UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary

GEOLOGICAL SURVEY
W. C. Mendenhall, Director

Bulletin 925–C

GEOPHYSICAL ABSTRACTS 102

JULY–SEPTEMBER 1940

COMPILED BY
W. AYVAZOGLOU

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1941

For sale by the Superintendent of Documents, Washington, D. C. . . . . Price 10 cents

CONTENTS

	Page
1. Gravitational methods	93
2. Magnetic methods	96
3. Seismic methods	101
4. Electrical methods	107
5. Radioactive methods	112
6. Geothermal methods	113
7. Geochemical methods	113
8. Unclassified methods and topics related to geophysics	115
9. New publications	123
10. Patents	126
Index	135

NOTE.—Geophysical Abstracts 1–86 were issued in mimeographed form by the Bureau of Mines; Abstracts 87–101 were published in bulletins of the Geological Survey.

GEOPHYSICAL ABSTRACTS 102, JULY–SEPTEMBER 1940

Compiled by W. AYVAZOGLOU

1. GRAVITATIONAL METHODS

5602. Boaga, Giovanni, Ventisette anni di attivita gravimetrica internazionale [Twenty-seven years of international gravimetric activity]: Geofisica pura e applicata, vol. 2, No. 1, pp. 1–11, Messina, 1940.

The author sums up the contents of the "Reports of the measurements of gravity," which Mr. E. Soler has discussed during various meetings of the International Geodetic and Geophysical Union from 1912 to 1939, taking into special consideration the latest report. The author examines the geophysical results obtained, during the above-mentioned period, with the torsion balance in some countries that have joined the U. G. G. I.—*Author's abstract.*

5603. Bowie, W., Gravity anomaly an important factor in earth science: Science, vol. 91, No. 2355, pp. 158–160, Lancaster, Pa., 1940.

The International Geodetic Association has adopted the following gravity formula, $\gamma_0=978.049(1+0.0052884 \sin^2 \phi-0.0000059 \sin^2 2\phi)$ gals, in which γ is the value of gravity at sea level and ϕ is the latitude of the station. The constants are derived from observed values of gravity in many countries and at different latitudes. The corrections which have to be applied to the observed value of gravity to obtain the gravity anomaly, and the variations of the anomaly over the earth are discussed. The means by which improved values for the constants may be obtained are considered, and Heiskanen is to derive a new formula along these lines.—*R. S. R., Sci. Abstracts, vol. 43, No. 509, 1940.*

5604. Browne, B. C., and Bullard, E. C., Comparison of the acceleration due to gravity at the National Laboratory, Teddington, and the Bureau of Standards, Washington, D. C.: Royal Soc. Proc., Sec. A, vol. 175, No. 960, pp. 110–117, London, March 28, 1940.

The values of the acceleration due to gravity at the points used for the recent absolute determinations of the National Physical Laboratories, Teddington, and at the National Bureau of Standards, Washington, D. C., have been compared. The difference found is 1.096$_0$ cm./sec.^{2} The difference between the two absolute determinations is 1.101$_5$ cm./sec.^{2}, whilst that deducted from previous indirect relative connections is 1.095$_0$ cm./sec.^{2} The agreement is within the uncertainties of the measurements and leaves little doubt that the hitherto accepted value at Potsdam is some 17 parts in a million too great.—*Authors' abstract.*

5605. Gay, M. W., Relative gravity measurements, using precision pendulum equipment: Geophysics, vol. 5, No. 2, pp. 176–192, Menasha, Wis., 1940.

The precision with which relative values may be obtained by the use of suitable pendulum equipment is illustrated by actual data obtained in

establishing calibration stations used to facilitate the calibration of gravimeters. A résumé of the operating technique, together with the salient features of the Gulf pendulum equipment, is given in connection with a tabulated summary of the various factors which must be considered in designing and operating pendulums in order to attain the desired precision of 10^{-7} gamma.—*Author's abstract.*

5606. Neumann, Gerhard, Arbeitsgrundlagen und Aufgaben der modernen Schweremesstechnik [Foundation methods and problems of the modern technique of gravity measurements]: Bohrtech. Zeitung, vol. 58, Nos. 4, 5, pp. 33–37, 53–58, Vienna, 1940.

This article is divided into three parts. In the first part the author discusses, in general, gravity measurements with regard to boring, the common purpose of which is to discover deposits of ores or oil; in the second, or main, part he describes the fundamental conceptions of gravity, units of measurements, methods of work, instruments (pendulum, gravimeter, torsion-balance), and practical problems of gravity measurements; and in the third part he examines the economic importance of gravity surveys, especially in the oil industry.

The author points out that the result obtained in Germany by geophysical surveys in general, and especially by gravimetric methods, is of great importance, as the number of known productive oil fields has increased during the past several years from 5 to about 20.—*W. A.*

5607. Pendse, C. G., Gravity and the rotation of the earth: Philos. Mag. & Jour. Science, vol. 29, No. 196, pp. 471–476, London, 1940.

The axes of reference for the motion of the members of the solar system, to which the law of gravitation applies, have for their origin the "center of mass" of the system, and their directions are toward the "fixed" stars. In problems of terrestrial mechanics, however, the observations of position refer to axes whose directions are fixed relative to the earth and whose origin is either on or above and near the surface of the earth. The successive steps by which one can obtain the equations of motion of a body (particle), valid for the frames of reference suitable for terrestrial mechanics, are shown. The combination of the centrifugal acceleration with the gravitational intensity due to the earth gives rise to the "acceleration due to gravity," [equation 7] the equation being transformed into equation (8), in which the value of the quantity at the origin of the frame is involved. Furthermore, the mutual relations between the different terrestrial frames are pointed out.—*Author's abstract.*

5608. Prey, A., Über Polschwankung und Polwanderung [Oscillations and wanderings of the pole]: Gerlands Beitr. Geophysik, vol. 56, No. 2, pp. 155–202, Leipzig, 1940.

1. Supposing that Chandler's period of pole movement (that is, free oscillation of the earth's axis about the inertia pole, the period of which is 14 months) is independent of the annual variation and perhaps is the remainder of a once much greater movement caused by catastrophic occurrence, the lower limit for the coefficient of viscosity of the earth may be derived. It is shown that this coefficient must be at least of the order of 10^{22}.

2. It is generally assumed that Chandler's motion of the pole is a phenomenon accompanying the annual motion, the latter being a forced oscillation of the earth's axis produced by meteorological conditions.

Chandler's motion must thus be considered a new motion produced by meteorological irregularities. In this case a much smaller viscosity of the earth must be assumed because the new motion produced constantly would, unless no accumulations occur, fade away very quickly; but such accumulations have never been observed. If the viscosity constant is assumed to be 10^{20} or even smaller, the times of the half-values of fading away become so short that the earth behaves almost like an ideal liquid.

3. The earth may be treated hydrostatically with regard to the slowly changeable forces corresponding to the wanderings of the pole. But we must consider that the earth's crust has a much higher degree of rigidity owing to its irregularities manifested by continents, mountains, and depths of the seas. Therefore, an attempt is made to determine the movement of the axis of the earth by taking into consideration the assumptions mentioned above. As the earth's crust is assumed to be in a state of complete isostasy, calculations were made according to the Hayford-Pratt and Airy hypotheses. It was found that the problem could be solved by elliptical integrals. The equilibrium of the main liquid mass is constantly disturbed by the rigid earth's crust. Wanderings of a pole of any size may occur, but the period of the wanderings is extremely short—according to Airy's hypothesis, of an order of 10,000 years. According to Pratt's hypothesis the values of the periods are 10 times shorter. Configurations of a rigid crust that may result in essentially longer periods are conceivable, but they would be of accidental character only. Therefore, we must assume that the earth's crust is far from being quite rigid and that it follows the movements of the liquid earth as if it were nearly liquid. If only a fraction—perhops not more than 1/100—is assumed to be rigid, the period will increase to 1 million years, which is great enough to satisfy the geologist. Therefore, we would have to assume that the earth is a liquid mass covered with a very thin unyielding skin.—*Author's abstract, translated by W. A.*

5609. Sellien, K., Beitrag zur Auswertung von Drehwaagenmessungen [Contribution to the evaluation of torsion-balance measurements]: Beitr. angew. Geophysik, vol. 8, No. 2, pp. 179–186, Leipzig, 1940.

The insufficiency of the present means for evaluating torsion-balance measurements is generally known. Partly to correct this insufficiency the author gives tables compiled for the maximum gradients of gravity above faults that have different angles, as these conditions of geologic structure are considered to be of greatest interest.—*W. A.*

5610. Siemens, Günter, Das Schwerebild des Wiener Beckens [The gravity picture of the Vienna basin]: Beitr. angew. Geophysik, vol. 8, No. 2, pp. 227–242, Leipzig, 1940.

An isogam picture of the German section of the Vienna basin is published as a result of regional gravimeter measurements. The level of the gravity anomalies is not considered to be definitively established. Gravity anomalies are caused in the first place by the structure of the uppermost kilometers of the earth's crust. Effects from greater depths caused by isostatic compensation are, in the present status of investigations, difficult to estimate; therefore they are neglected in interpreting the isogam picture. Geologic knowledge of the structure of the Vienna basin has been greatly improved by gravity measurements. Now it is possible to follow the lines of faults and other structural fea-

tures into the parts of the basin, unknown heretofore, that were covered by Miocene, Pliocene, and Recent deposits. Based on the isogam picture, individual structures may be traced and contoured with more accuracy. Major structural units are subdivided by minor transverse structures. The southern basin of Wiener Neustadt is separated from the main part of the Vienna basin.—*Author's abstract.*

2. MAGNETIC METHODS

5611. Birch, Francis, α-γ transformation of iron at high pressures, and problem of earth's magnetism: Am. Jour. Sci., vol. 238, No. 3, pp. 192–211, New Haven, Conn., 1940.

The change with pressure of the temperature of the α-γ or A_3 transformation in high-purity iron has been directly determined by a dilatometric method to over 4,000 kg./cm.^{2}, in N_2 and in A. The mean value for several different irons for the rate of change of temperature with pressure, above 1,000 kg./cm.^{2} is $-8.5°$ C./1,000 kg./cm.^{2}; at lower pressures, some curvature is found with A as the pressure medium, which can be accounted for in terms of the small N_2 content of the A. The latent heat is found from this rate and the change of volume to be about 4 cal./gm. It is shown that α-iron can be of limited importance in connection with the problem of the earth's magnetism, since its existence is restricted to a thin shell near the surface. The relation of Fe-Ni alloys to this question is discussed.—*Author's abstract.*

5612. Brant, Arthur, Geophysical investigation at Steeprock Lake: Canadian Min. Met. Bull., No. 338, pp. 374–384, Montreal, 1940.

Steeprock Lake lies about 2 miles north of the village of Atikokan. The possible presence of hematite beneath the waters of the middle arm of the lake was inferred by early geological investigators from the dense hematite float found on the southerly shores of this part of the lake. Magnetic and electrical investigations of the middle and west arms of the lake were made during December 1938 and January, February, and March, 1939, as a research study by the Physics Department of the University of Toronto. The results of this study are described in this paper by demonstrating the applicability of electrical resistivity measurements taken through the ice. The magnetic results served to show that, where differences in magnetic properties were present, the contact between rock materials could be accurately found. Diagrams and a map illustrate the results.—*W. A.*

5613. Dauvillier, Alexandre, Sur l'origine du magnétisme terrestre [The origin of terrestrial magnetism]: Acad. sci. Paris Comptes rendus, vol. 210, No. 5, pp. 177–179, 1940.

By the partial reduction by the then atmosphere of H_2 of the Fe_2O_3 of the basalts coming to the surface in connection with the formation of the ocean deeps (see Geophys. Abstracts 96, No. 4833) magnetite was formed, which on cooling past the Curie point (500°) was magnetized by the then existing cosmic field, and in the direction thereof. In addition to this "fossil field" to which the greater and constant part of the terrestrial magnetism is due, a small and variable portion results from the rotation of the globe in a field of which the lines of force are

sensibly normal to the plane of the ecliptic, and the intensity of which depends on the solar activity. The theory is elaborated in some detail, and figures are given showing the results to be of the right order of magnitude.—*C. A. S., Sci. Abstracts, vol. 43, No. 508, 1940.*

5614. Ferri, Francesco, La nuova carta magnetica d'Italia (isogone al 1° Gennaio 1940) dell' Instituto Geografico Militare [The new magnetic map of Italy (isogonic lines referred to January 1, 1940) compiled by the Military Geographical Institute]: Geofisica pura e applicata, vol. 2, No. 1, pp. 12–19, Messina, 1940.

After mentioning the earth-magnetic map of 1892, compiled by Professor Palazzo, the author emphasizes the need for a more detailed survey that would correspond to the increased civilian and military requirements. A new map of such an earth-magnetic survey of Italy was compiled by the Military Geographical Institute during the years 1932–37 and is based on measurements at 1,529 stations. The work is discussed and examined, especially in connection with the new map of isogonic lines referred to January 1, 1940.—*Author's abstract, translated by W. A.*

5615. Geophysical exploration through lake ice [editorial note]: South African Min. Eng. Jour., vol. 51, pt. 1, No. 2460, pp. 109–110, Johannesburg, 1940.

An interesting example is given of the value of applying magnetic and electrical methods of investigation to determine the potential value of mineral deposits that lie beneath the waters of Kelley Lake, Sudbury nickel district, Ontario. The object of applying electrical-resistivity and magnetic methods over Kelley Lake was to ascertain whether or not there lies concealed beneath its waters a major concentration of sulfides carrying pyrrhotite, with which nickel minerals might reasonably be expected to occur. The work was done in February and March 1938 while the lake was frozen over. Measurements were made along 18 profiles. From the results of the geophysical survey the location and course of two olivine diabase dikes have been defined and the continuation of a quartz diorite dike has been traced for some distance beneath the lake. From a miner's viewpoint the important conclusion drawn from the geophysical work is that no major concentration of pyrrhotite or other sulfide with which the nickel ores are habitually associated in this district can be expected to occur with quartz diorite within the area surveyed. It is therefore unnecessary to explore any further on this property. The cost of the geophysical survey was about $2,500. To have obtained similar information by drilling might have cost $10,000 or $15,000. This is a demonstration of how geophysical methods may eliminate prospective parts of a mining property.—*W. A.*

5616. Hallimond, A. F., and Butler, A. J., Magnetic survey over hematite ore, Newton mine, Furness: Geol. Survey of Great Britain, Dept. Sci. Ind. Research, Wartime pamphlet 1, 4 pp., London, 1940.

Magnetic vertical force measurements over an area northeast of Newton mine, Furness, indicate four linear features that agree in size and form with those to be expected from four hematite veins, from 5 to 30 feet thick, and under a cover of usually less than 30 feet. The total length is 1,100 feet. Three of the veins have normal

northwest strike, the other runs a little north or west. A geologic sketch map of the area near Newton mine, showing magnetic traverses and vertical magnetic-force profiles along these traverses, is given.—*Authors' abstract.*

5617. Jenny, W. P., Geological problems in the interpretation of the earth's major regional and local anomalies [abstract only]: Oil and Gas Jour., vol. 38, No. 48, p. 58, Tulsa, Okla., 1940.

