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BY

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AND

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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 section 11. An additional section on drill-hole methods, section 8, is introduced.

GEOPHYSICAL ABSTRACTS 135, OCTOBER–DECEMBER 1948

By V. L. Skitsky and S. T. Vesselowsky

FOREWORD

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, and geochemical methods and with underlying geophysical theory, research, and related subjects.

Inasmuch as geophysicists in the field may have little opportunity to consult libraries, the policy is to provide abstracts sufficiently informative in themselves to keep readers abreast of developments in the United States and abroad.

Distribution.—Geophysical Abstracts 1–86 were issued as Information Circulars by the Bureau of Mines; 87–111 were issued as Bulletins of the Geological Survey; and 112–127 were issued as Information Circulars by the Bureau of Mines. Beginning with 128, Geophysical Abstracts are published as Bulletins of the Geological Survey.

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

0. GENERAL GEOPHYSICAL SUBJECTS

10473. Bailey, S. W., and Anderson, R. E. Japanese geophysical research: U. S. Naval Technical Mission to Japan, Intelligence Targets Japan (DNI) of 4 Sept. 1945, Fasc. X–1, Target X–06, 24 pp., San Francisco, Calif., January 1946. (Library of Congress, OTS PB Rept. 31616.)

During the war years 1939–45 Japanese geophysical research, formerly outstanding in seismology, was reduced in scope because of shortages of material and personnel, financial restrictions, and interference from bombings. Nevertheless, new seismograph designs and modifications of existing types of seismographs were developed both for observatory work and for prospecting. Also land mine detectors based on seismic principles were experimented with, known models of gravimeters were improved, and investigations were made for the forecasting of earthquakes from tilting and magnetic data.

The work is outlined on the basis of interviews with 18 leading geophysicists and the inspection of 9 geophysical institutions. Dominant views on the state of the earth's core, isostasy, earth tides, crustal deformation, terrestrial ellipsoid, and forecasting of earthquakes are reported. Brief descriptions, diagrams, and photographs are given of M. Matsuzawa's duplex pendulum seismograph of new design for registration of strong earthquakes, K. Sassa's strain seismograph of the Benioff type for measuring wave velocities, K. Sassa's extension meter for recording horizontal displacement, T. Hagiwara's displacement seismograph with a calibration device of a new type, T. Hagiwara's vertical motion seismograph with a rectangular suspension, C. Tsuboi's clock drive for seismometer drums, K. Sassa's seismographs of models B and C for prospecting, K. Sassa's clinograph of the Schluter type for tilting investigations, S. Nakamura's proposed land-mine detectors of a nonmetallic and a seismic type, C. Tsuboi's gravity pendulum, and M. Hasegava's gravity variometer. No new magnetic, electrical, radioactive, or thermal instruments are reported.—*V. S.*

10474. Bubleinikov, F. Treasures of the earth, ch. 9, pp. 136–152, Moscow, Molodaia Gvardiia, 1946.

The elements of geophysical and geochemical exploration of ore deposits are explained in popular language to readers of high-school age who have little technical knowledge, with a view to encouraging their enrollment in courses preparatory to specialization in geology, geophysics, and geochemistry. Exposition includes a general background of the geological history of the earth.—*V. S.*

10475. Lasky, S. G. Search for new mineral supplies—Geophysical and geochemical methods: Hearings before a subcommittee of the Committee on Public Lands, U. S. Senate, 80th Cong., 1st sess., Investigation of National Resources, May 15, 16, and 20, 1947, pp. 198–200, Washington, D. C., 1947.

Geophysical and geochemical methods are examined to help further the search for mineral resources. The purpose is to clarify their places among other exploratory methods and to indicate their potentialities, so as to aid particularly in discovering metals and minerals in which the United States is deficient. It is found that, among the geophysical approaches, the magnetic methods are successful in the search for naturally magnetic materials, such as ores of iron, titanium, and chromium, and of nonmagnetic deposits associated with them. Gravity methods have application in the discovery of iron ore and chromite and also of lead and zinc under especially favorable conditions. Electrical methods are useful in prospecting for sulfide ore bodies. Geothermal methods may be helpful in detecting ore bodies that generate or absorb heat in reactions with ground waters. Ultraviolet light has aided in finding scheelite and may be useful in the search for fluorescent zinc minerals. The relatively new geochemical methods invite investigations as to their scope of application and objectives; some of their principal problems are listed.—*V. S.*

10476. Lee, F. W. Economic evaluation of geophysical work: Hearings before a subcommittee of the Committee on Public Lands, U. S. Senate, 80th Cong., 1st sess., Investigation of National Resources, May 15, 16, and 20, 1947, pp. 151–157, Washington, D. C., 1947.

To appraise the cost and profitableness of public projects for geophysical exploration of natural resources in the United States and its Territories, an economic evaluation is made of the past work of the Geophysical Division of the United States Bureau of Mines from its establishment in 1928 to November 1946, when geophysical activities were transferred to the United States Geological Survey. The account gives year-by-year descriptions of the investigations conducted and presents estimates of the dollar values produced by the resulting discovery of new oil pools, ore bodies, water supplies, and other resources. It includes also a statement on the reduction in the cost of drilling operations and engineering construction and the immediate benefits from advances in accessory research in geophysical sciences, instrumentation, and field techniques. The tabulation of data, summarizing the cost of Government exploration and the national returns in established values during 1928–45, shows a total allocation of $798,000 in 18 years and accrued national resources of the order of $459,891,000 in the same period.—*V. S.*

10477. Lundberg, Hans. On the history of geophysical exploration: Canadian Min. Met. Bull. 431, pp. 171–185, Montreal, Quebec, March 1948.

This paper, which was prepared for the jubilee meetings of the Canadian Institute of Mining and Metallurgy, gives a full account of the activities of this institution with numerous references to the development of

magnetic, electrical, gravity, seismic, geochemical, and other methods of geophysical prospecting for mineral deposits. Scandinavian and Canadian work is particularly emphasized, but it is pointed out that available information on prospecting in Canada is scant. The author shows how rapidly various methods have improved and how applications have increased in the past 25 years; he also indicates the probable course of further progress. This paper with that on "Geophysics and Petroleum in Canada," presented by R. E. Weichert, Jr., at the same meeting, will provide, when the latter is published, a valuable up-to-date summary of Canadian geophysical prospecting.—*J. T. W., Canadian Geophys. Bull., vol. 2, no. 1, p. 7, Ottawa, Ontario, 1948.*

10478. Shuleikin, V. V. The lines of development of Soviet geophysics [in Russian]: Akad. Nauk SSSR Izvestiia, Ser. Geog. Geofiz., vol. 12, no. 4, pp. 289–305, Moscow, 1948.

The development of geophysics in the USSR is sketched briefly, from its beginnings in the exploration of the Kursk magnetic anomaly in 1920 to the present time. Principal lines of investigation and their results are noted in the fields of hydrology, hydrophysics, meteorology, and climatology, with particular attention to the contributions of the Black Sea Hydrophysical Station in the Crimea, founded in 1929 by the author. The station has concentrated on the study of the thermodynamics of the sea and atmosphere in relation to the thermal state of water masses and to climatology, heat transfer from water-covered areas to continents by monsoon currents, utilization of the energy of sea waves, calculation of ship rolling, molecular physics of wave-damping oil spreads, sea chroma, and electric currents in the sea. Other developments of Soviet geophysics in the fields of magnetism, gravitation, seismology, and terrestrial electricity are outlined briefly.—*V. S.*

1. GRAVITATIONAL METHODS

10479. Barnes, V. E., Mathis, R. W., and Romberg, F. Gravity prospecting for lead and zinc, New Mexico [abstract]: Internat. Geol. Cong., 18th sess., Great Britain, 1948, Titles and abstracts of papers, p. 24, London, 1948.

Observations of the relative force of gravity were made on the Houston-Thomas group of claims in the Piños Altos Mountains, north of Silver City, New Mexico. The observed values of gravity were corrected for terrain effects, and the resulting map revealed two positive anomalies. The second of the United States Bureau of Mines diamond-drill holes on one of the anomalies penetrated a lead-zinc ore body, in which mining was started later. Two holes were directed toward the second anomaly but, being improperly placed, missed ore; the drilling was then discontinued.

This report is the first record of the use of a gravity meter in the discovery of a lead-zinc ore body. It proves that the use of a gravity meter in extremely rugged terrain for the discovery of such bodies is practicable. An explanation is suggested for the systematic difference found between the values of the Bouguer correction as computed from observed surface densities and from the graph of force against elevation. Maps of the geology, topography, and gravity observations, both before and after corrections for terrain, are included.

10480. Boaga, Giovanni. Sopra l'ipotesi di Bullen sulla variazione discontinua della densita nell'interno della terra e sulla conseguente variazione della gravità [Bullen's assumption of a discontinuous variation in density in the earth's interior and the resulting variations in gravity]: Pontif. Acad. Sci. Acta., vol. 5, pp. 1–5, Rome, 1941.

Taking as a point of departure the computations of Bullen concerning the discontinuous density variation in the interior of the earth, the author calculates the corresponding values of gravity and compares his and Bullen's results with the figures obtained on the basis of a continuous variation of the earth's density.—*S. T. V.*

10481. British Intelligence Objectives Subcommittee. Sensitive gravity meters, interrogation of Professor Tomaschek: Interrogation Rept. 664, 1 p., London, November 1947. (Library of Congress, OTS PB Rept. L88100.)

The purpose of the interrogation was to determine whether or not the investigations of Professor Tomaschek would have application in the production of a field instrument for gravitational surveys. He has constructed three gravity meters using the bifilar suspension principle. These were employed for a study of earth tide effects.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 9, no. 3, p. 232, Washington, D. C., 1948.*

10482. Dore, Paolo. Sull' uso della seconda funzione di Green nei procedimenti di calcolo degli scostamenti del geoide dall' ellissoide a mezzo delle anomalie gravimetriche [The use of Green's second function in the numerical calculations of the departure of the geoid from the ellipsoid on the basis of the established gravimetric anomalies]: Accad. Sci. Ist. Bologna Rend., n. ser., vol. 45, pp. 33–34, Bologna, Italy, 1941.

In this paper certain questions pertaining to the determination of the geoid from the results of gravity measurements are discussed. The analysis presupposes gravity determinations at a sufficient number of points distributed over the earth's surface.—*H. Schmehl, Zentralb. Geophys., Meterol. u. Geod., vol. 10, no. 2, p. 51, Berlin, 1942, translated by S. T. V.*

10483. Egyed, Laszlo. The determination of an infinite inclined dike from the results of gravity and magnetic surveys: Geophysics, vol. 13, no. 3, pp. 437–442, Tulsa, Okla., 1948.

Equations are given for the gravitational gradient and curvature as well as for the horizontal and vertical components of the magnetic anomaly caused by ore bodies of the Kursk type. It is then shown how from these equations the depth, width of crest, angle of dip, anomalous density, and magnetic susceptibility of the body may be determined.—*Author's abstract.*

10484. Haalck, H. Die Frage der Messung des vertikalen Schweregradienten [The problem of measuring the vertical gradient of gravity]: Beitr. angew. Geophysik, vol. 9, pp. 107–120, Leipzig, 1941.

The possibility of developing an instrument sufficiently sensitive and precise for measuring the vertical gradient of gravity is discussed. Such an instrument would have many important applications in geodesy and geophysics, but its accuracy must be high, not less than 10^{-7} cgs.

Several experimental investigations aiming at the design of such an instrument are discussed. To attain the necessary precision a new, indirect method is suggested, namely, the method of "differential measurements on horizontal pendulums," appropriately suspended in a common rigid frame. Also the curvature values of the gravity potential can be determined by such instruments, and from the measurement of the second derivatives of the potential with respect to x and y it is possible to calculate $\frac{\partial^2 W}{\partial z^2}$ from the Laplace equation.

The construction of the suggested instrument presents difficulties, which in the opinion of the author can be overcome. The dimensions of the frame must be about 1 meter, and the instrument must be protected against wind and against temperature variations. Its accuracy is estimated by the author as equal to that of a good torsion balance, but its efficiency is much greater.—*Author's abstract, translated and amplified by S. T. V.*

10485. Hunziger, E. Geoidprofile in der Schweiz [Profiles of the geoid in Switzerland]: Schweizer. Zeitschr. Vermessungswes., vol. 40, pp. 1–6, Zurich, 1942.

A condensed report is presented on four geoid profiles determined by an extensive gravity survey carried out in Switzerland. There are two profiles, one 186 kilometers in length along the Saint-Gothard meridan, the other 210 kilometers along the parallel of Zurich, and two shorter profiles, one 36 kilometers along the meridan of Lugano, the other 25 kilometers along the parallel of Locarno. The total number of observation points was 105. The profiles were determined by the method of astronomic surveying developed by F. R. Helmert. All profiles, especially the long ones, show good agreement with the reference ellipsoid computed for Switzerland.—*H. Schmehl, Zentralb. Geophys., Meteorol. u. Geod., vol. 10, no. 2, p. 51, Berlin, 1942, translated by S. T. V.*

10486. Jeffreys, H. H. The figures of the earth and moon: Royal Astron. Soc. Monthly Notices, Geophys. Suppl., vol. 5, no. 7, pp. 219–247, London, 1948.

The paper consists of a general adjustment of the data relevant to the radius and ellipticity of the earth, the lunar parallax, and the differences of the moments of inertia of the moon. The anomalies of gravity recently found to persist over distances of 10° and 30° imply similar anomalies in the deflexion of the vertical and provide a means of estimating the additional uncertainty that they introduce. When this is taken into account, it is found that the data are consistent. Attempts are made to find additional checks on the existence of the anomalies of gravity represented by harmonics of degrees 2 or 3 other than the main ellipticity term, but they are indecisive, and the final solution is a compromise between solutions with and without them.

The chief changes from current values are a reduction of the earth's equatorial radius from 6371.388 kilometers to 6371.099 ± 0.116 kilometers and of the value of g at Potsdam from 981.274 gals. to 981.2606 ± 0.0010 gals. Owing to recent work by the Anglo-Iranian Oil Co., the values of British stations are now strongly tied with the new determination of the absolute value of g at Teddington. The change in the

equatorial radius is due to the use of free air instead of isostatic reductions; reasons are given why the latter may have introduced a systematic error.—*Author's abstract.*

10487. Lagrula, Jean. Mesures gravimétriques dans l'Aurès, le Sahara sud-aurasien et le bassin du Chott Chergui [Gravity measurements in the Aurès, South-Aurasian Sahara, and the Chott ech Chergui basin]: Acad. Sci. Comptes Rendus, vol. 226, no. 13, pp. 1078–1079, Paris, 1948.

Gravity measurements made with a Holweck-Lejay pendulum instrument at 36 stations in Algeria during 1947 are reported with brief explanatory remarks. They amplify the local gravity network with respect to the important gap in the region of Aurès and fill in certain secondary gaps. The Aurès massif is found to cause negative Bouguer anomalies smaller in value than those of the Hodna basin, which is lower in altitude. Accordingly, it must be concluded that the rock density of the basin is independent of that of the massif, so that, apparently, there is no pronounced regionality in Algeria in the sense of the term of Vening Meinesz. H. P. Coster has made the same observation concerning the Mediterranean coast (Geophys, Abstracts 124, no. 8329). The gravity features of the areas of Hodna, Mitidja, and the Algerian coast appear to be correlated with comparatively recent geological processes, a relationship that has been considered probable in Finland and Sweden. Other observations are reported.—*V. S,*

10488. Lee, S. P., and Chin, H. L. The result of torsion balance survey of the lead-zinc deposit in Shuikoushan, South Hunan [in Chinese, with English summary]: Geophys. Comm. China, Geophys. Mem., no. 1, 22 pp., 9 pls., Peiping, May 1941.

The large lead-zinc deposit of Shuikoushan in South Hunan, China, mined for many years, was surveyed with the Askania torsion balance for the detection of new ore bodies. The local metallogenic limestone, which has a density of 2.5 to 2.7 gr./cm.^{3}, is overlain by sandstones and shales of a density of 2.4 to 2.5 and by surface residue of a density of 1.7 to 2.0. The ore proper has a density of more than 5.5 and is distributed in irregular pockets from 20 meters below the surface to a depth of 300 meters.

Three areas, selected as the most promising, were covered with a network of 400 stations averaging one station to each 10-foot square for a determination of gravity gradients, the use of curvatures being impractical in the prevailing local geology. The results are shown by means of maps and profiles. Their interpretation with the aid of theoretical curves of gradient variation over geologic structures of different types has indicated the presence of a dome in the first surveyed area, a fault in the second area, and a possible ore body in the third area. Mathematical calculation, verified by drilling, showed the dome to be paraboloidal in shape.—*V. S.*

10489. Liustikh, E. N. Tentative use of regional anomalies of gravity for a study of the causes of protracted vertical movements of plateaus [in Russian]: Akad. Nauk SSSR Doklady, vol. 61, no. 2, pp. 267–270, Moscow, 1948.

The causes of permanent or reversible vertical displacements of structural plateaus can be either horizontal shifts of masses in the in-

terior of the earth, or alterations in the volume of these masses, or both. To clarify the actual mechanism, the author calculates the changes that would be produced in extensive regional gravity anomalies by each of these processes and compares the results with the actual differences known to exist between the anomalies on the major terrestrial plateaus of various geologic age. The plateaus considered fall into the northern or Laurasian (Laurentian-Asian) group and the southern or Gondwana group, both of which comprise quiescent areas not subjected to vertical displacements during the Alpian cycle, and disturbed areas that were violently lifted or lowered.

The analysis tends to show that the permanent vertical displacements of the isostatically balanced quiescent areas are either wholly or largely caused by vast horizontal shifts of masses in the earth's interior, whereas the reversible movements of the overcompensated disturbed areas are caused mainly by compressions and expansions of materials at depth. This evidence points to the possibility that internal changes in volume are the cause of all vertical movement. They produce directly the violent reversible displacements and may, at the same time, set into operation the regulating mechanism of isostasy which effects equilibrium by a horizontal displacement of masses that results in permanant vertical displacements.—*V. S.*

10490. Marcantoni, Allessandro. Studi sul campo gravitazionale dell' ellissoide a tre assi [Studies of the gravitational field of a triaxial ellipsoid]: Istit. Veneto di Sci., Let., ed Arti Atti, vol. 103, no. 2, pp. 549–580, Venice, 1945.

The question of the exact shape of the geoid is of importance in many gravitational studies, especially in the computation of isostatic corrections. This amounts to the determination of the equatorial ellipse. The author introduces the conjugate eccentricity of the ellipsoid, that is, the eccentricity of two principal meridians. The shape of any meridian becomes then a function of its geographic longitude. Using ellipsoidal harmonics it is possible to express the gravitational potential at any point outside the ellipsoid in terms of coordinates of this point and eccentricities of the ellipsoid.

From this expression are obtained the values of the potential at any point of the surface of the ellipsoid and the three components of the gravitational force expressed in terms of its geographic coordinates, the angular velocity of the rotating ellipsoid, and the values of gravity at vertices of the terrestrial ellipsoid. From these equations it is possible to find the geometric constants of the geoid from measurements of gravity on the surface. The orientation of the equatorial ellipse remains unknown, but using the method of successive approximations, the most probable orientation can be determined.—*S. T. V.*

10491. Miller, A. H. Dominion Observatory, Gravity Division field work in 1947 [and] Field work proposed for 1948: Canadian Geophys. Bull., vol. 2, no. 1, pp. 47–50, Ottawa, Ontario, 1948.

The gravity field work carried out by the Dominion Observatory in Canada in 1947 is reported briefly, and plans for 1948 are outlined. Observations were made by two parties, each of which conducted both gravity and magnetic surveys. One party, using a Mott-Smith

gravimeter, made more than 1,000 determinations across Canada between Amherst, Nova Scotia, and Jasper, Alberta, and the other party, with a gravimeter of the North American Geophysical Co., made 670 determinations in the northern parts of Ontario, Manitoba, and Saskatchewan, as well as 220 determinations at Val d'Or. A strong anomaly in vertical magnetic intensity, surpassing the range of the magnetometer employed and estimated to exceed 10,000 gammas, was detected between Gladstone, Neepewa, and Minnedosa on Highway 4. Its magnetic and gravity profiles, which are presented, show a general correspondence, but the gravity values are less pronounced. Plans for 1948 call for gravity work mainly in Ontario, Quebec, and northwestern Canada.—*V. S.*

10492. Molodenskii, M. S., and Fedynskii, V. V. Thirty years of gravimetry in the Soviet Union [in Russian]: Acad. Sci. U.S.S.R. Bull. (Izvestiia), Sér. Géog. et Géophys., vol. 11, no. 5, pp. 395–408, Moscow, 1947.

Gravimetry has developed into an independent branch of applied physics only during the last three or four decades, since it became a method of exploration for useful minerals. In Russia it was first applied in 1921 to the exploration of the important magnetic anomaly near the city of Kursk. This was followed by a gravitational survey of the salt domes in the Emba region and by the investigation of several oil-bearing-formation in the Caucasus. In 1940 Russia had some 15,000 independent gravimetric stations, or one station per 1,000 square kilometers. Besides this general network a great number of field measurements were made in connection with industrial surveys. The gravity stations were distributed from the North Pole to the mountains along the southern boundary of the Soviet Union. In the search for chromite, sulfides, and other valuable ores, the station separation for these surveys averaged 10 to 25 meters. Besides this field work Soviet geophysicists have done a great amount of theoretical work. The geophysical industry in Russia is now producing its own instruments—pendulums, gravimeters, torsion balances—of an accuracy comparable to the instruments of western Europe.—*S. T. V.*

10493. Sans Huelin, Guillermo. Determinaciónes de la longitud del péndulo que bate segundos efectuadas por marinos de la Real Armada Española en el transcurso del siglo XVIII [Determinations of the length of the seconds pendulum made by the members of the Royal Spanish Navy during the eighteenth century]: Inst. Geog. y Catastral Mem., vol. 18, no. 2, 62 pp., Madrid, 1946.

The author presents a historical study of the gravitational measurements made by different members of the Spanish Navy during the eighteenth century. He not only relates the historical facts about the achievements of Spanish geodesists and navigators of that epoch but also presents a critical study of the evolution of knowledge about the shape of the earth and the properties of the pendulum as a time-measuring device as well as a geophysical instrument of precision. He also gives a description of the absolute determinations of gravity made by Spanish scientists at different places on the globe.—*S. T. V.*

10494. Sans Huelin, Guillermo. Gravimeters. Forma y Documento Professionale, vol. 5, no. 12, pp. 17–21, Madrid, 1946.

The author deals with the use of gravimeters in detecting changes of rock density in subterranean structures. Two gravimeters are described in detail. Both are based on the principle of measuring very small changes in position of a spring-loaded mass under different garvitational pulls. In the first gravimeter the movement is measured by the change in current due to variation of distance between two plates. In the second gravimeter the moving mass cuts off part of the light from a photoelectric cell. The sensitivity of one type of gravimeter is given as 0.64 millidyne.—*A. C. Jour. Inst. Petroleum, vol. 32, no. 274, p. 322A, London, 1946.*

10495. Shade, N. R. Geophysical history of the Cole Creek field near Casper, Wyoming [abstract]: Geophysics, vol. 13, no. 3, pp. 502–503, Tulsa, Okla., 1948.

This paper, with maps, describes the seismograph and gravity surveys and results obtained over Cole Creek oil field. A map made later from data obtained by development drilling is shown for comparison. There is close agreement between the geophysical data maps and the maps made from well data. The geophysical field methods and the methods of presentation of the data are described, and examples of seismic records and cross sections are shown.

10496. Thyssen, Stéphan von. Le compas de gravitation—appareil à mesurer la gravité d'un genre nouveau [The gravitational compass—an instrument of a new type for measuring gravity]: Ann. Géophys., vol. 4, no. 1, pp. 74–76, Paris, 1948.

The gravitational compass designed by the author is a variometer of a new type constructed as a T-shaped assembly. It consists of a horizontal nonmagnetic arm with suspended weights on the ends, which serves as the indicator needle, and of a supporting column rigidly attached to the arm. The column is enlarged at its base into a short cylindrical section, which is immersed in a basin of mercury and rests on a pivot point. Because of such an arrangement the column can so revolve on the pivot that the compass needle assumes any position without having to overcome resistance and compensate for rotational momentum.

This system is essentially analogous to that of the magnetic declination variometer. Its advantages over the torsion-balance principle are discussed mathematically, the technique of gravity measurements is explained, and the possibilities of a frictionless pivot are examined in the light of the work of V. Scott, R. Stribeck, S. Thyssen, and K. Tangl. It is found that a diminution of friction can be achieved by a reduction of the weight resting on the pivot through immersion of the enlarged section of the supporting column in mercury, so that the system is practically made to float in the basin and is merely centered on the pivot. A diagram shows the linear relationship observed between frictional momentum and angular velocity in the case of a system of quartz floating in purified mercury.—*V. S.*

10497. Zhuravlev, N. F. Determination of the flattening of the earth's ellipsoid from gravimetric observations [in Russian]: Sternberg Astr. Inst. Pub., vol. 14, no. 2, pp. 1–255, Moscow, 1940.

The author presents a catalog of gravity data from 10,712 stations. Some of the data represent repeated measurements. The list includes determinations through the year 1936 and is the first publication for many of them. The tables contain the station number, the geographic coordinates of the station, its altitude, the gravity value calculated with reference to the Potsdam gravimetric system, the free-air anomaly, the Bouguer anomaly, and the corresponding reference. The anomalies are computed by the international gravity formula. On the basis of the established data the flattening of the earth's ellipsoid is calculated by several methods. The results obtained range from 1/296.45 to 1/298.46. —*K. Jung, Zentralb. Geophys., Meteorol. u. Geod., vol. 9, no. 2, pp. 52–53, translated and condensed by S. T. V.*

2. MAGNETIC METHODS

10498. Bock, R. Ueber magnetische Orientierung (Magnetic orientation]: Zeitschr. Meteorol., no. 1, pp. 21–23, Potsdam, Germany, 1946.

During the last war the German Army used the magnetic compass extensively as an instrument for accurate orientation during the movement of a detachment. This made it imperative to have, in addition to a good compass, detailed magnetic declination maps of the countries invaded. The results of this method of orientation were very satisfactory, owing to the effectiveness of a special technical organization that consisted of some 30 groups of trained observers and technicians. The accuracy of the orientation attained in many cases was as high as $\pm 0.1°$. —*S. T. V.*

10499. Bullard, E. C. The secular change in the earth's magnetic field: Royal Astron. Soc. Monthly Notices, Geophys. Suppl., vol. 5, no. 7, pp. 248–257, London, 1948.

The hypothesis that the secular change in the magnetic field of the earth is due to electric currents induced in the material of the core by its movement through the general magnetic field of the earth is examined. Detailed calculations are made for the focus of rapid change in South Africa. It is shown that many of the observed facts can be accounted for by a circular motion with a diameter of a few hundred kilometers situated near the surface of the core. To get numerical agreement the field at the core has to be assumed larger than seems probable. The magnetic axis of the eddy is approximately horizontal and points N. 45° W.—*Author's abstract.*

10500. Burmeister, F. Grundlagen und Bearbeitung der Karte der magnetischen Missweisung für die Epoche 1945.0 [Ground work and elaboration of the map of magnetic declination for the epoch 1945.0]: Veröffentl. Erdphys. Warte Sternwarte, no. 7, 24 pp., Munich, 1941.

A comprehensive magnetic map was published by the German Geodetic Service for the use of the armed forces. In addition to Germany, the map covered France, Austria, Czechoslovakia, Denmark,

Netherlands, Belgium, southern Sweden, Poland, Lithuania, Hungary, and Switzerland. It was compiled from numerous individual maps that were based on surveys made at different times. All obtainable data were reduced to the epoch of 1945.0 by the author and critically analyzed. The procedure for each subdivision covered by the map is discussed, and formulas are derived.—*S. T. V.*

10501. Cook, K. L. Magnetic surveys in the Iron Springs district, Iron County, Utah [abstract]: Geophysics, vol. 13, no. 3, p. 503, Tulsa, Okla., 1948.

Some 62,000 magnetometer stations were established by the Division of Geophysical Exploration of the United States Bureau of Mines in the Iron Springs district in an area about 5 by 22 miles. Iron ore bodies occur as replacement pods in a favorable limestone bed at the margins of igneous intrusions. The ore is a mixture of magnetite and hematite with 14 to 58 percent magnetite. Surveys were made over outcropping bodies to determine their size, shape, and ore tonnage, and in geologically favorable areas to locate new ore bodies.

The survey was a means of locating 45 anomalies considered as possible evidence of ore bodies, including 13 on outcropping bodies of commercial size. Core drill testing has confirmed some of the findings, both of new ore bodies and of predicted form and extent of outcropping bodies. With the aid of the results obtained by the magnetic survey, confirmed by a single core test, a very few carefully planned additional core tests can give a large amount of information about an ore body.

10502. Ebert, A. Eine magnetische Aufnahme bei Aarhus, Dänemark, und ihre Bedeutung für die Wasserversorgung [A magnetic survey near Aarhus, Denmark, and its significance in water search]: Jahrb. Reichsamt Bodenforsch., 1941, vol. 62, pp. 155–162, Berlin, 1942.

The author describes the rare case of the tracing of a subsurface water course by a magnetic survey in Denmark. The area is underlain by thick Tertiary strata which are generally covered by relatively thin diluvium. There is, however, near the town of Aarhus, a deeply eroded trough stretching from east to west, in which the diluvial cover over the Tertiary reaches a thickness of 120 meters. The gravel and argillaceous deposits composing this cover contain considerable igneous rock debris and exert a marked effect on the local magnetic isoanomaly contours. Therefore, the diluvial trough and its ground water course, which is of considerable importance in the water supply of the town of Aahrus, could be traced by means of regional magnetic measurements over 18 kilometers westward into the country.—*Zeitschr. Prakt. Geol., vol. 51, no. 8, p. 94, Halle a. S., Germany, 1943, translated by V. S.*

Egyed, Laszlo. The determination of an infinite inclined dike from the results of gravity and magnetic surveys. *See* Geophys. abstract 10483.

10503. Giao, Antonio. Propriétés magnétiques de la matière en rotation [Magnetic properties of matter in rotation]. Gaz. Matématica, no. 34–35, pp. 1–6, Lisbon, Portugal, 1947–48.

