, 7.

11166. (3) Seismic surveying. P. J. Rudolph, San Antonio, Tex., assignor to O. S. Petty, San Antonio, Tex.: U. S. patent 2,463,430, issued March 1, 1949.

A method of seismic surveying which includes the steps of amplifying and recording extraneous noise at a high level prior to the arrival of wanted seismic signals, thereafter reducing the amplification to a lower level to substantially eliminate the recording of extraneous noise prior to the arrival of the first seismic impulse, and further reducing the amplification after such first arrival to maintain the record of the early high energy impulses within reasonable limits. Claims allowed, 7.

11167. (3) Method and apparatus for analyzing seismographic records. James E. Hawkins, Tulsa, Okla., assignor to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,463,534, issued March 8, 1949.

Apparatus for analyzing wave records of the type where the information contained thereon may be converted to variable frequency electrical energy, comprising a hollow rotatable drum formed of transparent or light-transmitting material, a roller having its axis in spaced relationship relative to the axis of said drum, means for adjustably varying the position of said roller relative to said drum so that wave records of varied lengths having their ends spliced together to form an endless belt may be rotatably supported on said drum and roller, means for transmitting a beam of light through said belt and drum, and a photoelectric cell assembly within said drum for converting said beam of light as caused to vary by the information contained on said belt to variable electrical energy. Claims allowed, 11.

11168. (3) Apparatus for solution of Snell's Law. Glenn M. McGuckin, Corpus Christi, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,463,788, issued March 8, 1949.

An instrument for determining the change in direction of propagation of wave energy at the interface of strata having different propagation velocities comprising a base member having a time-distance scale, an incident-angle bar pivotally supported from said base member at a point thereon corresponding with the point of origin of said wave energy, an interface bar normal to said base member at a distance on said scale from said point of origin related to the propagation velocity of the upper stratum, a reference bar normal to said base member at a distance on said scale from said interface bar similarly related to the propagation velocity of the lower stratum, a movable guide bar at all times parallel to said base member, a first pivotally interconnected means slidable with respect to said incident-angle bar, to said guide bar and to said reference bar, a second pivotally interconnected means slidable with respect to said incident-angle bar and to said interface bar, a refraction bar, and means for positioning said refraction bar from said second

means at such an angle that the distance from said point of origin to said second pivotally interconnected means is equal to the distance from said second means to the intercept of said refractor bar with said guide-bar.

The combination set forth in claim 9 in which a time-bar is slidably carried by said refraction bar, means operable as the angle of said incident-angle bar increases from zero for sliding said time-bar along said refraction bar a distance equal to the ratio of the propagation velocity of said energy in said lower stratum to that in said upper stratum multiplied by the increase from its zero-angle value in the distance from said point of origin to said interface, and means on said time-bar representative of at least one time interval after initiation of said energy. Claims allowed, 11.

11169. (3) Refracted ray calculating device. Glenn M. McGuckin, Corpus Christi, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,463,789, issued March 8, 1949.

An instrument of the character described, comprising a base member having a circle graduated in degrees from 0 to 90 degrees in both directions from each intercept with a vertical diameter to a horizontal diameter thereof and at least one trigonometric scale parallel to said horizontal diameter and calibrated for direct reading from angles read on said circle, a first arm pivoted about an axis at the center of said circle and having a line extending diametrically of said circle, said arm having graduations from the center of said circle outwardly along said arm forming a velocity-ratio scale, and a second arm pivoted about said axis at the center of said circle having a line corresponding with a radius of said circle and movable into a position corresponding with a refraction angle, said base member having a series of vertical lines for vertical transfer of a reading from one to the other of said ratio scale and of said graduated circle. Claims allowed, 5.

11170. (3) Method and means for surveying geological formations. Le Roy C. Paslay, Dallas, Tex., assignor to Marine Instrument Co., Dallas, Tex.: U. S. patent 2,465,696, issued March 29, 1949.