Magnetic anomalies are of various orders of magnitude. The largest may be called "continental" (Europe negative, North and South America positive); "regional" (West Texas or Transylvania negative, California Valley or Wallachia positive); and "local." Within the area of local anomalies there may be intralocal anomalies. Major anomalies show interesting trends, such as a positive major trend paralleling the Rockies and the Andes and a negative major trend paralleling the Alpine chains. Regional anomalies disclose the tectonics and the stratigraphic and petrographic character of the upper portion of the rock zone. A basin with strongly magnetic beds, such as Illinois, will be positive, whereas one without them, such as West Texas, will be negative. Uplifts with a thick section of Ordovician limestones, such as the Ozarks, will be negative, as the flanks show magnetic shales and sands above these limestones. The Nemaha ridge is positive, as the granite is sufficiently close to outweigh stratigraphic influences. Local anomalies lead to detailed studies within the uppermost layers so that the magnetic method, and particularly the micromagnetic method, has developed into a most valuable tool for the discovery and outlining of local structures.—*Author's abstract.*

5618. Logachev, A. A., Experimental application of aeromagnetic survey in determining depths of magnetic masses [in Russian]: Materials of the Central Geol. and Prosp. Inst., Geophysic, No. 8, pp. 35–38, Leningrad, 1940.

Depths of upper and lower boundaries of ferro-quartzites, producing the Kursk magnetic anomaly in the region of Stary Oskol, near the village of Saltikovka, are computed and are based on data obtained by the author during the magnetic survey with an airplane from heights of 1,000 m. and 1,500 m. That field of the layers is considered which is created by two poles with a distance of 2 l between them. The maximum of the field Z_a is determined as follows:

$$Z_a = 2\sigma\left(\frac{1}{r-l} - \frac{1}{r+l}\right),$$

where (σ) is the linear density of magnetism and Z the distance from the plane of observation to the center of the layer. Applying the values of Z_a to five profiles, the author determined that the depth of the upper line of poles is equal to 200–250 m. and of the lower from 1,900 to 2,100 m., that is, a distance between them of 1,700 to 1,900 m. Considering this distance to be 0.9 of the real vertical thickness of the magnetic mass, the upper boundary may be determined to be from 100 to 150 m. and the lower from 2,000 to 2,200 m. The real boundary of the upper boundary was found to be about 150 m.—*Author's English abstract.*

5619. Marsch, B., and Schoene, H. J., Ein Beitrag zur Messung magnetischer Suszeptibilitäten [A contribution to the measurement of magnetic susceptibilities]: Beitr. angew. Geophysik, vol. 8, No. 2, pp. 195–200, Leipzig, 1940.

An apparatus for measuring magnetic susceptibility and a way suitable for adjusting it are described. It is possible with the apparatus to make measurements of magnetic forces between 10 and 260 Oe as well as to determine magnetic susceptibilities of very low magnetized samples. A comparison made between the results of measurements of cylindrically shaped rocks and pulverized rock samples shows a good agreement, provided that the values obtained for pulverized samples are reduced to the natural specific gravity of the rock.—*Authors' abstract.*

5620. Neumann, Gerhard, Use of the Schmidt magnetometer in the search for oil deposits: Oel u. Kohle, vol. 36, No. 9, pp. 75–78, Berlin, 1940.

The author reviews the accomplishments of the Schmidt magnetometer in the field of oil prospecting. Elaborate studies of the salt domes of northern Germany, as well as experience in the Gulf coast region of the United States, have shown that the magnetometer has little claim as an independent means of geophysical exploration in the clastic formations of such regions. The most that can be said is that the faint anomalies observed in these regions are of interest as corroborative of the results of other methods. The case is different, however, when masses of heavy crystalline rocks occur in association with sedimentary deposits, whether as intrusive masses that cause arches or as basin walls within which lighter sediments have been deposited. The latter is the case with some German regions where oil is found in weakly magnetic strata flanked by zones of greater magnetic potency. The magnetometer is thus well suited for reconnaissance surveys, to be followed by detailed seismic and gravimetric surveys. Magnetic instruments have rendered especially good service in the southwestern United States for detecting crystalline rocks that have been responsible for structure. An example is the Hobbs field, New Mexico, where magnetic anomalies of several hundreds of gammas have been observed. Structurally high-lying Paleozoic beds have also been magnetically defined in the Texas Panhandle, where oil-bearing beds flank a buried granite mountain range. Magnetic observations have also been useful in locating buried laccoliths of basic volcanics that have intruded into sedimentary strata. Due to the strong magnetism of basalt and other basic eruptive rocks they readily show their presence, as in the East Carroll and Ridgland fields, Louisiana. The same applies to the products of the weathering of these young volcanic rocks, which produced porous beds for the accumulation of oil in the Balcones region of Texas, especially in the Austin district. Oil traps formed by intruded basaltic dikes have been successfully delimited in Mexico, and also faults in which the crystalline rocks have been involved.—*Abstract from World Petroleum, vol. 11, No. 6, 1940.*

5621. Newton, H. W., Sunspots, bright eruptions, and magnetic storms: Observatory, vol. 62, pp. 318–326, London, December 1939.

Four series of facts indicate the relationship between solar outbursts and magnetic storms and suggest that these are corpuscular streams taking about a day to travel from sun to earth. The author illustrates

by tables and diagrams the association of spots (according to size) and magnetic storms. Recurrence of lesser storms at about 27-day intervals (the solar rotation) points to their solar origin. He discusses the relation of H and K and H_a to the "bright patches" near sunspots; also of bright eruptions (for intensities 3 and 2) with magnetic storms (according to size) and gives diagrams. He suggests that a major bright eruption is a critical phenomenon in the occurrence of great magnetic storms; also a relationship between bright eruptions and simultaneous ionospheric disturbances, causing sudden fade-outs. He gives four characteristics, which harmonize with the idea that the solar flares of ultraviolet light may have a common point of origin with the corpuscular streams.—*A. S. D. M., Sci. Abstracts, vol. 43, No. 507, 1940.*

5622. Ogg, A., The purpose and progress of the magnetic survey of the Union of South Africa: South African Survey Jour., vol. 6, pt. 1, No. 38, pp. 4–19, Pretoria, 1940.

After a general outline on terrestrial magnetism, given under the headings (1) the earth as a magnet, (2) the earth's magnetic field in space, (3) nonuniform magnetism of the earth, and (4) the earth's magnetic field is changeable, the author discusses the importance of establishing magnetic observatories and gives some information both on the origin of the magnetic observatory at the University of Cape Town and on the recently established magnetic observatory at Hermanus in a location that is sufficently removed from electric-railway disturbance and is suitable also in other respects. A magnetic survey now in progress in the Union of South Africa uses the Askania declinometer for declination, the la Cour quartz magnetometer for horizontal intensity, and the la Cour magnetic balance for vertical intensity. Graphs of diurnal variations of declination and horizontal intensity, plotted from observations at Matjesfontein in August 1938, are given. A figure shows the results of an experiment to test whether the diurnal variations on a magnetic shale bed were the same as on a body of granite. The absolute values differ by about 2,000 gammas, but the diurnal variations, owing to the external field, are practically the same.

In conclusion, the author calls attention to the "remarkable fact that in South Africa there has been a marked decrease of the magnetic intensity of the earth's magnetic field, much greater than in any other part of the world, as far as observations show. That this rapid secular change may be in some way associated with unique geophysical and geologic phenomena is a question deserving the most intense study."—*W. A.*

5623. Schenk, Erwin, Tektonischer Beitrag zur Auswertung erdmagnetischer Messungen nach Untersuchungen im Rheinischen Schiefergebirge [Structural contribution to the evaluation of earth-magnetic measurements according to investigations in the Rhine Schiefergebirge]: Beitr. angew. Geophysik, vol. 8, No. 2, pp. 201–210, Leipzig, 1940.

A comparison between the earth-magnetic and tectonic structures in the Eifel (western part of the Rhine Schiefergebirge) shows a remarkable coincidence of earth-magnetic "highs" (Kelberg, Ahrweiler, Venn, etc.) and structural arching (main anticlines or "Hauptsättel"), while the N–S striking, earth-magnetic "low" is restricted to a structural depression where we find an en echelon arrangement of sedimentary synclines of middle Devonian limestone beds. The magnetic anomalies are explained

by Plutonic intrusions (H. Reich). Plutonic processes are equally the causes of certain structural deformations in the overlying sedimentary series in the Eifel as well as in other parts of the Variscian belt. Further comparisons show that geoanticlines generally coincide with positive magnetic anomalies. Not the sediments but the relief of the crystalline floor itself—the geoanticlines and geosynclines—determines the character of the regional magnetic anomalies.—*Author's abstract.*

3. SEISMIC METHODS

5624. Coulomb, J., Diffraction d'un ebranlement au voisinage d'une caustique—Application aux ondes *P'* [Diffraction of a perturbation near a caustic—Application to *P'* waves]: Seismol. Soc. America Bull., vol. 30, No. 1, pp. 27–34, Berkeley, Calif., 1940.

The problem of diffracted *P'* waves is considered on the basis of a theory of caustics, with special reference to seismic perturbations. A very approximate theory is developed and leads to a hodograph in disagreement with available data for seismic waves, making the existence of a focal point doubtful. To adapt the hodographs to the theoretical position would involve submitting those of P_2' and P_1' to an exaggerated deformation. Hence it may be necessary to abandon the idea of a focal point and to explain otherwise the observed amplitudes.—*N. M. B., Sci. Abstracts, vol. 43, No. 509, 1940.*

5625. Dalmasso, Fernando, Sul terremoto Palermitano del 15 Gennaio 1940 [The Palermo earthquake of January 15, 1940]: Geofisica pura e applicata, vol. 2, No. 1, pp. 42–55, Messina, 1940.

After mentioning the earthquake statistics of the region of Palermo, the author gives the microseismic and macroseismic data of the earthquake of January 15, 1940. The discussion shows the tectonic nature of the earthquake and its probable causes, especially in connection with the geologic conditions.—*Author's abstract, translated by W. A.*

5626. Eckhardt, E. A., Some reflections on seismic prospecting: Explosive Engineer, vol. 18, No. 4, pp. 101–104, Wilmington, Del., 1940.

The assistance given by the powder companies to the geophysical profession in adapting explosives to their needs is mentioned. The development of dynamite and blasting caps for geophysical prospecting is outlined briefly. The importance of seismic methods of prospecting in comparison with the torsion balance and gravimeter is illustrated by a chart showing the fluctuations of these three types of geophysical activity in States bordering on the Gulf of Mexico.—*W. A.*

5627. Fedotov, P. F., Prospecting at shallow depths by seismic methods [in Russian]: Materials of the Central Geol. and Prosp. Inst., Geophysic, No. 8, pp. 39–62, Leningrad, 1940.

Results of the work described in this paper prove that it is possible to investigate shallow depths by seismic methods. Further investigation is proposed. The analysis of the errors that occurred during the seismic-prospecting work allowed the author to develop some special, more accurate ways of interpreting field observations and also to make some changes in the construction of the self-registering apparatus. Basic methods and field techniques are worked out for solving prospecting problems with regard to shallow depths. Possibilities of applying seismic

methods to problems connected with hydrotechnical construction and detailed investigation of ore deposits are discussed.—*W. A.*

5628. Harris, Sidon, and Haskell, N. A., Note on the change in frequency of the reflection from basement as this reflecting horizon increases in depth: Geophysics, vol. 5, No. 2, pp. 194–195, Menasha, Wis., 1940.

A table is presented showing the variation in frequency of the reflection obtained from "basement" as this horizon increases in depth. The data were derived from seismograms obtained in the San Joaquin Valley, north of Bakersfield, Calif. The so-called "basement" reflecting horizon is followed from a depth of about 1,300 feet on the east side to a depth of about 4,400 feet farther out toward the middle of the valley. The results indicate that the frequency of the reflection decreases by about 27 percent, while the depth of the reflecting horizon increases approximately 340 percent. Gutenberg's equation, $T^2=T_0^2+aD$, where T is the period of the wave, D is the total distance traveled, and a is the constant, gives an approximate representation of these observations if $T_0^2=120$ and $a=0.05$ when T is expressed in thousandths of a second and D in feet.—*Authors' abstract.*

5629. Honda, H., and Ito, H., Period of *P*-waves and magnitudes of earthquakes: Geophys. Mag. Tokyo, vol. 13, pp. 155–161, December 1939.

A comparison of the periods of the initial motion of the *P*-waves with the magnitudes of the earthquakes for 12 deep-seated earthquakes of considerable intensity shows that the period increases with the intensity, the curves relating them being approximately parabolic.—*C. A. S., Sci. Abstracts, vol. 43, No. 509, 1940.*

5630. Honnell, P. M., Remote-control seismic instruments: Oil Weekly, vol. 98, No. 1, pp. 23–28, Houston, Tex., 1940.

Remote-control seismic instruments are designed to make feasible the exploration of inaccessible regions, particularly where water is too shallow for boats or where marshes have too much brush for marsh buggies. Such exploration is accomplished by keeping all the heavier recording equipment at a fixed location. A schematic view of a remote-control set-up and the distribution of such apparatus as the transmission line, control panel, and shooting set are shown in diagrams. The author notes that the remote-control system described differs very markedly in its physical components from the more common recording equipment. None the less, the over-all electrical characteristics and performance of the system approximate very closely those of more conventional recording systems.—*W. A.*

5631. Houghton, H. M., Change of reflection amplitude and character with geophone depth: Geophysics, vol. 5, No. 2, pp. 169–175, Menasha, Wis., 1940.

The relation between character and amplitude of reflection and the geophone depth was investigated at several locations in Oklahoma. It is shown that the variation of reflection amplitude down to a depth of the order of 200 feet is, in general, what would be expected from changes of the acoustic impedance of the strata traversed. Changes in reflection character are illustrated by tracings from the records obtained.—*Author's abstract.*

5632. Linehan, Daniel, The Chelmsford, Mass., earthquake: Seismol. Soc. America Bull., vol. 30, No. 2, pp. 99–108, Berkeley, Calif., 1940.

The Chelmsford earthquake of June 23, 1938, occurred at $3^h57^m56.5^s$ G. C. T. The epicentral determination made by the writer of this article is 71°25′ W., 42°37′ N. The distance arcual intersection occurs at the southernmost tip of an ellipse of greatest intensity, and this may be due to the fact that all three stations employed in the determination were to the south and west of the area, or that structural conditions elongated the greatest-intensity area. The major axis of the ellipse does coincide with the strike of the geologic structure in this area. The greatest intensity given by the writer is IV on the Rossi-Forel scale.—*Author's abstract.*

5633. Morita, M., and Yosimura, Y., Seismic waves at large distances in the north Chile earthquake, February 23, 1933, part 1, Traveltimes: Geophys. Mag. Tokyo, vol. 13, pp. 163–191, December 1939.