From his unitary-field theory of gravitation and electromagnetism, developed in previous publications, the author deduces a general formula expressing the proportionality between the magnetic moment and the

rotational momentum of spherical masses rotating with constant angular velocity. This formula is found to be valid under conditions of any electric charge of the mass, and also when this charge is zero. Thus, any electrically uncharged mass in rotation engenders a magnetic field by the very fact of its rotation. The formula is applied first to the electron and then to the neutron and proton for deducing anomalous values of their magnetic moment. Finally the recent results of P. M. S. Blackett on the magnetic moment of stars in rotation are found to be easily explained by this formula.—*Author's abstract, translated by V. S.* (For Blackett's paper *see* Geophys. Abstract 132, no. 9746.)

10504. Gião, Antonio. Sur l'effet mécano-magnetique a l'intérieur des masses sphériques en rotation; application au champ magnetique terrestre [On the mechanical-magnetic effect at the interior of spherical masses in rotation; application to the terrestrial magnetic field]: Acad. Sci. Comptes Rendus, vol. 226, no. 8, pp. 645–647, Paris, 1948.

The author's thesis that the rotation of all spherical masses, even those not electrically charged, results in the formation of a magnetic field about them by the operation of mechanical-magnetic effects, formulated in his unitary theory of gravitation and electromagnetism, is developed further by a calculation of the magnetic field in the interior of such masses. This field was recently measured for the earth by Hales and Gough in an experiment at a Witwatersrand mine (*see* Geophys. Abstracts 133, no. 9993).

The analysis yields a formula for the internal magnetic field of rotating masses, which satisfies the previously deduced condition of its continuity with the field at the external surface of these masses and has the same general form as the formulas advanced by Runcorn and Chapman (*see* Geophys. Abstracts 133, no. 9987). The author's formula gives for the depth of 1,463 meters and other conditions of the Witwatersrand measurements a value in good agreement with the results obtained by Hales and Gough.—*V. S.* (For the author's papers on the external magnetic field of rotating masses *see* Geophysical Abstracts 134, nos. 10251 and 10252.)

10505. Gulf Research and Development Company. Application of sensitive magnetic devices to detection of submarines from aircraft, final report, July 1, 1942: U. S. Office Sci. Res. and Devel. Rept. 1870, 16 pp., Washington, D. C., September 1943. (Library of Congress, OTS PB Rept. 27550.)

The work on the airborne magnetometer by the Gulf Laboratories under contract to the United States Government is reported, together with a review of research prior to this contract. The account includes a description of the vertically stabilized instrument built according to specifications of the Sperry Gyroscope Co. It consisted of an aluminum housing containing a gyroscopic horizon and a saturated-core magnetometer mounted on the gyroscope with its axis parallel to the spin axis. A summary is given of the development of the magnetic airborne detector (MAD) Mark I and II magnetometers, the fully magnetic stabilization control, and the (MAD) Mark IV and V magnetometers. Photographs and a circuit diagram for the (MAD) Mark II magnetometer are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 109, Washington, D. C., 1946, condensed by V. S.*

10506. Hanlon, F. N. A magnetic survey in the vicinity of the volcanic neck at Dundas, N. S. W.: Royal Soc. New South Wales Jour. and Proc., vol. 81, no. 1, pp. 69–76, Sydney, Australia, 1947.

The volcanic neck at Dundas, near Sydney, Australia, consists of a mass of breccia and basalt which has intruded Wianamatta shale. A magnetometer survey has shown that there are three areas adjacent to the neck which seem to have been intruded by igneous rocks. These intrusions are probably basalt dikes which have weathered outcrops and which tended to split and follow irregular fractures in the country rock. Plans of the neighborhood of the quarry, showing isogams and probable outcrops of the dikes, and examples of the magnetic profiles along some of the traverse lines are included in the paper.—*Author's abstract.*

10507. Henderson, R. G., and Zietz, Isidore. Analysis of total magnetic-intensity anomalies produced by point and line sources: Geophysics, vol. 13, no. 3, pp. 428–436, Tulsa, Okla., 1948.

The component of total magnetic intensity in the direction of the earth's total field—the quantity measured by the airborne magnetometer—is studied in relation to point-pole and line-of-poles sources. Theoretical profiles are examined for maxima and minima, and it is established that the depth is a linear function of the half-maximum abscissa. A family of curves is presented by means of which factors can be obtained for use in estimating depths. The well-known factors used with vertical-intensity profiles are included as a special case. An example is given in which the factors are employed in analyzing a theoretical anomaly.—*Author's abstract.*

10508. Istituto Geografico Militare. Lavori geodetici eseguiti dall Istituto Geografico Militare nel quarto trimestro 1941 [Geodetic work accomplished by the Italian Geographic Military Institute in the last quarter of 1941]: Bull. no. 2, pp. 47–48, Rome, 1942.

Of the various projects completed by the Italian Geographic Military Institute and publications prepared during the last quarter of 1941, the following are of importance: (1) A new magnetic map of Italy with isogons reduced to January 1, 1940; and (2) the magnetic surveys made in different parts of Italy and special magnetic determinations made in Lybia and in Albania—*G. Laclavere, Zentralb. Geophys., Meteorol. u. Geod., vol. 9, no. 8, p. 385, Berlin, 1942, translated by S. T. V.*

10509. Jensen, Homer. Some technical aspects of Bahamas airborne magnetometer survey [abstract]: Geophysics, vol. 13, no. 3, p. 495, Tulsa, Okla., 1948.

The Bahamas airborne-magnetometer survey, discussed last year as a project about to begin, was completed in November. As a large-scale, coordinated application of the airborne magnetometer, Shoran, and other new electronic devices, this survey illustrates most of the problems and procedures involved. New techniques of magnetic control were developed to take advantage of the surprisingly low diurnal variation encountered in the area. It was demonstrated that the quality of magnetic information derived from an aerial survey of basement structures

is superior to that of the best ground surveys and that Shoran provides a practical system for establishing low-order geodetic control as well as accurate local flight guidance. An analysis of production and cost factors in aerial surveying indicates that airborne-magnetometer surveys have certain optimum operational activity levels depending on such factors as base facilities, area involved, and weather.

10510. Kalashnikov, A. G. On a new method for the investigation of small variations of the geomagnetic field [in Russian]: Akad. Nauk SSSR Izvestiia, Ser. Geog. Geofiz., vol. 12, no. 2, pp. 137–146, Moscow, 1948.

The currently used magnetic variometers based on the principle of a suspended permanent magnet have limited sensitivities. Accordingly, in order to measure small variations of the geomagnetic field, the author built at the magnetic laboratory of the Institute of Geophysics, Moscow, an automatically recording installation operating on the inductive principle. As the magnetic flux generated by the geomagnetic field in a coil is proportional to the coil's area and the number of windings, it was considered that a very large coil, such as one with an area of 1,000,000 square centimeters and 100 windings, would have a constant of 10^8 square centimeters. Thus, a variation of 1 gamma in the intensity of the geomagnetic field would produce a change of 1,000 maxwells in the coil's flux, which can be recorded by a fluxmeter.

The station has 2 induction coils 100 meters in diameter, buried at a depth of 0.5 meter in the ground, and is believed to possess a sensitivity of 0.01 gamma per millimeter scale division. Its construction is described, and its uses are illustrated by the recording of the magnetic effects produced by the solar eclipse of July 9, 1945, by aurora, by meteoric flux, by lightning, and by small explosions on the surface of the ground.—*V. S.*

10511. Katskov, A. I. Aeromagnetic surveys and their value in geophysical studies [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz., no. 11, pp. 8–11, Moscow, 1948.

In 1944 an aeromagnetic survey of the northern part of Kuznetskiy basin, in western Siberia, was made. It covered an area of about 4,500 square kilometers where several magnetic anomalies had been discovered with ΔZ ranging from 300γ to 500γ. At one point, near the Izhmorka railway station, the anomaly was as high as $+1000\gamma$. The instrument used in this survey was a Logachev magnetometer, specially adapted for aerial surveying. The accuracy of the measurements is about $\pm 100\gamma$, as can be seen from a comparison of the results of the aeromagnetic determinations with those of the absolute magnetic survey of this area made in 1934. The surveying airplane was kept at an altitude of 200 to 300 meters.

The paper contains several profiles. The region surveyed is characterized by important positive anomalies reaching a value of $\Delta Z = 600\gamma$ in the central part, near the town of Kemerovo. The observed positive anomalies decrease in amplitude toward the periphery, dropping to zero in the west and becoming negative in the east.—*S. T. V.*

10512. Kazanskii, A. P., and Suslennikov, V. V. Determination of the lower boundary of the Man'ga iron ore body [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz., no. 12, pp. 97–102, Moscow, 1948.

In 1945 a strong magnetic anomaly was discovered in the southern part of the Karelo-Finnish S.S.R. with its center near the town of Man'ga. The maximum value of Z was about 50,000γ. Exploratory drilling indicated a magnetite ore body with almost vertical sides at a depth of only 15 meters. The authors give an approximate determination of the vertical dimensions of the ore body on the basis of data obtained by measurements from an airplane at an altitude of 350 meters and by measurements made on the ground using the formula for the horizontal component of the geomagnetic vector derived by the senior author in 1938 (*see* Geophys. Abstracts 100, no. 5305). The final equations do not contain the unknown intensity of magnetization, so making possible the determination of the unknown vertical dimension of the iron deposit. The value obtained was 145 meters. Having determined the dimensions of the ore body, the authors have calculated the magnetic field generated by it on the earth's surface. The results are in good agreement with the observational data.—*S. T. V.*

10513. La Cour, D. The magnetometric zero balance BMZ: Danske Meteor. Inst. Comm. no. 19, 57 pp., Copenhagen, 1942.

The BMZ is a portable instrument for relative determinations of vertical magnetic intensity. Its principal element is a small measuring magnet weighing 2.5 grams, rotatable on knife edges on a steel bar and provided with a mirror for optical indication of its position. The vertical component of the geomagnetic field is compensated by a special electromagnet placed so that the centroid of the measuring magnet remains on the axis of the compensating magnet. Variation of the vertical geomagnetic vector causes a deflection of the measuring magnet.

The following advantages are ascribed to the new instrument: The magnetic moment of the measuring magnet does not affect the reading; the determination of temperature becomes unnecessary; the readings of the instrument are not affected by gravity; and the instrument has two scales, one with a range as high as 2,300 γ and the other 8,000 γ.

The bulletin presents a detailed discussion of the theory of measurement and of instrument construction. The efficiency of the instrument is high, making it possible to occupy 30 stations in 1 hour.—*V. Laursen, Zentralb. Geophys., Meteorol. u. Geod., vol. 9, no. 6, pp. 287–288, Berlin, 1942, translated by S. T. V.*

10514. Lahaye, E. Les mesures magnétiques effectuées au Congo belge [Magnetic measurements made in the Belgian Congo]: Ciel et Terre, vol. 58, pp. 13–18, Brussels, Belgium, 1942.

A summary is given of the results of geomagnetic surveys made in the Belgian Congo. The first magnetic measurements in this country were made in 1890–91 as part of a general geodetic and geographic exploration. Noteworthy are the magnetic determinations made by the Carnegie Institution of Washington in 1914, 1916, and 1920. These measurements were made with instruments of high precision. In connection

with the International Polar Year of 1932–33 a permanent magnetic station was established at Elizabethville. This observatory became a base station for the subsequent surveys of 1934–37, which covered different parts of the Belgian Congo, especially the rich region of Katanga. Thus far determinations of the geomagnetic vector have been made at about 500 stations with an average separation of 50 kilometers. Several of these stations were selected at points where the magnetic vector was determined in 1914–20 by the Carnegie Institution, thus making possible the determination of the secular variation of the magnetic vector in this region.— *S. T. V.*

10515. Laporte, L., Cooper, C., Lange, I., Hendrix, W., and Vestine, E. Final values of elements of the geomagnetic field at 5-degree intervals of latitude and longitude, epoch 1945, 73 pp., Washington, D. C., Carnegie Inst. Washington, Dept. Terres. Magn., Oct. 1, 1946.

The tables given list values read at 5° intervals of latitude and longitude from large-scale isomagnetic charts of the geomagnetic field prepared for the Hydrographic Office, United States Navy, under contract NOrd-392 with the Naval Ordnance Laboratory. They are based on almost all magnetic data available since 1905, after careful derivation of geomagnetic secular change for all years since 1905. The details of this work will be published in volume form at a later date.—*Authors' statement.*

10516. Logachev, A. A. Aeromagnetic surveys in prospecting for iron ore deposits [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz., no. 11, pp. 3–7, Moscow, 1947.

Aeromagnetic surveying was introduced in the U.S.S.R. in 1939 and has proved practical in the exploration of vast inaccessible areas. However, certain drawbacks, unknown in surveying on the ground, were encountered. In aeromagnetic surveying the intensity of local anomalies decreases rapidly with altitude, whereas the regional, less pronounced, anomalies are not affected to the same extent. As a result, the sharp magnetic gradients, detectable on the earth's surface, may almost disappear with height. Therefore the surveying plane should fly as low as possible. However, this is not always safe and in mountainous regions not feasible.

Magnetic maps obtained from aeromagnetic surveys are lacking in details and reflect only the main geologic features of the region. It is not always possible to obtain a coincidence of the boundaries of the anomalies in aeromagnetic and ground surveying. Intrusive rocks of basic composition show prominent anomalies, whereas the acid rocks are not as sharply delineated. Magnetic maps obtained from aeromagnetic surveys invariably show over magnetic deposits characteristic transition zones from negative to positive anomalies with a pronounced maximum. These maxima are characteristic features of such maps. Airplanes best adapted for magnetic surveys are those of very low speed, 100 to 120 kilometers per hour. In 300 flight hours it is possible to survey an area of 15,000 square kilometers, resulting in about 20,000 kilometers of profiles.—*S. T. V.*

10517. Madill, R. G. The search for the north magnetic pole: Arctic, vol. 1, no. 1, pp. 8–18, Montreal, Quebec, 1948.

The Dominion Observatory, Ottawa, has expanded its network of magnetic stations in the Arctic to an extent rendering it possible to indicate the presence of the north magnetic pole in northern Prince of Wales Island. A brief historical summary of magnetic observations in the north is given, followed by an account of the observations made in the summer of 1947. Preliminary values of the results obtained from Arctic magnetic stations in 1947 and a chart of magnetic meridians constructed from recent declination observations are included.—*Author's abstract.*

10518. Mercanton, P. L., and Wanner, E. L'anomalie magnétique du Jorat (Vaud)—2, Composante horizontale, declinaison, champ perturbateur, esquisse d'une interpretation [The magnetic anomaly of the Jorat, Vaud—2, The horizontal component, declination, disturbing field, sketch of interpretation]: Soc. Vaudoise Sci. Natur. Bull., vol. 63, no. 270, pp. 443–452, 2 maps, Lausanne, 1948.

The investigation of the magnetic anomaly of Jorat Mountain, Switzerland, commenced in 1943 with measurements of the vertical component, was extended in 1946 to include determinations of the horizontal component and declination. The work was carried out with the QHM magnetometer of La Cour, the use of which is described, and covered 160 stations for the determination of H and 90 stations for the determination of D, controlled and reduced with the aid of registrations at the Regensberg observatory. At each station additional measurements were made at one or more points nearby for checks. The normal magnetic field of reference was calculated by means of formulas derived from measurements outside the investigated anomaly.

The results are presented in isoanomaly maps and are interpreted in the light of local geology with the aid of the theoretical curves of F. Gassmann for different shapes of the disturbing body. It is found that the data agree best with profiles for an elongated, fingerlike intrusive. The mass apparently is large and must be situated near the northern boundary of the local Tertiary molassic anticline, parallel to the general direction of the Alps, at an approximate depth of 11 kilometers.—*V. S.*
(For part 1 see Geophys. Abstracts 129, no. 9172.)

10519. Millar, W. T., Kuehn, H. E., Dent, G. E., and Sanford, R. S. Magnetometric survey of the Mahopac magnetite mine, Putnam County, New York: U. S. Bur. Mines, Rept. Inv. 4338, 4 pp., Washington, D. C., September 1948.

During the later part of 1943 a magnetometric survey was conducted by the Geophysical Division of the Bureau of Mines at the Mahopac magnetite mine, Putnam County, N. Y., in an endeavor to locate a segment of an ore body that, reports state, was cut off by a fault. The Mahopac mine was abandoned about 1895 after producing nearly 1,000,000 tons of high-grade magnetite iron ore. The results of the

investigation indicate that the ore body terminates by "pinching" or by a displacement of such magnitude as to place any extension at a considerable distance from the original ore body. The report describes the work done on the project and presents the data obtained.—*Authors' abstract.*

10520. Nagata, Takesi. The natural remanent magnetism of volcanic rocks and its relation to geomagnetic phenomena: Earthquake Res. Inst. Bull., vol. 21, no. 1, pp. 1–196, Tokyo, 1943.

An experimental study was made of natural remanent magnetism in volcanic rocks and its relation to geomagnetic phenomena. The method consisted in observing the magnetic properties of a variety of volcanic rocks of known petrological and chemical composition to determine the intensity and direction of remanent magnetization. The results showed that the natural remanent magnetization of volcanic rocks can be reproduced in the laboratory by a cooling of sufficiently heated rocks in the geomagnetic field. The generation and disappearance of thermo-remanent magnetization, observed at various temperatures under such cooling, are described, and examples are given of the use of the changes thus induced in the study of geophysical phenomena, such as local anomalies of the geomagnetic field and local geomagnetic changes accompanying volcanic activity.—*V. S.*

10521. Nagata, Takesi. The magnetization curves of volcanic rocks [in Japanese]: Earthquake Res. Inst. Bull., vol. 21, no. 15, pp. 354–365, Tokyo, 1944.

The magnetic hysteresis curves of various volcanic rocks were determined with the aid of a ballistic method in a field of 0 to 4,000 oersteds. The results show that the intensity of magnetic saturation in these rocks is nearly proportional to the amount of Fe_3O_4 contained and that their coercive force ranges from 60 to 465 oersteds. In a unit magnetic field the ratio of the intensity of saturated thermo-remanent magnetization to the intensity of saturation magnetization is nearly proportional to the coercive force. Thus, a magnetically impermeable rock acquires a larger degree of thermo-remanent magnetization than a magnetically permeable rock.—*Author's abstract, revised by V. S.*

10522. Olsen, Johannes. Some investigations on the constancy of the QHM magnetometer: Danske Meteor. Inst. Comm., no. 20, 9 pp., Copenhagen, 1942.

The author has investigated 14 magnetometers of the new type QHM for invariability of the instrument constants. During 1939–41 some of these instruments were continuously compared with the absolute instruments of the State Geomagnetic Observatory of Rude Skov. Other instruments were sent to different countries to be used in various surveys. The constants were determined before the instruments were sent and after they were returned. Comparisons shows that the changes of the instrument constants average about $\pm 1\gamma$ and are of a random character. —*G. Fanselau, Zentralb. Geophys., Meteorol. u. Geod., vol. 9, no. 1, p. 351, Berlin, 1942, translated by S. T. V.*

10523. Pawlowski, Stanislaw. Anomalie magnetyczne w okolicach wieš Sw. Katarzyna-Psary [Magnetic anomalies in the neighborhood of the villages Sw. Katarzyna-Psary]: Polski Inst. Geol. Bull., no. 35, 28 pp., Warsaw, 1947.

A detailed geomagnetic survey was made in 1946 in the region of the villages Sw. Katarzyna-Psary, because strong magnetic anomalies had been discovered previously in this region. The Watt's variometer was the main instrument used. The accuracy of an individual measurement is estimated as $\pm 3\gamma$. This survey covered 2,080 field stations with 135 traverses. Three local magnetic anomalies were discovered. Subsequent prospecting and geochemical analyses of samples, taken at places of greatest anomalies, have disclosed the presence of a rock, probably diabase, with a magnetic susceptibility of 0.004 and an iron content of 13 percent.—*S. T. V.*

10524. Peterson, R. A. Origin and reduction of maneuver noise in MAD equipped aircraft: U. S. Office Sci. Res. and Devel. Rept. 1348, 30 pp., Washington, D. C., March 1943. (Library of Congress, OTS PB Rept. 27542.)

It is reported from the Airborne Instruments Laboratory, Columbia University, that maneuver noise in the magnetic airborne detector (MAD) may be caused by a combination of 4 factors: magnetic fields produced by the magnetization of iron parts in the plane, eddy current fields generated by motion of the ship in the earth's magnetic field, translation of the MAD detector through regional gradients in the earth's magnetic field during turns, and imperfect operation of the orientation or stabilizer systems. These factors are discussed. The principal conclusions from the date presented are that it is essential to choose aircraft-installation positions having ferromagnetic fields as small as possible and that the most profitable approach in reducing maneuver noise is the compensation of permanent fields by methods similar to those reported. Considerable improvements in performance may be expected from careful compensation operations. Graphs of flight, noise records, and isometric views are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 110, Washington, D. C., 1946, condensed by V. S.* (*See* also Geophys. abstract 10536.)

10525. Procopiu, Ştefan. Valeurs des elements magnétiques et des variations seculaires à Jassy, pendant 17 ans, de 1931 à 1947 [Values of magnetic elements and secular variations at Iaşi during the 17 years from 1931 to 1947]: École Polytech. Jassy Bull., vol. 2, no. 2, pp. 457–470, Iaşi, Rumania, 1947.

The data on magnetic declination, inclination, and the horizontal component, determined at Iaşi in Rumania during 1931–47, are presented, and the values of the vertical component and total geomagnetic force are deduced therefrom, making it possible to calculate the annual secular variations dD, dI, dH, dZ, and dF in these fields. Both the observed and derived values are found to deviate in part from these calculated for Iaşi by L. Laporte, C. Cooper, I. Lange, W. Hendrix, and E. H. Vestine, as given in the tables "Final values of elements of the geomagnetic field at 5-degree intervals of latitude and longitude, epoch 1945"

(*see* Geophys. abstract 10515). The values obtained for Iaşi from the measurements of 1931–47 and the earlier data for both Iaşi and for Bucharest, available in some cases since 1772, are used for drawing a map of secular geomagnetic variation at these stations, which shows among other features a declination maximum in 1798 and a declination minimum in 1905.—*V. S.*

10526. Ramsayer, K. Die Änderung magnetischer Störgebiete mit der Höhe und ihr Einfluss auf die Flugnavigation [Variation of magnetic anomalies with altitude and its influence on aerial navigation]: Beitr. angew. Geophysik, vol. 9, pp. 65–97, Leipzig, 1941.

To investigate the disturbing influence of local magnetic anomalies on aerial navigation a series of measurements of the declination and horizontal intensity at different altitudes was made in a specially equipped airship over one of the strongest geomagnetic anomalies in Germany. The corresponding values were also computed from magnetic maps of this region, following Malkin's method. A comparison of the calculated data with those obtained from direct measurements shows close agreement, and in the opinion of the author the computed values are more accurate than those measured directly. The intensity of the magnetic anomaly decreases rapidly with the altitude; for instance at an altitude of 1 kilometer the greatest anomaly of declination was found to be 0.8°, as compared with 3.6° on the ground. The author concludes that the disturbing influence of the magnetic anomalies on aerial navigation when a magnetic compass is used is negligible.—*S. T. V.*

10527. Randell, J. T. Geological interpretation as a result of geophysical explorations of a section of the Lynn Lake area, Manitoba, Canada [abstract]: Geophysics, vol. 13, no. 3, p. 504, Tulsa, Okla., 1948.

A composite geomagnetic map of an 8,000-acre area discloses major structural features within a belt of pre-Cambrian rocks. Factual geologic data are scarce and alone hint at only minor structural features. The purpose of the paper is to show the possibilities of mapping the geology in covered areas of pre-Cambrian rocks by geomagnetic and electrical methods.

10528. Richardson, M. S., and Weid, A. C. Analysis of operation of the universal magnetometer head: U. S. Office Sci. Res. and Devel. Rept. 1776, 56 pp., Washington, D. C., August 1943. (Library of Congress, OTS PB Rept. 27545.)

This report deals with the theoretically permissible aerial maneuvers and regions of operation of the universal magnetometer head developed for the magnetic airborne detector at the Airborne Instruments Laboratory, Columbia University. It analyzes idealized forms of two types of proposed flight operations by examining first the operation for zero pitch and then determining the additional limitations imposed by dive or climb. The discussion is limited to the case when the apparatus is connected for Northern Hemisphere operation with the magnetometer head disposed forward of the motors. Operation in the Northern and Southern Hemispheres with the proper connections can be shown to be symmetrical.

The report includes a diagram of the universal head and several graphs.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 110, Washington, D. C., 1946.*

10529. Richardson, M. S., and Weid, A. C. A general type of operation of the universal magnetometer head: U. S. Office Sci. Res. and Devel. Rept. 1928, 35 pp., Washington, D. C., September 1943. (Library of Congress, OTS PB Rept. 27546.)

The universal head of the magnetic airborne detector is a triaxial gimbal system for mounting its magnetometer elements which permits three degrees of rotational freedom. This report is a theoretical examination of the limitations imposed on the maneuvers of the operating airplane by this type of magnetometer support. Actual operating ranges are calculated for assumed approximate axis limits. Curves and tables of limits are worked out.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 110, Washington, D. C., 1946.*

10530. Richardson, M. S., and Weid, A. C. Operation of the universal magnetometer head with linear non-ideal control mechanism: U. S. Office Sci. Res. and Devel. Rept. 1930, 13 pp., Washington, D. C., September 1943. (Library of Congress, OTS PB Rept. 27547.)

This report discusses methods of determining the operating regions of the universal magnetometer head that are permissible for certain types of control mechanisms. The universal head is a gimbal system with three degrees of rotational freedom, but each rotation is limited in range. Such a mechanism, subject to an error that is a linear function of the abscissa axis of rotation, is found to require only two measurements for the theoretical determination of the corrections that have to be applied to the operating range calculated on the basis of an ideal control mechanism for obtaining its workable span. These corrections define the widest range within which a control mechanism of this type is certain to operate satisfactorily but do not exclude other areas in which it may likewise give adequate performance. The curves obtained are given.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 110, Washington, D. C., 1946, revised by V. S.*

10531. Rössiger, M. Das erdmagnetische Normalfeld der Verticalintensität für Mitteleuropa, Epoche 1941.5 [The normal field of the vertical geomagnetic intensity for middle Europe, reduced to the epoch 1941.5]: Beitr. angew Geophysik, vol. 9, no. 1, pp. 121–128, Leipzig, 1941.

Values of Z taken from the observations of six properly selected stations, all reduced to epoch 1941.5, make possible the representation of the normal geomagnetic field of middle Europe by the equation:

$$Z=43460+499.0\Delta\varphi+19.28\Delta\lambda+0.952\Delta\varphi.\Delta\lambda-10.95\Delta\varphi^2+2.21\Delta\lambda^2.$$

In this formula $\Delta\varphi$ and $\Delta\lambda$ are the differences in latitude and longitude, measured in degrees, from Niemegk, positive toward north and east. The yearly variations of the coefficients are also determined. The gradients of Z with respect to φ and λ can be calculated from the

equation with sufficient accuracy. Tables of these values are given in the paper.—*S. T. V.*

Scharon, H. L. Application of geophysical methods in the Frederickstown lead district, Madison County, Missouri [abstract]. *See* Geophys. abstract 10597.

10532. Scherb, M. V. Cathode-ray magnetization curve tracer: Rev. Sci. Instruments, vol. 19, no. 7, pp. 411–419, Lancaster, Pa., 1948.

An instrument developed to measure the magnetic properties of materials in a variety of forms by oscillographic techniques is described. Magnetic hysteresis loops can readily be obtained for specimens in rod, powder, tape, or wire form having cross-sectional areas as small as 10^{-5} square centimeters or as large as 0.3 square centimeter (¼-inch rod). With slight modifications the instrument can be adapted to magnetic measurements of materials as a function of frequency, temperature, tension, torsion, or pressure, by using the appropriate set-up.—*Author's abstract.*

10533. Slaucitajs, L. Über die erdmagnetische Arbeiten, ausgeführt in Lettland vom Jahre 1936 bis 1941 [Geomagnetic work carried out in Latvia during the years 1936–41]: Acta Univ. Latviensis, 3d ser., no. 34, pp. 369-374, Riga, Latvia, 1941.

This is a report on the geomagnetic surveys planned or in progress in Latvia. An important project is the establishment of 15 base stations for observation of secular variation. These stations were built and equipped with instruments in 1939–40. Another important project is the establishment of stations 20 to 25 kilometers apart, for continuous measurement of *D–H–Z* and a system of *Z* points with a maximum distance of 7 kilometers between points. The last project was in progress in 1941.—*R. Mayer, Zentralb. Geophys., Meteorol., u. Geod., vol. 10, no. 2, p. 68, Berlin, 1942, translated by S. T. V.* (*See* also Geophys. Abstracts 132, no. 9769.)

10534. Socolescu, M. M. Mesurages du magnétisme terrestre dans la Dobrogea méridionale [Measurements of terrestrial magnetism in southern Dobrudzha]: Inst. Géol. Roumanie Comptes Rendus, vol. 26, pp. 42–48, Bucharest, 1941.

In 1936 the geomagnetic declination, inclination, and horizontal component were determined at 11 stations on the shore of the Black Sea between Mamaia and Balcic in Dobrudzha to explore the area for metalliferous deposits and to test remodeled galvanoscopes of Brünner and Edelmann. The procedures of measurement are described. The results showed little variation in magnetic elements and no marked anomalies. Geologically interpreted, they indicated uniform rock permeability to the south of the parallel of Constanta and rising permeability northward. Both galvanoscopes proved suitable for the measurements.—*V. S.*

10535. Tolles, W. E. Compensation of induced magnetic fields in MAD-equipped aircraft: U. S. Office Sci. Res. and Devel. Rept. 1386, 19 pp., Washington, D. C., April 1943. (Library of Congress, OTS PB Rept. 27548.)

This report presents the theoretical basis of a procedure for the com-

pensation of induced magnetic fields in aircraft equipped with the magnetic airborne detector (MAD). Preliminary practical trials have yielded results consistent with this theory. Results of flight tests of this compensation procedure will be presented in a later report.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 110, Washington, D. C., 1946.* (For later report *see* Geophys. abstract 10540.)

10536. Tolles, W. E., and Vacquier, V. V. Compensation of magnetic fields in MAD-equipped aircraft: U. S. Office Sci. Res. and Devel. Rept. 4187, 87 pp., Washington, D. C., July 1944. (Library of Congress, OTS PB Rept. 27551.)