A system for seismic prospecting comprising an explosive charge adapted to be launched from a moving vessel and sink within a body of water, means including a cable secured to said charge for firing the charge within the water when a predetermined length of cable has been payed out, an elongated flexible streamer towed by the vessel at a predetermined depth of submersion within the water, a plurality of pressure responsive devices arranged within the streamer and adapted to generate electrical signals in accordance only with pressure impulses received while said streamer is moving through the surrounding water, said pressure impulses respectively corresponding to seismic signals reflected from geological structures beneath the water, and means on the vessel for recording in time spaced relation the explosion of said charge and the signals generated by said pressure responsive devices. Claims allowed, 13.

11171. (3) Signal transmission circuit for seismographs. George B. Loper, Dallas, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,467,624 issued April 19, 1949.

The combination with an amplifier and a source of variable signals of a bridge circuit connected across one diagonal to the source of signals and connected across the other diagonal to the input of said amplifier, said bridge circuit including an arm having a pair of vacuum tubes connected therein for flow of current in opposite directions, an anode circuit for each of said vacuum tubes including an impedance for flow of anode current, a common source of anode potential connected to said impedances and between them and the respective cathodes of said vacuum tubes, and a source of grid-biasing potential for said tubes varying proportionately to the amplitude of signals transmitted to the amplifier. Claims allowed, 3.

11172. (4) Geological exploration system. D. H. Clewell, Dallas, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,454,911, issued Nov. 30, 1948.

A method of electrical prospecting which comprises applying alternating current between spaced points on the earth's surface to produce a system of equipotential surfaces, locating detecting stations at points on a selected one of said equipotential surfaces, varying the frequency of said alternating current to change the potential difference between said detecting stations by an amount due to reflections from a subsurface boundary, and measuring said resultant potential difference. Claims allowed, 7.

11173. (4) Sealed potentiometer. Irving Gordy, Eatontown, N. J.: U. S. patent 2,457,814, issued Jan. 4, 1949.

In a device of the class described, a tubular casing closed at one end with an opening in the opposite end thereof, a resistance strip mounted within the casing, a nonporous metallic tubular diaphragm mounted within the casing between the resistance strip and the opening and being normally closely spaced from said resistance strip, said diaphragm being secured at the outer end sealed to the casing, annular flexible sealing closure means formed at the inner end of the tubular diaphragm and extending from said end in sealing engagement with the closed end of the casing to protect and hermetically seal the resistance strip within the casing between the diaphragm and the inner wall of the casing, terminal posts extending through the casing wall and secured airtight therein, one post being electrically connected at its inner end with said diaphragm and another post extending into the closed space between the casing wall and the diaphragm and connected with said resistance strip, and rotatable shaft operating means extending centrally of the diaphragm and concentrically of the casing having means thereon to force a portion of the diaphragm into electrical contact with a selected part of the resistance strip to establish an electrical circuit including the resistance strip in the circuit of the device from said terminal posts through said diaphragm and said resistance strip. Claims allowed, 6.

11174. (4) Method for geophysical prospecting. L. F. Kitto, Glendale, Calif., assignor of one-half to Roderic Crandall, Roswell, N. Mex.: U. S. patent 2,460,297, issued Feb. 1, 1949.

Method of prospecting for subsurface accumulations of petroleum, the steps of detonating an explosive charge adjacent the surface of the earth, maintaining adjacent the point of detonation an electrical circuit in which current is flowing through non-metallic solid conductors lightly contacting one another and unshielded in relation to the earth, amplifying variations in flow of current through said circuit following immediately and within not exceeding 0.5 second. Claims allowed, 6.

11175. (5), (8) Radioactivity well logging method. Gerhard Herzog, Houston, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,458, 596, issued January 11, 1949.

An apparatus for logging the formations traversed by a bore hole which comprises a housing, a cable for lowering and raising said housing through said hole, a radiation detector of the current pulse producing type in said housing, a preamplifier in said housing for amplifying the pulses from said detector, means associated with said cable for conducting the preamplified pulses to the surface, means at the surface for amplifying the pulses, two integrating circuits connected to receive the output of said amplifying means, one of said integrating circuits having a time constant from 5 to 15 times as long as the other integrating circuit, and means for simultaneously and separately recording the outputs of said integration circuits. Claims allowed, 6.

11176. (5) Thin-walled Geiger-Müller counter. Roman Smoluchowski, Schenectady, N. Y., assignor to General Electric Co., a corporation of New York: U. S. Patent 2,465,821, issued March 29, 1949.