The traveltimes were obtained from data of the north Chile earthquake of 1933. The authors note that the strong emergence of the P_2'-phase, often observed in Europe and America, is less common in Japan. In the range 146°–160° the slope of the P_1' curve agrees with Macelwane's, but beyond that the curve is at present uncertain. The time curve of the *L*-phase has a slope similar to Macelwane's. These *L*-times have, however, an inexplicable peculiarity, viz the times in Japan are quite different before and after a distance of 152°.—*W. A. R., Sci. Abstracts, vol. 43, No. 509, 1940.*

5634. Mortimer, C. H., and Worthington, E. B., Echo sounding in bathymetric surveys of lakes: Nature, vol. 145, No. 3667, pp. 212–214, London, February 10, 1940.

Using the British Admiralty pattern magnetostriction echo-depth recorder, the authors have recorded the contours of the bottom of a number of lakes in the English Lake district. The records reveal not only the mud bottom, where such mud exists, but also the underlying glacial clay and rock beneath. The investigations of this character, commenced in Lake Windermere, were followed by (*a*) observations on the nature of the various layers forming the lake bed, and (*b*) surveys with the echo sounder on 14 of the other larger lakes in the district. In the survey of Windermere 200 cross sections representing 150 miles of continuous sounding were recorded in 5 weeks. In Esthwaite Water one of the records reveals a mound of hard rock projecting through an even layer of soft deposit, the thickness of the latter being roughly uniform and following the irregularities of the hard floor below. It is anticipated that the recorded stratification of the lake bed deposits will throw light on the postglacial history of the lake basin.—*A. B. W., Sci. Abstracts, vol. 43, No. 508, 1940.*

5635. Muskat, M., and Meres, M. W., Reflection and transmission coefficients for plane waves in elastic media: Geophysics, vol. 5, No. 2, pp. 115–148, Menasha, Wis., 1940.

The results are given of a systematic series of calculations on the coefficients of reflection and transmission for plane waves incident on elastic interfaces. Tables are given for the amplitudes of the reflected and transmitted longitudinal and transverse waves, for the intensities of these components, and for the fractions of the incident energy car-

ried away by them. For incident longitudinal waves calculations were carried out for angles of incidence between 0° and 30°, with 5° intervals. For incident transverse waves polarized in the plane of incidence, results are given for four angles of incidence up to approximately 16°. For incident transverse waves polarized normal to the plane of incidence, the calculations were carried through for all angles of incidence—in steps of 5°—up to total reflection. All the calculations were carried through for interfacial density ratios of 0.7 to 1.3, in steps of 0.1, and interfacial velocity ratios between 0.5 and 2.0, in steps of 0.25.—*Authors' abstract.*

5636. Muskat, M., and Meres, M. W., The seismic-wave energy reflected from various types of stratified horizons: Geophysics, vol. 5, No. 2, pp. 149–155, Menasha, Wis., 1940.

Two applications are made of the reflection and transmission coefficients reported in the preceding paper. These concern the effect of the angle of incidence upon the fraction of incident energy returning to the surface, and the effect of velocity stratification upon the energy return.—*Authors' abstract.*

5637. Patterson, W. D., Determination of ground periods: Seismol. Soc. America Bull., vol. 30, No. 2, pp. 129–138, Berkeley, Calif., 1940.

Ground periods have been determined at a number of Government sites in California by recording microseisms and vibrations induced by traffic, explosives, and a specially designed ground shaker. The ground shaker produced resonances at the outstanding ground periods when exerting forces of approximately 2,000 pounds or more. Ground vibrations were recorded with the Neumann-Labarre horizontal-component vibration meters and a newly designed vertical-component instrument, all of 10,000 magnification; and also with the Benioff electromagnetic 4-unit (horizontal) seismograph with a maximum magnification of 3,500. Descriptions of the ground shaker and recording instruments are given. Sample vibrograms on which were recorded vibrations from the ground shaker, a pile driver, and a passing train are shown, together with a table and a graph of ground periods obtained at one of the sites. Each site was found to have many distinctive ground periods of varying amplitude. Each separate layer or stratum appears to have its own outstanding period, and possibly one or more harmonics. It is also possible that periods result from two or more strata vibrating as a unit. Evidence was found to indicate that each site, and possibly each period, may have a different direction of maximum amplitude. Too many natural ground periods are found at each site to permit the construction of a building whose periods would be out of resonance with the ground; but it might be possible to avoid the most outstanding periods. Further research is needed before the practical usefulness of this work can be predicted.—*Author's abstract.*

5638. Ramirez, J. E., An experimental investigation of the nature and origin of microseisms at St. Louis, Mo., part 2: Seismol. Soc. America Bull., vol. 30, No. 2, pp. 139–178, Berkeley, Calif., 1940.

The purpose of part 2 (for part 1, see Geophys. Abstracts 101, No. 5499) is to analyze the motion of an earth's particle in the path of microseisms, with a view to establishing their wave type. In this analysis, besides the records of the network of stations in St.

Louis, the three components of the Galitzin-Wilip seismographs from Florissant were used. The results have demonstrated that microseismic waves are moving and not stationary. The speed of microseismic waves at St. Louis, as determined from several storms of microseisms, was 2.67±0.03 km./sec. The direction of microseisms was also determined for most of the storms. During the period July to December 1938, about 80 percent of incoming microseisms at St. Louis were from the northeast quadrant. No microseisms were recorded from the south, west, or southwest. The period of the waves varied between 3.5 and 7.5 sec. The average period was about 5.4 sec. A study of the nature of microseismic waves reveals many of the characteristics of Rayleigh waves; that is, the particles in the passage of microseismic waves move in elliptical orbits of somewhat larger vertical axis and with retrograde motion. The source of microseisms is not over the land but rather out over the surface of the ocean. The amplitudes of microseisms depend only on the intensity and widespread character of barometric lows traveling over the ocean. Special emphasis is laid on the fact that all the determined directions of incoming microseisms at St. Louis point to a deep barometric low over the ocean. The period of microseisms seems to be a function of the distance between the station and the source of the microseisms.—*W. A.*

5639. Riznichenko, G. V., Goniograph for constructing theoretical hodographs of seismic waves of different types [in Russian]: Razvedka Nedr, vol. 11, No. 1, pp. 50–52, Moscow, 1940.

The main criterion for distinguishing the type of a wave is its hodograph. In multilayers, formulas of hodographs become very complicated. A new mechanical device, the goniograph, is proposed, and its application for constructing hodographs of complicated reflected and refracted waves is discussed mathematically.—*W. A.*

5640. Riznichenko, G. V., Most probable value of the average velocity of a flat reflecting surface [in Russian]: Trudy Vses. Kontori Geofizicheskih Razvedok, Symposium on seismic prospecting, No. 12, pp. 64–68, Moscow, 1938.

The method of least squares is applied to determine the most probable value of the average velocity v in the reflection seismic prospecting of a flat reflecting surface. Distances x_i from the point of explosion to the seismographs and times T_i of propagation of the reflected waves are taken as the initial data for solving this problem. A formula for determining v from three points (x) of the hodograph is given—*Author's abstract, translated by W. A.*

5641. Riznichenko, G. V., On the average velocity in refraction seismic prospecting [in Russian]: Trudy Vses. Kontori Geofizicheskih Razvedok, Symposium on seismic prospecting, No. 12, pp. 39–63, Moscow, 1938.

The interpretation of results obtained by refraction seismic prospecting requires the determination of the average velocity of elastic waves. Errors in determining this average velocity often influence the results of the interpretation. In this article the author analyses the accuracies of the existing methods of determining the average velocity and gives some methods by which the possible errors in the results of calculations may be avoided. Formulas showing the

possible errors are illustrated by numerical examples. A new method is described for computing the velocity from the refraction time curve. This method requires neither the preliminary determination of the position x_0 of the time curve nor the preliminary calculation of the derivatives $\frac{dT}{dx}$, which cannot be determined with a sufficient degree of accuracy.—*Author's abstract, translated by W. A.*

5642. Rössle, Per, Fehlergrenzen bei seismischen Laufzeitplänen [Limits of the errors in seismic traveltime charts]: Beitr. angew. Geophysik, vol. 8, No. 2, pp. 187–194, Leipzig, 1940.

The results of refraction surveys are given by traveltime charts. The traveltimes registered at various points of fan observation are related to a common "standard distance." For this interpolation a suitable depth-speed function is assumed. The error caused by choosing an incorrect speed is smaller at higher speeds and greater at lower speeds; in either case the error grows with increasing difference between the shot-point distance and the standard distance. The effect of these errors upon the traveltime chart is not important; the position of "highs" and "lows" is not changed.—*Author's abstract.*

5643. Shepard, E. R., and Wood, A. E., Application of the seismic refraction method of subsurface exploration to flood-control projects: Am. Inst. Min. Met. Eng. Tech. Pub. No. 1219, 13 pp., New York, 1940.

In view of the large amount of exploratory work required in the flood-control program, Army engineers have welcomed the seismograph as a rapid and relatively inexpensive method of subsurface exploration. Field technique, methods of interpretation, costs, and accuracy are discussed.—*Authors' abstract.*

5644. Voiutsky, V. S., Experiments with a cathode-ray oscillograph for measuring velocities of elastic waves [in Russian]: Trudy Vses. Kontori Geofizicheskih Razvedok, Symposium on seismic prospecting, No. 12, pp. 3–18, Moscow, 1938.

The problem of measuring velocities of elastic waves of short distances and the possible use of a cathode-ray oscillograph for this purpose are discussed. The application of this oscillograph is based on the fact that electronic rays are deflected in two mutually perpendicular directions, and the curves thus obtained may be recorded on a photographic plate or may be observed on a flourescent screen. Such a cathode-ray oscillograph, adapted for field work, has been developed by the author. A detailed description and several schematic diagrams showing the design of the apparatus are given.—*W. A.*

5645. Voiutsky, V. S., Recording the direction of reflected waves [in Russian]: Trudy Vses. Kontori Geofizicheskih Razvedok, Symposium on seismic prospecting, No. 12, pp. 19–38, Moscow, 1938.

The separation of reflected waves from other waves, such as surface waves and refracted waves recorded on a seismogram, presents great difficulty. Filters based on the frequencies of various waves do not always give satisfactory results because the differences between the frequencies of the reflected and some of the other waves are very small. The new method of separating the reflected waves consists in selecting these waves according to the direction of their arrivals. Principles of this method are discussed mathematically. The last part

of the article describes the use of one seismograph in two adjoining groups and of variations in the method of grouping the seismographs. Several seismograms, diagrams, and graphs show the distribution of seismographs.—*W. A.*

5646. von Thyssen, Stephan, Kurze Bemerkungen zu der Arbeit von K. H. Waters und W. Wen-Po, "An investigation of the seismic-electric effect" [Brief remarks on K. H. Waters and W. Wen-Po's article, "An investigation of the seismic-electric effect"]: Beitr. angew. Geophysik, vol. 8, No. 2, pp. 256–257, Leipzig, 1940.

The author disagrees with some of the conclusions reached by Waters and Wen-Po concerning seismic-electric effect as disclosed in their paper, "An investigation of the seismic-electric effect" (see Geophys. Abstracts 99, No. 5216). He gives reasons for his viewpoint.—*W. A.*

5647. von Thyssen, Stephan, Die Temperaturabhängigkeit von Laufzeiten elastischer Wellen einiger Gesteine [The dependence on temperature of traveltimes of elastic waves in some rocks]: Beitr. angew. Geophysik, vol. 8, No. 2, pp. 243–255, Leipzig, 1940.

Dependence of the velocity of longitudinal seismic waves on temperature in samples taken from boreholes has been investigated from 20° to 320° C. A dynamic method was employed by using an apparatus described previously by the author (see Geophys. Abstracts 96, No. 4823). Special arrangements were made for heating cylindrical rock samples. Interesting results were obtained with regard to salt. Variations in velocities of 3 percent and more could be determined at relatively small temperature differences. It is suggested that in some seismological work, temperature corrections of average velocities may be advisable.—*Author's abstract.*

5648. Widess, M. B., and Haskell, N. A., The computation and mapping of seismic-reflection data: Geophysics, vol. 5, No. 2, pp. 156–168, Menasha, Wis., 1940.

The fundamental computation equations for dip shooting are reviewed. From a consideration of the curvature of the wave front of the reflected wave an expression is derived for the angle of arrival in terms of the reflection time difference over a finite spread. The effect of curvature of the reflecting bed is discussed. An outline is given of a rigorous computational procedure which takes full consideration of the three-dimensional aspect of seismic interpretation and which is based on the use of time cross sections and maps. Since this procedure is presented on the basis of a velocity equation which is a function only of depth, it is indicated that a modification must often be made to account for the deviation of the direction of velocity gradient from the vertical.—*Authors' abstract.*

4. ELECTRICAL METHODS

5649. Bogdanov, A. I., Graphical method of interpreting some types of three-layer curves by vertical electric resistivity measurements [in Russian]: Central Geol. and Prosp. Inst. Materials, Geophysic, No. 8, pp. 63–75, Leningrad, 1940.

Nomograms are given showing the combination of two types of curves connecting the unknown ratios $d_2 : d_1$ and $\rho_2 : \rho_1$ through the known values

adapted to the three-layer curves of the type $\rho_3=\infty$ and $\rho_3=0$ (by d and ρ the author designates the thickness and the specific electrical resistivity of the corresponding horizons). For $\rho_3=\rho_1$ two types of curves show the relation of the ratio $\rho_K:\rho_1$ to values $\frac{l}{2}=5d$ and $\frac{l}{2}=10d$, and to the ratio $\rho_2:\rho_1$ for different values of $d_2:d_1$.

Nomograms and curves of the relation $\rho_K:\rho_1$ and $\rho_2:\rho_1$ for different values of d_2 and d_1 make it possible to study the principle of equivalence and to obtain simple determinations of quantities d_2 and ρ_2.—*Author's English abstract.*

5650. Bossolasco, Mario, Sulla prospezione geoelettrica del vulcani [Concerning geoelectric prospecting on volcanoes]: Geofisica pura e applicata, vol. 2, No. 1, pp. 56–59, Messina, 1940.

The author proves that in geoelectrical prospecting inside of volcanoes a preliminary investigation on the distribution and behavior of natural earth currents is necessary. He shows how the morphological conditions of the Stromboli Volcano may well be suited for following the activity of this volcano by registration of the earth currents.—*Author's abstract, translated by W. A.*

Brant, Arthur, Geophysical investigation at Steeprock Lake. *See* Geophys. Abstract 5612.

5651. Currie, B. W., Earth currents: Royal Astron. Soc. Canada Jour., vol. 33, No. 8, pp. 313–323, Toronto, October 1939.

After an historical introduction the method of measurement is explained and means of avoiding earth anomalies, contact potentials, chemical and temperature variations, and electrostatic charges. The analysis of records at Keewatin shows a double wave for the northward component with minima at local noon and midnight and a slight increase of range during the day and in summer. The eastward component is a double wave with small amplitude in winter and 180° phase different from the northward component but with a larger amplitude in summer. The general effect of current changes is given. The relation of earth current and geomagnetic changes is not yet determined but is apparently complex. Physical evidence supports the relation for periodic and non-periodic changes. The regions of large electrical current eddies in the upper air are quoted.—*R. S., Sci. Abstracts, vol. 43, No. 506, 1940.*

5652. Dakhnov, V. N., Earth currents and ways of studying them in connection with prospecting for ores [in Russian]: Glavneft N. K. T. P., U. S. S. R., Transactions V. K. G. R., No. 8, 58 pp., illus., Moscow, 1937.