This report from the Airborne Instruments Laboratory, Columbia University, describes research on the elimination of spurious indications in the readings of the MAD magnetometer caused either by ferromagnetic parts of the operating aircraft or by magnetic fields set up by eddy currents generated in the conducting structures of the aircraft in the course of its maneuvers in flight. As these spurious effects may mask the effects from anomalies in the geomagnetic field, experience, research, and theoretical analysis were combined to develop a scheme of magnetic compensation. The problems involved in the choice of location for the magnetic airborne detector head in the plane are examined. Flight maneuvers for testing compensation, the separation of the magnetic components of the disturbing field, and the compensation procedure are discussed. A section of the report is devoted to the derivation of fundamental equations and working formulas.

The appendixes contain a calculation of induced compensation and of eddy-current ring compensators; a description of the adjustable permalloy compensator; and a discussion of direct-coupled amplifiers, electronic compensator for induced magnetic fields, electronic compensator for eddy-current fields, service compensations, and related subjects.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 110, Washington, D. C., 1946, condensed by V. S.* (*See* also Geophys. abstract 10524.)

10537. U. S. Coast and Geodetic Survey. Magnetograms, Tucson, Arizona, July–December 1946: Serial MG-T46.2, 56 pp., Washington, D. C., 1948.

The semiannual series, of which this report is a part, presents magnetograms of Tucson Magnetic Observatory in their entirety and gives more nearly current records than was possible with other series. The tracings are shown in quarter-size reproductions, and tables of numerical data are included with instructons for the scaling of any desirable values from the original records or from the reproductions. The magnetograph of the observatory consists of variometers for measuring changes in declination, horizontal intensity, and vertical intensity, with one recorder for all three instruments.—*V. S.*

10538. U. S. Naval Ordnance Laboratory. Physical principles of the fluxgate and other inductor magnetometers: Mine Unit Rept. 263, 44 pp., Washington, D. C., July 1941. (Library of Congress, OTS PB Rept. 31700.)

Types of portable marine magnetometers which operate on the inductor principle, either mechanically or electrically, are discussed in this report in considerable detail and with extensive illustrations. The W. I. T. and N. O. L. rotating coils, the sylphon, the rotating sector, the GE rotating coil, the inductor pistol, and the aeroid inductor are described, as well as six types of electrical (fluxgate) magnetometers. The basic fluxgate method is analyzed. The report includes a discussion of wave-form and signal amplification. Photographs, circuits, and schematic diagrams are given.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 11, pp. 804–805, Washington, D. C., 1946.*

10539. U. S. Naval Ordnance Laboratory. Physical principles of the General Electric magnetometer: Mine Unit Rept. 272, 42 pp., Washington, D. C., July 1941. (Library of Congress, OTS PB Rept. 31857.)

This report presents an exhaustive discussion of the physical principles underlying the operation of the General Electric Co.'s magnetometer, now in use to measure a ship's magnetic field. Both the portable and the range models of the instrument are discussed. Photographs and diagrams are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 9, p. 647, Washington, D. C., 1946.*

10540. Vacquier, V. V., and Tolles, W. E. Compensation of AN/ASQ-2 installation in Army B-18 bomber no. 7470: U. S. Office Sci. Res. and Devel. Rept. 1997, 29 pp., Washington, D. C., Nov. 1943. (Library of Congress, OTS PB Rept. 27544.)

This report from the Airborne Instruments Laboratory, Columbia University, describes the magnetic compensation of a wing-tip installation of a magnetic airborne detector (MAD) in an Army B-18 bomber, accomplished with copper rings, permalloy strips, and permanent magnets. The compensation procedure consisted in rolling the airplane at different frequencies and in recording the noise generated by these maneuvers with a direct current amplifier. Since the method used for compensating the B-18 is novel, the procedure which was followed is set forth step by step. A survey of the magnetic field at possible detector locations, made by moving the airplane away from a stationary magnetometer, is very helpful in determining the best spot. When the location has been selected, the survey should indicate the major components that require compensation.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 113, Washington, D. C., 1946.* (For related reports *see* Geophys. abstracts 10524, 10535, and 10536.)

Weiss, O., and Frost, A. Geological results of geophysical prospecting for water in the new goldfields of the Orange Free State, Union of South Africa. *See* Geophys. abstract 10600.

3. SEISMIC METHODS

10541. Amoros Portoles, J. L. La agitación microsísmica en la costa mediterránea española [Microseismic disturbances along the Spanish Mediterranean coast]: R. Acad. Cienc. Rev., vol. 40, no. 2, pp. 223–249, Madrid, 1946.

Microseisms observed along the Mediterranean coast of Spain are of the same general character as those of continental Europe, although they are more affected by the action of storms lashing the Iberian Peninsula. The influence of winds is at a maximum during the winter months with periods of relative calm in the summer. A diurnal variation of microseismic disturbances is noticeable also. Paralleling the variations of meteorological factors, microseisms decrease in intensity during the night and manifest a certain decrease in intensity around noon.

Although they constitute an exceedingly complex phenomenon, microseisms can be divided into several classes, with periods of variation ranging from 3 seconds to 10 minutes. Besides meteorological factors, geologic conditions influence the amplitudes of microseismic disturbances and the velocity of their propagation. The resistance of the ground to propagation of microseismic waves varies with the season of the year and with the geologic structure of the country.—*S. T. V.*

10542. Arons, A. B., and Yennie, D. R. Energy partition in underwater explosion phenomena: Rev. Mod. Phys., vol. 20, no. 3, pp. 519–536, Lancaster, Pa., 1948.

Pressure-time curves, continuous from initial shock-wave incidence through the second bubble pulse, are examined in the light of acoustic theory. Calculations of impulse and of reversible and irreversible energy flux are made for the various phases of the phenomenon. An estimate has been made of the amount of energy dissipation associated with the propagation of the shock front. A tabulation of the energy partition is included, and it is shown that substantial quantities of energy are radiated or dissipated by mechanisms other than those taken into account in this discussion.—*Authors' abstract.*

10543. Atwater, G. I. The discovery of the University oil field, East Baton Rouge Parish, Louisiana: Geophysics, vol. 13, no. 3, pp. 371–386, Tulsa, Okla., 1948.

The localized occurrence of salt water in shallow wells on and near the Louisiana State University campus and the fossil shells observed in the cuttings during the drilling of these wells attracted the attention of geologists to this area before 1926. A torsion-balance survey in 1931 was followed in 1933 by the drilling of a hole southeast of the present field, which proved to be dry. Three separate reflection seismograph surveys during the period 1934–37 revealed a structure on university land, but three wells drilled as a result of these surveys failed to establish production. In 1938 the original well, drilled in 1931, developed oil and gas shows. After that, an additional reflection survey was made to detail the structure as an aid in development.—*Author's abstract, edited by V. S.*

10544. Bakhshian, F. A. Spherical wave motion in an elasto-plastic medium caused by an explosion [in Russian]: Prikladnaia Matemat. Mekhan., vol. 12, no. 3, pp. 281-286, Moscow, 1948.

The author analyzes the problem of the spherical wave generated in an elasto-plastic medium of given properties by an explosion taking place in a spherical cavity. This explosion creates a pressure varying so that the deformation either increases or remains constant but never recedes. At any moment a certain sphere around the point of explosion encloses the points whose displacements are plastic; beyond this sphere they are elastic. Equations of wave motions for either of these regions can be written if the mechanical properties of the medium are known. Using the kinematic and dynamic conditions of continuity for the sphere separating the two regions, the integration of the established differential equations becomes feasible and gives the velocity of the propagating wave front and the stresses at these points.—*S. T. V.*

10545. Bechert, Karl. Über die Differentialgleichungen der Wellenausbreitung in gasen [Differential equations of wave propagation in gases]: Annalen der Physik, vol. 39, pp. 357–372, Leipzig, 1941.

The present paper is a summary of previous studies by the author on the propagation of elastic waves through gases, as well as an application of existing methods of solution to new problems. The laws of propagation of waves through gases are represented by nonlinear differential equations, the general solution of which is unknown. Only special cases of plane waves have been solved. In discussing the spherical and cylindrical waves the author found one of the equations offered a possible solution. Certain cases important in fluid dynamics are treated by a new method proposed by the author in which the usually assumed independent variable x, displacement, is replaced by m, the mass of a layer of gas having a thickness of a wave length. This transformation allows certain generalizations of the solutions found and, in the opinion of the author, offers new possibilities in solving other special cases in the same field.—*S. T. V.*

10546. Benioff, Hugo. Seismological instruments developed at C. I. T.: Eng. and Sci. Monthly, vol. 11, no. 2, pp. 24–25, 31, Pasadena, Calif., 1948.

An account is given of work on instruments at the Seismological Laboratory of the California Institute of Technology since its establishment in 1921. Among the instruments developed were the Wood-Anderson torsion seismograph, the torsion seismograph of Sinclair Smith for recording strong earthquakes, the Benioff vertical-component and horizontal-component seismometers, and the Benioff electromagnetic linear strain seismograph. Principal attention is given to the last three instruments.

The Benioff seismometers overcome the limitations of torsion seismographs in the recording of vertical motion and magnification by converting pendulum movement into electric power by means of a variable reluctance transducer designed on the principle of the telephone receiver. By its movement the pendulum changes the lengths of four magnetic air gaps so that two are increased while the other two are decreased. The resulting variation in magnetic flux through the associated armature produces an electrical potential in the coils surrounding the armature.

The Benioff linear strain seismograph records ground displacements produced by seismic waves. At the California Institute of Technology laboratory two steel piers are set into bedrock at points 60 feet apart, and a 2-inch iron pipe is suspended between them, being rigidly fastened to one pier and extending to within a short distance of the other. When seismic waves traverse the ground and cause the piers to be displaced relative to each other, the loose end of the pipe approaches or recedes from the adjacent pier and actuates a variable reluctance transducer generating electric current.—*V. S.*

10547, Bernard, Pierre. Dispositif optique d'inscription du temps sur les enregistreurs photographiques [Optic device for the registration of time by photographic recorders]: Ann. Géophys., vol. 4, no. 1, pp. 77–78, Paris, 1948.

The current system for registration of time signals on photographically recorded seismograms meets with two difficulties. The trace of the signal depends upon the entire length of the cylindrical magnifying glass and is so long that it usually cuts across several successive seismogram traces. Furthermore, an error of parallax is produced if the light rays from the argon lamp and from the incandescent lamp of the recording apparatus are not placed exactly in the plane of the axis of the magnifying glass.

To remedy these difficulties an optical device is suggested that consists of a small concave mirror slit in the middle parallel to the filament of the incandescent lamp and placed before this lamp and to the side of the argon lamp. By virtue of such arrangement the incandescent filament and the reflection of the argon lamp are projected on the mirror of the recording galvanometer and thence on the cylindrical magnifying glass. This glass reduces the image of the filament to the size of a point and the reflection of the lamp to a line on each side of that point. The device can be made to register time signals as short as necessary by reduction of the reflecting surface of the concave mirror through the use of black absorbent-paper covers. The results are illustrated by examples of the seismograms obtained.—*V. S.*

10548. Berson, I. S., and Gurvich, I. I. Selection of most rational methods for the determination of average velocities from hodographs of reflected waves [in Russian]: Moscow Geol. Prosp. Inst. Orjonikidze Trans., vol. 18, pp. 29–39, Moscow, 1941.

A fundamental problem in the interpretation of reflection data in seismic exploration is the selection of the most accurate method for determining average velocities from local hodographs when observations in wells are not possible. Actually the numerous existing methods are all variants of the same fundamental approach, which consists in choosing from a family of equilateral hyperbolas the particular curve that is the closest to the curve recorded in the field. The principal criterion for deciding which one of these variants is the best likewise is the same, namely, that of attaining the nearest approximation to average velocity, ultimately reducible to the requirements of greatest accuracy both in obtaining the empirical and the theoretical curve and in matching them.

To determine how well existing methods satisfy this criterion, the principal techniques of quadratic coordinates, asymptotes, finite dif-

ference, and theoretical hodographs are examined in the light of underlying mathematical theory, their advantages and limitations are noted, and curves of their relative or maximum accuracy in determining average velocity are given. It is concluded that, when the minimum point of a hodograph is established with precision, it is advisable to use the method of theoretical hodographs and to check the results by the method of asymptotes. When only one branch of a hodograph is available, the method of finite differences is recommended.—*V. S.*

10549. Bonchkovskii, V. F. A new method of determination of the thickness of earth's crust [in Russian]: Akad. Nauk SSSR Vestnik, no. 6, pp. 69–70, Moscow, 1948.

One of the important subjects of study in geophysics is the inner structure of the terrestrial globe. Seismological observations have shown that the earth is composed of a series of layers quite different in physical properties. The earth's crust proper consists of a granitic layer and a basaltic layer covered with sediments. The crust has a thickness of about 30 kilometers in western Europe and of 40 to 50 kilometers in middle Asia and Japan. Its thickness can be determined either from records of earthquakes or from observations of artificially produced explosions. Recently the Seismological Institute of the Russian Academy of Sciences conducted observations on the effects of an explosion at nine specially equipped stations at distances ranging from 53 to 554 kilometers from the shot point. From these experiments the thickness of the earth's crust was found to be 37 kilometers.

The records of remote deep-focus earthquakes are especially valuable, as they show waves reflected from the bottom boundary of the earth's crust and make possible the determination of the thickness of the earth's crust at the half distance from the epicenter. Thus seismic records made in Sverdlovsk in the Ural Mountains served to determine the thickness of the earth's crust in Italy and in equatorial Africa. The thickness of the earth's crust must be considered in isostacy computations and is important in many geological problems.—*S. T. V.*

10550. Brekhovskikh, L. M. Reflection of spherical waves from the "weak" separating boundaries [in Russian]: Zhur. Tekhn. Fiz., vol. 18, no. 4, pp. 473–482, Moscow, 1948.

The author applies the results of his previous study (*see* Geophys. Abstracts 134, no. 10282) to a special case of the reflection of acoustic or electromagnetic waves when the properties of the media, separated by a plane boundary, are not very different. Such "weak" separating boundaries are encountered quite often in practice, when the advancing wave reaches the second medium through an intermediate layer which continuously changes its physical characteristics. The author determines the limits of differences in physical properties of contiguous media still allowing the use of derived formulas and discusses the criteria permitting a transitional layer to be replaced by a definite plane boundary.—*S. T. V.*

10551. Dix, C. H. Correlation of reflections with electrical and geological logs [abstract]: Geophysics, vol. 13, no. 2, pp. 300–301, Tulsa, Okla., 1948.

By examining the pulse shapes on well velocity records where the transients were particularly short and well defined an average pulse

shape was established. Using the electrical log and the geological log, major contacts were determined. From the well's interval velocity results it was further decided whether the velocity increased or decreased with increasing depth at the main sharp contacts. A synthetic record then was made by using the well's time-depth data, the average pulse shape, and the depths of contacts, and by assigning direct (positive) character to the pulse when the velocity increased downward and inverted (negative) character when the velocity decreased downward.

This synthetic record shows a remarkable resemblance to nearby records actually shot. The timing is essentially correct, and the reflections are correctly identified as positive and negative. Inspection of the average pulse shows in this case a direct first part followed by a second part which is reflected from the ground surface. Since every reflection on the present synthetic record (and on the actual records) appears as a doublet, only the first parts are to be correlated simply and directly with geological contacts. This is also true of the basement, the second part of the basement doublet plotting well below the basement top. The bearing of these results on the problem of correlating from record is quite evident since the term "character" is made to refer to a really characteristic shape in the pulse.

10552. Galanopoulos, A. G. Earthquake study in Greece, 1947: Am. Geophys. Union Trans., vol. 29, no. 2, pp. 256–257, Washington, D. C., 1948.

Studies of the earthquake of September 26, 1932, in Chalcidice (Khalkidhiki), Greece, with its aftershocks in 1932 and 1933 and of the earthquake of March 1, 1941, at Larissa, Greece, are reported with remarks on the operation of Wiechert seismographs at the Athens Observatory. These investigations were aimed at verifying the field epicenter of the shocks of 1932–33 and the intensity of the shock of 1941 but failed because of insufficient records and lack of instrumental constants.—*V. S.* (For previous paper on the shock of 1941 *see* Geophys. Abstracts 130, no. 9378.)

10553. Gutenberg, Beno. A geophysicist X-rays mother earth: Eng. and Sci. Monthly, vol. 11, no. 2, pp. 19–20, Pasadena, Calif., 1948.

A brief account is given of the use of seismic waves for the study of the structure of the earth. The paths of different types of waves generated by shallow and deep earthquakes are described and are illustrated by diagrams. The phenomena of shadow zones, velocity changes at the surface of the core, low velocities at a depth of 80 to 100 kilometers, deep roots of mountains, relation of earthquakes to gravity anomalies, and other subjects are touched upon. Brief consideration is also given to the application of seismic methods to the study of structural features in superficial layers of the earth's crust as an aid to exploration of natural resources.—*V. S.*

10554. Gutenberg, Beno, and Richter, C. F. Earthquake study in southern California, 1947: Am. Geophys. Union Trans., vol. 29, no. 3, pp. 406–407, Washington, D. C., 1948.

A progress report is given for 1947 on earthquake studies at the Seismological Laboratory, Pasadena, Calif. Gutenberg investigated seismograms at epicentral distances from 4° to 26°, constructed revised

travel times for *P* and *S* phases, and determined the amplitudes of these phases as functions of distance. J. M. Nordquist and L. P. Geldart studied coincidences in calendar date between earthquakes in the same area in different years. H. Benioff continued research on the release of energy in sequences of earthquakes. J. P. Buwalda and Richter investigated fault-trace phenomena produced by the Manix earthquake in the central Mojave Desert, and Richter and Nordquist studied instrumental records of the aftershocks of this earthquake. Other work is reported.—*V. S.*

10555. Haarstick, Fritz. Der Einfluss der Tektonik auf die Tiefenangaben der Reflexionsseismik [Influence of tectonics on the depth indications obtained by the seismic reflection method]: Beitr. angew. Geophysik, vol. 9, pp. 146–157, Leipzig, 1941.

In geophysical prospecting by the seismic reflection method the value of the average velocity is usually determined, if possible, by shooting a well within the area investigated, or at least in the vicinity. Different geologic conditions often influence the average velocity and cause errors in determination of the depth of the reflecting horizon. Another source of still greater error is the dip of the formation, which completely changes the geometric picture of the subsoil. The author recommends checking the dip of the formations by the refraction method and repeating the entire calculations, using the angle thus obtained.

The good results obtained for depth determination by this method in the Gulf Coast area of Texas and Louisiana are to be explained by the moderate amount of folding of the formations there and the small variation in their thickness.—*S. T. V.*

10556. Hansen, R. F. Multiple reflections of seismic energy [translated and edited by C. H. Johnson]: Geophysics, vol. 13, no. 1, pp. 58–85, Tulsa, Okla., 1948.

This paper is a report of observations of multiple reflections in seismograph work in Argentina and includes successful methods of identifying them and unsuccessful attempts at eliminating them. It begins with generalizations regarding the expectancy of multiples and develops geometrically, using straight-line paths, the relation between multiples and their primary reflections for the cases of multiple reflection between a horizon and the surface and between two horizons, as regards time of reflection, dip, and average velocity. The importance of sharp reflecting contrast at the surface is emphasized, and it is concluded that the base of weathering may be more important in the formation of multiples than the surface of the earth.

Early observations of multiple reflections from a volcanic flow and from a shallow basement are described. Other areas showed discordant data on the seismograms and cross sections, which, if due to multiples, could only be caused by multiple reflections from good sedimentary reflectors. The paper closes with suggestions for identifying multiple reflections by their abnormal curvatures in discontinuous, symmetrical-spread dip shooting, and for using primitive qualitative methods where the topography or subsurface are not suited to the quantitative methods developed here.—*Translator's abstract, condensed by V. S.* (For reference to the original Spanish text *see* Geophys. Abstracts 128, no. 9016.)

10557. Hardtwig, Erwin. Ueber die Eintauchtiefe von Rayleigh-Wellen [The depth of the Rayleigh waves]: Zeitschr. Geophysik, vol. 18, no. 3–4, pp. 150–163, Braunschweig, 1944.

Rayleigh waves are investigated to ascertain the law according to which the amplitudes vary with depth. The following conclusions have been arrived at: The amplitudes do not decrease monotonically but go through extreme values; the horizontal component at a certain depth becomes negative; the movement of the soil element at this depth changes its direction; the depth of penetration of the wave is inversely proportional to the frequency.—*Author's abstract, translated by S. T. V.*

10558. Hodgson, E. A. Laboratory tests of the microseismic method of detecting critical rock pressures [abstract]: Royal Soc. Canada Proc., ser. 3, vol. 41, pp. 193–194, Ottawa, Ontario, 1947.

Experiments conducted in Lake Shore mines, Kirkland Lake, over a period of 3½ years indicated that critical rock pressures can be detected for rock in place. Rock bursts cannot be predicted because the critical pressure may be dissipated before rupture occurs.

To test the basic principle of the microseismic method the National Research Council, Ottawa, sponsored experiments at the laboratory of the United States Bureau of Mines. The investigation on samples of rock from Canada was conducted by three Canadian delegates with the assistance of the Bureau's officials. The results show that microseisms appear at about a 50-percent bursting pressure and become increasingly numerous as the pressure is increased. At 80 percent of the bursting value and above the incidence of microseisms is very marked. Only one sample of the 22 tested failed to give indicative microseisms. It was obvious that the characteristic timbre of the microseisms makes it easy to distinguish them by ear from ordinary noises occurring in a mine. They cannot be distinguished by any recording method so far devised.—*Condensed by V. S.*

10559. Johnson, C. H. Correlation in California—Summary of a symposium containing papers by John Sloat et al. [abstract]: Geophysics, vol. 13, no. 3, p. 497, Tulsa, Okla., 1948.

The meaning and nature of seismic correlation are discussed, and practical illustrations of the difficulties and successes encountered in employing character and time-tie correlation in California are shown. The relation between seismic correlations, electric logs, and lithology is discussed in general and in the light of specific examples. Possible uses of seismic character to outline stratigraphic traps and lateral changes of porosity and permeability are briefly considered.

10560. Kezeler, J. L. Technique for velocity error corrections: World Oil, vol. 128, no. 5, pp. 112–118, Houston, Tex., 1948.

The interpretation of the results of a seismic exploration of a region is to a great degree dependent upon the assumptions made about the velocity of seismic waves underground. The exact value of the velocity is very seldom known to the prospecting geophysicist; consequently an element of uncertainty is introduced into his prediction. The author describes a technique for checking the estimates made in the course of well logging

for the value of the velocity by placing geophones at various depths in the drill hole and measuring the time intervals between the moment of explosion and the arrivals of the seismic waves to the corresponding geophone. This procedure not only gives the exact value of the average velocity but also its variation with the depth, thus allowing corrections to be made of the initial interpretation of the survey.—*S. T. V.*

10561. Kirkwood, J. G., and Brinkley, S. R., Jr. Theory of the propagation of shock waves from explosive sources in the air and water, progress report: U. S. Office Sci. Res. and Devel. Rept. 4814, 39 pp., Washington, D. C., March 1945. (Library of Congress, OTS PB Rept., 32198.)

This report describes a new theory of propagation of shock waves from explosive sources. The partial differential equations of hydrodynamics and the Hugoniot relation between pressure and particle velocity are used to provide three relations between the four partial derivatives of pressure and particle velocity with respect to time and distance from the source at the shock front. An approximate fourth relation between the derivatives is set up by imposing a similarity restraint on the shape of the energy-time curve of the shock wave and by utilizing the second law of thermodynamics to determine, for an arbitrary distance, the distribution of the initial energy input from the source into dissipated energy residuals in the fluid already traversed by the shock wave and the available energy for further propagation.

The theory may be used with equal facility for the determination of the pressure-time curves and peak pressure-distance curves from the theoretical initial conditions and for the extrapolation of experimental curves to smaller or larger distances from the charge. Curve diagrams and tables illustrate the report.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 11, p. 826, Washington, D. C., 1946.*

10562. Kirnos, D. P., and Veshniakov, N. V. Modern seismometric instruments [in Russian]: Akad. Nauk SSSR Izvestiia, Ser. Geog. Geofiz., vol 12, no. 4, pp. 319–327, Moscow, 1948.

The present expansion of seismic research, aimed at a clarification of the physical mechanism of earthquakes at the focus, prompts the authors to examine the construction of instruments for seismic registration and to describe the new seismographs of Kirnos. The latter instruments reproduce ground vibrations having periods of 0.2 to 5 seconds and effect no distortions of wave amplitude and phase in excess of 5 percent of actual size.

The models are a horizontal seismograph and a vertical seismograph of the Galitzin type which was chosen on the basis of an analysis of the causes of distorted recording. It is shown that the frequency characteristic of a seismograph with galvanometer registration can be made equal to that of a simple mechanical pendulum by increasing the galvanometer constant of damping to at least a value of 10 to 15. The phase characteristic of the entire apparatus is then likewise equal to that of the pendulum proper.

The horizontal seismograph of Kirnos has a pendulum of an indicator length of 26 centimeters with a damping constant of 0.4–0.5 and a galvanometer of a sensitivity of 1×10^{-8} amp./mm. with a damping

constant of 10–12 that can be increased to 50–60. The induction coil is suspended on springs and is immersed in oil. The vertical seismograph's specification are likewise given. The instruments are used at seismic stations in Tadzhikistan, central Asia, and in Yalta, Crimea.—*V. S.*

10563. Lee, S. P. A horizontal seismograph of war time [in Chinese, with English summary]: Nat. Geol. Survey of China, Geophys. Mem., no. 3, 27 pp., 1 pl., Nanking, 1945.

In 1937, at the start of the Sino-Japanese war, the staff of the Chinese Seismic Station at Chiufeng moved to Chungking, where in 1939 the author designed and constructed out of available materials a provisional horizontal seismograph with mechanical registration having a stationary mass of 100 kilograms. The underlying equations are given, and the apparatus is described.

Notwithstanding limited facilities, lack of parts, and absence of craftsmen, which made it necessary to adapt an ordinary clock for use as a driving mechanism and an alarm clock as a time-signal recorder, a workable instrument was produced. Its prime constants were tentatively calculated to have a natural period $T=5$ seconds, a maximum frictional amplitude $r=0.1$ millimeter, and a geometric magnification $V_0=125$, on the provisional assumption of a friction $R=1$ dyne. A better approximation of these constants was obtained under actual performance: $R=0.7$ dyne, $T=4.5$ seconds, $r=0.8$ millimeter, and $V_0=152$. The seismograph has been in operation since September 1943 and has recorded satisfactorily many shocks, including some at considerable distance, such as the earthquake in Turkey with an epicenter at 6,700 kilometers from Pehpei.—*V. S.*

10564. Lucas, René. Réflexion des ondes longitudinales dans les liquides—conversion en ondes transversales [Reflection of longitudinal waves in liquids—their conversion into transversal waves]: Acad. Sci. Comptes Rendus, vol. 212, no. 3, pp. 118–119, Paris, 1941.

The author proves that when a longitudinal wave propagating through a viscous liquid is reflected by a rigid plane surface, then in addition to a reflected longitudinal wave a reflected transverse wave is also formed. This follows from the assumption that the reflecting plane is being wetted by the liquid, because the molecules of the liquid adjacent to the reflecting plane remain immovable. Both the tangential and the normal components of their displacement equal zero. In general these conditions can be satisfied only by simultaneous formation of longitudinal and transverse reflected waves. Under certain conditions only the transverse reflected wave is formed.—*S. T. V.*

10565. Lynch, J. J., and Bodle, R. R. The Dominican earthquakes of August 1946: Seismol. Soc. America Bull., vol. 38, no. 1, pp. 1–17, Berkeley, Calif., 1948.

The damage caused by the earthquakes of August 1946 in the Dominican Republic was investigated the following September by a commission of seismologists from the United States, invited by the Dominican Government. The observations made in Ciudad Trujillo, Puerto Plata, Santiago, Moca, San Francisco de Macoris, Castilla, Julia Molina,

Matanzas, Samana, and the Yuna River Valley are reported, and recommendations are made on the measures necessary to prevent earthquake damage in the future.—*V. S.*

10566. Mainka, Karl. Über die Realität der Seismographenauzeichnungen [The reality of the records obtained from seismographs]: Beitr. angew. Geophysik, vol. 9, pp. 129–145, Leipzig, 1941.

Records of seismographs are supposed to reproduce the movements of the ground without distorting either the amplitudes or the phases of the oscillations. The author analyzes records to determine to what extent these conditions are fulfilled by seismographs of various design and points to the weak points of several types. The methods of verification of the seismograms and possible corrections are also discussed, especially in reference to the correct recording of the first arrival of the seismic wave.—*R. Kohler, Zentralb. Geophys., Meteorol. u. Geod., vol. 9, no. 2, p. 62, Berlin, 1942, translated by S. T. V.*

10567. Neumann, Frank. Present status of engineering seismology [abstract]: Geol. Soc. America Bull., vol. 58, no. 12, pt. 2, p. 1267, Baltimore, Md., 1947.

Instrumental data obtained in recent years on destructive earthquake motions show wide variations from the hypothetical figures used by engineers in designing structures to withstand earthquakes. Early efforts to use the new data in predicting building stresses were largely stymied by the formidable mathematical problem involved, but the development of the torsion pendulum analyzer broke this bottleneck. The analyzer mechanically determines the maximum stress in terms of an equivalent static acceleration regardless of the complexity of the ground motion. But the torsion pendulum in its simplest form assumes absence of damping in the structure and rigid coupling with the ground so that actual conditions are seldom simulated and computed stresses are sometimes excessively high. Efforts are being made to study in more detail the influence of damping and foundation factors. Other lines of attack are open, but this is the theoretically correct one and should be followed through. Additional field data will probably be needed, and a more concentrated effort must be made in the analytical and laboratory phases of the problem before a satisfactory solution is reached.

10568. Neumann, Frank. The scope of modern seismology. New York Acad. Sci. Trans., ser. 2, vol. 10, no. 6, pp. 185–187, New York, 1948.