In a Geiger-Müller counter, a tubular cathode, an anode wire extending along the axis of said cathode, members hermetically closing the ends of said cathode and supporting said anode wire, and at least one window in said cathode, said window being covered by a sheet of polyvinylformal having a thickness not exceeding 1½ microns. Claims allowed, 3.

11177. (5) Radioactivity measurement. Robert E. Fearon, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,469,460, issued May 10, 1949.

A method of indicating the energies associated with gamma ray quanta which comprises absorbing a plurality of said quanta in a dense gaseous atmosphere, whereby equal numbers of positive ions and free electrons, are formed, separating said electrons from said ions, producing only from said separated electrons a plurality of electrical signals each proportional in amplitude to the number of said electrons freed in the absorption of one of said quanta, said positive ions being prevented from producing corresponding signals, and exposing said signals for observation. Claims allowed, 9.

11178. (7) Petroleum exploration by soil analysis. R. H. Fash, Fort Worth, and J. G. Campbell, Houston, Tex., assignors to R. H. Fash, trustee, Fort Worth, Tex.: U. S. patent 2,459,512, issued Jan. 18, 1949.

An oil exploration method which comprises extracting from a measured sample of earth material by a measured amount of an oil solvent the petroleum and such non-petroleum substances as are soluble in said solvent, effecting major separation of the non-petroleum component from the petroleum component in the extract by a separating procedure which includes the utilization of preferential adsorption, and arriving at an index of the petroleum content of the earth material sample by utilizing the residual soluble constitutents in an extract containing them. Claims allowed, 17.

11179. (7) Exploration by soil analysis. Leo Horvitz, Houston, Tex., assignor to Esme E. Rosaire, Houston, Tex.: U. S. patent 2,470,401, issued May 17, 1949.

In the art of exploration for oil, gas and related deposits in which the presence and proximity of such deposits to soil samples is indicated by the existence in the samples of diffused constituents from said deposits which have been modified in the soil into a form insoluble in the native environment of the samples, the method comprising collecting soil samples at spaced points in the area to be explored treating each soil sample successively with hydrochloric acid and an organic solvent for the wax-like material soluble in carbon tetrachloride contained in said soil samples, and measuring the amount of material extracted by the solvent whereby the amounts of said material extracted from the several soil samples may be correlated with soil sample locations to yield data useful in the location of the deposit sought for. Claims allowed, 10.

11180. (8) Geophysical exploration of boreholes by microwaves. N. D. Coggeshall, O'Hara Township, Allegheny County, and Morris Muskat, Oakmont, Pa., assignors to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,455,942, issued Dec. 14, 1948.

Borehole logging apparatus comprising a microwave generator, a tubular open-ended microwave guide coupled thereto, means for supporting said microwave guide so that its open end is directed substantially perpendicular to the axis of the borehole, means for urging an open end of said microwave guide substantially throughout its periphery against the wall of the borehole and means for measuring the power absorbed by the microwave generator. Claims allowed, 2.

11181. (8) Well surveying device. G. L. Kothny, Strafford, Pa., assignor to Sperry-Sun Well Surveying Co., Philadelphia, Pa., a corporation of Delaware: U. S. patent 2,457,826, issued Jan. 4, 1949.

In combination with a well surveying instrument having electrical recording means therein, a protective casing therefor, timing means for said instrument located within said protective casing, resilient means reacting between the casing and the timing means for supporting

the timing means within the casing, and means releasably mechanically suspending the well surveying instrument from the timing means, the last mentioned means providing an electrical connection between the timing means and the well surveying instrument insulated from the casing, and said resilient means being located between the timing means and the well surveying instrument. Claims allowed, 4.

11182. (8) Method of determining the fluid content of well cores. Morris Muskat, Oakmont, and N. D. Coggeshall, O'Hara Township, Allegheny County, Pa., assignors to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,458,093, issued Jan. 4, 1949.

A method of determining the connate fluid content of a well core sample comprising adding to the drilling fluid a known concentration of artificially radioactivated material soluble in the drilling fluid, cutting and removing the core sample from the well, measuring the radioactivity of a known quantity of core sample to determine the amount of drilling fluid absorbed in the sample, determining the nature and quantity of total fluids in the core sample and subtracting therefrom the said determined amount of drilling fluid absorbed. Claims allowed, 1.