This book gives general information on the nature of earth currents and proposes some means for practical use of them, such as an investigation of the upper layers of the earth's crust. Results of prospecting that has been already completed illustrate and support this practical use.—*W. A.*

5653. Löwy, H., Isodielectric lines and geologic structure: Philos. Mag., vol. 29, No. 192, pp. 32–35, London, 1940.

Basing his remarks on the theory of Terzaghi that the settlements of a clay layer of the initial thickness h=the height of the column of pure water pressed out per unit of surface, and pointing out that clay with water in its pores is electrically considered a metallic suspension (conducting particles of water dispersed in insulating clay), the author applies his former equations and on designating by ϵ the

dielectric constant of the mixture and by ϵ_c the dielectric constant of the clay and putting $(\epsilon-1)/(\epsilon+2)=[\epsilon]$ the following conclusions are reached: (1) If $\epsilon>\epsilon_c$ there must be water in the rock or ore; (2) if $\epsilon<\epsilon_c$ there must be pores or fissures in the rock. In the second paper the subject is further developed, and the infiltration depth of rain and the water content of rocks are dealt with. Diagrams are given from observations in the western desert of Egypt.—*J. J. S., Sci Abstracts, vol. 43, No. 508, 1940.*

5654. Petrucci, Guiseppe, Possibilita di applicazione dei metodi geoelettrichi di prospezione alla registrazione dei movimenti del magma entro i condotti vulcanici [Possibility of applying geoelectrical methods of prospecting to the registration of the movements of magma inside a volcano]: Geofisica pura e applicata, vol. 2, No. 1, pp. 20–28, Messina, 1940.

The author emphasizes the importance of registering the movements of magma inside a volcano, and he shows by several examples how to obtain registrations by applying geolectrical methods of prospecting, namely, the Wenner method, the method of direct resistance measurements, and the induction method.—*Author's abstract, translated by W. A.*

5655. Rayner, J. M., and Nye, P. B., Geophysical report on the Hercules gold mine, Pine Creek district: Aerial, Geol., and Geophys. Survey of Northern Australia, Rept. 16, 6 pp., Canberra, 1937.

The geophysical survey of part of the Hercules gold mine was an extensive test to determine whether the lodes could be detected by geophysical means. Four methods were used—electromagnetic, magnetic, self-potential, and potential-ratio. The electromagnetic and magnetic surveys gave no results that could be used satisfactorily for purposes of interpretation. The self-potential and potential-ratio surveys gave two pronounced indications agreeing closely in position with the eastern and western lodes. It may be claimed, therefore, that the self-potential and potential-ratio methods would probably be successful in a routine survey of the lodes of the Hercules mine and their possible extensions. Results of the surveys are shown by plans and profiles.—*W. A.*

5656. Rayner, J. M., and Nye, P. B., Geophysical test surveys on the Britannia, Zapopan, and Mount Wells areas, Pine Creek district: Aerial, Geol., and Geophys. Survey of Northern Australia, Rept. 15 (a), pp. 13–16, 3 pls., Canberra, 1937.

Geophysical surveys conducted in the Britannia, Zapopan, and Mount Wells areas were of very limited extent and were made with the object of determining which, if any, geophysical methods could be applied to detect the lodes or reefs if routine surveys were undertaken. The surveys of each area, and their results, are described separately. (1) Britannia area: The potential-ratio (Racom) and self-potential methods were used. The results are shown by profiles and by an indication plan. The potential gradients were generally not well pronounced. (2) Zapopan area: The potential-ratio, self-potential, and magnetic methods were used. The latter two gave no results capable of satisfactory interpretation. (3) Mount Wells area: A test survey was made by the magnetic method to determine whether the lodes could be

detected by this method. The test gave no anomaly over the lodes. As the hill slopes, old rails, and pipes interfered with the survey, the results of the tests cannot be regarded as conclusive.—*W. A.*

5657. Rayner, J. M., and Nye, P. B., The Evelyn silver-lead mine, Pine Creek district: Aerial, Geol., and Geophys. Survey of Northern Australia, Rept. 26, pp. 9–10, Canberra, 1937.

A test survey was conducted over the country north and west of the main group of workings of the Evelyn silver-lead mine. The potential-ratio (Racom) and self-potential methods were used. Results are reproduced on a plate in the form of profiles of potential ratios and logarithms of potential gradients. The results of the potential-ratio survey showed that zones of high conductivity existed in the limestones northwest of the Evelyn mine. The authors recommend that additional geophysical surveys be made by the electromagnetic method.—*W. A.*

5658. Rayner, J. M., and Nye, P. B., The Fountain Head area, Pine Creek district: Aerial, Geol., and Geophys. Survey of Northern Australia, Geophys. Rept. 7, pp. 17–25, Canberra, 1937.

A brief description of the geology of the area and of the reefs is given. The chief object of the geophysical survey was to detect reefs under cover. The potential-ratio method (Racom) was used for most of the survey. Among other methods used were the self-potential, magnetic, and electromagnetic. The final results of the survey are shown on maps and profiles. The potential-ratio method gave many narrow, irregular anomalies. An indication plan was prepared from the narrow and more sharply defined anomalies. The indications, which vary as regards intensity and length, are not all of equal importance and are considered to represent narrow, poor-conducting bands, probably quartz reefs.—*W. A.*

5659. Rayner, J. M., and Nye, P. B., The Iron Blow area, Pine Creek district: Aerial, Geol., and Geophys. Survey of Northern Australia, Rept. 13, pp. 15–18, 3 pls., Canberra, 1937.

The main problem was to detect any extensions of the Iron Blow lode. The shearing and the high sulfide content of the ore suggested that the lode would be a comparatively good electrical conductor and could be detected accordingly. Most of the survey was made by electromagnetic and self-potential methods. The potential-ratio (Racom) method was also used. The final results of the survey are shown on maps and profiles. Further extension of the geophysical survey is considered advisable, as the profiles obtained show encouraging indications.—*W. A.*

5660. Rayner, J. M., and Nye, P. B., The Yam Creek area, Pine Creek district: Aerial, Geol., and Geophys. Survey of Northern Australia, Rept. 9, pp. 11–16, 2 pls., Canberra, 1937.

The chief object of this survey was to detect reefs under cover. According to geologic information, reefs and veins of quartz traverse slates and sandstones (or weathered quartzites). Near the surface some of the narrow quartz veins contain small amounts of arsenopyrite and pyrite, but the sulfide content at depth is not known. The potential-ratio method (Racom) was used for most of the survey. The results were plotted in the form of profiles of potential ratios and logarithms of potential gradients Three distinct anomalous zones of high resistivity

were obtained. The anomalies are shown in the form of indication lines. It is thought that the indications represent narrow, poor-conducting bands, probably quartz reefs.—*W. A.*

5661. Schmidt, Adolf, Zur Frage der hypothetischen die Erdoberfläche durchdringenden elektrischen Ströme [On the question of hypothetical electric currents penetrating the surface of the earth]: Gerlands Beitr. Geophys., vol. 55, No. 2, pp. 292–302, Leipzig, 1940.

The history of vertical electric currents derived from geomagnetic observations is briefly outlined. The assumption that these currents are not essential but that they express only errors in observation is supported by a detailed comparison of such currents observed in 1885 and 1922. Improved means of observation show that the average hypothetical current densities decreased, from 1885 to 1922, by more than one-third. Geographic distribution of the current densities for these 2 years is quite different. The nature of the errors in the magnetic maps and means for their elimination are discussed.—*Author's abstract, translated by W. A.*

5662. Semenov, A. S., Ferchev, M., and Malchevski, V. S., Contribution to the question of the applicability of the parameter "*PP*" in geophysical prospecting [in Russian]: Central Geol. and Prosp. Inst. Materials, Geophysic, No. 8, pp. 76–84, Leningrad, 1940.

Studies concerning induced polarization (*PP*-polarisation provoquée) as described by Schlumberger, carried out in the geophysical section of the Central Geological and Prospecting Scientific Institute, have shown that the parameter "*PP*" has a very small value and requires very precise instruments for its measurement. The value of "*PP*," at least at first approximation, is proportional to the specific resistivity of rocks; thus Schlumberger's conclusions that the highest value of "*PP*" corresponds to water-bearing rocks must be denied. The authors conclude from the investigations that the method proposed by Schlumberger is of less importance than he assigned to it.—*Authors' abstract.*

5663. Stick, J. C., Electrical logging of oil wells: Alumni Rev., California Inst. Technology, vol. 3, No. 4, pp. 12–14, Pasadena, June 1940.

The author describes the early history of electrical logging since its introduction by Conrad and Marcel Schlumberger, and he shows in a diagram a typical electrical log that discloses characteristic formation responses and method of presentation. In another diagram he shows a photorecorder that continuously transfers electrical responses into a permanent photographic film. The whole equipment is carried in two trucks. A heavy-duty hoist unit can carry 15,000 feet of logging cable, together with electrode assembly, additional electrode weights, and associated apparatus. The main electrical power supply is a 1,000-watt gasoline-driven generator. The instrument truck carries all the electrical apparatus, including the control panel, photo-recorder, recording power supply, and it is convertible into a complete photographic dark room.—*W. A.*

5664. White, Gifford, Application of rapid-current surges to electric-transient prospecting: Am. Inst. Min. Met. Eng. Tech. Pub., No. 1216, 13 pp., New York, 1940.

It is shown that the response voltage of the earth to suddenly applied direct current or its derivative with respect to time are the most

general electrical data and that either allows the computation of all other responses to any other driving current. Field data are presented.—*Author's abstract.*

5. RADIOACTIVE METHODS

5665. Collie, C. H., and Roaf, D., Mode of action of a Geiger-Müller counter: Phys. Soc. Proc., vol. 52, pt. 2, No. 290, pp. 186–190, London, March 1940.

The action of a Geiger-Müller counter filled with He and alcohol has been examined. A series of experiments show that ionization by collision remains the dominant process over a large range of voltage and is sufficient to account for its action.—*Authors' abstract.*

5666. Lutz, W., Radioaktive Bodenuntersuchungen nach dem γ-Strahlenverfahren [Radioactive investigation of the ground by the γ-ray method]: Beitr. angew. Geophysik, vol. 8, No. 2, pp. 211–226, Leipzig, 1940.

The relation between the structure and γ-radiation of the ground was investigated by means of a portable counting-tube device. If the weathered or authigenic soil is thin, the faults and margins of the layers may be distinguished by irregular changes in the mean values of the radiation; but such changes are not observed where the allothigenic cover is thick. An increase in the values of radiation over faults has never been observed. Suggestions are made for further development of the method.—*Author's abstract, translated by W. A.*

5667. McMaster, Harold, and Pool, M. L., Some improvements in a Geiger-Müller counting system: Rev. Sci. Instruments, vol. 11, No. 6, pp. 196–198, Lancaster, Pa., 1940.

A new method of interpolation is described which eliminates one tube per scale-of-two and does not disturb the equilibrium of the trigger tubes. A resolving time of 10^{-4} second was obtained with a quenching circuit incorporating the desirable features of both the Neher-Harper and the multivibrator circuits.—*Authors' abstract.*

5668. Montgomery, C. G., and Montgomery, D. D., Ionization measurments of the radiations from radioactive substances: Franklin Inst. Jour., vol. 229, No. 5, pp. 585–611, Lancaster, Pa., 1940.

After outlining the methods of constructing ionization chambers in general and discussing some of the precautions to be taken, the authors calculate the limits of sensitivity for a particular chamber used with several kinds of measuring instruments. They present separate discussions concerning measurements of the ionization produced by alpha rays, beta rays, and gamma rays. Results of their calculations are expressed in tables that give the smallest number of alpha, beta, and gamma rays per second in this particular chamber, which number can be detected by means of the instrument in use, as the limiting factor is either the sensitivity of the instrument or the fluctuations in the residual ionization of the chamber. The corresponding limits for other chambers can easily be calculated in a similar fashion. When the chamber is small and the sensitivity large, other factors become important in setting the limitations, namely, the discreteness of the electronic charge and the thermal motions of the electrons. These factors are discussed briefly. A short bibliography is included.—*W. A.*

5669. Radioative standards [editorial note]: Canadian Min. Met. Bull., No. 336, pp. 130–131, Montreal, 1940.

A series of radioactive standards is being prepared under the direction of the committee of standards of radioactivity of the United States National Research Council. These standards will be deposited at the National Bureau of Standards in Washington, D. C., to be issued as working criteria to investigators who may desire them. The following are under preparation: (1) Radium standards, (2) thorium standards, and (3) standard rock samples.—*W. A.*

5670. Taft, R. B., Portable Geiger-Müller counters: Rev. Sci. Instruments, vol. 11, No. 2, pp. 63–64, Lancaster, Pa., 1940.

Two small portable Geiger-Müller counters are described, one for battery and one for A.-C. line operation. A "statosphere" tube, as made by G. L. Locher, is used as a Geiger-Müller tube. In both sets, headphones with one stage of amplification are used for recording the impulses. The high voltage for the battery set is derived from a spark coil and rectifying valve.—*J. B. W., Sci. Abstracts, vol. 43, No. 508, 1940.*

6. GEOTHERMAL METHODS

5671. Zanetti, Renzo, I frigorimetri "Z" caratteristiche, construzione, impiego [The *Z*-frigorimeter—its characteristics, construction, and application]: Geofisica pura e applicata, vol. 2, No. 1, pp. 29–41, Messina, 1940.

The *Z*-frigorimeter, designed and constructed by the author, is described in detail, with special emphasis on its characteristic features as compared with those of other types. Complete suggestions for practical use of the apparatus are given. The thermotechnical and climatological applications are discussed.—*Author's abstract, translated by W. A.*

7. GEOCHEMICAL METHODS

5672. Lundberg, Hans, Future of geophysics in connection with plant life: California Min. Jour., vol. 9, No. 9, p. 5, Auburn, 1940.

A new, economical, rapid, and accurate geochemical method, which consists in collecting samples of plant material, in burning this material, and in subjecting the ashes to a spectroanalysis, is outlined in connection with a search for metals (see similar article by Lundberg in Geophys. Abstracts 101, No. 5540).—*W. A.*

5673. Malyi, F. A., Some data on a gas survey in the territory of the Ukrainian S. S. R. [in Russian]: Trudy Neft. Konf. 1938 (Transactions of the Petroleum Conference of 1938), pp. 89–100, Kiev, 1939.

After a historical outline of the development and methods of performing a gas survey that was started in 1935 in the region of Romny, in the Ukraine, the author describes the geologic structure of the Dneprovsk-Donets lowland. He includes a map of the region. He gives the results of gas surveys on several diagrams, which show the saturation of the upper layers of the ground by heavy hydrocarbons and CH_4, according to the areas investigated. He concludes that further development of the gas-survey method is necessary to obtain effective results, and he recommends the continuation of investigations.—*W. A.*

5674. McDermott, Eugene, Geochemical exploration (soil analysis) with some speculation about the genesis of oil, gas, and other mineral accumulations: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 5, pp. 859–881, Tulsa, Okla., 1940.