In this paper, presented to the section of geology and mineralogy of the New York Academy of Sciences, the author outlines the problems and methods of seismology. Seismology is the most efficient method for studying the structure of the terrestrial globe. It is used to investigate the devastating effects of earthquakes and their probable causes. The application of seismological principles to controlled explosions represents a very effective method of exploration for oil-bearing structures and has been developed to a high degree of efficiency. Finally the study of microseisms has made it possible to detect and track hurricanes from great distances and to predict their approach. Basically, the

cause of earthquakes is believed to be associated with the cooling of the earth, resulting in shrinkage, mountain formation, and occasional ruptures.—*S. T. V.*

10569. Pekeris, C. L. Theory of propagation of explosive sound in shallow water: Columbia Univ., Div. War Res. Repts., 193 pp., New York, n. d. (Library of Congress, OTS PB Rept. 28993.)

This report presents a theoretical interpretation of pressure waves generated in shallow water by explosions of charges of TNT ranging from 0.5 to 300 pounds. The normal-mode theory of propagation of sound in layered media, developed by the writer in 1941, was extended to cover the case of explosive sound, and the predictions of the theory about the shape and variation of amplitude in the received pressure pulse were investigated in detail. It was found that the theory predicted the existence of a series of readily identifiable new features in the pressure wave, each of which is characteristic of the depth of water and the structure of the bottom. The deductions about the distribution of sound velocity in the bottoms, based on an analysis of the various features of the pressure waves, are given in tabular form, and it can be seen that they agree among themselves. Tables and graphs are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 7, p. 537, Washington, D. C., 1946.*

10570. Perkins, Beauregard, Jr. Subsurface structure of Snake River Valley, Idaho, from seismograph records of ammunition explosions [abstract]: Geophysics, vol. 12, no. 3, p. 496, Tulsa, Okla., 1947.

In August and October 1945 and October 1946 a series of explosions of unserviceable ammunition was made by the United States Army-Navy Explosives Safety Board. The charges ranged from 38,000 pounds of TNT to 500,000 pounds and were observed at distances ranging from 600 feet to 51,000 feet. The subsurface to a depth of 700 feet is shown by logs of two water wells.

Three distinct velocity zones are indicated. The first zone, comprised of thick beds of lava separated by thin layers of clay, sand, and gravel, has a sound velocity of 6,600 ft./sec. and is approximately 500 feet thick. The second zone is similar to the first to a depth of 700 feet except for the presence of water. The sound velocity in this bed is 9,900 ft./sec.; apparently the bed starts at the water table and extends to a depth of 4,500 feet. The third zone transmits the sound wave at 19,800 ft./sec. and may consist of tightly folded sediments or igneous rock. Absorption coefficients for the third zone are calculated. They are 0.14 per kilometer for the *P* wave, having a period of 0.2 second, and 0.09 per kilometer for the *S* wave, whose period is 0.5 second.

10572. Popov, V. V. Catalog of the earthquakes observed on the territory of the U.S.S.R., second issue, Siberia [in Russian]: Seismol. Inst. Trudy, no. 89, 40 pp., Moscow, 1939.

This issue of the catalog, prepared by the Seismological Institute of the Russian Academy of Sciences, covers the seismic zones of Siberia and describes, on the basis of noninstrumental observations, earthquakes that occurred between the years 1908 and 1936. Three seismic zones are denoted: the Altai Mountains with the eastern parts of the

Kazakh S.S.R. and of the Novosibirsk province; the Baikal Lake region including the Buriato-Mongolian A.S.S.R., the Irkutsk, and the Chita provinces; and the Pacific coast covering also the Sakhalin and Commander Islands.

The greatest intensity of the earthquakes observed in these three zones was of the VIIth degree of the Mercalli-Cantini scale. The Pacific coast had the greatest number of earthquakes, 246. Most of these occurred on the Kamchatka Peninsula, which is a part of the circumpacific seismic belt and has several active volcanoes. In the Baikal Lake region 110 earthquakes were observed and in the Altai Mountains, 42.

The catalog gives geologic characteristics for each of the abovementioned zones and a short description of each earthquake listed. The most violent earthquakes which occurred on the Kamchatka Peninsula between 1737 and 1807 are included.—*S. T. V.* (For the first issue of this catalog *see* Geophys. abstract 10572.)

10572. Popov, V. V. Catalog of the earthquakes observed on the territory of the U.S.S.R., first issue, Crimea [in Russian]: Seismol. Inst. Trudy, no. 89, 24 pp., Moscow, 1940.

The Seismological Institute of the Russian Academy of Sciences prepared a catalog of data on earthquakes observed in the territory of the U.S.S.R. This first issue of the general catalog contains a description of 53 earthquakes that occurred during the years 1908–36 in Crimea, some of them reaching an intensity of the VIIth degree according to the Mercalli-Cantini scale. Most of the data included in this issue were obtained from noninstrumental observations. Also included are data on five of the most violent earthquakes that occurred between the years 1838–75.

It is to be noted that almost all of the earthquakes observed have their epicenters on the bottom of the Black Sea, along the southern shore of the peninsula. Two maps of isoseismic lines and five photographs of damaged structures are included in the issue.—*S. T. V.*

10573. Press, Frank, and Ewing, Maurice. Low-speed layer in water-covered areas: Geophysics, vol. 13, no. 3, pp. 404–420, Tulsa, Okla., 1948.

It has been reported that in many water-covered areas the speed of sound in the topmost layers of the bottom ground is less than that in water. Several methods of investigating such layers are discussed. The normal-mode theory offers the best method of detecting and investigating a low-speed layer covered by water.—*Authors' abstract.*

10574. Rădulescu, N. A. Considérations géographiques sur le tremblement de terre du 10 November, 1940 [Geographic considerations on the earthquake of November 10, 1940]: Acad. Sci. Roumania Comptes Rendus, vol. 5, pp. 243–269, Bucharest, 1941.

After an analysis of the destruction caused by the earthquake in Rumania on November 10, 1940, the author proceeds with the determination of its hypocenter. The discrepancy between the macroseismic and microseismic evidence results in a difference of determined foci amounting to 40 kilometers. An analysis of the shape of isoseismic lines shows a close relationship with the geologic structure of the region affected. The earthquake is classified by the author as tectonic, though

other authorities have classified it as volcanic. The article contains many pictures of the damage to structures and of permanent deformations of the surface topography caused by the earthquake. *H. Jung, Zentralb. Geophys., Meteorol. u. Geod., vol. 10, no. 2, p. 67, Berlin, 1942, translated by S. T. V.*

10575. Richter, C. F. The Seismological Laboratory and earthquake study: Eng. and Sci. Monthly, vol. 11, no. 2, pp. 11–12, Pasadena, Calif., 1948.

The history and current work of the Seismological Laboratory of the California Institute of Technology are outlined briefly. Seismic investigations of local earthquakes in southern California were initiated by the Carnegie Institution of Washington in 1921. The laboratory's own station commenced seismic registration in 1927; the six auxiliary stations began operating by 1929, and one more station was added in 1939. Beginning with 1937 the California Institute of Technology assumed charge of the entire program. Under its direction the research work of the laboratory consists mainly in locating earthquakes the world over, calculating their depth of origin, and analyzing seismograms of distant earthquakes as an aid to determining the inner structure of the earth. The seven auxiliary stations record seismic disturbances photographically, and their reels are sent to the laboratory for a study of the upper layers of the earth's crust in the California area. The results of some investigations are outlined. The laboratory publishes a bulletin on distant earthquakes and a report on local shocks.—*V. S.*

10576. Rothé, J. P. Hypothèses sur la formation de l'Océan Atlantique [Hypotheses on the formation of the Atlantic Ocean]: Acad. Sci. Comptes Rendus, vol. 224, no. 18, pp. 1295–1297, Paris, 1947.

The geology of the floor of the Atlantic Ocean is reconstructed on the basis of seismic studies. A map of epicenters shows that the Mesogonic geosyncline does not cross the Atlantic Ocean from end to end and does not connect with the Pacific geosyncline. Thus, existing hypotheses on the origin of continents must be verified by evidence from the zone between the American coast and the median crest of the Atlantic.—*Cent. Nat. Rech. Sci., Bull. Anal., vol. 8, no. 9, pt. 1, p. 2001, Paris, 1947, translated by V. S.*

10577. Rozova, E. A. Determination of the epicenter and of the depth of the focus of an earthquake from records of two regional stations [in Russian]: Seismol. Inst. Trudy, no. 94, pp. 16–22, Moscow, 1939.

A method is presented for the accurate determination of the epicenter of a near earthquake from the intersection of the planes of azimuths recorded at two seismological observatories. The following advantages of this method are indicated: its independence of time, with the consequent elimination of errors inherent in clocks; its independence of data based on time curves, which are always affected by assumptions of the velocity of propagation; and its applicability to very complicated seismograms.

Moreover this method makes it possible, with the aid of the known coordinates of the epicenter, to determine also the depth of the focus. The results of determinations by this method are accurate for epicentral distances that are not too great.—*S. T. V.*

10578. Rust, W. M., Jr., and Mounce, W. D. Measurements of earth pressures and movements under detonation: U. S. Nat. Res. Council, Committee on Passive Protection Against Bombing, Interim Rept. 19, 41 pp., Washington, D. C., September 1942. (Library of Congress. OTS PB Rept. 48202.)

A report by the Geophysics Research Department of the Humble Oil and Refining Co. gives results of tests made to estimate the damage caused to structures by near explosions of bombs that penetrate the ground or are buried in it. It was deemed essential to obtain information concerning the pressures exerted against the foundation of a structure and the displacements of the earth adjacent to the structure as functions of time, of weight of exploded charge, and of distance from the charge to various points of the structure. Consideration was also given to the depth of the charge below the surface and the depth of the points at which measurements were made. The investigation is discussed by C. W. Lampson, and the findings are shown in tables, graphs, and photographs.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 4, no. 7, p. 595, Washington, D. C., 1947, condensed by V. S.*

10579. Savarenskii, E. F. The direction of emergence of seismic rays and the investigation of the structure of the earth [in Russian]: Akad. Nauk SSSR Izvestiia, Ser. Geog. Geofiz., vol. 12, no. 4, pp. 328–335, Moscow, 1948.

In seismology the structure of the earth is usually investigated by a study of the propagation time of seismic waves. However, considerable possibilities are offered by the utilization of the direction of arriving waves and of the angle of emergence of seismic rays, initiated by B. B. Galitzin in his last work in 1912–13 and rendered practicable by the new precise seismographs of D. P. Kirnos (*see* Geophys. abstract 10562). The mathematical principles of such investigations are discussed, and the work done at the Moscow and Pulkovo seismic stations and in the Pamir Mountains, central Asia, is reported with findings on the subsurface structure in the Pamir region.

The Moscow station was modified in 1947 by the introduction of instruments with practically identical seismograph periods, galvanometer periods, and damping constants for the registration of *E–W*, *N–S*, and *Z* components, so that all records are now made on one photographic film driven by the same mechanism. Such uniformity facilitates the various determinations involved in the proposed investigations. It simplifies calculation of the seismic angle of emergence and makes it possible to deduce from its determinations at a single station, on the occasion of different earthquakes, the subsurface geology in the area of the station. With the new Kirnos seismographs, used at the stations of the Pamir region, uniformity of constants is not necessary for such study. Another approach adopted for the determination of emergence angles is the use of differences of propagation times recorded at the Moscow and Pulkovo stations.—*V. S.*

10580. Seismological Society of America, Eastern Section. Earthquake Notes, vol. 19, no. 1–2, 16 pp., Washington, D. C., 1947.

This issue of Earthquake Notes is devoted largely to the description of the seismograph and is intended to be of aid to our universities.

Such a description, it is felt, will be welcomed by many institutions which are interested in seismological research but have little basic knowledge concerning this instrument and its use. The material does not constitute a technical paper but is intended to be of purely informative character—a substitute for a conference between a university official and a seismologist desirous of presenting to him the practical as well as the basic scientific aspects of seismology.—*Editorial note, condensed by V. S.*

Shade, N. R. Geophysical history of the Cole Creek field near Casper, Wyo. *See* Geophys. abstract 10495.

10581. Sloat, John. Correlation in California [abstract]: Geophysics, vol. 13, no. 2, p. 299, Tulsa, Okla., 1948.

The author discusses briefly the fundamental problem of cause and effect of seismic reflections. An attempt is made to define record character and the factors which affect character correlation. The question of the recognition of geologic members from seismic records and of correlation of these members is considered. It is argued that several known beds can be identified and correlated over a considerable area. The question of recognition of the basement reflection is discussed in detail, with records showing the appearance of this reflection at numerous points where the basement has been cored and where adequate velocity control is available.

10582. Snavely, B. L., Beresford, R., Clarkson, H. N., Erickson, K. W., White, Gale, and Atanasoff, J. V. Use of a water-coupled microphone system for seismic surveying [abstract]: Geophysics, vol. 12, no. 3, p. 500, Tulsa, Okla., 1947.

The use of pressure-sensitive microphones in place of inertial geophones for underwater-seismic prospecting is made possible by the direct relation between ground motion and corresponding variation in water pressure. The MK–1 Acoustic System of the Naval Ordnance Laboratory features a sensitive, low-impedance hydrophone responsive to frequencies from 0 to 300 cycles per second and consists in principle of an inductance whose variation with pressure produces linear unbalance of a 1,000 cycle per second alternating current bridge. The sensitivity of this instrument is comparable to that of a standard geophone, and it may be calibrated simply in absolute units. This system has been successfully used in seismic investigations in the Caribbean and in the shallow water off the east coast of the United States during the war. It was also used in the refraction survey of the subsurface structure of Bikini Atoll at the time of the atomic bomb tests.—*Condensed by V. S.*

10583. Tsvetaev, A. A. Testing the application of air explosions in seismic reflection exploration [in Russian]: Prikladnaia Geofizika, no. 1, pp. 82–87, Moscow, 1945.

To obviate the drilling of shot holes in seismic exploration, an investigation was made in several localities of the U.S.S.R. in 1942–43 to test the use of explosions set off in air. The procedure employed in the Emba region, Kazakh S.S.R., in connection with salt-dome exploration, consisted in laying out spreads equal in length to the minimum shooting

distance and firing shots from both directions along the line of the section. As the anticipated depths to the reflecting horizons ranged from 3,000 to 4,000 feet and the average velocity of propagation thereto is about 8,000 feet/sec., expectations of arrival times not greater than 1 second lead to the choice of a minimum shooting distance of 1,150 feet. Explosions were fired over rocky soil, grassy fields, sand, and clay saturated with salt water.

It was found that seismograms obtained from air shots do not differ materially from those recorded from buried charges in the same locality, except that all arrival times for air shots are about 0.03 to 0.04 second longer than for buried charges. Since this difference does not complicate interpretation, it appears that air shots reduce the cost of operations without impairing the efficacy of seismic exploration. Optimal results were obtained with the charge suspended at a height of 5 to 7 feet above the ground. Other findings are given.—*Review by A. J. Hermont, Geophysics, vol. 13, no. 3, pp. 485–486, Tulsa, Okla., 1948, abstracted by V. S.*

Wells, R. J. Well velocity shooting in California. *See* Geophys. abstract 10633.

10584. Widess, M. B. Multiple reflections in seismic surveying [abstract]: Geophysics, vol. 12, no. 3, p. 502, Tulsa, Okla., 1947.

Multiple reflections are classified, and their properties are examined. Analysis of a specific example favors the conclusion that the intermediate reflection is at the base of the low-velocity layer. Multiple reflections may appear as individual arrivals, or a large number of them may combine to produce "cumulative multiple reflections." It is suggested that most of the abnormally late reflections which appear to originate below the basement complex are in reality multiple reflections, possibly of the cumulative type.

10585. Wilson, J. T. Increase in period of earthquake surface waves with distance travelled: Seismol. Soc. America Bull., vol. 38, no. 2, pp. 89–93, Berkeley, Calif., 1948.

Seismic surface waves of the South Atlantic earthquake of August 28, 1933, were used by the author to test the theory of wave propagation advanced by C. G. Rossby for oceanic and atmospheric waves. This theory attributes the increase in period with long-distance propagation to a "stretching" of wave groups in which the wave crests are conserved. It was recently applied to tsunamis, swell, and seismic surface waves by W. H. Munk, who obtained a reasonable agreement between the theoretical and the observed increase (Geophys. Abstracts 129, no. 9208).

The author measured the first period on the seismograms of stations at Tananarive, Kodaikanal, Colaba, Ivigtut, and Honolulu, to which the wave paths were 90 percent oceanic. He found the increase of period with distance to be of the order of 10^{-3} sec./km., which is in good agreement with previously observed values. The periods, taken as twice the time interval from the first trough to the first crest, were further plotted against the corresponding velocities and gave a dispersion curve corresponding to a theoretical curve calculated according to Love's theory. The records employed showed a similarity of ground motion at all

stations and indicated a conservation of wave crests. This evidence, notwithstanding its consistent character, is considered not to preclude the possibility of a partial period increase attributable to selective absorption caused by the viscosity of the earth, because the data were derived from a relatively small number of wave lengths of long period.—*V. S.*

4. ELECTRICAL METHODS

10586. Alekseev, V. V. The ondometric field apparatus for geoelectrical mapping [in Russian]: Inst. Geol. Nauk Trudy, no. 22, pp. 21–28, Moscow, 1940.

A detailed description is given of an ondometric field station designed by the author under the direction of A. A. Petrowsky. The equipment comprises a radio transmitter and an apparatus for electrical sounding with a horizontal antenna stretched above the ground, suitable particularly for exploration in permafrost areas. The distinctive feature of this assembly is a device for switching the antenna in or separating it from the transmitter without changing the antenna's capacitance. The antenna has two wings, each made up of a single homogeneous wire 5 meters in length. The ondometric radio transmitter generates a current of 0.2 to 0.9 ampere in the primary circuit and has a wave length controllable within a range of 59 to 252 meters. The potential difference on the valve plates is 160 volts.

Geologically indicative variations of the antenna's effective capacitance, observed in field work, are reported to be very distinct when the antenna wires are stretched at a height of 60 centimeters above the ground. Measurements can be made with an accuracy of 0.1 $\mu\mu$ F. Instructions on the operation of the apparatus are given, and the results of test measurements are presented.—*Author's abstract, revised by V. S.* (For a description of the method of prospecting *see* Geophys. abstract 10594.)

10587. Belluigi, Arnoldo. Il problema dell' induttore elettro-magnetico orizzontale circolare accopiato a suoli omogenei, isotropi e stratificati orizzontalmente [The problem of a horizontal circular electromagnetic inductor, coupled with a homogeneous, isotropic, horizontally stratified soil]: Facolta Ingegneria Cagliari Pub., no. 12, 18 pp., Cagliari, Italy, 1940.

The author presents a solution of the problem formulated in the title and discusses some special cases of its application. This is followed by an interpretation of the physical meaning of the magnetic field, first investigated by Stefanescu and later by Koenigsberger and Nunier. The author states that in the present paper the problem has been solved under general conditions making it possible to extend its validity to cases of both horizontal and vertical inductors, circular and rectangular shapes of coils, and to a homogeneous or horizontally stratified ground.—*V. S.*

10588. Boissonnas, Eric, and Leonardon, E. G. Geophysical exploration by telluric currents, with special reference to a survey of the Haynesville salt dome, Wood County, Tex.: Geophysics, vol. 13, no. 3, pp. 387–403, Tulsa, Okla., 1948.

The fact that natural currents flow through the ground has been known for a long time. Some of these currents are local in character; some involve the whole of the earth's surface. These latter currents are called telluric currents. Their behavior and properties are outlined, and their usefulness for the practical purpose of geophysical exploration is discussed at length. In conclusion, an example of an actual survey by telluric currents on the Haynesville salt dome, Texas, is given to illustrate the quality of the results that can be obtained in similar regions.—*Authors' abstract.*

10589. Breusse, J. J. La prospection électrique appliquée aux recherches hydrologiques dans la presqu'île de Dakar, A.O.F. [Electrical prospecting used for water search in the peninsula of Dakar, A. O. F.], abstract: Internat. Geol. Cong., 18th Sess., Great Britain, 1948, Titles and abstracts of papers, p. 24, London, 1948.

The principles of exploration of the subsurface by the method of electrical soundings are reviewed briefly, and results of an extensive hydrological survey in the administrative division (circonscription) of Dakar in French West Africa (A.O.F.) are given. It is shown that the electrical investigation has rendered possible the finding of the most favorable zones containing sands with fresh water in the local salt-bearing sediments, the determining of the thickness of these sands, and the location on the coast of the places where fresh water issues in streams of different volume into the ocean.—*Translated by V. S.*

10590. Fritsch, Volker. Die Voraussetzungen für die Anwendung der Funkmutung in Kalilagerstätten [Conditions favoring the application of radio methods in prospecting for potassium deposits]: Kali, vol. 35, pp. 165–181, Halle a. S., Germany, 1941.

A general discussion of theoretical foundations of radio methods is presented, and conditions that are necessary for the application of these methods to prospecting for potassium deposits are analyzed. It is essential in such cases to trace structural formations typical of such deposits and to take into account influences on the measurements of possible gaseous and alkalic intrusions often present in the formations. Several variations of the radio method are possible, and the corresponding wiring schemes are described. The author recommends the capacitance method. Detection of gas pockets is possible by measuring the dielectric constant but the results of the measurements are influenced by the frequency employed. Alkalic intrusions can be detected by the electrical resistivity method.—*S. T. V.*

10591. Hough, J. M. Interpretation of data from electrical resistivity geophysical surveys: Nature, vol. 161, no. 4099, pp. 812-813, London, 1948.

The analytic methods advanced by J. N. Hummel and G. F. Tagg for the interpretation of results of electrical-resistivity surveys are discussed

in the light of principles underlying resistivity measurements, and the difficulties encountered are pointed out. The mathematical expression of resistivity variations is excessively complex for any but the simplest geologic structures and even then not entirely satisfactory from a practical viewpoint. Thus, in the simple case of a ground composed of parallell layers of homogeneous material, often met with in practice, the mathematical solution of Hummel for two layers, demonstrated to apply to complex types of rock, gives a theoretical curve without maximum or minimum which cannot be easily fitted to field results. The method suggested by Tagg for the application of Hummel's solution likewise does not satisfy practical needs because it involves considerable calculation in each particular problem.

To overcome these difficulties the author advances a new graphic method based on Hummel's formula. It consists in plotting a set of master curves of log ρ/ρ_1 against log a/h for different values of k and α (Hummel's symbols) and in employing these curves to interpret logarithmic plots of the experimental results. Computation of the curves is simplified by a use of the tables of I. Roman. The results obtained by this method have agreed closely with borehole data.—*V. S.*

10592. Kraev, A. P., and Zatsepin, V. R. Deep electromagnetic sounding of a stratified terrain, principles of the method and instruments used [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz., no. 12, pp. 90–96, Moscow, 1948.

After indicating several defects inherent in direct-current methods of ground exploration, the authors describe the method of nonstationary electrical fields, especially its application to deep sounding of a stratified rock. For this purpose an alternating electromagnetic field is generated in the rock by a radial horizontal antenna, and secondary vortical currents are induced in each layer of the rock. Varying the dimensions of the antenna and the frequency of the energizing current, it is possible to determine the electric and magnetic properties of each layer. To generate currents of a very low frequency, 1 to 20 hertz, the authors utilize the beating effect produced by two generators coupled in series but running with slightly different speeds. The paper contains a detailed description of the experimental arrangement, the characteristics of the instruments used, and a wiring diagram.—*S. T. V.*

10593. MacCarthy, G. R., and Shuler, R. M. Resistivity investigations of some tungsten deposits in Vance County, North Carolina, and Mecklenburg County, Virginia: U. S. Geol. Survey, Section of Geophysics [Prelim. Rept.], 28 pp., 15 figs., Washington, D. C., 1948. [Mimeographed.]

Geophysical surveys were made to assist in a study of the possible occurrence of tungsten ore bodies in the general area subject to submergence in the Guggs Island project. Several magnetometer traverses were first run. When it became obvious that little, if any, useful information could be gained by magnetic methods, resistivity measurements were undertaken, and some 35 constant-depth resistivity profiles were run in selected localities. It was observed that in all cases known quartz veins gave rise to resistivity peaks and that the diabase dikes present in the area gave resistivity lows. In almost every case the data obtained rendered it possible to correlate corresponding resistivity indi-

cations on adjacent traverses and thus to trace the concealed outcrops of quartz veins and general structural trends in areas where there were no exposures.

Since the tungsten minerals huebnerite and scheelite do not give rise to measurable geophysical effects even when present in far larger quantities than here, no distinction could be made between mineralized and nonmineralized quartz veins. Correlations of veins and structural trends are shown in a series of inter-traverse charts, and detailed maps of most of the areas are given.—*Authors' abstract, condensed by V. S.*

10594. Nesterova, M. A., and Nesterov, L. I. Electric conductivity of minerals at negative temperatures [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz., no. 11, pp. 78-88, Moscow, 1947.

Several hundred samples of different minerals were tested in the laboratory of the Russian All-Union Geophysical Research Institute and their electrical resistivity measured at temperatures ranging from −20° C. to +20° C. The following conclusions were reached: (1) Minerals possessing ionic conductivity show an increase of electrical resistivity on freezing. Sulfides possessing metallic conductivity do not change their resistivity on freezing. Therefore the contrast between the resistivity of the metallic ores and that of the surrounding formations increases at temperatures below freezing. (2) Freezing temperature of different rocks is determined by minerals dissolved in the water contained in their pores. (3) Resistivity ρ of the rock containing w percent of water can be computed from the resistivity, ρ_i, of ice by the formula $\rho=\rho_i\times\frac{300}{w}$ The paper contains several tables with experimental findings of the authors.—*S. T. V.*

10595. Petrovsky (Petrowsky), A. A. The use of a horizontal antenna in geoelectical mapping [in Russian]: Inst. Geol. Nauk Trudy, no. 22, pp. 1–20, Moscow, 1940.

The author describes a method of electrical exploration by means of high frequency currents devised especially for overcoming the difficulties of soundings in permanently frozen ground. The principle adopted consists in measuring the effective capacitance and effective resistance of a horizontal antenna stretched at a certain height above the ground. Detailed instructions explain the use of apparatus and the field procedures of geoelectrical mapping. For the calculation of the dielectric constant and the specific resistivity of the substratum in the surveyed area formulas are given on the basis of the author's previous investigations, in particular his study "Partial capacitance and the calculation of losses of a horizontal antenna." The errors caused by radiation from the antenna are examined, and the special case of an antenna stretched on the ground is considered. The method's efficacy is illustrated by the results of field surveys, which have shown good agreement with laboratory measurements.—*Author's abstract, condensed by V. S.* (For the author's previous work *see* Geophys. Abstracts 91, no. 4042; 98. nos. 5080 and 5081; and 107, no. 6301.)

10596. Poldini, E. La prospection electrique du sous-sol [Electrical prospecting of the subsurface], 120 pp., Lausanne, Switzerland, F. Rouge Co., 1947.

The basic elements of electrical prospecting are considered briefly, and certain phases of the subject, such as anisotropy, telluric currents, and electromagnetic forces resulting from the movement of subsurface waters, are dealt with at greater length and illustrated by examples. A mathematical treatment clarifies the discussion of anisotropy in relation to prospecting, and a concept of apparent anisotropy is developed.—*V. S.* (A review appeared in Geophysics, vol. 13, no. 2, p. 287, Tulsa, Okla., 1948.)

Randell, J. T. Geological interpretation as a result of geophysical explorations of a section of the Lynn Lake area, Manitoba, Canada. *See* Geophys. abstract 10527.

10597. Scharon, H. L. Application of geophysical methods in the Fredericksburg lead district, Madison County, Missouri [abstract]: Geophysics, vol. 13, no. 3, p. 503, Tulsa, Okla., 1948.

Magnetic and electrical measurements were carried out in two local mining areas to develop techniques for locating lead ores and possibly to discover new lead deposits. The lead ore occurs as replacement of dolomite where the underlying sandstone wedges out on the flanks of igneous masses. Magnetic measurements were made to locate buried igneous knobs and ridges. Resistivity measurements were used to map contacts of dolomite and sandstone with each other or with igneous masses and to locate fractures favorable for mineralization.

Tests over areas known from mining operations indicated reliable results. Mining and drilling results following magnetic and resistivity work over nearby untested areas confirmed the findings with regard to the inferred fractured area, the location and depth of the buried igneous highs, and the positions of the various geological contacts indicated by geophysical data. The measurements indicate conditions favorable for mineralization but do not give direct indications of ore.

10598. Schofield, R. K., and Dakshinamurti, C. Ionic diffusion and electrical conductivity in sands and clays: Faraday Soc. Discuss., no. 3, pp. 56–61, London, 1948.

A technique has been developed for measuring separately the diffusion coefficients of the cations and anions of a salt solution. When these coefficients are known, measurements of ionic diffusion give the effective-fraction area of the water channels in porous systems ranging from glass beads through sands to fine clays. In the clay systems there are more cations than anions, owing to the negative charges on the clay particles. Taking this into consideration, the electrical conductivities are found to be concordant with the diffusion measurements.

The conductivity of N./10KBr solution is reduced 16 percent by adding 0.91 percent of very fine bentonite particles, which form under these conditions a thixotropic gel, whereas the conductivity of N./40KBr is increased 3 percent by adding 0.57 percent of the same bentonite, which forms in this case a deflocculated suspension devoid of rigidity. The bentonite particles are plates 10 angstroms thick. These results

strongly support the view that the bentonite particles in a thixotropic gel form a network in which the edges of neighboring particles are drawn toward each other—*Authors' summary.*

10599. Tarkhov, A. G. Resistivity and dielectric constant of rocks in alternating current fields [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz., no. 12, pp. 3–42, Moscow, 1948.

The development of electrical methods of exploration, especially those using alternating currents, necessitates an accurate knowledge of electrical properties of different rocks. The author investigates the problem theoretically on the basis of the theory developed by Debye and Falkenhagen and studies it experimentally, proceeding with the determination of electrical properties of numerous samples of minerals in alternating electrical fields. He concludes that: Natural electric conductivity of most rocks is negligible except for some metallic ores; the electrical conductivity of rocks is determined by their water content and mineralization; the electrical resistivity, ρ, of a rock which has a volumetric humidity content of W percent is determined by the relation $\rho=\rho w\times\frac{425}{w}$, where ρw is the resistivity of the water; and the dielectric constant of dry rocks is fully determined by the mineralogical content and can be computed from the known properties of the ingredients. The author denies the possibility of dispersion of these electrical properties in moist rocks. The values of dielectric constants can be represented by an empirical exponential function of their water content. Three kinds of minerals are to be distinguished: sedimentary porous rocks, all of which have the same exponent; igneous rocks with discontinuous porosity, with the exponent varying from rock to rock; and hard nonhygroscopic rocks with their dielectric constant fixed. The article contains numerous tables and graphs representing the results of the experiments made by the author.—*S. T. V.*

10600. Weiss, Oscar, and Frost, A. Geological results of geophysical prospecting for water in the new gold fields of the Orange Free State, Union of South Africa [abstract]: Internat. Geol. Cong., 18th Sess., Great Britain, 1948, Titles and abstracts of papers, p. 31, London, 1948.