11183. (8) Electrical logging method and apparatus. W. H. Stewart, Beaumont, Tex., assignor to Sun Oil Co., Philadelphia, Pa., a corporation of New Jersey: U. S. patent 2,459,196, issued Jan. 18, 1949.

An electrical process for determining the nature of the geological formations traversed by a cased drill hole comprising applying terminals of a voltage supply to the casing of the drill hole and to a remote ground, moving two exploring electrodes having a fixed spacing between them to various depths in said cased hole in electrical metallic contact with the interior of the casing thereof, and measuring voltage variations between said electrodes. Claims allowed, 9.

11184. (8) Casing joint locator. J. H. Castel, Houston, Tex., assignor to Schlumberger Well Surveying Corp., Houston, Tex., a corporation of Delaware: U. S. patent 2,459,499, issued Jan. 18, 1949.

A device for determining the distance between the bottom of a well and a joint in a casing therein formed of a plurality of casing sections connected by joints of different internal diameter than the internal diameters of said casing sections, comprising a support adapted to be lowered into said casing, guide means on said support engageable with said casing, an electrically actuated indicator, joint locating means associated with said guide means, electrically connected with said indicator, and responsive to variation in the internal diameter of said casing at said joints for controlling the supply of electrical energy to actuate said indicator, bottom locating means movably mounted at the lower end of said support and movable in response to engagement thereof with the bottom of the bore hole, and a switch actuated by said bottom locating means and electrically connected to said indicator for actuating said indicator. Claims allowed, 8.

11185. (8) Frequency stabilization of alternating current networks. H. G. Doll, Houston, Tex., assignor to Schlumberger Well Surveying Corp., Houston, Tex., a corporation of Delaware: U. S. patent 2,463,252, issued March 1, 1949.

A system for balancing simultaneously for more than one frequency an alternating current network having an input and an output, said output being unbalanced by changes in frequency, comprising means to supply current to said input at more than one frequency, two compensating means for introducing into said output two components of a first phase which are respectively proportional to two different powers of the frequency, and two other compensating means for introducing into said output components of a second phase different from said first phase, the last mentioned component being respectively proportional to two different powers of the frequency. Claims allowed, 11.

11186. (8) Well logging. Frederic W. Albaugh, Los Angeles, Calif., assignor to Union Oil Co. of California, Los Angeles, Calif., a corporation of California: U. S. patent 2,463,733, issued March 8, 1949.

A method of determining the characteristics of a well bore which comprises initially measuring the natural gamma-ray intensities of various strata of the well bore, subsequently bombarding said strata of said well bore with fast neutrons followed by a simultaneous measurement of the secondary gamma rays returning from said strata and lastly subjecting said strata to bombardment with neutrons, allowing at least one hour after said bombardment for the decay of the prevailing gamma-ray flux and thereafter measuring the gamma rays originating in the radioactive isotopes synthesized during said last named bombardment. Claims allowed, 14.

11187. (8) Method and apparatus for determining the inclination of substrata. Gerhard Herzog, Houston, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,464,930, issued March 22, 1949.

A method of measuring the dip of an underground formation penetrated by a bore hole which comprises bombarding the formations surrounding a portion of the hole with neutrons from a source in the hole, whereby some of the neutrons are scattered in the formations and returned to the hole substantially in the horizontal plane of said source, and separately measuring the amounts of said scattered, returned neutrons reaching the hole from sectors spaced substantially 120 degrees apart in a generally horizontal direction. Claims allowed, 8.

11188. (8) Geophysical prospecting method. Armand J. Abrams, Dallas, Tex., assignor to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,465,563, issued March 29, 1949.

The method of geophysical prospecting which comprises sinking bore holes at points distributed over the area to be prospected to depths below the limit of atmospheric "breathing" of the soil, selecting a zone in each of said bore holes of substantially uniform hole-wall surface area at a depth below the limit of said atmospheric "breathing," isolating said

zone from access thereto of gases from other levels in said bore hole, determining the natural rate of evolution of gases from the surrounding soil into said zone, and correlating variations in the rate of said evolution in the individual holes throughout the area examined whereby information useful in locating petroliferous deposits may be obtained. Claims allowed, 4.