The newly developed methods of geochemical exploration will undoubtedly play an important role in exploration for oil and gas fields. There has been a tendency in this country among the explorers for oil and gas to undervalue the role of surface evidences of such deposits. Most of the great oil fields of the world have been indicated by surface evidences. In view of the prevalence of visible oil and gas seeps it is reasonable to expect to find microscopic seeps in much greater abundance. In practically all cases maximum leakage occurs from the edges of accumulations. These leaking gases are absorbed by the earth particles near the surface and are then polymerized to the heavier hydrocarbons. The gases in leaking to the surface transport quantities of subsurface waters and dissolved minerals, resulting in many cases in high mineral concentrations near the surface. The data of geochemistry have led to some very interesting speculations regarding the genesis of oil and gas fields. Evidence strongly suggests that oil and gas fields result from the polymerization of migrating hydrocarbon gases. Two sources of such gases have been measured, namely, vegetable matter that is being devolatilized and the basement rocks. There may of course be others as yet unmeasured. The important consideration is that so far as migration is concerned the gases are the principal participants. It is believed that the oil accumulations and the concentrations of absorbed hydrocarbons in the soil and in the oil shales are genetically related. As the principal difference between marine and nonmarine sediments is the presence of sodium chloride (not organic content according to Trask), and as this will act as a catalytic agent to polymerize the hydrocarbon gases, it is reasonable to suppose that this is why oil fields occur in marine rather than nonmarine sediments. Experimental laboratory investigation verifies this. If one goes back far enough in point of origin of the organic gases either in the buried vegetable matter or the basement rocks, both origins would immediately become inorganic. In view of this, can it be said that there has ever been an organic theory of the origin of oil and gas? On the basis of the hypothesis proposed it is possible to explain the differences in mineralization of subsurface waters in different geologic provinces, as well as the relation between volatility of accumulations as a function of the carbon ratio (rock deformation) and overburden. Caliche may owe its existence to the transporting power of the vertically migrating gases. It should be kept in mind the method of geochemical exploration is not predicated on the theoretical conceptions here presented. Rather, the reverse is true, in that the theory is derived from the data of geochemistry.—*Author's abstract.*

5675. Merritt, J. W., Petroleum exploration by means of soil analysis: Oil and Gas Jour., vol. 39, No. 5, pp. 68–69, Tulsa, Okla., 1940.

In the development of the soil-analysis survey, observations show that the ideal pattern over producing areas takes the form of a set of high hydrocarbon values directly above the margin of the oil body. The marginal anomaly, frequently called a halo, is not necessarily related to structure but may occur above the margins of any oil body,

whether in the form of a dome, faulted structure, shore line, or other stratigraphic trap. The importance of the direct relation must be well noticed, as it means that a method of oil exploration directly related to the oil itself has been discovered. It is believed that most of the failures of drilling tests in geochemically favorable areas are due to imperfect interpretation of data rather than to faulty laboratory procedure. Means for avoiding errors in interpretation are discussed. Three sketches are given: One illustrates the contour method of showing hydrocarbon-value relations where a group of profiles is taken to cover a certain area; the other two show the hydrocarbon-value relation along a single profile.—*W. A.*

5676. New geophysical methods [editorial note]: South African Min. Eng. Jour., vol. 51, pt. 1, No. 2464, p. 225, Johannesburg, 1940.

A summary is given of a paper by Hans Lundberg that proposed the extension of geophysical investigation to large regions where the bedrock is completely masked by thick vegetation and glacial and alluvial deposits. The new method may be called geochemical, and in general it consists in systematically collecting samples of plant material, taken either from living or dead plants, from the area to be investigated. The material is then burned, and the ashes are subjected to spectroanalysis, from which are obtained comparative values of the concentrations of one or more of the desired elements (see also Geophys. Abstracts 101, No. 5540).—*W. A.*

8. UNCLASSIFIED METHODS AND TOPICS RELATED TO GEOPHYSICS

5677. Abstracts of papers before Society of Exploration Geophysicists: Oil and Gas Jour., vol. 38, No. 48, pp. 69–72, Tulsa, Okla., 1940.

The Oil and Gas Journal published the following abstracts of papers presented at various meetings of the Society of Exploration Geophysicists held in April 1940 in Chicago, in connection with the A. A. P. G. Convention: (1) The evaluation of magnetic anomalies by means of scales, by Irwin Roman; (2) Fifteen years of geophysics—a chapter in the exploration of the United States, 1924–39, by J. B. Macelwane; (3) Average vertical velocities from refraction and reflection profiles, by W. R. Ransone and F. E. Romberg; (4) Electrical-prospecting methods, by W. M. Rust, Jr.; (5) The Gulf gravimeter, by R. D. Wyckoff; (6) Modern seismic amplifiers, by Herbert Hoover, Jr.; (7) Some neglected aspects of chemical exploration, by Dr. R. T. Sanderson; (8) Some properties of radioactivity logs, by W. G. Green and R. E. Fearon; (9) The history and development of seismic prospecting, by B. B. Weatherby; (10) The effect of the placement of a seismometer on its response characteristics, by Harold Washburn and Harold Wiley; (11) The mechanics of the upside-down core, by E. D. Lynton; (12) A transformed wave-front chart, by R. A. Peterson; (13) A brief history of the gravity method of prospecting, by E. A. Eckhardt; (14) A note on the attentuation constant of earth materials, by W. T. Born; (15) The range of amplitudes in seismic-reflection records, by J. M. Kendall; (16) The effect of density on seismic reflections, by S. S. West; (17) On the form and nature of seismic waves and the structure of seismograms, by Norman Ricker;

(18) Network adjustment by least squares—alternative formulation and solution by iteration, by M. O. Gibson; (19) The time delay of a wave group in the weathered layer, by Alfred Wolf; (20) The reliability, on the basis of probability considerations, of geophysical anomalies, by T. A. Elkins; (21) Michigan weathering, by N. N. Zirbel; (22) Transient testing of seismic-recording apparatus, by Harold Washburn and R. C. Oleson; (23) A critical survey of recent developments in geochemical prospecting, by S. J. Pirson; (24) Resolution control in seismic surveys, by R. F. Beers; (25) Combination of wave transients, by Thomas Wiancko and Martin Echelberger; (26) Shothole characteristics in reflection seismology, by H. J. McCready; (27) The computation and mapping of seismic-reflection data, by M. B. Widess and N. A. Haskell; (28) A perspective of exploration for petroleum, by E. E. Rosaire; (29) The Gulf underwater gravimeter, by T. B. Pepper; (30) Relative gravity measurements using precision pendulum equipment, by M. W. Gay.—*W. A.*

5678. Aerial, geological, and geophysical survey of northern Australia, Parliament of Commonwealth of Australia, 93 pp., 6 pls., L. F. Johnston, Commonwealth Government Printer, Canberra, 1939.

This is a report of the committee appointed to direct and control the aerial, geologic, and geophysical survey of northern Australia for the period ended December 31, 1938. Geophysical surveys of several areas in Northern Territory and Queensland are described on pages 71–92 of this report. Plates 2 to 6 showing plans and profiles are attached. The following methods were applied: (1) Electromagnetic, (2) potential-ratio, (3) self-potential, (4) resistivity, and (5) magnetic. Testing in accordance with recommendations made prior to 1938 were conducted in several areas. The nature and results of such testing is described for each area separately.

Western Australia.—(1) Wiluna: The principal results of the magnetic survey, shown on plate 2, reveal structural features, which from the geologic aspect are possibly favorable for ore deposition. Moreover, the results suggest that unsuspected geologic formations and structures may be present that call for investigation. The bedrock of the area is completely obscured by salt-water lakes, sand hills, and other features. (2) Norseman: The principal method used in this area was the electromagnetic, supplemented by the potential-ratio method, some magnetic work, and a few resistivity tests. The results indicate that the shear zones are exceedingly wide, that the reefs are not necessarily confined within the zones of high conductivity, and that the shear zones are not necessarily good conductors. Because of these facts, the geophysical results are of much less economic value than they might otherwise have been, but it is very difficult at present to assess the economic value of the geophysical surveys made at Norseman.

Queensland.—(1) The Herberton deep lead: Preliminary tests were made with the magnetic method and with various modifications of an electrical-resistivity method. Tests made with the magnetic method were unsuccessful, as no anomalies were obtained that could be correlated with the thickness of the basalt cover. Electrical tests revealed considerable differences in the resistivity values of the various formations comprising the geologic succession in the lead. These differences are indicated in a table. (2) Herberton tin lodes: The potential-ratio

and electromagnetic methods were used. According to the results of the surveys, shown on plate 5, favorable reactions were obtained only above the main Canberra-Phoenix break. No further work is suggested. (3) Watsonville tin lodes: The self-potential and electromagnetic methods yielded several strong anomalies, of which the principal ones are shown on plate 5. (4) Golden Gate area, Croydon: The electromagnetic method, the only one employed, disclosed several anomalies, which are shown on plate 6. Some of the indications obtained are well-defined and are assumed to be due to fault or shear zones. (5) Supposed True Blue deep lead, Croydon: Tests were made by the resistivity and magnetic methods. The resistivity curves show three layers. The first or upper layer is highly resistive and about 50 feet thick; the second is less resistive and of unknown thickness; and the third or lowest layer is more resistive. These layers could be sandstone, weathered granite carrying water, or unweathered granite. The magnetic results show two zones of minor disturbance on an otherwise very regular profile.—*W. A.*

5679. Aerial, geological, and geophysical survey of northern Australia, Parliament of Commonwealth of Australia, 24 pp., 3 pls., L. F. Johnston, Commonwealth Government Printer, Canberra, 1939.

This report, which covers the early part of the field season ending June 30, 1939, describes geophysical surveys by gravimetric, electric-resistivity, and magnetic methods in the Blair Athol coal field, in eastern Queensland, and the granite area, in the Northern Territory. Resistivity tests by the Gish-Rooney method and the depth (or ratiometer) probe method in the Newcastle open-cut proved that the coal seam was more resistive than the sandstones above or below it. Several comparatively good conductive zones were interpreted as representing lenticular beds of shale (and not coal) in more resistive sandstone. Calculations of the specific gravities of the coal, sandstone, and shale showed that gravity gradients up to 60 Eötvös should exist and, therefore, could be easily measured. Gravity-gradient surveys were made over five traverses. Pronounced gradients were obtainable over sections of the area where no basalt was present.—*W. A.*

5680. Aerial survey and geophysical prospecting [editorial note]: Min. and Ind. Mag. of Southern Africa, vol. 27, No. 3, pp. 52–53, Johannesburg, 1940.

The aerial-survey and geophysical-prospecting methods are at present adopted by the Geological Survey Department of the Union of South Africa. General principles of magnetic, gravimetric, seismic, and electrical resistivity methods are discussed briefly, and instruments used by each of these methods are mentioned.—*W. A.*

5681. Atwill, E. R., Significant developments in California, 1939: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 6, pp. 1112–1125, Tulsa, Okla., 1940.

Stratigraphic traps have assumed an increasingly important place in the consciousness of California geologists. All possible structures, new and old, are being scrutinized or reviewed with this dominant thought in mind. Four new oil fields were discovered in California during 1939, one of which is definitely established as a field of major proportions. In addition, five important extensions of known fields were

made. The near-future exploration in California will probably be guided largely by detailed subsurface studies in the vicinity of proved fields, although use of the reflection seismograph will continue, but in lesser degree. Wildcat drilling in the State is declining as more and more thought is devoted by company managements to the financing and arrangement, under rather severe curtailment, of required development programs in recently discovered fields.—*Author's abstract.*

5682. Bossolasco, Mario, and Bonetti, Alberto, Le possibilita minerarie della provincia di Messina [Mineral possibilities in the Province of Messina]: Geofisica pura e applicata, vol. 2, No. 1, pp. 60–71, Messina, 1940.

Mineral deposits in the Province of Messina, the mining of which is considered worth while, are described and discussed on the basis of data obtained from investigations by the Royal Institute of Geophysics and Geodetics of Messina. General geologic conditions are mentioned. It is shown that the Province of Messina has rich deposits of such ores as copper, lead, antimony, zinc, and iron. Their distribution is, of course, complicated and irregular. Deposits of other materials, such as bituminous slate and brown coal, are also mentioned.—*Authors' abstract, translated by W. A.*

5683. Cosmic terrestrial relationship [editorial note]: Royal Astron. Soc. Canada Jour., vol. 33, No. 10, pp. 415–430, Toronto, December 1939.

In this report to the American Geophysical Union the functions of the several committees for coordinating interests in geophysics are explained. The part dealing with cosmic terrestrial relationships provides a summary from the point of view of the structural geologist of the evidence that the earth itself affords regarding crustal movements. Geologic evidence for crustal movements is reviewed first and next astronomical evidence for variation in geographical coordinates. The investigations of variations in longitude which have been completed are discussed, and lines projected for further research are outlined.—*R. S. R., Sci. Abstracts, vol. 43, No. 508, 1940.*

5684. Eby, J. B., Recent progress in geophysical, geochemical, and electrical-prospecting methods for petroleum: Petroleum Engineer, vol. 11, No. 10, pp. 122–126, Dallas, Tex., 1940.

Better understanding of the general principles, applications, limitations, and reliability or accuracy of results obtained by each of the various geophysical methods in use today has followed from a study appraising the relative values of these methods available for use in locating subsurface structure. The magnetometer, the gravity meter, electrical prospecting, and soil analysis are now generally regarded as valuable reconnaissance methods that aid in rapid appraisal of new territory. The torsion balance is recognized as being an instrument both of reconnaissance and of detail. The refraction seismograph has also been used for both reconnaissance and detailed study, but the reflection seismograph is now generally conceded to be the superior instrument for making detailed studies of an area and for estimating the depths of important formations, such as massive limestones, sandstones and igneous rocks. Geochemical methods have stimulated more discussion than other methods. Geochemical well logging deserves

special consideration. This prospecting technique, which was only recently developed, depends on the analysis of cuttings obtained in routine drilling and yields a new prospecting tool but does not replace or substitute for electrical well logging and core analysis. Diagrams of three geochemical logs are given: (1) The one that led to the discovery of the East Bernard field, Texas; (2) that of a well drilled on a serpentine plug in Atascosa County, Tex.; and (3) that of a dry hole in Nueces County, Tex. The author concludes that "although electrical prospecting and geochemistry are both in active development, the brunt of the work will still probably be borne by the reflection seismograph and the gravimeter."—*W. A.*

5685. Flerova, O. V., Investigation of a new oil-bearing region in the Amga River Basin in the Yakutsk S. S. R. [in Russian]: Razvedka Nedr, vol. 9, No. 12, pp. 9–20, Moscow, 1939.

From preliminary geologic, geophysical (magnetic), and gas surveys made during the years 1932–38, the writer concludes that (1) the Amga River Basin is a new, prospective oil-bearing region, on which two deposits of oil have already been established; (2) three other oil-bearing regions (the Tolba, Amga Pervaia, and Amga Vtoraia), far away one from another, make the whole Lena-Aldansk region a very promising oil-bearing region; and (3) oil has already been found in three places by drilling.