With the commencement of mining operations, the immediate requirements for water had to be met from local underground water supplies in an area where water has been scarce for a century. Electrical and magnetic measurements were carried out for the mapping of younger dike systems and for the selection of borehole sites. The geological results of the subsequent drilling of shallow water boreholes are described, together with the geophysical results.

10601. Zhelezniak, A. I. Certain data on the causes of the formation of a natural electrical field in the coal strata of the Donbas [in Russian]: Razvedka Nedr, vol. 13, no. 4, pp. 43–46, Moscow, 1947.

Data on the composition of Donbas coals, obtained by core analysis, are discussed with a view to clarifying the causes of strong permanent anomalies of spontaneous polarization known to exist in the local strata of anthracite, graphite, and graphitic schists. In all, 92 coal layers were studied, some marked by anomalies and others free of them. The

evidence revealed that, with all types of Donbas coals, anomalies of spontaneous polarization are related to the degree of carbonization and to the sulfur content of the coals, but not to the content of volatiles, except in coals of type A. The sulfur in the Donbas coals is mostly present in the form of pyrite, and the anomalies are typically associated with certain types of local sulfide concentrations usually dependent on the mineral constituents of coals. In 1940 V. N. Dakhnov explained the presence of natural potentials in local layers as the result of electrical fields generated by processes of oxidation and reduction of coals and pyrite (*see* Geophys. Abstracts 103, no. 5804.).—*V. S.*

5. RADIOACTIVE METHODS

10602. Becker, A., and Shaper, Ilsemarie. Zur Gehaltbestimmung radioactiver Lösungen [Determination of radioactive substances in solutions]: Zeitschr. Phys., vol. 118, pp. 357–374, Berlin, 1941.

The method described by the authors makes possible a precise determination of even very small amounts of radioactive substances such as radium, radiothorium, and mesothorium contained in solutions. The measuring apparatus is a quadrant electrometer, provided with additional adaptable capacities and connected on one side to a cylindrical condenser of 10–15 liters capacity for the measurement of γ radiation. On the other side the electrometer is connected to a small cylindrical condenser of 0.5 liter capacity for measurement of thorium emanation. The substances to be investigated are placed in a Glucker's flask of 75 cubic centimeters capacity. The absolute determination of the content is made by comparison with two standard radiothorium solutions of different intensities attached to the instrument.—*S. T. V.*

10603. Bonner, J. F. Jr. Alpha and beta ray counters: Univ. Rochester. Dept. Radiology, doctoral dissertation, 83 pp., Rochester, N. Y., May 1947. (Library of Congress, OTS PB Rept. L78663.)

This report to the United States Atomic Energy Commission describes the investigation and development of suitable high-voltage supplies for portable Geiger-Müller counters. The blocking oscillator circuit presented is believed to be the simplest and most efficient circuit yet developed. Also given are the design and construction details of a simple alpha counter for the measurement of foil samples. The circuit uses no batteries and is operated entirely from the alternating current line. The noise level is sufficiently low so that the radiation of foil samples may be counted accurately. Several of the circuits developed for use with the alpha counter can be used with little or no modification with a Geiger-Müller counter. A simplified quenching circuit and an oscillator for producing the required high voltage are also described. Wiring diagrams, graphs, and a bibliography are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 6, no. 4, pp. 326–327, Washington, D. C., 1947, revised by V. S.*

10604. Brown, S. C. Theory and operation of Geiger-Müller counters—1, The discharge mechanism; 2, Counters for special purposes; 3, The circuits: Nucleonics, vol. 2, no. 6, pp. 10–22; vol. 3, no. 2, pp. 50–64; vol. 3, no. 4, pp. 46–61, New York, 1948.

An understanding of the characteristics of Geiger-Müller counters is essential for their proper use. In the first of three articles the author discusses the break-down characteristics of the discharge for simple and polyatomic gas counters, properties of gas fillings, need for and method of quenching a discharge, relationship between pulse size and plateau, the nature and effect of spurious discharges, and probable life of gas fillings. In the second article details of construction are presented for various types of counters, including those for gamma, beta, and X-rays, for photons, for liquid and gaseous sources, and for various special purposes. Advantages and disadvantages are cited. In the third article a discussion in given of various types of external circuits essential for counter operation, including preamplifiers, coincidence circuits, high-voltage circuits, battery-operated supplies, scalers, integrating circuits, and recorders.—*Author's abstracts.*

10605. Dreyer, R. M. Radioactivity surveys in the Kansas part of the tri-State zinc and lead mining district, Cherokee County, Kansas: Kansas Univ., Geol. Survey Bull. 76, pt. 5, pp. 115–120, Lawrence, Kans., 1948.

To test the efficacy of the radioactivity method of exploration in the tri-State zinc and lead mining district, a survey was made during 1947 of a representative geologic structural feature and several characteristic ore bodies located in Cherokee County, Kansas. The Mullen trough and the unmined parts of the Mullen and other ore bodies were covered with five traverses, and a grid was run on the Garrett property across ore bodies not disturbed by mining. The readings were taken with a portable Geiger-Müller counter checked each day with a radioactive standard. At each station the pulses were counted, at first for 10 minutes and at later stages of the survey for 60 minutes, to obtain a representative average count, because radioactive emanations do not strike the counter at a constant rate and the rate of incidence of cosmic rays affecting the counter is likewise not constant.

It was found that the Geiger-Müller counter is of no value either in locating ore bodies or in delineating major structural features in this area. Cosmic-ray counting indicated a range of incidence from 8 to 20 counts per minute, with an average of 10 to 12, and the data for the traverses showed no count that could not be attributed to variations in this incidence. The geologic correlation of the results from 60-minute counts was no better than that of the results from 10-minute counts. The readings taken at the same stations at different times did not even duplicate each other. It is concluded that the values plotted for the radioactivity traverses represent mainly variations in cosmic ray incidence. The possibility of a successful application of radioactivity instruments other than the Geiger-Müller counter is not excluded by the findings.—*V. S.*

10606. Drigo, Angelo, and Rostagni, Antonio. Ricerche di radioattività nella zone termale euganea [Research on radioactivity of the thermal zone of the Euganean Hills]: Istit. Veneto di Sci., Let., Arti Atti, vol. 102, no. 2, pp. 407–413, Venice, Italy, 1943.

Studies of radioactive substances contained in the earth's crust are of interest in many problems of geology and geophysics. Particularly important is the question of radioactivity of eruptive masses brought by volcanic action to the earth's surface from depths not accessible to direct observation. The authors have investigated water, mud, and rocks, using the method of Aliverti and Lovera for water and Geiger-Müller counters for mud and rock samples at different points in the Euganean Hills, Italy. They found a radium content in water ranging from 1×10^{-13} to 10×10^{-13} g/cm^3 and 14 to 80 emanations per liter.

For mud, the radium content was found to range from (10 to 20) 10^{-12} gr/gr. In samples of lava of recent origin the radium content was found to be equal to 12.6×10^{-12} gr/gr or about four times higher than in normal acid rock.—*S. T. V.*

10607. Hagen, G. E., and Loughridge, D. H. Circuit for testing efficiency of Geiger counters: Rev. Sci. Instruments, vol. 19, no. 8, pp. 526–528, Lancaster, Pa., 1948.

Design and operating characteristics of an electronic device for measuring over-all efficiencies of Geiger counters are described. The device yields these data rapidly without any standard tube and also provides a means of checking the relative sensitivity of various sections of a counter tube.—*Authors' abstract.*

10608. Jaffey, A. H., and others. A manual on the measurement of radioactivity: U. S. Atom. Energy Comm. Rept. MDDC–388, 49 pp., August 1944, 1946. (Library of Congress, OTS PB Rept. 52739.)

This manual was written as an introduction to radioactivity measurements for chemists and other scientists. It provides fairly explicit operating instructions, together with the minimum background necessary for intelligent use of the instruments and interpretation of results. Exposition is restricted to equipment and techniques employed in developing chemical engineering scale separation of plutonium from uranium and to processes for obtaining fission products. The manual has three sections: Alpha counting, measurement of beta and gamma radiation, and statistics and counting. Diagrams and graphs are included.

A foreword written in 1946 indicates the data that are now obsolete and the new methods and instruments that are in general use. A list of references is included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 4, no. 3, p. 218, Washington, D. C., 1947, condensed by V. S.*

10609. Maier-Leibnitz, H. New quenching circuit for Geiger counters: Rev. Sci. Instruments, vol. 19, no. 5, pp. 300–302, Lancaster, Pa., 1948.

A quenching circuit is described that works on the multivibrator principle but uses two different grids of the input tube for the signal and for the regenerative feedback. The initial discharge in the counter excites the counter to one oscillation, during which the counting voltage is kept below threshold and the counter has time to recover. At the end

of the oscillation (after about 0.2 millisecond) the counter voltage and all other voltages are rapidly restored to their initial values. Thus the next count will take place under exactly the same conditions as the first, all amplifier pulses will be equal, no discharges will take place in the Geiger counter while the amplifier is unable to quench them, and corrections for dead time will be quite simple.—*Author's abstract.*

10610. Northern Miner. Uranium-thorium prospecting not a specialized job: Vol. 34, no. 1, pp. 17–18, Toronto, Ontario, 1948.

R. F. Errington's paper on uranium and thorium exploration, presented at the convention of the Prospectors and Developers' Association, is summarized in connection with the lifting of Government restrictions on the private ownership of radioactive deposits by discoverers in the Northwest Territories and Yukon. The author advised prospectors to make the search for radioactive minerals a part of their regular routine, pointing to the simplicity of the necessary procedures, the limited knowledge necessary, and the widespread occurrence of uranium and thorium, which may be found in connection with the more common ore deposits, veins, gossans, and pegmatites.

Uranium is twice as abundant as zinc and four times as abundant as lead. Its principal ore, pitchblende, is ordinarily associated with silver, chalcopyrite, hematite, nickel cobalts, and other familiar ore minerals. The veins are usually characterized by banded and vuggy structures. The use of the Geiger-Müller counter is recommended for search. Thorium is found mainly in sands derived from rocks carrying monazite. It occurs in small amounts in quartz and carbonate veins. Final recognition of thorium ordinarily requires chemical analysis.—*V. S.*

10611. Trabacchi, G. C. Un tipo di elettrometro a filo [A string electrometer of a special design]: Ricerca Sci. progr. Techn., vol. 13, pp. 15–20, Rome, 1942.

The principal part of this instrument is a platinum filament 2 microns thick attached at one end to a semicircle 15 millimeters in diameter. A microscope of 200 diameters magnification makes possible a sensitivity of 1,000 mm/volt. The instrument is provided with an ionization chamber serving for the measurement of radioactivity. The chamber is filled with CO_2 under 45 pounds pressure.—*Karl Stockl, Zentralb. Geophys., Meteorol. u. Geod., vol. 10, no. 2, p. 77, Berlin, 1942, translated by S. T. V.*

6. GEOTHERMAL METHODS

10612. Bowden, K. F. The processes of heating and cooling in a section of the Irish Sea: Royal Astron. Soc. Monthly Notices, Geophys. Suppl., vol. 5, no. 7, pp. 270–281, London, 1948.

The heat-balance equation is applied to the Holyhead-Dublin Bay section of the Irish Sea. It is shown that the seasonal variation in the heat content of the section as a whole can be accounted for largely by the local effects of radiation and exchange of heat with the atmosphere. There is, however, a considerable transfer of heat from the coastal waters toward the center of the channel in summer and in the reverse direction in winter. This transfer is attributed to mixing due to horizontal turbulence, and an estimate is made of the horizontal eddy diffusivity.—*Author's abstract.*

10613. Glebovskaia, V. S. Determination of the thermal properties of minerals by the method of controlled conditions [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz., no. 12, pp. 72–89, Moscow, 1948.

Accurate knowledge of heat conductivity and heat capacity of minerals is very important in many problems of geophysics. Usually heat conductivity is determined by creating a stationary heat flow across a plane-parallel specimen of the mineral and measuring the corresponding temperature gradient. In spite of precautions usually taken in order to prevent leakage of the heat in the direction perpendicular to the main flow this method, in the case of poor conductors, results in errors as large as 15–20 percent. Following a suggestion of G. M. Kondrat'ev the author proposes a new method for determining the heat conductivity by observing a specimen under nonstationery, but strictly controlled conditions. It can be proved that, when a sample is cooled in a medium of constant temperature, the logarithm of the temperature of the sample is a linear function of time. Influence of the shape of the specimen can be eliminated by making preliminary experiments with geometrically similar specimens made of materials of known thermal properties. The usual form of the specimens is cylindrical, corresponding to core samples obtained during well drilling. The paper describes the experimental installation and presents computations of several examples. The error of the measurements made by the proposed method is estimated to be not greater than 3 percent.—*S. T. V.*

10614. Schwinner, Robert. Über den Wärmehaushalt des Erdballes [The thermal balance of the terrestrial globe]: Gerlands Beitr. Geophysik, vol. 58, no. 1–2, pp. 236–296, Leipzig, 1941.

The thermal balance of the earth's interior is not sufficiently explored. The amount of heat reaching the earth's surface through conduction from the interior can be estimated as equal to $1-2\times10^{-6}$ cal./cm.^{2} sec.

The heat generated by volcanoes constitutes about 2 percent of this amount. Another source of heat is the decomposition of the radioactive substances in the earth's interior. The amount of such substances can be evaluated on the basis of their probable distribution in different layers of the crust. Assuming the same rate of radioactivity in the earth's interior as that on the surface, an amount of heat is obtained which is many times greater than that calculated above. But even this heat is negligible in comparison with that received from the sun by radiation, and, therefore, it cannot be of importance in determining the temperature of the earth's surface.

In the study of the thermal balance of the terrestrial globe, two hypotheses were formulated about its final outcome: the earth is becoming either continuously colder or continuously warmer. Joly advances a third possibility with his theory of thermal cycles with periodically rising and falling earth temperatures. This hypothesis presents certain advantages to geologists, but it is not tenable from the physical point of view.

The hypothesis of continuous cooling of the earth fits better in our cosmogonic theories, as well as in the theory of geological and geochemico-petrographic evolution. The opposite hypothesis which assumes an initially cold terrestrial globe cannot be supported. Thus only the first

hypothesis of continuous cooling can be accepted, even if certain statistical discrepancies in the thermal balance cannot be refuted.—*Author's abstract, condensed and translated by S. T. V.*

7. GEOCHEMICAL METHODS

10615. Brannock, W. W., Fix, P. F., Gianella, V. P., and White, D. E. Preliminary geochemical results at Steamboat Springs, Nevada: Am. Geophys. Union Trans., vol. 29, no. 2, pp. 211–226, Washington, D. C., 1948.

Since 1945 the area of Steamboat Springs, Nevada, has been investigated geologically and geochemically with special emphasis on the origin of the local hot springs and the conditions of formation of deposits of stibnite, cinnabar, native mercury, pyrite, and other epithermal-ore minerals. Preliminary geochemical results, obtained to February 1, 1946, show the springs to be structurally related to recent faults and genetically connected with the magmatic source of the recent volcanic domes of pumiceous rhyolite.

Many of the springs are at or near the boiling point, and their temperatures appear to depend on their acidity or alkalinity, with the most alkaline waters occurring in the hottest springs. Cinnabar, stibnite, pyrite, and other sulfides have crystallized at depths of 5 to 50 feet below the surface in sinter and gravels attacked by hot waters after burial under new sinter. Some siliceous muds deposited from the springs contain gold and antimony in amounts equivalent to commercial ores and also considerable silver, mercury, copper, and arsenic.—*V. S.*

10616. Fletcher, M. H., and White, C. E. A simple test for the detection of beryllium minerals: Am. Mineralogist, vol. 31, pp. 82–83, Lancaster, Pa., 1946.

The mineral is fused with Na_2CO_3 on platinum wire, dissolved in HCl, and either quinizarin or 1-amino-4-hydrozyanthraquinone with NaOH is added. The purple solution gives a strong orange-red flourescence in ultraviolet rays.—*L. J. S., Mineralog. Mag., vol. 28, no. 200, p. 246, London, 1948.*

10617. Maliuga, D. P. Toward determining copper in rocks, soils, and organisms by the polarographic method [in Russian]: Lab. Biogéochim. Acad. Sci. U.R.S.S. Trav., vol. 7, pp. 86–97, Moscow, 1944.

Since 1930, K. Suchy, K. Heller, and other investigators have developed various polarographic techniques for the determination of the presence of small quantities of copper in natural waters and soils. Among these methods the author considers Heller's dithizone test superior to others, but not fully reliable and very time consuming. He advances a simpler polarographic method for identifying any quantity of copper in rocks, soils, and organisms.

This method consists in the use of rubeanic acid as a general reagent for the separation of copper from Fe, Mn, Ti, Al, and other elements in diluted, weak ammonia solutions containing 0.5 percent of citric acid, 0.02 N NaCl, and in the subsequent polarographic estimation of copper under the same conditions, the potential of copper separation being equal to 0.35 volt. The procedures of preparation of samples, isolation

of copper, polarographic recording, and verification of the method, used by the author in his tests, are described, and some results are given on copper content in human organs.—*V. S.*

10618. Motyka, Jozef. O celach i metodach badán geobotanicznych (On the aims and methods of geobotanical research): Curie-Skłodowska Univ. Ann., Sec. C, Suppl. 1, 168 pp., Lublin, Poland, 1947.

The geobotanical survey made by the author in the borderlands of Podolia and Volynia in Poland is reported with a description of the method and results, a comparison of findings with those obtained by other methods, and an examination of various viewpoints in geobotany. The differential analysis of Czekanowski, upon which the survey is based, is an outgrowth of Pearson's statistical method applied to geobotany. It is useful for classifying individual items on the basis of their likenesses in a number of distinct botanical characteristics. The procedure consists in adding up the likenesses by a technique of tabulation and graphical plotting and calculating coefficients of correlation among botanical specimens for grouping them into classes. The method is described. Generally the results show low coefficients of correlation among botanical varieties.—*V. S.*

10619. Rankama, Kalervo. Some recent trends in the geochemical investigation of the lithosphere: Comm. Géol. Finlande Bull. 140, pp. 129–133, Helsinki, 1947.

Geochemistry is defined as the study of the chemical composition and evolution of the earth. The stages of its development are outlined. In the years 1908–20 much basic knowledge was gained on the geochemistry of the lithosphere, mainly through the work of W. C. Brøgger, J. H. L. Vogt, and V. M. Goldschmidt. Beginning with 1920, the fundamental laws of the distribution of elements were discovered as the result of advances in nuclear and atomic physics and in scientific methods, successfully applied by V. M. Goldschmidt, G. Hevesy, and the Noddacks.

At present, classical "mineralogical" geochemistry appears to be superseded, particularly in the study of the lithosphere, by a new development viewed by the author as "geological geochemistry." The trends characterizing this new phase, observed mainly in the Scandinavian countries, are in evidence in the work on the regional distribution of trace elements, conducted by T. Sahama, K. Rankama, V. Vahätälo, and others; in research on the order of the pre-Cambrian granites in Finland by Sahama and Rankama; and in investigations on the geochemistry of the formation of ore deposits by S. Landergren, T. Oftedal, S. Gavelin, O. Gabrielson, and others. The last-named problem was studied by Landergren in Sweden in application to the Grängesberg iron deposits, which were found to be of secondary magmatic origin. The classical mineralogical tradition is likewise continued in the studies of F. Wickman on igneous and sedimentary rocks. The review is supplemented with a bibliography.—*V. S.*

10620. Vogt, T. Geokjemisk og geobatanisk malmleting—7, Sporelementer i myrmalm og sjømalm [Geochemical and geobotanical ore prospecting—7, Trace elements in bog and lake ores]: Kon. Norske Vidensk. Selsk. Forh. 1942, vol. 15, no. 24, pp. 91–94, Trondheim, Norway, 1943.

Trace elements in bog and lake ores may give an approximate chemical characterization of ore minerals in the fluvial basin of the bog or lake. Some X-ray spectrograms of bog and lake ores from Norway are given. It is presumed that the mutual coagulation of the electrically positive Fe_2O_3—hydratesol and the electrically negative MnO_2-hydratesols and Humussols, and particularly the chemosorption of the Mn (II) cation (sorbent: MnO_2-hydratesol) are important for the formation of bog and lake ores. The pH values of the water also play some part in the formation of these ores. The present MnO_2-hydrates have precipitated the cations Zn, Cu, Ni, Co, Ca, probably Ba (adsorption or rather chemosorption), and the electrically positive TiO_2-hydratesol (mutual coagulation). Zn is found to be a prominent key element of the acid eruptive rocks of the Oslo area; Co is also present in these rocks. The Ni contents of the bog ores of Finnmark are of some interest.—*Author's abstract.*

10621. Vogt, T., and Bugge, J. Geokjemisk og geobotanisk malmleting—8, Bestemmelse av kobber i planter fra Rørosfeltet ved kvantitativ røntgenanalyse [Geochemical and geobotanical ore prospecting—8, Determination of copper in plants from the Røros district by quantitative X-ray analyses]: Kon. Norske Vidensk. Selsk. Forh. 1943, vol. 16, no. 14, pp. 51–54, Trondheim, Norway, 1944.

The geochemical ore prospecting method of Sven Palmquist, originating in the investigations of V. M. Goldschmidt, is based on the fact that many elements from ores are concentrated in plants growing on or near covered outcrops of the ores. The results of quantitative X-ray copper analyses of different plants species, partly growing on soil rich in copper (Nyberget) and partly on normal soil (Koiedalen), are tabulated. The leaves of the bushes contain more copper than the stems, and the dwarf birch contains more of this metal than the willows and other plants. It is recommended that material of only one plant species, or group of species, be used for trace-element investigations, the leaves of the birch species being well-suited. Judging from the present data, the method does not appear to be very useful as regards exploration for copper in the Røros area.—*Authors' abstract.*

10622. Zobell, C. E. Microbial transformation of molecular hydrogen in marine sediments, with particular reference to petroleum: Am. Assoc. Petroleum Geologists Bull., vol. 31, no. 10, pp. 1709–1751, Tulsa, Okla., 1947.

Molecular hydrogen is produced by a large number of bacterial species, many of which occur in marine-bottom deposits, oil-bearing sands, and reservoir fluids from oil wells. Geologically important among these bacteria are various kinds of anaerobes which oxidize hydrogen with the formation of methane, simple organic acids, ammonia, and hydrogen sulfide. The processes effected are described to the extent that they are known, the different sources of hydrogen and the ener-

getics of some hypothetical reactions are considered, and the hypothesis is advanced that various kinds of hydrogen-oxidizing bacteria, in conjunction with radioactivity and other catalytic agents in sediments, may contribute to the formation of petroleum hydrocarbons. The paper contains a bibilography.—*Author's abstract, condensed by V. S.*

8. DRILL-HOLE METHODS

10623. Belluigi, Arnoldo. Stato attuale del carotaggio elettrico [Present state of electrical well logging]: Metano, vol. 5, pp. 55–80, Rome, 1943.

This is a critical review of the principles and methods of electrical logging of oil wells. In an introductory section the author describes, in addition to his own measuring device, those of Schlumberger, von Card and von Meinzer. This is followed by a description of the procedure for construction of the self-potential curve and of the curve of electrical resistivity, with many practical details concerning the instruments used in different methods, as those of Hummel, Martinssen, and Linden. Generation of electrical potential in the well due to electrofiltration and electro-osmosis is explained and the geological interpretation of the curves obtained is shown for several oil wells with and without casing. The possibility of detecting a missed oil-bearing formation is also shown. Finally thermal and radioactive methods are described and certain related problems, such as measurement of the deviation of the hole from the vertical, and the determination of the dip of a formation reached by the drill, are discussed.—*S. T. V.*

10624. Bulashevich, Iu. P. The theory of neutron logging in application to exploration of oil and coal deposits [in Russian]: Acad. Sci. U.R.S.S. Bull. (Izvestiia), Sér. Géog. et Géophys., vol. 12, no. 2, pp. 155–168, Moscow, 1948.

To remedy the lack of a comprehensive explanation of processes underlying neutron and gamma logging, the authors make a theoretical analysis of neutron penetration, deceleration, diffusion, absorption, and dispersion characteristic of various rocks and minerals. Experimental data on transverse atomic parameters determining probabilities of the dispersion of slow neutrons and of their absorption by atoms are used for a calculation of neutron constants for oil, coals, iron, quartzite, dolomite, limestones, sandstones, and other rocks and minerals. A solution is given for the problem of diffusion of slow neutrons in a dispersing and absorbing medium in the case of a point source, with special attention to the effects of the deceleration of fast neutrons in various rocks. It is shown that the character of rock signals in neutron logging depends largely on the dimensions of the neutron sounding probe and that the relations among these signals can be reversed.

Consideration is also given to gamma logging on the assumption that the absorption of every neutron is accompanied by the formation of a gamma quantum, and a reversion of the values of relative characteristics of rocks is likewise found possible. The deductions of the analysis are compared with data of measurements.—*V. S.*

10625. Campbell, J. L. P., and Winter, A. B. Radioactivity well logging, with discussion: Texas Agr. Mech. Coll. Bull. 93, pp. 119–131, College Station, Tex., 1946.

Radioactivity well logging is usually made by means of an ionization chamber to measure either the intensity of gamma rays naturally emitted by formations or the intensity of response of formations to bombardment from a neutron source attached to the ionization chamber and shielded from it. The gamma-ray curve reveals the location of radioactive formations, and the neutron curve shows their relative fluid content, so that these logs may supplement one another as indices of oil and gas.

The ionization chamber consists of a cylinder containing two insulated electrodes and an inert gas under high pressure. Both the gamma rays and the effects of neutron bombardment cause the gas to become partially ionized and to conduct through the electrodes a current proportional to the intensity of ionization, and accordingly proportional to the effects of radiations emanating from the formations. The applications of gamma-ray logs and neutron logs that can be made separately or in combination are listed. Included is a discussion of the above remarks at the conference on well-logging methods held at the A. & M. College of Texas in March 1946.—*V. S.*

10626. Castany, G. Carottage électrique et étude des sondages mécaniques [Electrical logging and investigation of boreholes, abstract]: Internat. Geol. Cong., 18th sess., Great Britain, 1948, Titles and abstracts of papers, p. 25, London, 1948.

Two years ago the Office of Public Works in Tunisia undertook the systematic electrical logging of all boreholes in the territory under the administration of the Regency. The application of this method has given good results. It made possible the determination of local stratigraphic and lithologic sections. Moreover, in numerous cases precise correlations could be established between different holes. The most typical examples are those of Manouba in the vicinity of Tunis, Djérid, and Gabès.—*Translated by V. S.*

10627. Doll, H. G., and Schwede, H. F. Radioactive markers in oil-field practice: Am. Inst. Min. Met. Eng. Tech. Pub. 2261, Petroleum Technology, vol. 10, no. 5, 10 pp., New York, 1947.

This paper describes a method to provide identification of particular depths in a borehole through the use of radioactive markers, The correlation of a marker, placed in the wall of a borehole, with known points of the electrical log and with the casing collars in the cased hole permits accurate positioning of tools with respect to a formation regardless of absolute depth. Such a process is particularly useful in gun perforation of a casing in a well. Techniques and equipment are discussed and illustrated. Examples are given of practical application in the field.—*Authors' abstract.* (*See also* Geophys. Abstracts 130, no. 9428.)

10628. Guyod, Hubert. Electrical logging fundamentals, with discussion; Interpretation of electric logs: Texas Agr. Mech. Coll. Bull. 93, pp. 32–98, College Station, Tex., 1946.

Electrical well logging can be performed by measuring the resistivity

of formations or their natural potential. The elementary principles of resistivity logs are explained briefly by analogy with hydrodynamics and are illustrated by diagrams of the disposition of circuits and electrodes in a drill hole and of the various common types of electrode arrangements. Principles underlying potential logging are clarified in a few words by a comparison of the effects of contacts, which may exist between sand, shale, and mud in a well, with the action of an electrochemical cell and are likewise illustrated by diagrams.

These remarks served as an introduction to a discussion of electrical logs at the well-logging conference held at the A. & M. College of Texas in March 1946. The discussion is given, and there follows a brief exposition of principles of electrical-log interpretation which deals with the factors controlling formation resistivity and mud invasion, likewise illustrated by diagrams. Various applications of electric logs are listed.—*V. S.*

10629. Kolbel, H. Geoelektrische Formationsmessungen in Erzbohrungen [Geoelectric measurements of formations in drill holes through the ore bodies]: Zeitschr. Prakt. Geol., vol. 51, pp. 73–76, Halle a. S., Germany, 1943.

Electrical logging can be applied to prospecting for metallic ores by making measurements in deep drill holes through ore bodies. Following the method of Martienssen only one electrode is used. Alternating current of a very low frequency or direct current of low voltage is applied. Such logging serves for detecting and delineating ore deposits and is especially effective when these have good electric conductivity. It is also useful in correlating formations among different holes. The article describes the procedure used in making measurements and discusses the method of interpretation of the results obtained.—*S. T. V.*

10630. Komarov, S. G. Techniques of geophysical exploration of oil wells [in Russian], 488 pp., Moscow, Gostoptekh, 1947.

This is a handbook of well-logging operations, containing a detailed description of apparatus and instruments employed for this purpose, methods of measurements, and procedures to be followed. Electrical measurements in wells involving determination of the resistivity of formations, spontaneous potentials and resistivity of the drilling mud are discussed in detail. Possible errors in measurements and precautions to be taken against them are specially mentioned. This is followed by a description of temperature measurements in wells, determination of radioactivity of formations, gas and oil detection in mud, determination of dip of a formation by inclinometers of different designs, determination of depth of casing. This handbook of practical well logging does not contain geological interpretations of the diagrams obtained.—*S. T. V.*

10631. Migaux, Leon. L'exploration electrique et thermique des sondages [Electrical and thermal exploration of drill holes]: Annales des mines, vol. 18, no. 2, pp. 93–178, Paris, 1941.

