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GEOPHYSICAL ABSTRACTS 103

OCTOBER–DECEMBER 1940

COMPILED BY

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CONTENTS

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GEOPHYSICAL ABSTRACTS 103, OCTOBER–DECEMBER 1940

Compiled by W. Ayvazoglou

1. GRAVITATIONAL METHODS

5743. Brockamp, B., Die Anwendung der Geophysik im Salzgitterer Gebiet [Application of geophysics in the Salzgitter region]: Metall. u. Erz, vol. 37, No. 1, pp. 1–6, Halle (Saale), 1940.

The writer describes some geophysical investigations of deposits of brown iron ore in the Salzgitter region. Seismic and torsion-balance measurements were made. Although no detailed information on the location of iron ore was obtained by seismic methods, owing to the similarity between the elastic properties of the iron ore and of the surrounding rocks, nevertheless seismic investigations made it possible to locate large areas of probable iron-ore deposits. Salt domes were delimited by torsion-balance measurements, and the depths of salt deposits were established by the seismic-reflection method. Measurements of the resistivity and porosity of rocks penetrated by drilling were made by electrical methods. The writer shows, in several maps and profiles, the results of the geophysical investigations, and finally he gives a geologic profile of the Salzgitter region that is based on data obtained from the electrical investigations of the boreholes.—*W. A.*

5744. Bullen, K. E., The problem of the earth's density variation: Seismol. Soc. America Bull., vol. 30, No. 3, pp. 235–250, Berkeley, Calif., 1940.

The present paper examines the problem of the earth's density variation and includes a quantitative discussion of the errors likely to be involved. Figures are given for the density distribution of the earth's outer mantle, and it is shown that all these are probably accurate within about 0.05 gm./cm.^{3} On the figures presented, the density in the earth's mantle ranges from 3.32 gm./cm.^{3} at the base of the crustal layers, to 5.68 gm./cm.^{3} at the base of the mantle. The mean density of the central core is shown to be 10.7 gm./cm.^{3} within an error of order 0.1 gm./cm.^{3} Application of equations derived by Birch from Murnaghan's theory of finite strain indicates agreement with the density figures found, but it is to be noted that the rigidity of the lower portion of the earth's mantle appears to increase more slowly with increase of depth than would be consistent with the equations of Birch. Values which are expected to need very little future amendment are also given for the pressure and gravitational attraction within the earth's mantle.—*Author's abstract.*

5745. Eckhardt, E. A., A brief history of the gravity method of prospecting for oil: Geophysics, vol. 5, No. 3, pt. 1, pp. 231–242, Menasha, Wis., 1940.

An historical outline of the development of the gravity method of prospecting is presented. While the early gravity work with pendulum

equipment was for geodetic purposes alone, the increased instrumental sensitivity made available with the development of the torsion balance by Eötvös (1888) led in 1915 to the first gravimetric survey for oil prospecting in the Egbell field, Czechoslovakia. The application of the method to prospecting in the United States started in 1924 with the discovery of the Nash dome in coastal Texas by a torsion-balance survey. The development and use of improved pendulum equipment is discussed, and finally the recent marked increase in gravity work resulting from the introduction of the gravimeter about 1930 to 1935.—*Author's abstract.*

5746. Gennaro, Ida, Determinazione di gravita relativa tra l'Instituto Idrografico della R. Marina in Genova ed il vertice di 3° ordine Montecastello, eseguita nel 1934 [Determining the relative gravity, as made in 1934, between the Royal Naval Hydrographic Institute in Genoa and the third-order station at the top of Montecastello]: R. Accad. Lincei Rend., vol. 29, No. 7, pp. 312–319, Rome, 1939.

The writer discusses the results of gravitational measurements that were made in 1934 in Genoa and Montecastello. The difference in gravity between these two stations was determined by means of Sterneck's double pendulum. Montecastello is near a subterranean body of low density. A gravity value of 980.557 at Genoa having been assumed, the observed value for Montecastello was determined to be 980.435.—*W. A.*

5747. Ising, Gustaf, Über die Eichung von astasierten Gravimetern [On the calibration of astatized gravimeters]: Arkiv mat. astron. och fysik, vol. 27, No. 1 (art. No. 4), 13 pp., Stockholm, 1940.

This article is written to disprove a statement in Graf's article "On the determination of the gravimeter constant in a freely suspended spring-system" (see Geophys. Abstracts 97, No. 4888) that the calibration of astatized gravimeters cannot be made accurately. The author defines "astaticism" and derives a formula applicable to the determination of the accuracy of any astatized gravimeter by showing, among other things, that the statement made in Graf's article is based on an error. The relations between the gravimeter described by the author and an astatized pendulum having almost vertical position are examined in detail. Finally the author gives the results of some measurements made in 1938 between Stockholm and Copenhagen with two gravimeters. These measurements may serve as experimental evidence of attained accuracy of calibration, which is estimated to be about one-half percent.—*Author's abstract, translated by W. A.*

5748. Johnston, W. D., Jr., Gravity section across the Sierra Nevada: Geol. Soc. America Bull., vol. 51, No. 9, pp. 1391–1396, Washington, D. C., 1940.