A schematic geologic map of the whole region and a profile of the geologic structure of the Amga River are given.—*W. A.*

5686. Geophysical work at Steep Rock Lake [editorial note]: Eng. and Min. Jour., vol. 141, No. 5, p. 36, New York, 1940.

The objective of the work at Steep Rock Lake, in northwestern Ontario, where an important deposit of hematite has been explored, was to study the limitations of some geophysical methods. Hematite was indicated by electrical measurements. The method applied is briefly described. In addition, torsion-balance measurements were made with the aim of locating denser hematite ore. It is hoped that the final gravitational results may serve to indicate the extent and breadth of the ore body already indicated by drilling, as well as other ore bodies along the unexplored section of the contact.—*W. A.*

5687. Leet, L. D., Status of geological and geophysical investigations on the Atlantic and Gulf Coastal Plain: Geol. Soc. America Bull., vol. 51, No. 6, pp. 873–886, Washington, D. C., 1940.

Major features of the structure of the Gulf and Atlantic Coastal Plains of the United States are summarized. They include a postulated geosyncline of proportions comparable to those of the Appalachian of Paleozoic time. The attitude of the basement floor in Arkansas and along the Atlantic coast, as inferred from wells which penetrated it and geophysical data on basement configuration, are discussed, with emphasis on seismic methods. Seismic velocities in the basement rocks and younger sediments, possible depth limitations of the seismic method, and tests of the method are described. Seismic investigations on the Atlantic Coastal Plain are reviewed, with special reference to work at sea near the edge of the continental shelf, where attempts to map the basement rocks gave inconclusive results.—*Author's abstract.*

5688. Nesterov, L. J., Physical properties of limestones, sandstones, and schists [in Russian]: Central Geol. and Prosp. Inst. Materials, Geophysic, No. 8, pp. 1–15, Leningrad, 1940.

The author shows that on the basis of laboratory determinations the density of sandstones, limestones, and schists depends mainly on their porosity and only very little on their mineral composition and structure. The elastic properties and the electrical conductivity of rocks also depend on their porosity and are influenced by other factors, such as the specific resistivity of water in rock pores. Thus, the porosity of rocks is one of the most essential properties to be solved by the geophysicist who uses geophysical prospecting. The author points out the effect on the porosity of rocks of the depth of occurrence (static pressure) or dynamic metamorphism or both these factors acting under different conditions. He shows graphically the dependence of porosity, moisture capacity, and saturation on the electrical resistivities of rocks.

The article contains many practical results on density; porosity; moisture capacity; specific resistivity; Young's modulus; Poisson's coefficient; velocity of propagation of elastic waves; radioactivity; magnetic susceptibility; remanent magnetization; heat conductivity; heat capacity of sandstones, limestones, and schists; and specific resistivity of water that fills the pores of these rocks.—*W. A.*

5689. Nesterov, L. J., and Bereskin, M. A., Some data concerning physical properties of Donbass coals [in Russian]: Central Geol. and Prosp. Inst. Materials, Geophysic, No. 8, pp. 31–34, Leningrad, 1940.

A curve based on laboratory investigations of Donbass coals shows the dependence of the density (δ) of coals on the volatile matter (V) contained in them, and on the rate of their carbonization (C).

Mean values of some of the physical properties of these coals are given, as follows:

Physical property	Type of coal	Value
Moisture	Anthracites	2.6 percent.
	Bituminous coals	3.1 percent.
Porosity	Anthracites	4.46 percent.
	Bituminous coals	4.03 percent.
Young's modulus		2.54.
Poisson's coefficient		0.27.
Velocity of propagation of elastic waves		4100 m./sec.
Electrical resistivity:		
Dry coals	Anthracites	3.8×10^5 Ω cm.
	Bituminous coals	2.3×10^9 Ω cm.
Coals with maximum moisture	Anthracites	1×10^2 Ω cm.
	Bituminous coals	1×10^6 Ω cm.
Coefficient of anisotropy	Anthracites	4.6.
	Bituminous coals	6.5 ($\lambda=\rho_n/\rho_t$).

—*Authors' summary.*

5690. Nesterov, L. J., and Nesterova, M. A., A comparative study of some physical properties of igneous rocks of the northeastern part of the Azov region and of Karelia [in Russian]: Central Geol. and Prosp. Inst. Materials, Geophysic, No. 8, pp. 16–30, Leningrad, 1940.

A comparative study of physical properties of 176 samples of igneous rocks from the Azov region and from Karelia, made in the laboratory of

the geophysical section of the Geological and Prospecting Institute, led to the following conclusions:

(1) Density (δ) of igneous rocks depends mainly on their composition. Porosity plays only a subordinate role, although greater density of Karelian rocks as compared with the density of the rocks of the Azov region may partly be explained by it. Densities of Karelian rocks increase slightly with the transition from acid to basic rocks, whereas the densities of several groups of rocks of the Azov region remain nearly the same. Tables showing the chemical composition of the rocks of both regions explain this fact.

(2) The moisture capacity (ω) of igneous rocks varies, on an average, from 0.17 to 0.78 percent, and the maximum changes of the specific resistivities (ρ) of rocks occur just within this interval. The moisture of rocks therefore plays the main role in values of ρ, whereas the mineral content of the water is of less importance. The mean values of ρ of all the samples investigated varied from 1.0×10^6 to 3.0×10^6 Ω cm., but single samples had a range of changes of ρ from 3.1×10^2 to 4.5×10^7 Ω cm. The investigation thus shows in the first place variations of ω from 0.07 to 2.94 percent and in the second place variations of the specific resistivities of water filling the pores from 4.7×10 to 8.1×10^3 Ω cm.

(3) The elastic constants of Karelian rocks are higher than those of similar rocks of the Azov region. The elastic constants of the rocks from both these regions increase from acid to basic, the character of the increase being the same as that for density.

(4) Twenty-nine percent of the samples investigated had noticeable remanent magnetism (I_r). Thus, it is evident that a study of remanent magnetism in igneous rocks is necessary. It is shown that (I_r) and (μ) of Karelian samples are higher than in those taken from the Azov region. Both these parameters increase from acid to basic rocks.—*Authors' abstract.*

5691. Russell, H. N., Even the earth errs: Sci. Am., vol. 162, No. 5, pp. 272–273, New York, 1940.

Man's most accurate clock is the rotating earth, but the earth goes fast and slow. The changes in the speed of rotation in 1898 and 1920, for example, amounted to 1.3 seconds per year. The reasons for such changes and the possibilities of watching for them are discussed.—*W. A.*

5692. Saudi Arabia major factor in eastern hemisphere [editorial]: Oil Weekly, vol. 97, No. 2, pp. 56–60, Houston, Tex., 1940.

Commercial production has been developed on the Damman dome and also in Kuwait [in southeast Arabia]. Only 2 wells have been failures out of 67 on Bahrein Island, which is estimated to have reserves of 150,000,000 barrels. The Damman reserve is put at 300,000,000 barrels. The Damman production is piped to Ras Tanura, and recent developments have been confined to the 4,300-foot zone. Seismic and gravity work is being carried out in Saudi Arabia in addition to geologic work and structure drilling. The Abu Hadriya well failed to yield anything of commercial importance down to 8,655 feet. A second test is being made 120 miles west of Damman, and on the Oatar peninsula a well has logged commercial showings of oil and gas. Favorable results have been obtained on the Burghan structure.—*G. D. H., Inst. Petroleum Jour., vol. 26, No. 199, 1940.*

5693. Thomas, J. E., A. A. P. G.'s growth parallels expansion of petroleum geology: Oil and Gas Jour., vol. 38, No. 48, pp. 30–37, 40, Tulsa, Okla., 1940.

A historical outline of the organization and growth of the American Association of Petroleum Geologists is given. The author discusses (1) earliest geologic work, (2) the anticlinal theory, (3) surface mapping, (4) paleontology, (5) subsurface mapping, (6) electrical well logging, (7) geophysics, (8) soil-gas analyses, (9) estimates of reserves, (10) proration problems, (11) study groups, (12) public educational work, and (13) changes in geologic theory.—*W. A.*

5694. United States Geological Survey using geophysics in search for Plumas gold [editorial note]: California Min. Jour., vol. 9, No. 11, p. 7, Auburn, 1940.

A geophysical survey of the Newton Flat placer mining district, about 5 miles north of Quincy, Plumas County, Calif., has been started recently by the section of geophysics of the Geological Survey. The plan of field work includes magnetic and electrical-resistivity surveys across buried placer channel and adjoining channels. The purpose is to determine whether these methods of geophysical surveying may be used to locate the troughs or bottoms of the buried channels and to determine depths to the buried bedrock surface.—*W. A.*

5695. von Thyssen, Stephan, Subjective Fehler bei Skalenablesungen und ihr Einfluss auf die Genauigkeit einiger geophysikalischer Messverfahren [Subjective errors in scale-reading and its influence on the accuracy of some geophysical methods of measurement]: Beitr. angew. Geophysik, vol. 8, No. 2, pp. 143–178, Leipzig, 1940.

In this paper errors are described which depend on the observer performing the geophysical work, the so-called personal equation. General conditions of the interrelationship of the human eye and the design of the scales of the instruments are explained. Torsion balance, gravimeter, magnetometer, and time readings are analyzed, using simple calculations of probabilities. Errors due to the personal equation of the observer are of the magnitude of 1 to 2 Eötvös for torsion balance, up to 0.05 and 0.1 milligal for gravimeter, and about 2 to 3 gammas for magnetometer. It is impossible to eliminate the personal equation, but it is possible to reduce the systematic errors of this origin by means described in this paper. By reducing the errors introduced by the observer higher accuracy in geophysical work may be obtained. It is suggested that the readings of the observers be analyzed by the method of statistics.—*Author's abstract.*

5696. Weber, George, Discovery on small geophysical structure arouses Mississippi: Oil and Gas Jour., vol. 38, No. 48, pp. 25–26, Tulsa, Okla., 1940.

The discovery of oil on a relatively small structure in eastern Yazoo County, indicated by geophysical investigations, produced great interest in the State, as the discovery marked a definite turning point in opinion regarding the potentialities of oil in Mississippi.—*W. A.*

5697. Weller, J. M., and Sutton, A. H., Mississippian border of Eastern Interior basin: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 5, pp. 765–858, Tulsa, Okla., 1940.

The Mississippian system along the borders of the Eastern Interior basin has been studied in considerable detail during the last 30 years,

but the results of most of this work have not yet been published. This paper briefly discusses the stratigraphy, paleontology, sedimentation, and structure, and lists petroleum-bearing beds of the Mississippian system in Illinois, Indiana, western Kentucky, eastern Missouri, and southeastern Iowa as based on the published and unpublished investigations of more than 25 geologists and their numerous assistants, who worked mainly under the auspices of the various State geological surveys. Accompanying maps show the areal geology from Mercer County, Ill., to Putnam County, Ind., and include more than fifty 15-minute quadrangles, which have been studied in detail.—*Authors' abstract.*

5698. Zabelli, Arnaldo, Contributo delle ricerche geofisiche alle ricerche minerarie nazionali [Contribution of geophysical prospecting to the search for national minerals]: L'Industria min. d'Italia e d'Oltremare, vol. 18, No. 6, pp. 131–133, Rome, 1940.

A brief discussion is given of (1) the scientific principles of geophysical prospecting, (2) the various fields of application, and (3) the most efficient methods for practical geophysical search for minerals.—*W. A.*

5699. Zavistovski, V. S., Results of geophysical work for investigating deep-seated geological structure and its connection with the existence of oil in some regions of the Ukrainian S. S. R. [in Russian]: Trudy Neft. Konf., 1938 (Transactions of the Petroleum Conference of 1938), pp. 163–178, Kiev, 1939.

Two regions were investigated—that near the Black Sea and the Dnepr-Donets lowland. The results of seismic and gravitational investigations in the Dnepr-Donets lowland in 1937, the geologic structures, and its relation to salt domes are shown on maps and profiles. Velocities of propagation of longitudinal waves in the regions investigated are given in a table.—*W. A.*

9. NEW PUBLICATIONS

5700. Cagniard, Louis, Reflexion et refraction des ondes seismiques progressives [Reflection and refraction of propagating seismic waves], 250 pp., illus., tables, Gauthier-Villars, Paris, 1939. Price, 120 francs.

In this work the author reacts against the usual tendency of theoretical seismologists to consider an earthquake as a permanent harmonic phenomenon, whereas on the contrary it is a transitory occurrence—a motion gradually propagated in the midst of a medium which was originally in equilibrium.

Taking up by new methods a classic memoir of Lamb's which supplies indispensable generalizations, Cagniard discusses, with extensive use of mathematics, the solution of one of the fundamental problems of seismology—that of the reflection-refraction of a spherical wave at the plane surface which separates the two media. The phenomena of propagation, so much discussed today, on which was founded the refraction method of seismic prospecting, are definitively explained by the formation of waves with conical fronts at the time of reflection. In addition are studied the kinematic discontinuities, of which the various wave fronts may be the seat. These discontinuities become very complex when conical fronts are formed. However, the essential

part of the phenomenon consists neither in the propagation of wave-front surface nor in the kinematic discontinuities of which they are the seat. It lies rather in the subsequent phases of the disturbance, which correspond to the "coda" of seismograms. This coda shows, at great distances from the epicenter, a characteristic aspect caused by the superimposing of complex phenomena designated by the author as pseudo-waves. The Rayleigh wave is a pseudo-wave whose structure is very different from that of the permanent harmonic phenomenon generally studied under that name in seismology. Besides the Rayleigh wave, there are many other pseudo-waves of varying types. Some are superficial like the Rayleigh wave and similarly characterized by an annular propagation. Others travel through the interior of the two media and not along their inner surface, and these are spherical or conical—*E. E., Franklin Inst. Jour., vol. 229, No. 5, 1940.*

5701. Finding and producing oil: Am. Petroleum Inst., 338 pp., Dallas, Tex., 1939. Price, $3.

This is an excellent concentrated manual on finding and producing oil, prepared by the Institute and assisted by 15 authors. There are 15 sections in which are included geological methods (46 pp.), geophysical methods (16 pp.), drilling, sampling, coring, surveying, production, testing, training, laws, associations, societies, manufacturers, drilling contractors, and fundamental research. Good reference lists accompany each section, some of which are longer than the articles they amplify. As an illustration of the compactness, only one page each is devoted to electrical logging, gravitational methods, and reflection methods of geophysical prospecting. Obviously, details are lacking—purposely. That is why it should prove a handy reference to one who wishes, first, a general viewpoint, and second, somewhere to turn for detail.—*Review in Econ. Geology, vol. 35, No. 3, 1940.*

5702. Johannsen, A., Descriptive petrography of igneous rocks, vol. 1, Introduction, textures, classifications, and glossary, 2d ed., 318 pp., illus., diagrams, charts, tables, Chicago, Univ. Chicago Press, 1939. Price, $4.50.

The first volume of this treatise is an introduction to the subject and contains definitions of textures, a selection of modern methods of classifying rocks, glossaries of general and textural terms, and a collection of tables. It contains several additional systems of classification and a complete glossary of all the rocks described.—*W. A.*

5703. Kemp, Garrett, Lecture notes on practical petroleum geophysics: Agr. and Mech. College of Texas Bull., 4th ser., vol. 11, No. 5, 65 pp., 44 figs., College Station, Tex., 1940.