The author states that rock drilling at a depth of some thousands of feet is a difficult operation. It is still more difficult to know exactly what is being drilled at a given moment. It is the purpose of electrical well logging to provide this information. The geological properties of

the formations around the drill hole are determined on the basis of their measured electrical properties, namely, electrical resistivity and spontaneous potentials. The variation of these two properties with the depth gives two curves which, if properly interpreted, may supply information on the underground geology of the area.

The correct interpretation of these curves is discussed in examples taken from oil fields of different geological structure. Other electrical operations, such as determination of the dip of the formation, and of the deviation of the hole from the vertical, are also discussed. A special section is devoted to thermal logging of drill holes and to interpretations of results obtained. In the concluding section the author analyzes the possibility of application of electrical logging methods to exploratory drilling for coal.—*S. T. V.*

10632. Polubarinova-Kochina, P. Ia. Hydraulic theory of wells in stratified media [in Russian]: Prikladnaia Matemat. Mekhan., vol. 11, no. 3, pp. 359–362, Moscow, 1948.

The problem of filtration of fluids through porous media is of importance in the hydrogeology of oil-bearing strata. Usually Dupuit's equation is applied for the evaluation of the capacity of an oil well, but, as A. N. Miatiev has proved, a better correlation with empirical measurements is obtained when the vertical permeability of the strata is also taken into account because of the great areas affecting the results. The author extends Miatiev's method to three oil-bearing strata and gives the solution of the derived differential equation for an axially symmetrical formation.—*S. T. V.*

10633. Wells, R. J. Well-velocity shooting in California [abstract]: Geophysics, vol. 13, no. 2, p. 302, Tulsa, Okla., 1948.

Well-velocity shooting stands as probably the most direct way of getting seismic velocity information at the present time. Sources of error and approximate magnitudes of errors are summarized, and the disturbing and misleading effects of impulses transmitted down the well geophone cable are discussed in detail. Several examples of the latter phenomenon in California are shown, and analyses are made indicating the probable path the energy travels from the shot to the cable, and thence down the cable to the geophone. The attenuation and velocity of the wave down the cable are evaluated, and the effect of cable-transmitted energy in using multiple geophones on the same cable is discussed. The paper concludes with a rough evaluation of accuracy requirements for usable well-velocity data and suggests refinements in techniques to achieve these accuracies and, in particular, to eliminate or reduce the uncertainties introduced by cable-borne energy.

10634. Weng, Wen-Po. Electrical logging by single electrode: Geophys. Comm. China, Geophys. Mem., no. 2, 2 pp., 2 figs., Peiping (?), May 1941.

An experiment was made in a 4,300-foot well drilled through several salt-bearing formations to compare the application of Schlumberger's single-electrode logging method, U. S. patent 1,819,923, with his three-electrode method for wells with concentrated salt water. The logging curves obtained showed a close similarity in sandstone sections, but in limestone sections the single-electrode curve gave more detail and fur-

nished clearer indication of salt-water horizons than did the three-electrode curve. It is concluded that the single-electrode method is very useful for locating formations producing salt water and for investigating their details, though it may not be as effective as the three-electrode method for studing formation resistivities.—*V. S.*

10635. Wolf, Alexander. Acoustic well sounding [abstract]: Geophysics, vol. 13, no. 3, p. 496, Tulsa, Okla., 1948.

The principle of the acoustic determination of fluid level in a producing well can be traced to an idea patented 50 years ago. The paper outlines the development of the method, the instruments now available, and the purpose of acoustic well sounding.

9. UNCLASSIFIED GEOPHYSICAL SUBJECTS

10636. Carnegie Institution of Washington. Year Book No. 46, July 1, 1946–June 30, 1947, 211 pp., Washington, D. C., 1947.

Accounts are given of the administration and research activities of the institution. The terrestrial sciences are covered by reports from two departments.

Geophysical Laboratory, by L. H. Adams.—Work has commenced on the redefined postwar program placing primary emphasis on the study of the melting and solubility relations of silicates in the presence of water and other volatile components under pressure. The purpose is to obtain a more complete understanding of the genesis of rocks, other geologic phenomena, and the constitution of the earth. Advances have been made in problems of wet silicates and dry silicates.

Department of Terrestrial Magnetism, by M. A. Tuve.—With the completion of the observatory and field work of the world magnetic survey and the transfer by gift of the two observatories of the department to the governments of Peru and Australia, the staff turns to a program of short-term experimental investigations in magnetism, exploratory geophysics, laboratory physics, and biophysics, in which other agencies will have a large part. The research undertaken in these fields is reported, and the department's program of magnetic surveys and observatory work during 1904–46 is reviewed.—*V. S.*

10637. Ecuador. Dirección general de minería y petróleos. La minería y el petróleo en el Ecuador, Enero 1946—Marzo 1947 [Mining and petroleum industries in Ecuador from January 1946 to March 1947], 111 pp., Quito, 1947.

This is the report of the director of the mining and petroleum industries of the Republic of Ecuador on the activity of the department and different branches of these industries during the year 1946. It contains extensive statistical data on industrial production in Ecuador and also gives information on geophysical exploration, mostly for oil, done in this republic by the government or by private companies. Gravimetric and magnetic surveys of several regions were made, but the results are not yet ready for publication. Seismic explorations were begun along the Río Aguarico and Río San Miguel. Also, new oil wells were explored by the Schlumberger method. In certain regions of the country the personnel working on geophysical exploration was drastically reduced near the end of the year.—*S. T. V.*

10638. Gassmann, Fritz. Auswertung geophysikalischer Sondierungen mit Hilfe von Potentialfeldern [Evaluation of geophysical soundings made with the aid of potential fields]: Schweizer. Min. Pet. Mitt., vol. 28, no. 1, pp. 335–352, Frauenfeld, Switzerland, 1948.

This paper deals with methods of geophysical prospecting which consist in the measurement and interpretation of potential fields. Its aim is to set out briefly and coherently the fundamental principles governing these methods. In Section 1 the methods of geophysical prospecting are divided according to the mathematical instruments employed into two main groups—the potential field methods and the dynamic methods. In Sections 2–4 some basic facts relating to potential fields are assembled. Section 5 contains the conventional symbols and examples relating to the most important spheres of application of the potential theory in geophysics. Section 6 gives a survey of the methods used to determine the fields of disturbing bodies located underground. In Section 7, a discussion is given of the principles by which measurements of potential fields are to be interpreted, so that the disturbing underground bodies could be determined from measurements taken at the surface of the earth with all the precision called for by the problem.—*Author's abstract.*

10639. Gilchrist, Lachlan. Some useful geophysical methods of exploration of structure at the site of power dams [abstract]: Royal Soc. Canada Proc., ser. 3, vol. 42, p. 27, Ottawa, Ontario, 1948.

Stable geologic structure and retaining ground conditions are essential economic features of the site of a power dam. The presence of caverns containing water and sludge in dolomitic rocks and the existence of folded and sheared rocks associated with disturbed subsurface topography in areas of pre-Cambrian rocks constitute a menace to ground stability and retaining power. Preliminary surveys made by means of properly applied geophysical methods can give useful information on irregular rock topography, location of disturbed and sheared subsurface rock conditions, and delineation of extensive, homogeneous, and stable rock masses adjacent to the proposed sites of power dams.—*Revised by V. S.*

10640. Iuneev, M. V. Possibility of geophysical prospecting for manganese ores in the southern part of the Ural Mountains [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Material., Geofiz., no. 12, pp. 103–125, Moscow, 1948.

Considering geophysical prospecting for manganese ores in several regions of U. S. S. R. by different investigators, the author concludes that the magnetic method used to the present cannot be successful. In its application numerous magnetic anomalies were discovered and precise magnetic maps traced, but no correlation could be established with the existing manganese deposits. In connection with a planned exploration of the Abzelilovskiy district, near the city of Magnitogorsk, the author made a preliminary reconnaissance of the region and succeeded in discovering several manganese ore bodies employing the "combined physico-chemical" method. The region surveyed contains a variety of manganese silicates and oxides of strikingly different physical properties. The author used the magnetic method for locating porphyrite, serpentine, or diabase, having high magnetic susceptibility. However, the magnetic method could not detect jasper. This could be

located by electrical methods owing to its high electrical resistivity. When searching for manganese silicates, such as rhodonite or bustamite, characterized by high density, the author used the gravimetric method. For locating small isolated ore bodies, the author recommends the geochemical method of taking samples of alluvium and analyzing them by the Marshall method after treating the specimens with sulfuric acid.—*S. T. V.*

10641. Ivanov, N. A., and others. Geophysical methods in the search and exploration of natural resources [in Russian]: Ural Sci. Res. Inst. of Geology, Prospecting and Econ. Mineralology Trans., no. 1, Geology and Geophysics, pp. 115-140, Sverdlovsk, U.S.S.R., 1938.

The development of institutions of geophysical research and exploration in the Ural Mountains (Ural'skiy Khrebet), U.S.S.R., is outlined, and separate accounts are given of the application of geophysical methods to the search for iron ore, bauxite, chromite, mica, oil, and sulfide ores, and to geological mapping in the Urals and adjacent regions.

Iron and bauxite deposits are successfully detected and delineated by detailed magnetic surveys. Chromite can be detected by the gravitational method under favorable geologic conditions; the magnetic method aids only in the delineation of general promising zones. Mica-bearing pegmatites are detected by electrical methods but not by magnetic and radioactive methods. Structures favorable for the accumulation of oil can be revealed in some areas, preferably by magnetic methods and in others by gravitational methods; the results of electrical surveys had not been verified by drilling when this paper was written. As is well known, sulfide ores are detected most successfully by electrical methods, so that only four investigations have been made for research purposes. The mapping of geological structures can often be conducted by means of the magnetic method.—*V. S.*

10642. Janoschek, R. Die bisherigen Ergebnisse der erdölgeologischen Untersuchungen im inneralpinen Wiener Becken [The results obtained to present date from geological exploration for oil in the alpine Vienna basin]: Oel u. Kohle, vol. 38, pp. 125–150, Berlin, 1942.

Geophysical exploration for oil in the Vienna basin was begun some twenty years ago, and as a result, the geology of the region is well known. A detailed geological map was prepared on a scale of 1:25,000. Surveys with torsion balance and gravimeters were made first. They succeeded in detecting a deep fault which creates favorable conditions for oil accumulation in this region. Later the entire basin was surveyed, first magnetically and then seismically. Finally, numerous exploratory drill holes were logged electrically by the Schlumberger method. Owing to favorable geological structure, geophysicists were able to give a detailed and correct interpretation of the logs obtained and to correlate stratigraphic horizons. The article contains numerous maps and sketches.—*S. T. V.*

10643. Kunz, Bruno. Geophysik und Erdöl [Geophysics and petroleum]: Bohrtech. Zeitung, vol. 63, no. 11-12, pp. 5-12, Vienna, 1943.

Since 1861, after Sterry Hunt's discoveries, the search for oil in a region has been concentrated on the exploration of its subsurface geology

for the presence of anticlines and faults. For geological exploration of an area, two geophysical methods are available: gravitational and seismic. The gravitational method is older. The article contains the geologic profile of the Arad basin, Austria, delineated by R. Eötvös, inventor of the torsion balance. In recent years the torsion balance has not been used in industrial surveys, being replaced by the more efficient gravimeter. For deep exploration of geologic strata, seismic methods, both refraction and reflection, were found to be very effective. As a more recent and efficient method of prospecting for oil, the author mentions the drilling of an exploratory well and its logging by the Schlumberger method. The article discusses the underlying principles of various methods and gives descriptions of different apparatus, as well as practical applications to local Austrian conditions.—*S. T. V.*

10644. Lundberg, Hans. Choice of methods in geophysical exploration for ore [abstract]: Geophysics, vol. 13, no. 3, p. 507, Tulsa, Okla., 1948.

This paper discusses the methods used in two surveys for ore bodies in the Canadian pre-Cambrian shield. The results of the surveys and of the drilling are shown. The need for using more than one geophysical method and of adapting their choice to the geologic problem at hand is clearly indicated.

10645. Mackay, D. K., and Danforth, L. F. Oil and gas development in Arkansas in 1946: Am. Inst. Min. Met. Eng., Statistics of Oil and Gas Development and Production, 1946, pp. 1–22, New York, 1947.

Geophysical activity in Arkansas increased from 286 crew weeks in 1945 to 467 crew weeks in 1946, divided as follows: seismic 380, magnetic 52, gravity 35. The number of crews actively operating at the end of the year was: seismic 10, magnetic 1, and gravity 1. Exploration was limited to southern Arkansas in the Gulf coastal plain—where oil, condensate, and gas are produced from Cretaceous and Jurassic sediments on anticlines, structural terraces, and along the high side of faults—and to northwestern Arkansas, where dry gas is produced from sandstones of lower Pennsylvania age on faulted anticlines in the Arkansas Valley. The distribution of geophysical exploration during 1946 is indicated on a sketch map, which shows concentration of activity particularly in Lafayette, Columbia, Union, Drew, Desha, and Jefferson Counties.—*V. S.*

10646. National Research Council of Canada, Associate Committee on Geodesy and Geophysics. Canadian Geophysical Bulletin, vol. 2, no. 1, 58 pp., Ottawa, Ontario, 1948.

The Canadian Geophysical Bulletin gives information on theoretical and applied work carried on in various branches of geophysics in Canada. It furnishes reports on current investigations, general geophysical information, bibliographies, and abstracts of recent Canadian publications. The present issue contains, among other items, reports concerning the work of the International Council for the Exploration of the Sea, studies of the Arctic, geophysical surveys off Canadian coasts, seismic research at Kirkland Lake in Ontario, local earthquake recording at

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Ottawa, magnetic surveys in Canada, and the field work of the Gravity Division of the Dominion Observatory. Current Canadian bibliography is given for each branch of geophysics.—*V. S.*

10647. Pugh, W. E. On-the-job training in exploration geophysics [abstract]: Geophysics, vol. 13, no. 3, p. 500–501, Tulsa, Okla., 1948.

The lack of men trained specifically for exploration geophysics resulted in the institution of an on-the-job training program for overcoming the difficulty at least in part. The problem is treated principally from the point of view of seismograph work. The development of the program from conception to inauguration is discussed briefly, along with presentation of selected excerpts from the training material and diagrams to illustrate its proposed (theoretical) execution. The actual operation of the training program and the difficulties encountered are analyzed objectively and in retrospect. The paper closes with a brief résumé of the results obtained and conclusions.

10648. Society of Exploration Geophysicists. Cumulative index of the publications of the Society of Exploration Geophysicists (1931–47), 127 pp., Houston, Tex., Gulf Pub. Co., 1948.

This volume comprises the second comprehensive index of the publications of the Society, the first index having been a compilation of titles and authors' names which appeared in the two Journals of the Society during the initial period of 1931–39. (See Special Supplement of July 1940, vol. 5, no. 3, pt. 2.) The present index replaces the first index, as it is complete for the period 1931–47.

Two special features are important in the new index: the replacement of the alphabetical list of titles by a Subject Classification, and the addition of a Patent Index. The Subject Classification of geophysical literature is composed of the following classes: Exploration, Seismographic, Gravimetric, Magnetic, Electrical, Geochemical, Well Measurements, Case Histories, Miscellaneous, Society Round Table. The Seismographic, Gravimetric, and Magnetic classes are further subdivided into subclasses: Aerial Surveys, General, Instruments, Theory and Technique.

The separate Patent Index covers the patents abstracted in the section of Patents of the journal "Geophysics" since the inception of that section in the October 1939 issue through the January 1947 issue. It is divided into three parts arranged by subject, by patent number, and by name of the inventor to facilitate the search for patents when only incomplete information is available.—*Editorial note, amplified by V. S.*

10649. Tarkhov, A. G. Application of geophysical methods to the exploration of geological structures of the northern part of U.S.S.R. [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz., no. 11, pp. 40–57, Moscow, 1947.

The author summarizes experiences in geophysical exploration of the extreme northeastern portion of European U.S.S.R. along the rivers Ukhta and Pechora. The area is covered with forests and swamps and has a very short summer and a severe winter, which make conditions

exceedingly difficult for any method of exploration. When the magnetic method of surveying was used, large variations of the geomagnetic field were noticed, often interfering with measurements. Appreciable differences in magnetic variations were found between stations only 10–15 kilometers apart. In summer, great daily variations in temperature caused errors in the indications of the instruments because the thermal inertia of the thermometer and that of the magnetic system are very different. In winter, extremely low temperatures caused erratic readings of the instruments. The same difficulties were noticed when working with gravimeters. Aeromagnetic surveying is indicated for this region.

In electrical exploration, the complicating effect of frozen ground was noticed. In winter, its resistivity becomes very high; in summer, its upper layer produces a powerful screening effect. Another difficulty is the great variation in electrical properties of frozen and thawed portions of the ground. Geological heterogeneity of the upper formations also creates difficulties. In electrical measurements intense telluric currents were observed, reaching thousands of millivolts per kilometer. The respective variations in time were often as high as 50 mV./sec., making difficult the application of the zero method in the measurements of currents. In winter, it is difficult to ground conductors owing to the deeply frozen soil. In exploring the oil-bearing formations, Al'pin's dipole method was found very effective and also presents a saving in cables. Seismic methods were less frequently used, but in some places interesting results were obtained. Thus in the Vymskiy district the seismic reflection method established six horizons, reaching a depth of 1,650 meters. An interesting feature is the presence of a deep stratum of anhydride limestone which has an infinite electrical resistivity.—*S. T. V.*

10650. Vening Meinesz, F. A. Major tectonic phenomena and the hypothesis of convection currents in the earth: Geol. Soc. London Quart. Jour., vol. 103, no. 3, pp. 191–207, 1 map, London, 1948.

The hypothesis of terrestrial convection currents is reviewed as an explanation of major tectonic phenomena. In the gradually cooling earth a plastic and homogeneous layer is postulated below the rigid crust, sufficiently thick to allow the formation of currents by the cooling in their descending columns and heating in their ascending columns. At least two types of currents appear to be demonstrated: those responsible for the subsidence of deep basins in tectonic island-arc areas and for the deeper earthquakes in these areas, and those which exert a more powerful drag on the crust and cause its down-buckling with the attendant surface folding and overthrusting in tectonic belts. Shear stresses are produced by these currents in the plastic layer, which in the case of smaller currents are found to correspond with the occurrence of deep-focus and intermediate earthquakes.

The gravitational, seismic, geothermal, and radioactive evidence supporting this hypothesis is examined in its tectonic implications, and the hydrodynamics of the convection mechanism and related processes are discussed in application to the sinking of the Banda Sea basin and other features of the Indonesian Archipelago.—*V. S.*

10651. Vlodavets, V. I. On the activity of the Kamchatka volcanological station [in Russian]: Acad. Sci. U.R.S.S. Bull. (Izvestiia) Sér. Géog. et Géophys., vol. 9, no. 1, pp. 40–49, Moscow, 1945.

Kamchatka, the great peninsula of eastern Siberia opposite Alaska, is a volcanic region of great interest, having over 20 active and solfataric volcanoes, 109 extinct volcanoes, 68 groups of thermal springs, and 17 large geysers. The most active volcano, the Klyuchevskaya Sopka, is near the line of juncture of Kuril-Kamchatka and Aleutian tectonic arcs. It last erupted in 1935 with lava flow continuing to March 1939. Eruption of Sopka Avacha, another volcano, took place from March till December 1938. One of the smaller volcanos, Sopka Berezovaya (formerly called Karim) erupted during 1940–1943. A gravitational survey of the Klyuchevskaya Sopka region was recently completed, which shows an interesting condition of the gravitational differentiation in the magmatic reservoir; some of the anomalies can be explained by enormous eruptions of lava. The lava from the most recent eruptions amounts to more than a cubic kilometer. The lava contains over 50 percent sulfur.—*S. T. V.*

10. RELATED GEOLOGICAL SUBJECTS

10652. Bijlaard, P. P. On the linear patterns of the earth's crust: Kon. Nederland. Akad. Wetensch. Proc., vol. 51, no. 4, pp. 450–456, Amsterdam, 1948.

Vening Meinesz has explained the diagonal linear patterns in the earth's crust as the result of drag exerted by subcrustal currents or of movement of the poles. The author points out that, besides these principal patterns, there exist world-wide north-south and east-west lineaments which can be traced to the joint influence of the earth's contraction and the decrease of the earth's flattening because of the slowing down of its rotation by tidal friction. As a basis for this hypothesis he summarizes his theory of local plastic deformations, wherein such processes are attributed to the amount of elastic shearing energy at the focal point and the accompanying apparent raising of the yield points are considered to be caused by shifts of stress in consequence of minor deformations. The application of this theory to the explanation of linear patterns is supported by a brief review of the results of Kuenen's experiments on plastic buckling.—*V. S.*

10653. Bonchkovskii, V. F. Deformations of the earth's surface under the action of external influences [in Russian]: Akad. Nauk SSSR Doklady, vol. 60, no. 6, pp. 981–984, Moscow, 1948.

The deformation of the earth's surface caused by the varying pressures of violent atmospheric disturbances, such as cyclones, may be significant in precise geodetic surveys. The possible extent of such deformations is calculated by the author from meteorological and geological data by the use of the formulas of G. H. Darwin. From these results a determination is made of the modulus of hardness of the crustal layers that may be subject to such deformations to estimate their extent. The modulus is found to have the value of 0.3×10^{11} dyn./cm.^{2}, which is about one-tenth of the average modulus of the earth's crust or the modulus of crystalline rocks as deduced from seismic data. It is thus shown that deformations caused by atmospheric pressures can take place only in

the upper layers of the crust. The analysis indicates that they are of the nature of continuous down-sliding movements on the surface depending generally on the homogeneity of local rocks but produce no changes in average crustal configuration.—*V. S.*

10654. Carsey, J. B. Continental shelf along Gulf Coast—rich hunting ground for new oil: Texas Oil Jour., vol. 15, no. 4, pp. 12–16, 25–27, Longview, Tex., 1948.

Information available on the topography and geology of the continental shelf along the Gulf Coast is reviewed briefly, and the history of the formation of the principal local oil-denoting structures (salt domes) is outlined. A generalized geologic cross section through eastern Louisiana, from Washington Parish in the north to Grand Isle in the south, shows that the upper northern portions of the Tertiary formations contain continental sands and shales which southward grade progressively into marine sands and shales, and finally into marine shales. Near the Gulf Coast the marine sands and shales most favorable for oil accumulation are found at several horizons.

Since the shelf is geologically continuous with the coastal plain, it is believed that the disposition of bands of greatest sand content on the coast may aid in locating their probable extensions into the shelf. A sketch map of coastal bands suggests that the shelf along the coasts of Texas and southwestern Louisiana may contain oil in Miocene sands around salt domes. On the basis of this and other maps it is tentatively estimated that the 31.4-mile zone of the shelf adjacent to Texas and Louisiana may yield 4 to 5 billion barrels of oil.—*V. S.*

10655. Jardetzky, W. Bewegungsmechanismus der Erdkruste [Mechanics of the movements of the earth's crust]: Akad. Wiss., Wien, Math.-Naturwiss. Kl., Denkschr., vol. 108, pp. 1–38, Vienna, 1948.

The astronomical motion of our planet, described by the laws of Kepler and Newton, is complicated by a number of disturbing factors negligible to the astronomer but of capital importance to the geologist studying the evolution of the terrestrial globe. Variation in the period of rotation of sun spots depending upon their equatorial distance and similar phenomena observed on Jupiter and Saturn force the geophysicist studying the evolution of the earth and its motion in space to abandon the concept of a rigid celestial body and to consider instead a rotating system, containing rigid and liquid elements. Moreover the motion of the terrestrial globe is not isolated in space, but is exposed to the action of the sun and of other members of the solar system.

Of the solutions found for the motion of such a system, not only the known periodic motions are to be considered, but also those of aperiodic nature and their asymptotic values, approached at the end of two billion years of earth's history. Referring to a theorem of Zhukovskii, the author predicts the existence of a limiting final stage of such motion and suggests that the explanation of many important questions of the geologic history of our planet can be found through analysis of this motion. From such an analysis the concept of the oscillation of the terrestrial axis is obtained, and a theory that the limiting state of this motion has not yet been reached. The principal oscillations of a liquid globe can be represented by a spherical function of the second order,

becoming zero at a latitude of 35°15′33″N. Just along this parallel circle lies the belt of the most frequent and violent earthquakes—in which is located Japan, San Francisco, Lisbon, Sicily, Iran.

The author considers it probable that the terrestrial axis initially was perpendicular to the ecliptic. Assuming with Wegener that the North American continent in the Tertiary period was a part of the polar cap, the author concludes that the axis of the ecliptic, the earth's axis, and the geomagnetic axis initially coincided.—*S. T. V.*

10656. Krynine, P. D. The megascopic study and field classification of sedimentary rocks: Jour. Geology, vol. 56, no. 2, pp. 130–165, Chicago, 1948.

To improve the accuracy of petrologic descriptions of rocks, important in the search for stratigraphic traps and in oil-well studies, a classification of sedimentary rocks is proposed that is sufficiently detailed for an understanding of relationships among sediments observable megascopically. It is based on the preliminary division of sediments into detrital and chemical, and on the fundamental division of the detrital fraction of either class into three types of mineral assemblage corresponding to the orthoquartzite, graywacke, and arkose series. The classification is presented with its subdivisions and is illustrated by diagrams. The accompanying discussion deals with the basic terms employed, with the fundamentals of composition, texture, and structure of sediments, and with the principles and applications of the classification. A procedure consisting of 7 steps is suggested for an accurate megascopic description of sediments.—*V. S.*

10657. Levorsen, A. I. Our petroleum resources: Geol. Soc. America Bull., vol. 59, no. 4, pp. 283–299, Baltimore, Md., 1948.

In considering how much new oil and gas remain to be discovered on the North American continent the author lists as the geologic requisites of a petroleum province the existence of direct indications, sediments, unconformities, and up-dip wedge belts of permeability. Applying these criteria he inquires into the potentialities of three representative types of prospective petroleum areas selected for study: the overthrust fault belts, the plains of western Canada and Alaska and of eastern Mexico and Guatemala, and the wedge-out of lower Cretaceous and Jurassic sediments in the southeastern States. The formation of known oil and gas pools in these areas is examined in the light of underlying generic processes, and the petroleum possibilities of geologically similar localities are appraised.

The analysis shows the presence of enormous volumes of rocks more or less favorable to the occurrence of petroleum and relatively unexplored. It is concluded that, on the assumption that these masses contain proportionately large petroleum deposits, exploration is still far from complete in North America. Maps and geologic sections of the areas studied illustrate the discussion.—*V. S.*

10658. National Research Council. Bibliography on frost action in soils, annotated: Highway Res. Bd., Bibliog. no. 3, 57 pp., Washington, D. C., 1948. [Mimeographed.]

This bibliography, prepared under the supervision of the Committee on Frost Heave and Frost Action in Soils, Highway Research Board,

gives a chronologically arranged, annotated, and indexed list of 283 publications within this committee's province that have appeared during 1890–1948. Among the subjects of interest to exploration geophysicists are: the effect of frost action on geologic formations; thermal properties and temperatures of soil; test methods and apparatus for studies of frost action; depth of freezing; isothermal diagrams; permafrost; frost-proof bench marks; aerophoto identification of soils. Bibliographies are included.—*V. S.*

10659. Němec, Alois. O, silách, které formuji povrch zemsky—Geomechanika [On the forces which have formed the earth's surface—Geomechanics], 216 pp., Převov, Czechoslovakia, Bartoš, 1947.

The author defines geomechanics as the branch of science dealing with the action of mechanical forces on the earth's crust throughout its history. These forces are gravitational and centrifugal caused by both the rotation of the terrestrial globe and its revolution around the sun. Phenomena leading to the establishment of the theory of isostasy are discussed. This is followed by an analysis of tangential forces on the oceanic currents and on the movement of subcrustal masses. Chapters are devoted to orogenic processes, to formation of geosynclines, to the genesis of rift valleys, to probable causes of the movement of the continents and the displacement of the polar axis.

In the concluding chapters the causes of seismic phenomena are discussed and various factors influencing gravity measurements and their importance are evaluated.—*S. T. V.*

10660. Parker, J. M. Prospecting for oil in the Northwest Territories: World Oil, vol. 128, no. 5, pp. 210–218, Houston, Tex., 1948.

The history of geologic and petroleum exploration in the Mackenzie Basin, Northwest Territories, Canada, is outlined. During the period 1920–1942 four wells, all in the Norman Wells field, and three dry holes, all within 10 miles of the Normal Wells field, were drilled in the Mackenzie Basin. Thus, to 1942 seven holes had been drilled in a petroliferous province 700 miles long and 200 miles wide. This lack of development was due to difficult access to the area and to climatic and terrain conditions. During the war period 1942–1945 the Norman Wells field was developed under the direction of the Canol Project, and extensive geological exploration was carried out. From 1945 to date the Imperial Oil Co., Ltd., has drilled about 20 wildcat wells in the central part of the Mackenzie Basin, and all these tests were abandoned as dry holes. To aid further exploration the author discusses briefly the sedimentary section of the Mackenzie Basin and the geologic and geophysical methods suitable for it and gives a new stratigraphic chart of the east flank of the Mackenzie Mountains.—*Abstract prepared by the author for this report.*

10661. Spencer, L. J. Catalogue of topographical mineralogies and regional bibliographies: Mineralog. Mag., vol. 28, no. 201, pp. 303–332, London, 1948.

All of the books of the library of the Mineral Department, British Museum, which give a systematic account of minerals in particular regions of the world, have been collected since 1894. The more im-

portant of these works are listed in the present catalogue for general use. The bibliographies included are mostly those relating to geology but covering also mineralogy, petrology, and economic minerals. The arrangement is by country and follows that scheduled for the International Catalogue of Scientific Literature, comprising nearly 75 countries and broad regions in some cases further differentiated into minor subdivisions.—*V. S.*

10662. Straley, H. W. Is the basement complex involved in Appalachian folding? [abstract]: Internat. Geol. Cong., 18th sess., Great Britain, 1948, Titles and abstracts of papers, p. 29, London, 1948.

Gravitational and magnetic surveys, supported by modified pressure box experiments, lead to several conclusions on the geology of the Appalachian Mountains. Most of the major anticlines in the Appalachians west of the Blue Ridge fault may not be cored by crystalline (basement) rocks. Some of these anticlines may be localized over thrust faults in which the basement complex is not involved. The Blue Ridge fault block, the easternmost in the Appalachian system of single blocks, may have acted as a plunger, slipping over the basement complex and folding the yielding sediments before it.