In 1939 the Coast and Geodetic Survey occupied 11 pendulum gravity stations, approximately 12 miles apart, extending from Sacramento to Reno across the northern part of the Sierra Nevada. Eight stations located upon predominantly granodiorite bedrock showed negative isostatic anomalies ranging from −4 to −44 milligals, and their average is about the same as the average of the anomalies of the 62 pendulum stations in the California-Nevada block. Three stations, located upon the belt of Carboniferous and Jurassic sediments, have positive isostatic anomalies ranging from +6 to +16 milligals. The positive anomalies are near areas of gabbro and are believed to express the excess mass of gabbro intrusives extending downward from the surface to a depth of about 5,000 to 10,000 feet.—*Author's abstract.*

5749. Lukavchenko, P., and Ivonin, A., Gravitational work with the variometer in the Caspian lowland of the Turkmen Socialist Soviet Republic [in Russian]: Razvedka Nedr, vol. 11, No. 2/3, pp. 41–47, Moscow, 1940.

The authors outline briefly the geologic structure of the Caspian lowland, where several oil-bearing regions were investigated, and they show the results in maps of (1) anomalous values of gravity, and (2) gradients of gravity. They believe that the results obtained so far are significant and that the gravimetric survey should be continued.—*W. A.*

5750. Mott-Smith, L. M., Gravimeter in world-wide exploration: World Petroleum, vol. 11, No. 7, pp. 64–67, New York, 1940.

The author discusses briefly the application of the gravimeter, which for many practical purposes has replaced the torsion balance, and mentions improvements of the instrument and an interesting new development of a gravimeter that can be submerged in water. Photographs show the conditions under which gravimeter parties have to work in many parts of the world.—*W. A.*

5751. Pentz, H. H., Formulas and curves for the interpretation of certain two-dimensional magnetic and gravitational anomalies: Geophysics, vol. 5, No. 3, pt. 1, pp. 295–306, Menasha, Wis., 1940.

Curves and formulas for the interpretation of the two-dimensional "dike" and "step" are given because they offer an easy, rapid method of solving all cases to which they apply. Horizontal and vertical polarization of the bodies are considered. This method applies to torsion-balance surveys and to magnetic surveys where the horizontal and vertical components of the earth's magnetic field are measured. Two curves for the interpretation of an anomaly in terms of a point pole (or a point mass) are given. The depth to the two-dimensional structures is considered, with formulas and curves.—*Author's abstract.*

5752. Sajina, N. B., Results of gravitational variometric work in the central part of the Dnepr-Donets Valley [in Russian]: Razvedka Nedr, vol. 10, No. 5, pp. 39–48, Moscow, 1940.

The author describes some detailed gravitational variometric work in the central part of the Dnepr-Donets Valley. He shows by means of maps the distribution of stations at which observations were made, as well as the gradients of gravity of the Mount Zolotukha anomaly in the Romni region and of the Dmitrovsk anomaly in the Chernigov region. He concludes that the cap rock, breccia, and salt deposits of the region investigated are well defined, and he interprets them in many profiles.—*W. A.*

5753. Vening-Meinesz, F. A., Earth's crust deformation in the East Indies (Provisional paper): K. Ned. Akad. Wetensch. Proc., vol. 43, No. 3, pp. 278–293, Amsterdam, 1940.

For further investigation of the results of the gravity expeditions with submarines of the Netherlands Navy, new tables for regional isostatic reduction have been prepared. The system published in the Bulletin géodésique, No. 29, 1931, has been applied to give different degrees of regionality. Details of the method are given. The tables have been made for five different values of l, that is, 10, 20, 40, 60, and 80 km., corresponding to values of the outer boundary t of 29.05, 58.10, 116.20, 174.30, and 232.40 km. In the fundamental tables the compensation has been assumed to be distributed uniformly over a depth H below sea level,

and the tables comprise all values of H from 0 to 60 km. From these tables others have been derived for practical use in which the compensation extends from a depth of 30 km. to a depth of $30+4.45\ S$, where S is the height of the typography above sea level. The new tables adopt the system of hydrostatic equilibrium of the crust but assume the root at the lower boundary of the crust to be broader according to a bending of the crust, instead of its sinking locally under the load of the topography. Some conclusions derived from the results of these reductions for the East Indies are given. Later, maps of the anomalies and a great many profiles for all the values of l are to be published, and a comparison can be made.—*R. S. R., Sci. Abstracts, vol. 43, No. 510, 1940.*

5754. Zahradnicek, Josef, Gajdos, T., and Nespor, R., Elektrisches Gravimeter [Electrical gravimeter]: Phys. Zeitschr., vol. 41, No. 5, pp. 109–110, Leipzig, 1940.