The aim of this work is to satisfy the practical needs of those interested in producing petroleum. The subject matter is treated in a nonmathematical way. In this series of "lecture notes" the author outlines the following four main groups of geophysical methods of prospecting: (1) General principles and developments of geophysical methods—isostasy, gravitation, and pendulum; (2) general principles and applications of the gravimeter and torsion balance; (3) general principles and application of magnetism, the magnetometer and earth inductor, and temperature; and (4) general principles and application of seismology, the refraction and reflection methods, electrical methods, and the electrical-potential and electrical-resistivity methods.—*W. A.*

5704. Neumann, Frank, United States earthquakes, 1937, 55 pp., illus., U. S. Coast and Geodetic Survey, serial 619, Washington, 1940. Price, 15 cents.

This publication is a summary of earthquake activity in the United States and the regions under its jurisdiction for the calendar year 1937. Contents: (1) Introduction, (2) Instrumental results, (3) Non-instrumental results, (4) Miscellaneous activities, (5) Seismological observatory results, (6) Strong-motion seismograph results, (7) Tilt observations, and (8) Additions and corrections to previous publications.—*W. A.*

5705. Nickles, J. M., Siegrist, Marie, and Tatge, Eleanor, Bibliography and index of geology exclusive of North America, 1939, vol. 7, 522 pp., New York, Geol. Soc. America, 1940.

This volume contains a bibliography of the papers that were published in 1939 on the geology of the world, excluding North America. An alphabetic list of authors is followed by a comprehensive subject index.

5706. Rosaire, E. E., Handbook of geochemical prospecting, 60 pp., Subterrex, Houston, Tex., 1939.

A summary of the book is given in World Petroleum, vol. 11, No. 4, April 1940, as follows: "This handbook of geochemical prospecting is said to be the first of its kind and is worth reading by persons interested in the not uninteresting problem of finding new oil pools, even though it has much of the character of an advertisement of the services which Subterrex has to offer in the way of surveying and analyzing soils for telltale traces of petroleum. As here set forth, geochemical prospecting for oil is based on the known fact that traces of oil and gas have a tendency to leak out of buried petroleum deposits and find their way upward into the overlying formations and even in the top soil, where, by using refined methods, a chemist can find them. Where these hydrocarbons are found in amounts beyond the ordinary it is a moral certainty that a more or less valuable deposit of petroleum material is underneath. After all, the idea of setting a chemist to looking for oil is not really strange; many oil wells have been drilled on the evidence of visible oil and gas seeps; what the geochemical prospector does is to look for seeps that are not visible to the naked eye.

Although the theory of geochemical prospecting is thus very simple, in practice it requires close attention to details, and the geochemical prospector needs a considerable background of experience and knowledge in order that he may interpret what he finds. These matters are illuminatingly explained in the text. As the author freely admits, geochemical prospecting is one among many of the tools available to the oil prospector. However, indications are not lacking to forecast for it an increasing usefulness. Practically all visible oil and gas seeps have been preempted and exploited; the geophysicists are nearing or at least approaching the time when all possible structural traps will have been discovered, and an oil-hungry world will eventually have to depend on finding the stratigraphic traps that are beyond the ken of the geophysicist. It is in such work that geochemical prospecting will be called on. Even now the chemical oil prospector is in a position to render valuable help in evaluating and defining marginal and submarginal low-relief structural prospects."

5707. Tables of the exponential function e^x, 535 pp., Federal Works Agency, Work Projects Administration, 1939.

This volume is one of a series of mathematical tables prepared by the "Project for the computation of mathematical tables," conducted by the Federal Works Agency, Work Projects Administration, for the city of New York under the sponsorship of the National Bureau of Standards, Washington, D. C. The computation of all the entries in this volume was made to depend on the values of e^x and e^{-x} for certain selected key arguments.—*W. A.*

10. PATENTS

5708. Method of underground exploration; Gerald L. Hassler, Berkeley, Calif., assignor to Shell Development Co., San Francisco, Calif., a corporation of Delaware: U. S. patent 2,197,453, issued April 16, 1940.

In an apparatus for exploring underground formations for the presence of radioactive bodies, an elongated casing adapted to be lowered into a borehole; an electrical counter within the casing, said counter comprising an evacuated ionization chamber containing two electrodes; means to impress between said electrodes a potential below that necessary for sparking but sufficient to cause a momentary current to flow between the electrodes when an ionizing electrified particle from a radioactive body enters said chamber; means within said casing to amplify said current; a tubular hood of known absorbing power for radioactive radiation adapted to slide over said casing; means extending to the surface for causing a limited coaxial motion of said hood with regard to the casing; an electrical-indicating device at the surface; and means to convey to said device the amplified indications of the electrical counter. Claims allowed, 2.

5709. Borehole exploring apparatus; John W. Millington and William T. Evans, Beaumont, Tex., assignors by mesne assignments to Sperry-Sun Well Surveying Co., Philadelphia, Pa., a corporation of Delaware: U. S. patent 2,197,571, issued April 16, 1940.

This invention relates to borehole-exploring means comprising apparatus adapted to be lowered within a borehole, said apparatus including a motor and recording means operated by the motor; supporting means for said apparatus; and means controlled by lengthwise movements of the supporting means for effecting movements of said motor in proportion to the movements of the supporting means within the hole. Claims allowed, 5.

5710. Geochemical exploration; Leo Horvitz, Houston, Tex., assignor to Esme E. Rosaire, Houston, Tex.: U. S. patent 2,198,619, issued April 30, 1940.

This invention relates to the method of prospecting for buried hydrocarbon deposits by soil-gas analysis, which comprises the steps of collecting samples of soil from the earth near the surface; subjecting the samples to treatment to evolve the significant gases therein; removing from the gases all traces of water; subjecting the dehydrated gas to combustion; and analyzing the products of combustion for water formed by combustion by the entire free and combined hydrogen in the dry gas as an indication of relative proximity of the soil samples to the sought deposits. Claims allowed, 2.

5711. Method of logging boreholes; Lawrence F. Athy and Harold R. Prescott, Ponca City, Okla., assignors to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2,199,367, issued April 30, 1940.

This invention relates to a method of logging boreholes to determine the dips of the strata pierced thereby, including the steps of passing a current through the geological section pierced by the borehole; observing the potential difference between horizontally disposed electrodes positioned in a borehole adjacent a stratum being investigated; simultaneously observing the potential difference between vertically spaced electrodes positioned within the borehole adjacent the stratum being investigated; and ascertaining the dip of the stratum from said potential differences. Claims allowed, 8.

5712. Apparatus for making electrical surveys of boreholes; John C. Karcher, Dallas, Tex.: U. S. patent 2,199,705, issued May 7, 1940.

This invention relates to apparatus for exploring earth formations within a borehole; means comprising an electrode; means for raising and lowering said electrode in said borehole; means for passing electrical current between said electrode and a fixed point in the earth; means for measuring said electrical current; and means for switching said electrode from the current source to a second fixed point in the earth through a potential measuring device. Claims allowed, 5.

5713. Geophysical exploration by time-variant electric currents; Esme E. Rosaire and Samuel S. West, Houston, Tex., said West assignor to said Rosaire: U. S. patent 2,200,096, issued May 7, 1940.

This invention relates to geophysical exploration by time-variable electric currents wherein the waveform distortion caused by the media traversed by the current serves as a measure of the properties of said media, the method of eliminating extraneous electrical effects superposed upon the phenomena under examination comprising: Causing a current impulse of predetermined wave shape to flow in a portion of the earth's crust; detecting the superposed potentials resultant from said current and from the extraneous sources; impressing said potentials on an instrument for indicating waveform to produce a weak image of the indicated waveform; and repeating the current impulse and its resultant potential phenomena at such intervals of time that the superposed extraneous phenomena are not each time superposed in the same phase with respect to the current impulse and sufficient times to produce a strong latent image of the phenomena under observation with only weak images of the superposed phenomena. Claims allowed, 1.

5714. Core-taking device; Marcel Schlumberger, Paris, France, assignor to Société de Prospection Électrique, Procédés Schlumberger, Paris, France, a corporation of France: U. S. patent 2,200,683, issued May 14, 1940.

This invention relates to a device for shooting a projectile within a borehole, comprising a body adapted to be lowered or placed in said borehole and having a combustion of powder chamber therein; a firing tube adapted to chamber a projectile, said tube projecting into said chamber with the inner end spaced from a wall of said chamber and its outer end secured to a wall of said chamber and substantially flush

with the outer wall of said body; and means for igniting powder in said chamber. Claims allowed, 2.

5715. Electric earth transients in geophysical prospecting; Ludwig W. Blau and Louis Statham, Houston, Tex., assignors to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,202,369, issued May 28, 1940.

This invention relates to the method of investigating the properties of matter, which comprises passing a steady-state current between spaced electrodes in the matter; locating an equal potential line in said matter due to said steady-state current; locating a second pair of spaced electrodes on said equipotential line; changing the value of said current; and exhibiting a value indicative of the difference in potential between said receiving electrodes due to said changing current. Claims allowed, 7.

5716. Apparatus for determining horizon productivity of wells; Will S. Sease, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,202,404, issued May 28, 1940.

This invention relates to apparatus for determining the horizon productivity in a producing oil or gas well, which comprises an elongated case; means for changing the elevation of said case within said well; means within said case for holding a supply of liquid; means responsive to the velocity of the fluid flow adjacent the exterior of said case parallel to the longitudinal axis thereof for changing the level of said liquid; means for converting the changes in level of said liquid into electrical variations; and means for transmitting said electrical variations to the top of said well. Claims allowed, 5.

5717. Well-logging electrode; Cecil J. Haynes, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,202,656, issued May 28, 1940.

This invention relates to an electrode for borehole logging, comprising an elongated body of substantially uniform diameter throughout its length having a surface composed of electrical insulating material and having a section of its surface intermediate its ends perforated; a body of electrically conductive material of reduced cross sectional area mounted inside said perforated section and insulated from the remainder of said elongated body; a cable for suspending said elongated body in the borehole; and a conductor carried by said cable and connected to said electrically conductive body. Claims allowed, 9.

5718. Apparatus for geophysical exploration; Theodor Zuschlag, West Englewood, N. J., assignor to Hans T. F. Lundberg, Montreal, Quebec, Canada: U. S. patent 2,202,885, issued June 4, 1940.

This invention relates to an apparatus comprising two pick-ups adapted to change continuous mechanical vibrations into continuous electrical oscillations; a plurality of similar electrical resistances in circuit with said pick-ups; similar phase-shifting devices electrically connected to one said resistance in each circuit; and a direct-reading and balance-indicating device electrically connected to the said circuits for measuring the amplitude and phase relation of the artificially produced mechanical vibrations without the employment of a

recording device involving manual procedure for obtaining its indication. Claims allowed, 8.

5719. Method for seismic prospecting; William Gladstone Green, Tulsa, Okla.: U. S. patent 2,203,140, issued June 4, 1940.

In the method of geophysical prospecting in which a charge of explosive is detonated to create seismic waves of a plurality of frequencies, selected frequencies of said waves being detected after their reflection from the interfaces of the substrata and signals corresponding to the detected waves being recorded, the novel steps of improving the frequency spectrum of said seismic waves by generating an increasing pressure within a confined zone above the earth's surface; confining said pressure within a portion of said zone out of compressive contact with the earth's surface until said pressure has attained a predetermined value; thereafter abruptly releasing the pressure of said predetermined value; and applying this pressure uniformly over a definite area upon the earth's surface in a direction perpendicular to the earth. Claims allowed, 3.

5720. Apparatus for determining seismic velocities; Neil R. Sparks, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,203,272, issued June 4, 1940.

This invention relates to apparatus for determining seismic-wave velocities comprising a source of seismic waves located beneath but relatively close to the surface of the earth; a reference seismometer located below said source and separated from said source by a relatively large vertical distance and a substantial but relatively small horizontal distance; a well seismometer located below said reference seismometer and separated from said reference seismometer and from said source by substantial but relatively small horizontal distances and by vertical distances which are large relative to all of the distances previously mentioned, the direct wave path from said source to said reference seismometer being substantially equivalent as to seismic wave travel time with the same length of path starting from said source and measured in the direction of said well seismometer; and means associated with said seismometers for determining the time interval between wave arrivals at said two seismometers. Claims allowed, 4.

5721. Method and apparatus for use in determining the geologic nature and characteristics of a formation traversed by a borehole; John Jay Jakosky and Patrick B. Lyons, Los Angeles, Calif., assigned by direct and mesne assignments to Schlumberger Well Surveying Corporation, Houston, Tex., a corporation of Delaware: U. S. patent 2,203,729, issued June 11, 1940.

This invention relates to a method of determining the nature of the geologic formation traversed by a borehole at different depths. The steps comprise passing electric current through the earth between electrodes connected thereto, in such manner as to produce a flow of electric current through the formation adjacent the borehole in a direction substantially along and parallel to the bedding planes of the strata of the formation and also to produce a flow of current in a direction substantially transverse to the bedding planes of the said strata adjacent the borehole; and taking an electrical measurement indicative of the relation between an electrical characteristic of the formation in a direc-

tion substantially along and parallel to the bedding planes of the strata and a comparable electrical characteristic in a direction substantially transverse to the bedding planes of said strata. Claims allowed, 11.

5722. Method and apparatus for determining the strike and dip of subsurface strata; Curtis H. Johnson, Santa Monica, Calif.: U. S. patent 2,203,730, issued June 11, 1940.

This invention relates to the method of determining the strike and dip of substrata of the earth, which includes the steps of impressing a polarity on said substrata; determining the direction of said polarity prior to removing a sample from said substrata; removing a sample from said substrata; and determining the direction of said polarity in said sample after removing said sample from said substrata. Claims allowed, 20.

5723. Electrical logging of earth formations; Raymond T. Cloud, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,206,863, issued July 9, 1940.

This invention relates to the method of logging earth formations traversed by a well, which comprises measuring the ratio of the natural potential differences between each of two points within said well and a reference point in electrical contact with the earth. Claims allowed, 15.

5724. Electrical logging of earth formations; Raymond T. Cloud, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,206,864, issued July 9, 1940.

This invention relates to the method of logging earth formations traversed by a well, which comprises measuring a function of the difference between the substantially vertical natural potential gradients existing across each of two different zones disposed substantially vertically with respect to each other in said well. Claims allowed, 13.

5725. Electrical logging of wells; Paul F. Hawley, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,206,890, issued July 9, 1940.

This invention relates to a method of electrical logging comprising applying current to the ground at two points, one located near the surface of the earth close to a borehole and the other near the surface of the earth at least twice as far from said borehole, and measuring the potentials set up at various depths within said borehole. Claims allowed, 10.

5726. Electrical logging of earth formations; Paul F. Hawley, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,206,891, issued July 9, 1940.

This invention relates to the method of logging earth formations traversed by a borehole, which comprises passing two electrical currents into said borehole, the paths of said electrical currents in said borehole including different vertically disposed portions of the strata adjacent said borehole, and producing electrical effects responsive to the relative magnitude of said electrical currents. Claims allowed, 20.

5727. Electrical logging of earth formations; Paul F. Hawley, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,206,892, issued July 9, 1940.