10663. Struth, H. J. 1947 oil discoveries largest since 1937: Petroleum Engineer, vol. 19, no. 4, pp. 51–58, Dallas, Tex., 1948.

In 1947 the search for new oil fields in the United States led to the drilling of 10,866 exploratory wells, exceeding all previous records and resulting in the discovery of about 1,860,000,000 barrels of oil. These figures compare with 9,548 wells drilled in 1946 and 7,618 wells drilled in 1944, which resulted in the discovery of 1,558,000,000 and 1,231,000,000 barrels of oil respectively. Total additions to underground oil reserves in 1947 from new discoveries and from reappraisals of fields found in the past eight years may aggregate 3,260,000,000 barrels of oil, the greatest annual gain in reserves since the year 1937 when the addition was 3,723,028,000 barrels.

The cost of finding new oil in 1947 is expected to average 55.7 cents per barrel, which is six times greater than in 1935. Increased costs are due in part to diminishing returns on drilling. In 1947 it was necessary to drill 5.4 wells to find one million barrels of oil, whereas in 1936 the same amount of oil was discovered by drilling 1.3 wells. Statistics for 1947 are compared with those for 1935–46, and tables and charts are given to show trends in drilling, discoveries, costs, reserves, and related factors.—*V. S.*

10664. Tarkhov, A. G. A new method of determination of the modulus of elasticity of rocks [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz. no. 12, pp. 62–71, Moscow, 1948.

The development of seismic methods in prospecting for minerals and in exploring for engineering structures makes imperative an exact knowledge of the elastic properties of geological formations. Determinative elastic properties of minerals can often serve as important diagnostic criteria. The usual method for determination of the modulus of elasticity of rocks, borrowed from the theory of elasticity, is neither precise

nor convenient. The author suggests a new method based on the rebound of elastic bodies after shock, as first suggested by E. Oddone. As long as the strain of the material does not reach the limit of plasticity, the hardness of the bodies tested does not enter into play.

The proposed apparatus consists of a glass tube 0.5 inch in diameter and about 50 centimeters high, fixed vertically over a small piece of the tested mineral, which has one face ground and polished. The height of rebound of a steel ball falling on the polished face of the specimen is a measure of the modulus of elasticity of the mineral. The author investigated numerous minerals and cites the results of 60 tests. In many cases agreement between the values obtained by the new method and those given in handbooks is close, but in several samples discrepancies are very great. The author explains them as the uncertainty of accepted values and the great differences in values published by different investigators, and points to the influence of possible impurities, microscopic cracks, and anisotropy of samples. The proposed method has the great advantage of rapidity and is well adapted to field work.—*S. T. V.*

10665. Tseng, T. C. Bibliography of geology and allied sciences of Tibet and regions to the west of the Chinshachiang: Nat. Geol. Survey of China, Bibliography of Chinese Geology, 114 pp., Nanking, December 1946.

This bibliography lists books, articles, and maps on geology, branches of geophysics, geography, surveying, and other topics pertaining to Tibet and regions of China to the west of the Chin-sha Chiang, which appeared in Chinese, English, German, French, Italian, and other languages from the 17th century to the present time. The differentiation of entries is by subject. The fields primarily covered are geography and geology. The 16 geophysical publications included deal with meteorology, astronomy, and geomagnetism.—*V. S.*

10666. U. S. Bureau of Mines and Geological Survey. Mineral position of the United States: Hearings before a subcommittee of the Committee on Public Lands, U. S. Senate, 80th Cong., 1st sess., Investigation of National Resources, May 15, 16, and 20, 1947, Appendix, pp. 165–310, 29 charts, 37 figs., 41 tables, Washington, D. C., 1947; also Public Affairs Press, Washington, D. C., 1948.

An official summary is given of the present economic position of the United States in most of the mineral raw materials used by industry. It is based on the data assembled during intensive exploration of national resources in 1939–44 and is believed to represent the most comprehensive effort of its kind yet attempted. The contents include 39 commodity chapters, presenting appraisals of reserves in known domestic deposits and related economic data, and 3 introductory chapters on the validity of the estimates made. In the section on the search for new mineral supplies consideration is given to geologic, geophysical, geochemical, and physical methods of exploration. (See Geophys. abstract 10475.) Numerous charts, tables, and maps are included.

Reviewing the situation, the Secretary of the Interior concludes: "In general, America's mineral outlook is favorable, but it is obvious that a dynamic program of research and exploration must be pursued if new sources are to be developed to supply future needs."—*V. S.*

10667. U. S. Geological Survey. Publications of the Geological Survey, May 1948, 322 pp., Washington, D. C., 1948.

This catalogue contains a complete list, to date, of the book publications of the Geological Survey, which include annual reports, monographs, professional papers, bulletins, water-supply papers, circulars, chapters and volumes of Mineral Resources of the United States (1882 to 1923), folios of the Geologic Atlas of the United States, and the World Atlas of Commercial Geology. Important maps and charts published by the Geological Survey are described in a special section under the headings: Geologic maps, Mineral resources maps (including Preliminary geophysical maps), Topographic maps, and Miscellaneous maps. A finding list of States, areas, and subjects and a finding list of authors are provided.—*Reprinted in part from Introduction, p. V.*

10668. Van Tuyl, F. M., Levings, W. S., and LeRoy, L. W. Review of petroleum geology in 1947: Colorado School of Mines Quart., vol. 43, no. 3, 334 pp., Golden, Colo., 1948.

The important events and advances in petroleum geology and petroleum geophysics as well as developments of interest in the basic geologic sciences during 1947 both in the United States and abroad are surveyed, and an effort is made to decipher certain trends in petroleum exploration and development procedures and techniques. Brief supplemental statistical information on production and reserves and a comprehensive classified bibliography are also included.—*Authors' abstract.*

10669. Wundt, W. Über die Kräfte bei der Bildung der Erdkruste [On the forces involved in the formation of the terrestrial crust]: Experientia, vol. 4, no. 7, pp. 241–250, Basel, Switzerland, 1948.

In reviewing various hypotheses concerning the formation of the earth's crust, it is observed that there is lacking an universally accepted theory to account for its developmental history. Isostasy, contraction of the earth's crust, radioactivity of different ores, Wegener's emphasis on the horizontal forces, and many other current theories fail to provide a complete and adequate explanation of all phenomena involved and often additional "cosmic" forces are considered in order to elucidate certain significant aspects of this question. In developing the theory of subcrustal magmatic movement the author has analyzed the consequences of the fact that the oceanic floors have near freezing temperature whereas at equal depth under the continents a temperature of about 150° C. is to be expected. The cooled and therefore heavier bottom presses upon the adjacent fluid zone and produces a subsurface streaming of the solid lands which are thus raised. The denudation of the solid land carries the uplifted masses back again into the sea, and thus a compression of the outer shell arises that furthers the process already begun and maintains it in a circulatory form. The rhythmical character of the earth's history can be explained by the interruptions that this circulatory process has undergone through physical discontinuities.—*Author's English abstract edited by S. T. V.*

11. TECHNICAL AIDS TO EXPLORATION

10670. Bench, B. M. Discovery of oil structures by aerial photography: Oil and Gas Jour., vol. 47, no. 17, pp. 98–100, 146–152, Tulsa, Okla., 1948.

The advantages of geologic reconnaissance by means of aerial photography are discussed with reference to oil exploration. Diagnostic clues are suggested for the determination of dip and strike from photographs and the identification of faults, fractures, and shear zones. The interpretation of stereoscopically studied photographic sequences is considered in connection with requisite ground checks. An aerial view often reveals features overlooked on the ground because general structural trends stand out more clearly; characteristic topographic expressions of outcrops, faults, formation contacts, and scarp traces are seen in relief; different soils and rocks of unlike composition reflect light variously; vegetation expresses underlying thermal and chemical processes; and chromatic photographs show distinctive gradations and contrasts in the coloring of rocks and soils. Full benefits can be derived from this evidence with the aid of sufficient knowledge of structural relationships and geomorphology, experience in surface exploration, familiarity with local geology, and competence in appraising the photographic expression of topographic forms, fabric patterns, and landscape characteristics.—*V. S.*

10671. Bock, Hubert. Der Vermessungsautomat. [The automatic surveyor]: Allg. Vermess. Nachr., vol. 54, pp. 117–118, Liebenwerda, Germany, 1942.

This instrument has been developed with the purpose of eliminating or essentially reducing numerical computations from the surveyor's work. It consists of a double calculating machine, combined with a tachymeter, which is electrically operated and automatically gives the differences of the coordinates for a given set of angle readings. According to the author the instrument is capable of calculating one hundred sets of coordinate combinations in one hour.—*H. Jung, Zentralb. Geophys., Meteorol. u Geod., vol. 10, no. 2, p. 54, Berlin, 1942, translated and condensed by S. T. V.*

10672. Cabrera, Blas, Amiot, Odette, and Colson, Helene. Une installation pour la mesure des susceptibilités des corps faiblement magnétiques [An installation for measuring the susceptibility of weak magnetic substances]: Acad. Sci. Comptes Rendus, vol. 212, no. 26, pp. 1115–1118, Paris, 1941.

This measuring arrangement utilizes the action of a nonuniform field generated between the poles of a suitable electromagnet on the small test specimen. The magnetic moment of the test piece is counteracted by a minute torsion balance, and the angular deflection is observed. The instrument is suspended in a hermetically sealed housing, where the air pressure is reduced to a few millimeters. The instrument and the sample tested can be kept at any desired temperature by a small electrical heater placed on the bottom of the housing. The corresponding temperature is measured by an electric resistance thermometer.—*S. T. V.*

10673. Chambers' mineralogical dictionary. [New ed.], 47 pp., 40 pls., Brooklyn, N. Y., Chemical Pub. [Co.], Inc., 1948.

This dictionary lists more than 400 mineralogical terms, giving the definition, chemical compostion, crystal form, physical and chemical properties, mode of occurrence, and uses of minerals. More than 100 of these minerals are shown in natural colors on plates.—*V. S.*

10674. Funder, Ludger. Beitrag zur praktischen Lagerstättenforschung in den Kolonien [A contribution to practical prospecting for minerals in the colonies]: Metall u. Erz, vol. 38, pp. 358–361, Halle a. S., Germany, 1941.

This is a description of a portable self-contained station for geophysical prospecting designed by the German State Bureau for ground exploration. Special attention is given to the question of safe transportation; details are presented referring to the construction of the truck, truck motor, and other parts, including a complete electrical power station specially adapted for prospecting work.

A drill rig is included in the equipment for drilling shot-holes and for geological surface exploration. The entire equipment is designed for use in locations remote from industrial centers.—*J. Renner, Zentralb. Geophys., Meteorol. u. Geod., vol. 9, no. 3, p. 157, Berlin, 1942—translated by S. T. V.*

10675. Hawkins, J. E. Radio survey and navigation systems [abstract]: Geophysics, vol. 13, no. 3, p. 501, Tulsa, Okla., 1948.

A general description is given of the various radio position locating systems. The differences are pointed out between pulse-type systems and continuous-wave systems. The essential features are described of a system which has been developed to meet the requirements of the oil exploration industry.

10676. Ingersoll, L. R., Zobell, O. J., and Ingersoll, A. C. Heat conduction, with engineering and geological applications, 278 pp., New York, McGraw-Hill Co., 1948.

This book presents the fundamentals of the theory of heat conduction and describes its practical applications for the use of students, physicists, engineers, and geologists. The contents cover the steady thermal state, the heat flow in one, two, and three dimensions, and the formation of ice. The Fourier conduction equation with its boundary conditions and Fourier series are reviewed, and special attention is given to auxiliary methods for treating heat-conduction problems, namely the method of isothermal surfaces and flow lines, the electrical methods, the graphical method of Schmidt, the relaxation method, the step method, and solutions from tables and curves. Methods of measuring thermal-conductivity constants are included. Among the various applications of heat-conduction theory, consideration is given to the geological problems of ground-temperature fluctuations, temperatures in decomposing, granite and postglacial time calculation.—*V. S.*

10677. Istituto Geografico Militare. Nozioni di fotogrammetria [Elements of photogrammetry], 318 pp., Florence, 1942.

This is a series of articles published in the Italian military magazine, l'Universo, and reprinted in book form. After an introductory chapter on basic principles of geometric optics, methods, and procedures of photogrammetry are discussed in the framework of terrestrial and aerial photography and its application to photographic surveying. Both numerical and automatic methods of iconometric restitution of oblique photographs to orthographic projections are described, greatest attention being paid to the description of various instruments used for this purpose. Most of the instruments described are of European make, such as the Orel-Zeiss stereoautograph, Santoni stereocartograph, Hugershoff-Heide autocartograph, and others. The closing chapter contains a description of different cameras used in aerial photography.—*S. T. V.*

10678. Jellinghaus, W. Ein neuer Magnetwerkstoff auf der Basis Eisen-Mangan [A new magnetic material developed from an iron-manganese alloy]: Tech. Mitt. Krupp, Forschungsber. 4, pp. 257–260, Essen, Germany, 1941.

Ferro-manganese of low carbon content and of 14–15 percent of manganese is austenitic and almost nonmagnetic. But it can be made martensitic by cold working with the result that its magnetic saturation, with 80 percent of austenite transformed, can reach 16,400 gauss and its coercive force is equal to about 20 oersted. Varying the initial composition of the austenitic alloy steel and the degree of its transformation it is possible to obtain values of remanence ranging from 4,500 to 11,000 gauss and the coercive force from 60 to 220 oersted. This steel also contains, besides manganese, certain additions (1–2 percent) of aluminum and titanium.—*Schafmeister, Zentralb. Geophys., Meteorol. u. Geod., vol. 9, no. 1, p. 10, Berlin, 1942, translated and condensed by S. T. V.*

10679. Kell, N. G. The application of azimuthal projections for the solution and investigation of photogrammetric problems [in Russian]: Acad. Sci. U.R.S.S. Bull. (Izvestiia), Sér. Géog. et Géophys., vol. 12, no. 2, pp. 119–136, Moscow, 1948.

It is shown that azimuthal projections are adequate and convenient for a graphic solution and analysis of photogrammetric problems. They can be applied to photographs taken at low angles, as is the case in aerial mapping, or at any angle when the problem is one of investigating errors caused by inaccuracy. A new method is given for the orientation of a series of photographs used in mapping and for the determination of elevations, and it is demonstrated how the "precision ellipsoid" employed to estimate the accuracy of graphic construction can be plotted by making use of a cartographic net drawn in a transverse azimuthal projection. A graphic procedure is also given for constructing the ellipsoid of dispersion, which requires much work when calculated by analytical methods.—*Author's abstract, translated by V. S.*

10680. Knappwost, A. Die Bestimmung kleinster Mengen ferromagnetischer Metalle, Oxyde usw. durch magnetische Messungen [Determination of small amounts of ferromagnetic metals or their oxides by magnetic measurements]: Zeitschr. Elektrochem., vol. 47, pp. 890–894, Halle a. S., Germany, 1941.

The author describes an apparatus for accurate determination of ferromagnetic substances present in a mineral in only microscopic amounts. The error in analysis made with this instrument is exceedingly small; its sensitivity makes possible the determination of iron content of one part per million. Only 1 gram of the mineral is necessary for the analysis. The principal part of the apparatus for the analysis is a small cavity in which a magnetic field of about 6,000 oersted is maintained which is sufficient for suppressing the influence of terrestrial magnetism. Electromagnets enclosing the cavity have specially shaped pole shoes insuring the uniformity of the magnetic field. Forces developed due to the presence of iron particles are measured by a torsion balance built into the instrument.—*S. T. V.*

10681. Kullenberg, B. The piston core sampler: Svenska Hydrogr.-Biol. Kommis. Skrift., ser. 3, vol 1, no. 2, 46 pp., Göteborg, Sweden, 1947.

A new instrument has been developed for sea-bottom core sampling by an application of the principle introduced by the Geotechnical Department of the Swedish State Railways. Inside a long, thick steel tube loaded with heavy weights is placed a closely fitting, movable piston. As the tube is dropped from a ship and penetrates into the sea floor under its own weight, the piston is kept automatically immobilized immediately above the sea bottom. To prevent the formation of a vacuum under the piston, hydrostatic pressure forces a core up the settling tube. The construction and operation of the instrument are described, the theory of the freely falling core sampler and of the elastic vibrations of the sounding cable is considered, and examples are given of the use of the sampler in the Mediterranean Sea aboard the Swedish research ship *Skagerak* in 1946. A plate shows a sediment core 13.76 meters long obtained during that cruise.—*V. S.*

10682. Meister, F. I. Schwingtisch für dynamische Prüfungen im Tonfrequenzbereich [Oscillating table for dynamic testing in the region of audio-frequency]: Akust. Zeitschr., vol. 7, pp. 51–56, Berlin, 1942.

A description is given of an oscillating table for testing vibrometers and seismometers of small dimensions. The frequency of oscillations can be varied from 5 to 10,000 hertz, and amplitudes can be made as high as 1 millimeter for frequencies below 100 hertz. Vibrations produced are purely sinusoidal so even the third derivative of the amplitude with respect to time is still a sinusoidal function. On the other hand the wave curve can be changed so that a jerking motion will be produced with an acceleration equal to 50 g.—*H. Jung, Zentralb. Geophys., Meteorol. u. Geod., vol. 9, no. 7, pp. 350–352, Berlin, 1942, translated by S. T. V.*

10683. Moore, R. C. Aerial photographs as aids in stratigraphic studies: Photogram. Eng., vol. 13, no. 4, pp. 550–557, Menasha, Wis., 1947.

Stratigraphic studies are aimed essentially at investigating composition, arrangement, order of succession, lithologic character, fossil content,

and thickness of divisions of rock strata. Aerial photographs can be useful in this work because they show where the diagnostically important features can be found and what they are. Such photographs also have the advantage of revealing, thanks to the breadth of aerial coverage, general relationships between outcrops, topography, soil, vegetation, and facies changes that escape observers working on the ground. Full benefits are obtained by a stereoscopic examination of air-photo pairs. The various stratigraphic features that can be studied with the aid of aerial photographs are discussed, and an indexing and filing scheme developed by the author for use in field work is outlined.—*V. S.*

10684. Parodi, Maurice. Petites oscillations de deux pendules couplés par élasticité dont les points de suspension exécutent des oscillations harmoniques verticales, identiques, en phase ou en opposition de phase [Small oscillations of two pendulums, elastically coupled, when their points of suspension oscillate harmonically in the vertical direction in phase or in opposition]: Acad. Sci. Comptes Rendus, vol. 212, no. 4, pp. 144–146, Paris, 1941.

The author analyzes the problem of the construction of precise pendulum apparatus used in gravimetric surveys, namely the motion of two pendulums, elastically coupled and suspended so that their points of suspension oscillate harmonically in the vertical plane in different phase relation to one another. The author proves that in this installation of pendulums an unstable motion can result with the indefinite increase of the amplitude of the oscillations. Two graphs are given showing the possible zones of instability, one for the motion of the pendulums in phase, another in opposition. The position of the instability zone is determined by the period and the amplitude of the disturbing impulse. Frictional resistance, always present, is of importance in creating stability of oscillation.—*S. T. V.*

10685. Rooney, G. W., and Levings, W. S. Advances in the use of air surveys by mining geologists: Photogram. Eng., vol. 13, no. 4, pp. 570–584, Menasha, Wis., 1947.

Recent and proposed applications of aerial photography to geologic investigations in Canada are described, and an account is given of instruction offered at the Colorado School of Mines on the use and interpretation of aerial photographs. Aerial mapping can assist prospectors, geologists, mining exploration companies, and government geological agencies to a greater extent than is recognized. The fundamental requirements, neglected in the past, consist in choosing the type of aerial photography most advantageous for the problem and in making use of the most suitable time of the year, filter, photographic scale, and other technical assets. The experience derived from work in the pre-Cambrian shield of Canada is considered applicable, with a few modifications, for geologic exploration in most other regions.—*V. S.*

10686. Rothe, Rudolf. Zur Integration der Potentialgleichung des Raumes [The integration of the equation of potential in space]: Math. Gesell. Berlin Sitzungsber., vol. 38–39, pp. 9–13, Berlin, 1940.

Solution is obtained of the Laplace equation for three dimensional cases by a linear transformation of the equation with introduction of

complex coefficients, which leads to a partial differential equation of the second order with three constants. This transformation makes possible the development of a new class of harmonic functions of three independent variables which finds wide applications in the potential theory.—*Zentralbl. Geophys., Meteor., Geod., vol. 9, no. 1, pp. 46, Berlin, 1942, translated by S. T. V.*

10687. Thyssen, Stéphan, von. Einige Fehlerquellen schneidegelagerter Systeme [Some sources of errors inherent in systems with knife-edge suspension]: Zeitschr. Geophysik, vol. 18, nos. 3–4, pp. 180–182, Braunschweig, 1944.

Phenomena connected with microscopic deformations of knife edges and their supporting bearings are analyzed and the effect of these deformations upon the period of vibrations of the supported system is studied. Such systems are to be found in the construction of chemical balances, pendulums, gravimeters, and many other measuring instruments. It is obvious that the assumption of a geometric center of rotation at the extremity of a rigid knife edge must be abandoned and replaced by that of a bearing, with an undetermined rolling friction coefficient and a variable radius of curvature.—*S. T. V.*

10688. Woods, J. P. Design equations for the rotating coil galvanometer [abstract]: Geophysics, vol. 12, no. 3, p. 503, Tulsa, Okla., 1947.

The equations and the equivalent electric circuit for a simple electromagnetically driven vibrator are given for reference. Matching the vibrator to its power source is discussed, and a power sensitivity is defined. The design of a rotating-coil galvanometer element is considered from the viewpoint of this power sensitivity. The construction of such an element is described, and data are given showing the performance of the completed galvanometer.

10689. World Oil. 1948 World Oil Atlas, 33 pp., 110 maps, Houston, Tex., July 1948.

The Atlas for 1948, the third edition of this annual publication of World Oil, presents up-to-date maps and statistics on the petroleum industry in various countries. It is organized on the same plan as the editions of 1946 and 1947, but additions of new information and refinements of the material have resulted in superior and more detailed maps and broader, more complete statistical data.—*V. S.*

10690. Worzel, J. L. Ocean bottom sampler for ships under way: Geophysics, vol. 13, no. 3, pp. 452–456, Tulsa, Okla., 1948.

This is the full text of the paper. For abstract published in advance, see Geophys. Abstracts 131, no. 9669.

12. PATENTS

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

10691. (1) Apparat för uppmatning tyngdkraften [Apparatus for measuring the force of gravity]. Aktiebolag Elektrisk Malmletning. Stockholm: Swedish patent 106,216, issued Dec. 29, 1942.

Two or more thin elastic antennae of quartz or other suitable material, rigidly attached at one end to a common base in pairs and left free at the

other end, so that they assume, when in operation, an almost vertical position and thus stand to some extent inclined toward or away from each other, are immersed in a liquid serving to dampen their movement and indicate the effect of the force of gravity by their deviation from the vertical and the corresponding change in their relative position to each other, observable through a graduated microscope placed over them. Claims allowed, 2. (Same as Dutch patent 51,864. For apparatus with horizontal antennae *see* Geophys. Abstracts 133, no. 10170.)

10692. (2) Earth inductor compass. Henry Lehde, Brooklyn, N. Y., assignor to Control Instrument Co., Inc., Brooklyn, N. Y., a corporation of New York: U. S. patent 2,434, 324, issued Jan. 13, 1948.

In an inductor compass, a rotatable member, a pair of spaced vibratory crystals, means to clamp adjacent ends of said crystals in spaced relation to each other and to said rotatable member, a support on said rotatable member having means to receive the free opposite ends of said crystals so as to restrain the same against movement in one direction, a pair of series connected coils each attached to one of said crystals, a grounded source of alternating current, connections from said source to said crystals to torsionally vibrate the latter in opposite directions and generate in said coils a voltage of the frequency of said crystal vibration while preventing electrostatic pick-up of voltage by said coils, and means responsive to said voltage for turning said rotatable member to thereby orient the torsional vibration of said crystals with respect to the earth's magnetic field. Claims allowed, 1.

10693. (2) Remote indicating compass. A. T. Sinks, Beach Bluff, Mass., assignor to General Electric Co., a corporation of New York: U. S. patent 2,437,132, issued Mar. 2, 1948.

A telemetering system comprising a transmitter unit and a receiver unit, each unit comprising a stator member and a rotor member, each stator member comprising a ring core of saturable magnetic material carrying winding means thereon provided with polyphase second-harmonic connections and single phase excitation connections and each rotor member comprising a rotatable, poled permanent magnet, circuit means for connecting the single phase connections of the transmitter and receiver stator winding means to a common source of periodically varying current, circuit means interconnecting the polyphase connections of the transmitter and receiver stator winding means to permit flow of induced, second-harmonic currents between the transmitter and receiver units, a first phase-shifting impedance means electrically connected in the excitation circuit of one of said units to shift the relative phase angle of the transmitter and receiver excitation currents, and a second impedance means electrically connected in the circuit including said polyphase connections to shift phase angle of second harmonic currents flowing between transmitter and receiver units, said first and second impedance means being dimensioned so that the resulting phase shift causes the maximum and minimum values of the transmitter generated second-harmonic currents flowing in the receiver approximately to correspond in time phase with the minimum and maximum values of permeability in receiver core permeability variation cycle and the maximum and minimum values of receiver generated second-harmonic currents flowing in the transmitter

to be displaced approximately 90 electrical degrees in time phase from the maximum and minimum values of permeability variation cycle, whereby the rotation of the transmitter magnet is effective in producing in the receiver a torque tending to rotate the receiver magnet in angular correspondence with the transmitter magnet but the rotation of the receiver magnet produces no feedback torque in the transmitter tending to rotate the transmitter magnet. Claims allowed, 4.

10694. (2) Repeater compass. L. P. Crosman, South Orange, N. J., assignor to Monroe Calculating Machine Co., Orange, N. J., a corporation of Delaware: U. S. patent 2,437,506, issued Mar. 9, 1948.

In an instrument, which is described, the combination with a magnetic compass controlled motor driven follower mechanism; of direction indicating mechanism including a repeater dial and a repeater hand, part of the driving connection between the motor and the follower mechanism forming part of movement transmission means between the motor, said dial and said hand normally ineffective with respect to said dial and said hand for other than repeater compass purposes, and means including manipulable means for rendering said transmission ineffective with respect to said follower mechanism and effective with respect to said dial and said hand to drive both dial and hand in a single direction in unison to reset the same relative to the magnetic compass. Claims allowed, 5.

10695. (2) Deviation correcting means for magnetic devices. F. D. Braddon, Babylon, N. Y., assignor to the Sperry Corp., a corporation of Delaware: U. S. patent 2,443,595, issued June 22, 1948.

In a system for correcting for deviation effects of a magnetic compass, the combination with an intermittently operable deviation-causing apparatus and a magnetic compass mounted in subjective relation thereto, of a plurality of relatively angularly disposed coils mounted in cooperable relation to said compass, means for providing a continuous and controlled energization of said coils to thereby provide a magnetic field of a first predetermined intensity and direction to compensate the compass for local fixed deviation-causing effects, means for additionally controlling the current flow respectively in all of said coils to subject said compass to a field of a second fixed and predetermined value in magnitude and direction substantially equal and opposite to the combined magnetic effect of said apparatus and the local fixed deviation-causing effects on said compass, and a switch for rendering said last mentioned means operative and inoperative in timed relation to an "on-off" control of said apparatus. Claims allowed, 3.

10696. (2) Earth induction compass. C. E. Granqvist, Lidingo, Sweden, assignor to Svenska Aktiebolaget Gasaccumulator, Lidingo, near Stockholm, Sweden, a corporation of Sweden: U. S. patent 2,444,290, issued June 29, 1948.

In an induction compass, a magnetic path sensitive to the earth's magnetic field, comprising a pair of relatively stationary magnetic members and a rotatable magnetic member mounted to vary the reluctance of said path, means rotating the rotatable member at a uniform speed, said relatively stationary members being mounted for orientation in the

earth's field, windings on said last members connected to carry an induced voltage, a polarizing winding associated with said magnetic path, a source of alternating current connected to energize said last winding for producing an alternating polarizing field, whereby said induced voltage represents a voltage due to said alternating polarizing field modulated by the voltage due to the earth's field, a rectifier connected to rectify said induced voltage and an alternating current watt meter having a pair of windings connected respectively to said alternating current source and to the output of said rectifier. Claims allowed, 3.

10697. (2) Compass. R. C. Burt, Pasadena, Calif., assignor to Lockheed Aircraft Corp., Burbank, Calif.: U. S. patent 2,446,258, issued Aug. 3, 1948.

A navigational compass comprising a case, means suspending the case for rotation about a vertical axis, a course setting scale on the case, a frame supported in the case for rotation about said axis and having a magnetic azimuth scale for cooperating with the course setting scale, a magnetic needle mounted in the frame for rotation about a horizontal axis so as to remain parallel with the earth's magnetic flux, the needle being operable to turn the frame, a reference mark on the lower portion of the frame, a drum type scale movable with the needle about said horizontal axis and cooperable with the reference mark to indicate the magnetic dip, the case being constructed of transparent material so the azimuth scale, the reference mark and said drum type scale are visible from the exterior of the case, and a reflector supported below the case for reflecting the images of the reference mark and said drum type scale forwardly so that all said scales and the reference mark may be viewed from a position in front of the case. Claims allowed, 4.

10698. (2) Magnetic compass. Lester Wolfe, United States Navy: U. S. patent 2,446,568, issued Aug. 10, 1948.

A magnetic compass comprising a base; a transparent cup shaped cover joined to said base; a compass card having a scale visible through said cover and pivotally supported within said base and cover; at least one pole seeking magnetic element carried by said card; a relatively fixed electrical conductor cutting the lines of magnetic flux from said element to damp the movement of said card; spaced lubber line means in a vertical plane by which said scale can be read without parallax; a groove in the bottom of said base in the same vertical plane as said lubber line and providing sighting means whereby the compass can be used as a pelorus; a support operable to clamp said compass and fasten it to an instrument panel or the like; aligning means adjustably positioned in said support and operable to engage said groove in said base whereby said compass may be positioned parallel to the fore and aft axis of a vehicle or the like. Claims allowed, 11.