11189. (8) Location of buried hydrocarbon deposits. Armand J. Abrams, Dallas, Tex., assignor by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,465,564, issued March 29, 1949.

The method of prospecting for hydrocarbons which comprises sinking bore-holes at points distributed over the area to be prospected to depths below the limit of atmospheric "breathing" and within the zone of water saturation, selecting a zone in each bore-hole located below the limit of atmospheric "breathing" and within the zone of water saturation, determining the amount of hole-wall surface from which soil gas evolution may occur into said zone, isolating said zone from access thereto of gases from other levels in the bore-hole, contacting the soil gases evolved from the exposed hole-wall surface at their natural rate into said zone with a plurality of selective sorption materials for different indicative constituents of the soil gas in succession whereby the rate of evolution of a plurality of individual indicative gaseous constituents of the soil gases may be determined, and correlating variations in the rate of evolution of the plurality of constituents as determined per unit area of hole-wall surface in the individual holes throughout the area examined whereby information useful in locating petroliferous deposits may be obtained. Claims allowed, 2.

11190. (8) Gamma-ray logging. William L. Russell, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,469,461, issued May 10, 1949.

The method of gamma ray well logging comprising the steps of passing through a well a source and a detector of gamma rays, said source and detector being substantially in contact with each other, maintaining said source and detector substantially in contact with the formations exposed by said well, and indicating the response of said detector as a function of depth in said well. Claims allowed, 8.

11191. (8) Neutron well logging. William L. Russell, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,469,462, issued May 10, 1949.

The method of well logging which comprises the steps of irradiating the formations of a well with fast neutrons from a concentrated source thereof, measuring at a plurality of distances from said source the gamma rays of capture of said neutrons after they have been slowed down by passage through said formations, one of said distances being that at which changes in formation hydrogen content produce substantially no change in slow neutron concentration, and indicating as a function of depth in said well the magnitudes of the measurements at said distances. Claims allowed, 6.

11192. (8) Neutron logging of wells. William L. Russell, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,469,463, issued May 10, 1949.

Apparatus for logging wells comprising a source of neutrons and two detectors of gamma rays spaced therefrom and adapted to be passed through a well, one of said detectors being surrounded by a shield containing boron and spaced from said source at a distance where variations in the hydrogen content of the formations of said well produce substantially no change in slow neutron density, the other of said detectors being lined with a substance having a large capture cross section for slow neutrons and in which captures are accompanied by the emission of ionizing radiations, and means for indicating as functions of depth in said well the responses of said detectors. Claims allowed, 3.

11193. (8) Method and apparatus for geophysical prospecting. Frank P. Hochgesang, Woodbury, and Carleton H. Schlesman, Camden, N. J., assignors to Socony-Vacuum Oil Co., Inc., a corporation of New York: U. S. patent 2,470,743, issued May 17, 1949.

An apparatus for geophysical prospecting comprising in combination an elongated sealed housing adapted to be lowered and raised in a drill hole, means including a cable for lowering and raising said housing in the drill hole, milling cutters carried by said housing for removing the mud sheath from at least a portion of the wall of said drill hole, squeegees also carried by said housing for scraping that portion of the wall from which the mud sheath has been removed, means defining a chamber in said housing, a window in the means defining the chamber adapted to contact the cleaned wall of the drill hole, means including a bellows for extending and retracting said window with respect to the housing, guide means for said housing, pneumatic means for extending said guide means into contact with the wall of the drill hole, separate pneumatic means for operating the milling cutters, the squeegees, the guide extending means, and the means for extending and retracting the window, a multifrequency source of power, electrical means responsive to different frequencies of power for selectively energizing said pneumatic means, an X-ray tube in said chamber for generating X-rays, means for directing the X-rays through said window against the cleaned walls of the drill hole, and a photosensitive element in said chamber for recording the X-rays that have been dispersed by diffraction produced by the crystalline substance or substances in the wall and which have been back-reflected into the chamber. Claims allowed, 1.

11194. (11) Radio direction and range indicator. F. E. Bartholy, Wilkinsburg, Pa., assignor to Westinghouse Electric Corp., East Pittsburgh, Pa., a corporation of Pennsylvania: U. S. patent 2,447,728, issued Aug. 24, 1948.