This invention relates to the method of logging earth formations traversed by a well, which comprises passing an electrical current through the earth between an electrode in said well and a distant grounded electrode, and measuring and recording the potential difference between points above and below said electrode in said well. Claims allowed, 19.

5728. Method and apparatus for logging wells; Paul F. Hawley, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,206,893, issued July 9, 1940.

This invention relates to the method of logging earth formations traversed by a well comprising passing an electrical current through the earth between points on either side of said well whereby said current flows transversally across said well at various levels therein, and measuring the density of the portion of said current flowing across said well at a given level. Claims allowed, 20.

5729. Method and apparatus for electrical logging; Daniel Silverman, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., a corporation of Delaware: U. S. patent 2,206,894, issued July 9, 1940.

This invention relates to the method of logging subsurface strata traversed by a well, which comprises simultaneously passing an electrical current between each of two vertically spaced points within said well and at least one point in contact with the earth distant from said spaced points, and measuring a function of the relative magnitude of said electrical currents. Claims allowed, 14.

5730. Method and apparatus for electrical exploration of the subsurface; John Jay Jakosky, Los Angeles, Calif.: U. S. patent 2,207,060, issued July 9, 1940.

This invention relates to a method of electrical exploration of the subsurface, in which measurements are taken during the passage of an electric current through the earth, of an electrical variable which is influenced by said current and by inhomogeneities in the subsurface. The steps comprise taking a primary series of measurements of said electrical variable at different positions within a region to be explored, while successively passing an electric current between differently spaced pairs of points within said region in such manner that the measurements so obtained are influenced by inhomogeneities at different depths in said region and also by relatively near-surface inhomogeneities at said different positions; and taking an auxiliary series of measurements of said electrical variable at said different positions, while passing an electric current through the earth in said region in such a manner that the measurements so obtained are primarily indicative of relatively near-surface inhomogeneities at said different positions; whereby the measurements of the primary series may be corrected for the effects due to relatively near-surface inhomogeneities at said different positions, as determined by the measurements of said auxiliary series, to provide a corrected series of values indicative of inhomogeneities at different depths in said region. Claims allowed, 18.

5731. Method of electrical logging; Lawrence F. Athy and Harold R. Prescott, Ponca City, Okla., assignors to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2,207,280, issued July 9, 1940.

This invention relates to a method of logging boreholes, including the steps of passing an alternating current of predetermined frequency through the earth between two separated points adjacent the surface of the earth; receiving the potential difference between a point adjacent the earth's surface lying between said current source points and a point within a borehole; rejecting alternating potentials higher in frequency than the predetermined frequency; and measuring the remaining potential difference. Claims allowed, 10.

5732. Seismic method of logging boreholes; Lawrence F. Athy and Harold R. Prescott, Ponca City, Okla., assignors to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2,207,281, issued July 9, 1940.

This invention relates to a method of logging boreholes, including the steps of generating seismic waves of a predetermined frequency within a borehole; receiving seismic energy within a borehole at a plurality of points spaced from each other a predetermined vertical distance; converting respective seismic energies received into electrical energies in sympathy therewith; adding the electric energies; and recording the sum of said electrical energy. Claims allowed, 20.

5733. Seismic surveying; Francis M. Floyd, Houston, Tex., assignor to F. M. Kannenstine, Houston, Tex.; U. S. patent 2,207,398, issued July 9, 1940.

This invention relates to a method of geologic exploration, including the steps of creating elastic waves in the earth; translating into electrical impulses the waves so created; and amplifying and recording such band of frequencies, including the highest frequencies of the electrical impulses as will provide a usable amplitude of wave trace, and simultaneously varying the frequency amplification characteristic to lower the lower limit of said band of frequencies so amplified as a function of the time elapsed after the arrival of the initial elastic wave. Claims allowed, 4.

5734. Electric geological apparatus; Engineering Research Corporation, assignee of William Morris Barret, both of Shreveport, La., United States of America: Canadian patent 386,705, issued February 6, 1940.

In an electromagnetic means of determining geologic features, an apparatus comprising a generator of electromagnetic waves; a means of maintaining constant the frequency of the waves of said generator; a means of adjusting the power level of said generator; a means of maintaining constant the power level of said generator; and an antenna adapted to concentrate in the earth a large part of the electromagnetic energy radiated by said generator. Claims allowed, 16.

5735. Seismic surveying system; Stanolind Oil & Gas Co., Tulsa, Okla., assignee of Western Geophysical Co., assignee of Raymond T. Cloud, both of Los Angeles, Calif., United States of America: Canadian patent 387,159, issued February 27, 1940.

This invention relates to a method of seismic surveying, comprising receiving first refracted and then reflected artificial seismic waves at a point at or near the surface of the earth; converting the received seismic waves into electrical waves; amplifying and recording said

electrical waves gradually; and continuously increasing the amplification of said electrical waves, in a definite and predetermined relation to time, from the time at which said refracted waves are received to the time at which said reflected waves are received, whereby the effects of high-energy refracted waves and low-energy reflected waves are recorded in the same operation. Claims allowed, 22.

5736. Geophysical-prospecting method; Esme Eugene Rosaire, coinventor with and assignee of Leo Horvitz, both of Houston, Tex., United States of America: Canadian patent 387,692, issued March 26, 1940.

In the art of exploration for subterranean deposits from which leakage of gaseous constituents occurs, whereby such constituents become entrained in the soil at points remote from the deposits, the method of locating such deposits by determining the entrained constituents, comprising the steps of systematically procuring soil samples in a predetermined area; vaporizing the volatilizable contents of said soil samples; and analyzing said contents quantitatively for the entrained constituents in the soil samples. Claims allowed, 9.

5737. Seismic surveying method; Stanolind Oil & Gas Co., Tulsa, Okla., assignee of Western Geophysical Co., assignee of Henri Salvatori and James N. Walstrum, coinventors, all of Los Angeles, Calif.: Canadian patent 388,428, issued April 30, 1940.

This invention relates to the method of profiling at least one subsurface stratum, which comprises producing seismic waves at a first source; receiving seismic waves from said first source after reflection from said stratum at two or more reception points spaced from said source and out of line therewith; recording the effects of said seismic waves as a plurality of traces on a common record; producing seismic waves at a second source spaced from said first source and out of line with said reception points; receiving seismic waves from said second source after reflection from said stratum at said reception points; and recording the effects of said last-mentioned seismic waves as a plurality of traces on a second common record, the length of the reflected wave path between said first source and one of said reception points being substantially the same as the length of the reflected wave path between said second source and the other of said reception points, and said two reflected wave paths having substantially identical reflection points on said subsurface stratum. Claims allowed, 19.

5738. Method of electrical coring; L. M. Alpin: Russian patent 56,025, issued November 30, 1939.

This invention relates to the method of electrical coring. The method is characterized by the fact that the electrodes inside of the borehole are disposed in such a manner that the difference of the potentials between the electrodes (M) and (N) is kept in proportion with the voltage drop in the direction transverse to the axis of the borehole. Claims allowed, 5.

5739. Method of electrical coring of cased boreholes; L. M. Alpin: Russian patent 56,026, issued November 30, 1939.

This invention relates to the method of coring cased boreholes. The method consists of lowering the electrodes into the boreholes, keeping the electrodes sliding along the surface of the casing, and measuring

the difference in potentials caused by the current spreading over the casing. Claims allowed, 3.

5740. Magnetic variometer; D. S. Mikov: Russian patent 56,148, issued December 31, 1939.

This invention relates to a magnetic variometer provided with magnetic needles balancing on a prism. For determining the horizontal and the vertical components of the terrestrial magnetism, the vertical axis of the small cube with prisms is turned with respect to the magnetic axis of the needles at an angle of 45°. Claims allowed, 2.

5741. Apparatus for measuring temperature in boreholes; R. V. Yudkevich: Russian patent 56,254, issued December 31, 1939.

This invention relates to apparatus for measuring temperature in boreholes by using a Wheatstone bridge and is characterized by the fact that one of the arms of the bridge, which is on the upper surface of the holder, has a metal covering applied by electrolytic process. To reduce the thermal inertia of the apparatus the arm of the bridge mentioned above is made from oxidized aluminum wire. Claims allowed, 2.

5742. Gravimeter; V. H. Dakhnov: Russian patent 56,427, issued January 31, 1940.

This invention relates to a gravimeter containing a metal thread under strain, produced by means of a weight and inserted into the branch of the Wheatstone bridge balanced at the reference value of the force of gravity. Claims allowed, 1.

INDEX

[The figure in parentheses refers to the class in which the entry stands; see list in table of contents]

	Abstract
Alpin, L. M. (10)	5738, 5739
American Petroleum Institute (9)	5701
Athy, L. F. (10)	5711, 5731, 5732
Atwill, E. R. (8)	5681
Barret, W. M. (10)	5734
Bereskin, M. A. (8)	5689
Birch, Francis (2)	5611
Blau, L. W. (10)	5715
Boaga, Giovanni (1)	5602
Bogdanov, A. I. (4)	5649
Bonetti, Alberto (8)	5682
Bossolasco, Mario (4)	5650
—— (8)	5682
Bowie, W. (1)	5603
Brant, Arthur (2)	5612
—— (4)	5612
Browne, B. C. (1)	5604
Bullard, E. C. (1)	5604
Butler, A. J. (2)	5616
Cagniard, Louis (9)	5700
California Mining Journal (editorial) (8)	5694
Canadian Min. Met. Bull. (editorial) (5)	5669
Cloud, R. T. (10)	5723, 5724, 5735
Collie, C. H. (5)	5665
Commonwealth of Australia, Parliament of (8)	5678, 5679
Continental Oil Co. (10)	5711, 5731, 5732
Coulomb, J. (3)	5624
Currie, B. W. (8)	5651
Dakhnov, V. N. (9)	5652
—— (10)	5742
Dalmasso, Fernando (3)	5625
Dauvillier, Alexandre (2)	5613
Eby, J. B. (8)	5684
Eckhardt, E. A. (3)	5626
Engineering and Mining Journal (editorial) (8)	5686
Engineering Research Corporation (10)	5734
Evans, W. T. (10)	5709
Federal Works Agency (9)	5707
Fedotov, P. F. (3)	5627
Ferchev, M. (4)	5662
Ferri, Francesco (2)	5614
Flerova, O. V. (8)	5685
Floyd, F. M. (10)	5733
Gay, M. W. (1)	5605
Green, W. G. (10)	5719
Hallimond, A. F. (2)	5616
Harris, Sidon (3)	5628
Haskell, N. A. (3)	5628, 5648
Hassler, G. L. (10)	5708
Hawley, P. F. (10)	5725, 5726, 5727, 5728
Haynes, C. J. (10)	5717
Honda, H. (3)	5629
Honnell, P. M. (3)	5630
Horvitz, Leo (10)	5710, 5736
Houghton, H. M. (3)	5631
Ito, H. (3)	5629
Jakosky, J. J. (10)	5721, 5730
Jenny, W. P. (2)	5617
Johannsen, A. (9)	5702
Johnson, C. H. (10)	5722
Kannenstine, F. M. (10)	5733
Karcher, J. C. (10)	5712
Kemp, Garrett (9)	5703
Leet, L. D. (8)	5687
Linehan, Daniel (3)	5632
Logachev, A. A. (2)	5618
Löwy, H. (4)	5653
Lundberg, Hans (7)	5672
—— (10)	5718
Lutz, W. (5)	5666
Lyons, P. B. (10)	5721
Malchevski, V. S. (4)	5662
Malyi, F. A. (7)	5673
Marsch, B. (2)	5619
McDermott, Eugene (7)	5674
McMaster, Harold (5)	5667
Meres, M. W. (3)	5635, 5636
Merritt, J. W. (7)	5675
Mikov, D. S. (10)	5740
Millington, J. W. (10)	5709
Mining and Industrial Magazine of Southern Africa (editorial) (8)	5680
Montgomery, C. G. (5)	5668
Montgomery, D. D. (5)	5668
Morita, M. (3)	5633
Mortimer, C. H. (3)	5634
Muskat, M. (3)	5635, 5636
Nesterov, L. J. (8)	5688, 5689, 5690
Nesterova, M. A. (8)	5690
Neumann, Frank (9)	5704

	Abstract
Neumann, Gerhard (1)	5606
—— (2)	5620
Newton, H. W. (2)	5621
Nickles, J. M. (9)	5705
Nye, P. B. (4)	5655, 5656, 5657, 5658, 5659 5660
Ogg, A. (2)	5622
Oil and Gas Jour. (editorial) (8)	5677
Oil Weekly (editorial) (8)	5692
Patterson, W. D. (3)	5637
Pendse, C. G. (1)	5607
Petrucci, Guiseppe (4)	5654
Pool, M. L. (5)	5667
Prescott, H. R. (10)	5711, 5731, 5732
Prey, A. (1)	5608
Ramirez, J. E. (3)	5638
Rayner, J. M. (4)	5655, 5656, 5657, 5658, 5659, 5660
Riznichenko, G. V. (3)	5639, 5640, 5641
Roaf, D. (5)	5665
Rosaire, E. E. (9)	5706
—— (10)	5710, 5713, 5736
Rössle, Per (3)	5642
Royal Astronomical Society of Canada (editorial) (8)	5683
Russell, H. N. (8)	5691
Salvatori, Henri (10)	5737
Schenk, Erwin (2)	5623
Schlumberger, Marcel (10)	5714
Schlumberger Well Surveying Co. (10)	5721
Schmidt, Adolf (4)	5661
Schoene, H. J. (2)	5619
Sease, W. S. (10)	5716
Sellien, K. (1)	5609
Semenov, A. S. (4)	5662
Shell Development Co. (10)	5708
Shepard, E. R. (3)	5643
Siegrist, Marie (9)	5705
Siemens, Günter (1)	5610
Silverman, Daniel (10)	5729
Société de Prospection Électrique (10)	5714
South African Min. Eng. Jour. (editorial) (2)	5615
—— (7)	5676
Sparks, N. R. (10)	5720
Sperry-Sun Well Surveying Co. (10)	5709
Standard Oil Development Co. (10)	5715, 5717
Stanolind Oil & Gas Co. (10)	5716, 5720, 5723, 5724, 5725, 5726, 5727, 5728, 5729, 5735, 5737.
Statham, Louis (10)	5715
Stick, J. C. (4)	5663
Sutton, A. H. (8)	5697
Taft, R. B. (5)	5670
Tatge, Eleanor (9)	5705
Thomas, J. E. (8)	5693
Volutsky, V. S. (3)	5644, 5645
von Thyssen, Stephan (3)	5646, 5647
—— (8)	5695
Walstrum, J. N. (10)	5737
Weber, George (8)	5696
Weller, J. M. (8)	5697
West, S. S. (10)	5713
Western Geophysical Co. (10)	5735, 5737
White, Gifford (4)	5664
Widess, M. B. (3)	5648
Wood, A. E. (3)	5643
Worthington, E. B. (3)	5634
Yosimura, Y. (3)	5633
Yudkevich, R. V. (10)	5741
Zabelli, Arnaldo (8)	5698
Zanetti, Renzo (6)	5671
Zavistovski, V. S. (8)	5699
Zuschlag, Theodor (10)	5718