10699. (2) Magnetometer. C. H. Fay, Houston, Tex., assignor to Shell Development Co., San Francisco, Calif., a corporation of Delaware: U. S. patent 2,447,849, issued Aug. 24, 1948.

A system for magnetic field measurements, comprising a coil, means pivoting said coil for oscillation in said field, a light source, a photoelectric element, optical means carried by the coil for varying the illumination of the photo-electric element by the light source propor-

tionally to the oscillation of the coil, amplifier means energized by the output of the photo-electric element, rectifier means in circuit with the amplifier means for rectifying a portion of the output current of said amplifier means, Helmholtz coil means energized by the direct current output of said rectifier means for neutralizing the magnetic field in which the pivoted coil oscillates, said Helmholtz coil means being disposed in planes parallel with the axis of oscillation of said pivoted coil on either side thereof, means in circuit with the amplifier means and the pivoted coil for passing through said pivoted coil the non-rectified portion of the output current of said amplifier means, and indicator means in the Helmholtz coil circuit for indicating a current value capable of producing a neutralizing field necessary for just maintaining the pivoted coil in oscillation by the reaction of the current passed therethrough with the resultant of the magnetic field under measurement with the neutralizing field produced by the Helmholtz coil means. Claims allowed, 3.

10700. (2) Device for testing magnetic materials. T. T. Goldsmith, Jr., Cedar Grove, and E. R. Mann, Upper Montclair, N. J., assignors to A. B. Du Mont Laboratories, Inc., Passaic, N. J., a corporation of Delaware: U. S. patent 2,448,794.

A device for testing specimens of magnetic materials by examining their magnetic properties, which comprises a high frequency vacuum tube oscillator having an inductance soil in the oscillator circuit thereof with a condenser in parallel with said coil, one end of said coil and the corresponding side of said condenser being grounded, an inductance coil aligned with said first named coil, said coils being adapted to be coupled magnetically by the specimens of material to be tested, means to produce low frequency oscillations in said second named inductance coil and an oscillograph having one set of deflection plates connected to the output of said high frequency oscillator and another set of deflection plates connected to said means which produced low frequency oscillations whereby a visible pattern is produced on said oscillograph which is characteristic of the magnetic properties of said material. Claims allowed, 4.

10701. (3) Ultrasonic prism. W. P. Mason, West Orange, N. Y., assignor to Bell Telephone Laboratories, Inc., New York, N. Y., a corporation of New York: U. S. patent 2,434,667, issued Jan. 20, 1948.

An electromechanical transducer comprising a plurality of electromechanical translating prisms of the compressional-wave, frequency-directional type each having a potential range of 180° arranged with lines normal to their longitudinal axes radiating from a common point, and an electrical network associated therewith for controlling said prisms within that portion of their ranges measured by the angles formed between said radii. Claims allowed, 5.

10702. (3) Blasting cartridge. F. H. Armstrong, Chicago, Ill., assignor to Armstrong Coal Break Co., a corporation of Michigan: U. S. patent 2,435,116, issued Jan. 27, 1948.

A blasting cartridge comprising: a round hollow casing provided with laterally extending discharge ports; a sleevelike valve in said casing

adapted to close said ports and provided with a differential head whereby high gas pressure in the casing urges said valve to open position; expansible locking dogs in said casing for releasably holding the valve in closed position; a removable plug member in one end of the casing for receiving said dogs; and said plug member having an opening for permitting contact with said valve from outside of said casing; and a trigger member slidably mounted in the other end of the casing, extending through the differential head and adapted to hold the dogs releasably in locking position. Claims allowed, 5.

10703. (3) System for determining the direction of a source of sound. C. H. Waterman, South Portland, Maine, assignor, by mesne assignments, to Submarine Signal Co., Boston, Mass., a corporation of Delaware: U. S. patent 2,438,526, issued Mar. 30, 1948.

A method of intensifying the balance between two signal elements which comprises amplifying each signal element separately and impressing at least a portion of the amplified signals of each signal element back on the amplifier of both signal elements separately, the portion of the signal impressed upon its own original signal element being in a direction to increase that signal intensity and on the other signal element being in a direction to reduce that other signal intensity. Claims allowed, 9.

10704. (3) Vibrating apparatus. E. W. Larsen, Elmhurst, Ill., assignor to Western Electric Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,438,755, issued Mar. 30, 1948.

A vibratory apparatus comprising a vibratory table, a shaft substantially midway between the ends and underneath said table, a pair of arms, a pivotal support for each of said arms, eccentric means on said shaft settable for oscillating said arms, a link connected to each arm between said pivotal support and said eccentric means for vibrating said table in one direction, a pivotally mounted bell crank lever having one end attached to said table for vibrating said table in another direction, a second eccentric means on said shaft connected to the opposite end of said bell crank lever and settable to rock said bell crank lever, means for rotating said shaft to vibrate said table, and means connectible to render both of said eccentric means operative simultaneously to move the table in a predetermined path by setting them to a position of eccentricity with respect to the shaft. Claims allowed, 28.

10705. (3) Method of seismic exploration operations. (T. O. Harkness, Shreveport, La., assignor, by mesne assignments, to C. H. C. Patent Corp., Texarkana, Tex., a corporation of Texas: U. S. patent 2,449,037, issued Sept. 7, 1948.

A method of creating pulsations in the earth in seismic exploration operations comprising the steps of drilling a hole in the earth, setting a relatively malleable steel pipe having a gauge within the limits of 0.055 inch and 0.075 inch in the hole and detonating an explosive charge in the lower reaches of the pipe whereupon the pipe will collapse inwardly adjacent the explosion substantially closing the pipe. Claims allowed, 1.

10706. (3) Submersible seismometer system. R. A. Peterson, Pasadena, Calif., assignor, by mesne assignments, to United Geophysical Co., Inc., Pasadena, Calif., a corporation of California: U. S. patent 2,449,085, issued Sept. 14, 1948.

Means for coupling a seismic detecting device to a water medium carrying seismic waves, which comprises a float for floating at the surface of the water and a platform adapted to be submerged in the water suspended from the float and adapted to have placed thereon the seismic detecting device, the platform being nonresonant at frequencies within the effective seismic wave range and being sufficiently rigid to be set into vibration as a whole in correspondence with seismic waves in the water. Claims allowed, 7.

10707. (3) Echo sounding system with sensitivity control. A. D. Zappacosta, Havertown, Pa., assignor to Radio Corporation of America, a corporation of Delaware: U. S. patent 2,449,358, issued Sept. 14, 1948.

In an underwater signalling system having a common electromechanical transducer for transmission and reception, a receiver having an input circuit coupled to said transducer, a pulse transmitter coupled to said transducer, rectifier means coupled to said transmitter and in circuit with said receiver for reducing the sensitivity thereof during periods of transmission, said means also effectively short-circuiting said receiver input circuit in response to applied signalling voltages exceeding a predetermined minimum. Claims allowed, 6.

10708. (3) Seismic wave correction means and method. R. G. Piety, Yonkers, N. Y., assignor to Phillips Petroleum Co., a corporation of Delaware: U. S. patent 2,450,352, issued Sept. 28, 1948.

In an apparatus of the type described, the combination comprising means for converting physical vibrations into electrical currents comprising closely succeeding wave trains, a tuned amplifier connected to said means and having an output circuit, means connected in said output circuit for generating a similar current delayed in time one-half cycle, said means comprising a time delay network having a substantially linear response over a frequency range and including a plurality of cascaded vacuum tubes, means connected in said output circuit and to said last means for algebraically adding said currents, and means for converting said added currents into a graphic representation thereof. Claims allowed, 3.

10709. (3) Sound pickup device. R. E. Peterson, Danvers, Mass., assignor, by mesne assignments, to Submarine Signal Co., Boston, Mass., a corporation of Delaware: U. S. patent 2,452,068, issued Oct. 26, 1948.

A sound pickup device comprising a casing having a sound lens at one side thereof, a substantially rigid member positioned in another part of the casing extending over the focal surface of the lens and a plurality of pickup elements mounted on said rigid surface adapted to receive sound waves arriving substantially in the same phase at said focal surface, said pickup elements comprising a plurality of Rochelle salt crystals mounted with one compressional surface on said rigid ele-

ment and a sound propagating medium within said casing to which the other compressional surfaces of said crystals are exposed. Claims allowed, 7.

10710. (4) Werkwijze voor electrisch bodemonderzoek [Method of electrically exploring the ground]. Bataafsche Petroleum Maatschappij, The Hague: Dutch patent 53,024, issued Sept. 15, 1942.

Electrical circuits are sent into the ground by means of two feeding electrodes connected with a common source to produce separate current paths extending to different depths in the earth, and the resulting potential differences created between two grounded receiving electrodes are measured. The findings, depending on relations between the current's strength in different paths, are compared with potential differences typical of homogeneous ground to gain information on anomalous subsurface conditions. At least one feeding electrode is then exchanged with at least one receiving electrode, and the measurements are repeated. Claims allowed, 2.

10711. (4) Electrode assembly for moisture meters. A. L. Smith, Harrison, N. Y.: U. S. patent 2,437,134, issued Mar. 2, 1948.

An electrode assembly for use in measuring soil moisture which comprises a tubular composite shaft, a pointed metal electrode mounted at the lower end of said shaft, a metal tube extending substantially the length of said shaft insulated from said electrode and having a constructed portion just above said electrode, an insulating sleeve mounted outside said constricted portion having a diameter corresponding to the diameter of said electrode and a surface merging at its lower end into the surface of said electrode, a metal section forming part of said tube just above said insulating sleeve, having a diameter larger than that of said sleeve and said pointed electrode and having a surface which at its lower end tapers and merges into the surface of said sleeve, said tapered portion of said tube serving as a second electrode. Claims allowed, 1.

(5) Improvement in or relating to electric discharge devices for use as radiation detectors. Texaco Development Corp., Wilmington, Delaware: British patent 594,776, issued Nov. 19, 1947. *See* Geophys. abstract 10719.

10712. (5) Electrical apparatus for indicating the counting rate of a detector of penetrative radiation. Texaco Development Corp., Wilmington, Del., a corporation of Delaware: British patent 598,191, issued Feb. 12, 1948.

This device is of the integration-meter type used for indicating the counting rate of a detector of penetrative radiation such as a Geiger-Müller counter. It comprises a resistance and a condenser connected in series with the output of said detector, means for measuring the voltage collected on said condenser due to the pulses of the detector, said means comprising a voltage connected so as to buck the voltage on the condenser, voltage dividing means for adjusting said bucking voltage to balance the condenser voltage, and means for indicating the amount of adjustment of said voltage dividing means necessary to balance the condenser voltage. Claims allowed, 8.

10713. (5) Ionization chamber. B. L. Weller, Chicago, Ill., assignor to the United States of America, as represented by the Atomic Energy Commission: U. S. patent 2,436,084, issued Feb. 17, 1948.

Apparatus for measuring penetrating radiations comprising, in combination, a vacuum-tight sealed metal envelope, a collecting electrode and a high-potential electrode contained therein, lead-ins connected thereto, insulators for insulating said lead-ins from said envelope, a guard ring secured to said envelope and extending into the chamber formed thereby in a manner so as to electrostatically shield the interior surface of said collecting electrode insulator from said high potential electrode and lead-in, an electrical meter connected to said collecting electrode lead-in, said collecting electrode being maintained at substantially the same potential as said envelope exclusive of said collecting electrode lead-in, thereby draining leakage currents from the surface of said high voltage insulator to the voltage source in preference to said collecting electrode or meter. Claims allowed, 8.

10714. (5) Radiation detector. D. G. C. Hare, Roslyn, N. Y., assignor to Texaco Development Corp., New York, N. Y., a corporation of Delaware: U. S. patent 2,440,511, issued Apr. 27, 1948.

A device for detecting gamma rays comprising a housing, a plurality of metallic, frusto-conical plate members in said housing, said members being disposed in an intermeshed, separated relation about a center axis and connected together to form a cathode, an anchor member disposed so as to coincide with said center axis, a plurality of anode wires attached to said anchor member and extending outwardly through the spaces between and parallel to said plate members, and an ionizable medium in said housing. Claims allowed, 7.

10715. (6) Image-forming heat detector. W. A. Tolson, Princeton, N. J., assignor to Radio Corporation of America, a corporation of Delaware: U. S. patent 2,435,519, issued Feb. 3, 1948.

In a heat-detecting system, the combination of a heat-responsive unit comprising a sealed housing, a heat-wave receiving window in one side of said housing, a second window formed of light-transmitting material in the opposite side of said housing, a membranous diaphragm mounted between said windows and spaced therefrom to form two chambers, said diaphragm being deformable by heat waves from said receiving window, means creating a differential pressure in said chambers to maintain said diaphragm initially concave toward said second window, a mirror attached to the concave side of said diaphragm and having a matching contour, and an optical system including a source of light for viewing rays of light reflected from said mirror to determine incremental deformations of said diaphragm whereby an approximate image of the source of heat waves is observable. Claims allowed, 7.

10716. (7) Framgangsmate till oppsøkning og lokalisering av malm eller andre mineralforekomster [Method of detecting and locating ore and other mineral deposits.] Ismay Zeros Mining and Research, Lmtd., Dagenham, Essex, England: Norwegian patent 72,380, issued Aug. 28, 1947.

At a number of points, distributed at regular intervals over the investigated area, samples are collected of living or dead vegetable matter

and are subjected to chemical analysis in such a way that comparable quantitative values are obtained of one or more of the chemical elements contained therein. Leaves and needles of trees are burned and subjected to spectral analysis. The data obtained are plotted on a map of the studied area in substantial agreement with the geographical positions of the points at which the samples were taken, so that the distribution of values can aid in the location of ore and other mineral deposits. Claims allowed, 6.

10717. (7) Gas Analyzer. G. B. Bailey, Long Beach, Ind., assignor to the Hays Corp., Michigan City, Ind., a corporation of Indiana: U. S. patent 2,448,206, issued Aug. 31, 1948.

In a gas analyzer, the combination with a burette, gas supplying means and gas absorbing means, of a chambered valve housing having a plurality of relatively angularly disposed ports connected respectively with said burette and gas supplying and absorbing means, a valve element rotatable in said chamber and having a pair of passages therein each selectively registrable with certain of said ports, a conduit carried by said valve element in communication with one passage and extending into said burette with a capillary clearance, the other passage communicating with said burette through the clearance around said conduit, said valve element being rotatable step by step from a starting position through a predetermined angle and then reversely to starting position successively register said passages and ports during a complete cycle of operation of said analyzer, and interengageable stop members on said valve housing and valve element to limit rotation of said valve element in each direction to the limits required in said cycle of operation. Claims allowed, 12.

10718. (7) Oil prospecting method. W. J. Sweeney, Summit, N. J., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,449,627, issued Sept. 21, 1948.

A method of geochemical oil prospecting comprising sinking a bore, disposing an adsorbent for hydro-carbon gases therein in such relation to said bore that the gases in said bore have access to the adsorbent, removing said adsorbent and analyzing the gases adsorbed for the presence of significant gases. Claims allowed, 3.

10719. (8) Improvements in or relating to electric discharge devices for use as radiation detectors. Texaco Development Corp., Wilmington, Delaware: British patent 594,776, issued Nov. 19, 1947.

This invention relates to the detecting and measuring of penetrative radiation and more particularly of gamma rays. Its principal object is to provide a more efficient and rugged instrument than the conventional Geiger-Müller counter, for use in comparatively rough service, such as the logging of wells. The device comprises a casing or housing, a plurality of plates disposed in said casing in separated relation and connected together electrically to form a cathode member, each plate being provided with at least one hole and the holes in the plates being disposed in alinement, an anode member comprising a wire extending through said alined holes and insulated from said cathode plates, and a gaseous filling in said housing, said filling comprising a mixture of argon and petroleum ether. Claims allowed, 10.

10720. (8) Gun perforator. W. E. Neal, Houston, Tex.: U. S. patent 2,436,118, issued Feb. 17, 1948.

A gun perforator including a body, said body having formed therein a plurality of lateral cavities at spaced longitudinal intervals, a removable firing unit in threaded position in each cavity, an annular enlargement formed substantially centrally of each cavity, said body peripherally contacting said unit at either side of said enlargement so that the body and the unit define an annular space about the unit, an axial passage in said body joining the enlargements of successive cavities, and means for successively firing said units, including a primer in said passage above the uppermost of said enlargements, a booster charge in each axial passage portion intermediate successive enlargements, and a propellant charge in each of said units in communication with the surrounding annular enlargement. Claims allowed, 5.

(8) Radiation detector. D. G. C. Hare, Roslyn, N. Y., assignor to Texaco Development Corp., New York, N. Y., a corporation of Delaware: U. S. patent 2,440,511, issued Apr. 27, 1948. *See* Geophys. abstract 10714.

10721. (8) Method of determining the fluid contents of underground formation samples. J. F. Redmond, Houston, Tex., assignor to Shell Development Co., San Francisco, Calif., a corporation of Delaware: U. S. patent 2,445,494, issued July 20, 1948.

In a method for measuring the natural formation fluid contents of a core drilled out while circulating an oil-base drilling fluid in a bore hole, the steps of adding a tracer material to the drilling fluid in known concentration, confining the core and a portion of the surrounding drilling fluid in situ at bottom hole pressure in a sealed container, raising said container to the surface, injecting mercury into said container to displace the drilling fluid therefrom while maintaining the pressure within said container substantially constant at bottom hole pressure until the drilling fluid has been completely displaced therefrom, releasing said pressure, removing said mercury from said container and the fluids present in the core from said core, determining the amount of the fluids present in said core, and analyzing said fluids for the concentration of said tracer material in said fluids, whereby the respective amounts of the drilling fluid contaminating said core and of the natural formation fluid in said core may be determined. Claims allowed, 6.

10722. (8) Well logging apparatus. J. E. Owen, Tulsa, Okla., assignor to Geophysical Research Corp., New York, N. Y., a corporation of New Jersey: U. S. Patent 2,446,303, issued Aug. 3, 1948.

Apparatus for electrically logging a bore hole comprising an elongated electrode having two vertically spaced sections, an exploring electrode intermediate the sections of the elongated electrode and in fixed vertically spaced relation thereto, a grounded electrode, means for simultaneously setting up approximately equal potential drops between the first two electrodes and the grounded electrode, means for simultaneously moving said electrodes in said fixed spaced relation along the bore hole and means for simultaneously measuring the electric current flowing between the exploring electrode and the grounded electrode. Claims allowed, 6.

10723. (8) Phase shift logging of well bores. M. E. Chun, Huntington Park, and J. C. Stick, Jr., South Pasadena, Calif., assignors to Lane-Wells Co., Los Angeles, Calif., a corporation of Delaware: U. S. patent 2,446,-527, issued Aug. 10, 1948.

A method of electrically logging well bores, characterized by: passing an alternating electric current through formations traversed by a well bore; establishing a probe circuit for electrically sampling portions of the resultant electric fields at different locations in said formations; deriving from the electric field portions thus sampled, alternating currents having substantially constant phase angles with respect to those of said sampled field portions; limiting the amplitude of said derived alternating currents so that they remain substantially constant in amplitude regardless of amplitude changes occurring in either the said current passed through the formations or in the said sampled field portions; converting the thus derived and limited alternating currents to pulsating currents having variable undirectional components and having pulsations in synchronism with said derived and limited alternating currents; controlling said conversion by means operating in synchronism with the said alternating current passed through said formations and having a substantially fixed phase relationship thereto, to vary said unidirectional current components of said pulsating currents in accordance with a function of the phase difference between the said alternating current passed through the formations and the said derived alternating currents, to obtain therefrom unidirectional current components independent of amplitude variations of said sampled field portions and amplitude variations of said alternating current passed through said formations; probing the formations at different locations within said bore and measuring the said unidirectional current components resulting from said conversion to indicate thereby, a shifting of the phase of the sampled alternating field portions in the formation with respect to said alternating current passed through said formations, due to differences in the inductive or capacitive characteristics of the formations at said different locations. Claims allowed, 10.

10724. (8) Cable tensiometer. Herbert Hitchen, Doncaster, England, assignor to British Ropes Lmtd., Doncaster, England: U. S. patent 2,452,302, issued Oct. 26, 1948.

A cable tensiometer comprising a frame, a resilient bar rigidly secured at each of its ends to the frame, two pulleys mounted on the frame for rotation about spaced parallel axes, member engaging the bar intermediate its length, bearings in the member, a third pulley mounted in said bearings for rotation about an axis between and parallel to said axes, the lower peripheral portion of said third pulley being below the lower peripheral portions of the said two pulleys, two additional pulleys mounted on the frame for rotation about axes parallel to said previously recited axes, all of said pulleys lying in a common plane, said two additional pulleys being positioned respectively outwardly of said two pulleys and with their upper peripheral portions above the lower peripheral portions of said two pulleys whereby a tensioned cable passing over the said two additional pulleys is maintained in contact with the lower peripheral portions of the three first mentioned pulleys and means for indicating the deflection of said resilient bar. Claims allowed, 1.

10725. (9) Underwater image-transmitting apparatus. H. A. Adams, Bakersfield, Calif., assignor of one-tenth to A. R. Cassidy, Bakersfield, Calif.: U. S. patent 2,433,971, issued Jan. 6, 1948.

A scene-illuminating unit; an image-pickup device; an amplifying and modulating unit for converting said image pickup into electrical signals; and enclosure housing said illuminating pickup and electrical signal-converting units; a directionally reversable means of propulsion attached to said housing; a vertical-travel control mechanism attached to said housing; a horizontal-travel control mechanism attached to said housing; a flexible cable of conducting wires attached to said housing, an image-reproducing mechanism, connected to said conducting wires; a control-device panel connecting at various points with said conducting wires; a motion-picture-recording mechanism connected to said conducting wires; a power source connected to said conducing wires; a switching mechanism mounted on said panel controlling said scene-illuminating unit and connected to said conducting wires; switching mechanisms mounted on said panel connected to said conducting wires and controlling said vertical-travel mechanism; horizontal-travel mechanism, and hoisting winch and flexible cable. Claims allowed, 3.

10726. (10) Method and apparatus for measuring permeability. W. A. Bruce, Tulsa, Okla., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,448,955, issued Sept. 7, 1948.

A method for determining the permeability of a rock core from a fragment thereof which comprises selecting a fragment of said core of irregular configuration having at least one substantially flat face, arranging said fragment in a bed of loose particles with said substantially flat face exposed, building up a vacuum on said substantially flat face and observing the rate at which said vacuum is dissipated. Claims allowed, 2.

10727. (11) High gain amplifier. R. H. Park, Millington, N. J., assignor to American Cyanamid Co., New York, N. Y., a corporation of Maine: U. S. patent 2,434,223, issued Jan. 6, 1948.

In combination a high-gain, multi-stage vacuum tube amplifier, converting means feeding said amplifier for translating variations in radiant energy into variations in electrical current, a metal supporting frame for said amplifier and said converting means, a metal shell containing said converting means electrically connected to said frame, a first-stage vacuum tube for said amplifier having the control grid thereof directly connected to the otherwise ungrounded output of said converting means, a metallic shield surrounding said first-stage vacuum tube, said shield and the cathode of said first-stage vacuum tube being fully insulated from the remaining metal parts of the apparatus and from each other, and separate conductors electrically connecting said first-stage tube shield and cathode to a common point, said metal shell being also directly connected to said common point, and said point being independently and directly connected to ground. Claims allowed, 4.

10728. (11) Electric air-position indicator. W. H. T. Holden, Woodside, N. Y., assignor to Bell Telephone Laboratories, Inc., New York, N. Y., a corporation of New York: U. S. patent 2,434,270, issued Jan. 13, 1948.

In an air-position indicator for an aircraft, as indicator for indicating

the instant latitude position of said aircraft, an indicator for indicating the instant longitude position of said aircraft, a direct-current generator for generating a potential commensurate with the air speed of said aircraft, said generator having a bipolar field and two pairs of commutator brushes positioned in quadrature, means operative in accordance with the true flight course of said aircraft for causing an angular displacement between the polar axis of said generator field and said pairs of brushes whereby said potential is resolved into potentials commensurate with the instant rate of change of latitude and rate of change of departure of said aircraft, and means responsive to said latter potentials for operating said latitude and longitude indicators. Claims allowed, 11.

10729. (11) High-speed recording system. J. A. Wilson, Linden, and J. J. Heigl, Cranford, N. J., assignors to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,434,531, issued Jan. 13, 1948.

A device for producing an indication of the value of a voltage which comprises means for producing a beam of radiations, means for deflecting said beam of radiations, said means being responsive to the voltage the value of which is to be indicated, a rotating spiral slit in the path of said deflected beam of light adapted to break said beam of light into intermittent beams, means adapted to convert said intermittent light beams into intermittent electric impulses, a rotating voltage-measuring means, means for impressing said impulses upon said voltage-measuring means, and means for synchronizing the rotation of said voltage-measuring means with the rotation of said rotating slit so that the electric impulses are displaced across said rotating measuring means as a function of the voltage to be indicated. Claims allowed, 3.

10730. (11) Object detecting and locating system. R. H. Varian, Bellmore, and W. W. Hansen and J. R. Woodyard, Garden City, N. Y., assignors the Board of Trustees of the Leland Stanford Junior University, Stanford University, Calif., a corporation of California: U. S. patent 2,435,615, issued Feb. 10, 1948.

Apparatus for measuring the distance of a remote object comprising means for projecting electromagnetic radiation containing a plurality of ultra-high frequencies, means for mixing each of said ultra-high frequencies with its respective reflection from the remote object to produce a plurality of beat frequencies, and means for comparing the phase relations existing between said beat frequencies to determine the distance of said object. Claims allowed, 18.

10731. (11) Dually frequency modulated altimeter. Daniel Blitz, Princeton, N. J., assignor to Radio Corporation of America, a corporation of Delaware: U. S. patent 2,436,627, issued Feb. 24, 1948.

A distance-measuring system comprising a radio transmitter, means for cyclically frequency modulating said transmitter at a certain rate to produce a frequency-modulated wave, means for simultaneously shifting the mid-frequency of the frequency-modulated wave at a periodic rate that is low compared with said cyclic rate, means for transmitting said frequency-modulated wave to a wave-reflecting surface, means for receiving the reflected wave, means for mixing the received wave with a portion of the modulated wave transmitted directly from the trans-

mitter to produce a beat frequency signal, a frequency-indicating means, and means for applying said beat frequency signal to said last means whereby a distance indication is obtained, said frequency-indicating means having a time constant or damping period that is longer than the period of said periodic mid-frequency shift. Claims allowed, 5.

10732. (11) Frequency modulated radio distance measuring system and indicator. R. C. Sanders, Jr., Hightstown, N. J., assignor to Radio Corporation of America, a corporation of Delaware: U. S. patent 2,436,672, issued Feb. 24, 1948.

A radio-locator system comprising means for cyclically frequency modulating a radio wave and for transmitting it to a reflecting object, a detector, means for applying to said detector both the reflected wave and the wave direct from the transmitter to produce a beat-frequency signal which may have a discontinuity at the end of each frequency-modulation sweep, a frequency indicator comprislng a tuned element, and means for damping said tuned element at least once during each frequency-modulation cycle with the damping occurring simultaneously with a discontinuity in the beat-frequency signal. Claims allowed, 7.

10733. (11) Apparatus for removing random fluctuations from intensity measurements. C. J. Gibbs, Laingsburg, Mich., and J. H. Stein, Toms River, N. J., assignors to Texaco Development Corp., New York, N. Y., a corporation of Delaware: U. S. patent 2,438,747, issued Mar. 30, 1948.

An instrument for indicating continuous variations in a quantity, said instrument having a pointer arm movable in response to said variations and also in response to random fluctuations, means for smoothing out said random fluctuations comprising an inertia member provided with a slot in the plane of movement of the pointer arm, an indicating device on said inertia member, the outer end portion of said pointer arm projecting into said slot, and compression springs between opposite sides of said end portion of the pointer arm and the walls of the inertia member at the ends of the slot, said spring serving to absorb movements of said pointer arm caused by said random fluctuations and to transmit to said inertia member and indicating device movements of the pointer arm caused by average variations in said quantity. Claims allowed, 1.

10734. (11) Radio navigational aid. C. E. G. Bailey, Bournemouth, Hants, England, assignor to Radio Transmission Equipment Limited, London, England, a company of Great Britain: U. S. patent 2,438,987, issued Apr. 6, 1948.

In a system for radio-navigation, a receiver for a wave modulated by a first set of pulses, means coupled to said receiver to generate a second set of pulses and a third set of pulses, the pulses of said third set occurring during the duration of the pulses of said second set and having a duration less than the duration of the pulses of said second set, means to generate a radio frequency wave modulated proportional to the amplitude variations of the pulses of said second set, means to generate a radio frequency wave modulated proportional to the amplitude variations of the pulses of said third set, and means to radiate said modulated radio frequency waves in different azimuthal directions with overlapping radiation patterns. Claims allowed, 8.

10735. (11) Portable radio transmitting and receiving set. D. H. Mitchell, Chicago, Ill., assignor to Motorola, Inc., a corporation of Illinois: U. S. patent 2,439,408, issued Apr. 13, 1948.

A self-contained combination radio receiver and transmitter set adapted to be held in one hand by the operator therefor, and in but one position for both receiving and transmitting including a housing member, microphone and earphone means relatively arranged on said housing so as to be simultaneously in position near the mouth and an ear, respectively, of the operator when the set is in said one position, means for supplying all of the energy to said set, combination transmitter and receiver circuit means, with said energy supply means and circuit means being carried within said housing member, an antenna operatively connected with said circuit means and extending outwardly from said housing member, and switch means for changing the operation of said set as a receiver or transmitter having an actuating portion projecting from said housing and positioned thereon so as to be manipulated by the hand of the operator supporting said set. Claims allowed, 18.

10736. (11) Area measuring machine using light beams. P. E. Nokes, Beverly, Mass., assignor to United Shoe Machinery Corp., Flemington, N. J., a corporation of New Jersey: U. S. patent 2,450,054, issued Sept. 28, 1948.

An apparatus for measuring the area of sheet material including a work supporting member having a reflecting surface for light received from a source spaced therefrom, a mirror system for scanning the said reflecting surface to transfer light reflected from said surface in the form of a beam, a photocell positioned in the path of the said beam, a shutter mounted to operate in synchronism with the mirror scanning system and regularly to interrupt passage of the beam to the photocell, and means associated with said photocell for counting the impulses produced therein as an indication of the area of sheet material placed upon said supporting member. Claims allowed, 2.

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