In a radio direction and range finding system, a signal receiver having a directional energy collector rotating in one coordinate of bearing, a dial rotating in synchronism with said collector, markings on said dial corresponding to instantaneous positions of said collector with respect to a fixed point, means at said fixed point for illuminating a portion of said dial, means operable by said receiver for actuating said illuminating means at the instant signal is being received, and means independent of

said receiver for limiting the actuation of said illuminating means to a selected signal. Claims allowed, 6.

11195. (11) Tridimensional obstacle detection system. H. G. Busignies, Forest Hills, N. Y., assignor to International Standard Electric Corp., New York, N. Y., a corporation of Delaware: U. S. patent 2,449,976, issued Sept. 28, 1948.

Apparatus for determining the location of an object including radiant energy impulse transmitting apparatus for directively transmitting impulses in a plurality of directions in a common plane, receiving means responsive to impulse energy reflected from the object, cathode ray indicating means operated by said receiving means, a sweep circuit for the beam of said cathode ray indicating means for sweeping said cathode ray beam from a predetermined origin over a predetermined path, commutator means associated with said receiving means and said indicating means and operated in synchronism with the directing of said transmitting means, said commutator means serving to successively change said origin to provide for indication of received directive impulses on a portion of said indicating means corresponding to the general direction of the received reflected energy, said receiving means including antenna means directionally sensitive above and below said common plane, receiver network means responsive to received impulse energy from said antenna means for producing output impulses of the effective magnitude of reflected energy as received by said antenna means, and means responsive to said effective magnitude for modulating the beam of said cathode ray indicating means. Claims allowed, 7.

11196. (11) Radio remote-control system. J. M. Brian, Westmount, Quebec, Canada, assignor, by mesne assignments, to Radio Corporation of America, New York, N. Y., a corporation of Delaware: U. S. patent 2,451,150, issued Oct. 12, 1948.

In combination, a plurality of remote control devices for controlling the operation of radio apparatus from a plurality of remote points, each control device comprising a plurality of push-button operated switches, means associated with the several push-buttons at each control device whereby operation of a selected one of the push-buttons at any one of the control devices effects the release of a previously operated push-button at said one control device, and circuit means interconnecting the plurality of remote control devices whereby operation of said selected push-button at said one control device effects the release of a previously operated push-button that may have been operated at one of the other control devices without effecting anew the operation of any of the remaining push-buttons at any of the other control devices. Claims allowed, 4.

11197. (11) Radio direction finder. E. N. Dingley, Jr., Arlington, Va.: U. S. patent 2,454,783, issued Nov. 30, 1948.

Apparatus as described, comprising a pair of radio wave collector loops laterally spaced apart, and unconnected to each other, a third loop equi-distant from the loops of said pair, all of said loops being mutually parallel, a rotatable member upon which all of said loops are

fixed, an oscillator connected to supply energy to said third loop to be radiated therefrom, the frequency of the energy from said oscillator differing from that of the energy from a distant source received by said collector loops by a value within the audio range, an amplifying receiver connected to each of the loops of said pair, and a cathode ray oscilloscope having its vertical deflection plates connected to the audio output leads of one of said receivers and its horizontal deflection plates connected to the audio output leads of the other of said receivers, whereby to indicate the phase relation between the outputs of the two receivers. Claims allowed, 4.

11198. (11) Radio position finding system. J. A. Ebeling, Charleston, W. Va.: U. S. patent 2,455,164, issued Nov. 30, 1948.

In a radio position finding system for mobile craft, an orientable directional antenna, a receiving set having its input connected to said antenna, tuning means for tuning said receiving set selectively to any one of three different carrier frequencies of three different transmitting stations, electrical indicating means connected to the output of said receiving set and responsive to the delivery of minimum output therefrom, a master control switch shaft adapted in successive positions to control the setting of said tuning means to said three frequencies successively, ratchet means for step-by-step rotation of said shaft, solenoid means for advancing said ratchet step-by-step, and being connected for actuation by minimum signal response of said indicating means, a translucent map plate representing the terrain being traversed by said craft, three individual rotatable visual projecting units each comprising a projecting element adapted to project an individual illuminated line on said plate, and each further comprising a rotatable telemetric element and electrically actuatable clutch means for controllably connecting said telemetric element to said projecting element, a telemetric system adapted to coordinately control the orientation of said telemetric elements of said projecting units, and being adapted to be controlled by the orientation of said directional antenna, and individual switch means controllable by said shaft in particular positions thereof adapted to connect or disconnect each of said telemetric elements to said telemetric system, other individual switch means actuatable by said shaft in particular positions thereof adapted to actuate each of said clutch means, said switch means and the connections thereof to said clutch means being so arranged that in a first position of said shaft, the illuminated line projected from the first of said rotatable projecting units represents the observed bearing of a first one of said transmitting stations, and in a second position of said shaft the illuminated line projected from the second of said rotatable projecting units represents the observed bearing of a second one of said transmitting stations without disturbing the previously projected line representing the bearing of said first station, and in a third position of said shaft the illuminated line projected from the third of said rotatable projecting units represents the observed bearing of the third one of said transmitting stations without disturbing the two previously projected lines representing the bearings of said two first stations. Claims allowed, 5.

11199. (11) Piezoelectric temperature measuring and control system. R. K. Blackburn, East Hartford, Conn., assignor to Crystal Research Laboratories, Incorporated, Hartford, Conn., a corporation of Connecticut: U. S. patent 2,456,811, issued Dec. 21, 1948.

In a temperature control system a pair of piezoelectric crystals, one of said piezoelectric crystals being sensitive to changes in temperature for producing shifts in frequency and variable frequency oscillations corresponding thereto, the other of said piezoelectric crystals being temperature controlled for the production of constant frequency oscillations, means for combining the oscillations from each of said piezoelectric crystals, a resistive capacitive network interposed in a path common to the combined oscillations, a rectifier connected with said resistive capacitive network, an electron tube including input and output circuits, a connection between said input circuit, and the output of said rectifier, a load circuit and a power source connected with said output circuit, whereby, the power impressed upon said load circuit is controlled in accordance with the frequency difference between said piezoelectric crystals. Claims allowed, 2.

11200. (11) Airplane course indicating system. O. S. Field and S. N. Wight, Rochester, and S. P. Saint, Port Washington, N. Y., assignors to General Railway Signal Co., Rochester, N. Y.: U. S. patent 2,463,094, issued March 1, 1949.

In a radio course indicating system for airplanes, the combination with a plurality of distinctive radio code creating apparatuses on the ground arranged along the ground to define the course over which an airplane is to fly, a cathode ray responsive display area supported within view of the pilot on such airplane, a scanning antenna on the airplane scanning continuously horizontally and vertically at different rates, gyroscopic means for stabilizing said antenna with respect to orientation of the airplane about its longitudinal axis, and radio responsive means coupled to said antenna for displaying cathode ray images of said apparatuses on said display area by a plurality of lighted coded spots one for each apparatus and so juxtaposed as are the lines of sight connecting such airplane and apparatuses and each spot blinking in accordance with the distinctive code assigned to that apparatus. Claims allowed, 18.

11201. (11) Altimeter. Morris C. White, Mill Valley, Calif.: U. S. patent 2,465,775, issued March 29, 1949.

An altimeter comprising a casing, an air screw rotatable in said casing, a constant speed motor for rotating said screw in said casing, a wall in said casing against one side of which said screw discharges air, said wall having an aperture therein, said casing having an air inlet and discharge apertures, a rotor, a shaft supporting said rotor for rotation under the influence of air forced through the casing by said air screw, spring means for applying a resisting force to said shaft opposing rotation of said shaft by said air acting on said rotor, a shield carried on said shaft between said aperture and said rotor and movable with said shaft to vary the effective opening provided by said aperture to control the amount of air admitted to rotate said rotor, an indicator arm on said shaft, and a dial comparatively positioned with respect to said indicator arm. Claims allowed, 3.

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ERRATA

In the preceding issue of Geophysical Abstracts (136, January–March 1949, numbers 10737–11001, Geological Survey Bulletin 966–A) on page 79 the patent number given as 2,450,336, should read 2,450,366, and on page 86 the patent number given as 2,450,365, should read 2,450,265.

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