Very small capacity changes, and thus also changes in length, can be measured by the method of superposition. Relative displacements of 10^{-7} can still be measured by using Whiddington's method. The author applies this method for measuring changes of g with the aid of the deflection of a loaded spring. The normal gradient of g is 3×10^{-7} for 1 m. and may be measured with the apparatus. A detailed description of the apparatus and of the measurements made with it will appear in a future publication.—*Kühne's abstract in Physikal. Ber., vol. 21, No. 9, 1940, translated by W. A.*

2. MAGNETIC METHODS

5755. Bartels, J., and Johnston, H. F., Geomagnetic tides in horizontal intensity at Huancayo, part 1: Terres. Magn. and Atmos. Electr., vol. 45, No. 3, pp. 269–308, Baltimore, Md., 1940.

Following an introductory survey of the main features of the solar and lunar daily variations S and L in horizontal intensity H in January at Huancayo—days with conspicuous lunar influences—geomagnetic tides are discussed. A separation of S and L on such "big-L-days" is attempted. Daily ranges A and H are then introduced for the study of the intensity of S and thereby of the solar wave radiation W. Up to international character figures $C=1.1$, A is found independent of changes in the solar corpuscular radiation P. Various methods for studying L are compared. Lunar semimonthly waves in the ranges A are computed and discussed in their change with season and sunspot cycle. In the months November to March, when L is larger than in the rest of the year, L and S increase in their effects on A proportionally to each other from sunspot minimum to sunspot maximum, but around June, when L is small, it does not participate in the change of S with the sunspot cycle. The day-to-day variability of S and L is studied in some detail; S and L fluctuate rather independently of each other, and the relative fluctuations of L seem to be greater than those of S. The elimination of the lunar effect A_L is described; $(A\text{-}A_L)-A_S$ is proposed as a measure for W.—*Authors' abstract.*

5756. Bartels, J., Heck, N. H., and Johnston, H. F., Geomagnetic 3-hour-range indices for the years 1938 and 1939: Terres. Magn. and Atmos. Electr., vol. 45, No. 3, pp. 309–337, Baltimore, Md., 1940.

The paper gives 3-hour-range indices K for seven observatories for July 1, 1938, to December 31, 1939 (table 1), world-wide 3-hour-range

indices K_w for 1938 and 1939 (table 2, which will be used most often), and, based on K_w, daily indices B (table 3) and monthly frequencies and averages (table 4). Section 1 contains all the information necessary for using these tables in geophysical or ionospheric work. Sections 2 to 5 show how the indices K are standardized by means of keys for transforming K into reduced indices K_r. The world-wide K_w is introduced as an average of the reduced indices K_r, in which the K_r from polar stations enter with higher weight than the K_r from equatorial stations. K_w is proposed as a measure of the intensity P of solar corpuscular radiation.—*Authors' abstract.*

5757. Bartels, J., Solar radiation and geomagnetism: Terres. Magn. and Atmos. Electr., vol. 45, No. 3, pp. 339–343, Baltimore, Md., 1940.

Solar-wave radiation, W, and corpuscular radiation, P, may be estimated in their variations of intensity by their geomagnetic effects. A classification of magnetic storms is proposed, and geomagnetic evidence for the traveltimes of solar corpuscles is discussed.—*Author's abstract.*

5758. Bartels, J., Sonnenstrahlung und Erdmagnetismus [Sun radiation and earth magnetism]: Zeitschr. Geophysik, vol. 16, No. 3/4, pp. 101–104, Brunswick, 1940.

The author establishes that variations of intensity of the radiation of the solar waves, W, and of the corpuscular radiation, P, can be estimated by earth magnetism. The variations of the intensities of W and P are parallel to the 11-year cycle of the sunspots. A classification of magnetic storms is proposed.—*W. A.*

5759. Brant, Arthur, Geophysical work at Steeprock Lake, 1938–39: Canadian Min. Jour., vol. 61, No. 9, pp. 573–574, Gardenvale, Quebec, 1940.

The writer discusses briefly the results of the magnetic and electrical surveys at Steeprock Lake in 1938–39 and draws the following conclusions: "(1) It is apparent that where suitable differences in electrical properties exist, rock formations beneath lakes may be delineated by electrical-resistance measurements. Waters of most lakes, owing to dissolved sulfides, carbonates, etc., will be sufficiently conducting to carry the currents well down into the underlying rock materials as desired; (2) from the magnetic work it is apparent that limestone-lava contacts, for example, can be traced and faults indicated if they are marked by less magnetic, leached gouge material; (3) when the magnetic rock formations are roughly tabular in form approximate calculations of their dip and depth below the surface may be made from a vertical-intensity profile curve."—*W. A.*

5760. Burger, A., Potsdamer erdmagnetische Kennziffern [Potsdam's magnetic character numbers]: Zeitschr. Geophysik, vol. 16, No. 3/4, pp. 185–195, Brunswick, 1940.

A series of magnetic character numbers is given for November 1939 to April 1940, inclusive. Daily sums, frequencies, and daily variations of single numbers are shown in tables and by graphs. A comparison is given of the results obtained for 1938 and 1939.—*Author's abstract, translated by W. A.*

5761. Burmeister, F., Über die Bestimmung der Temperatur eines schwingenden Magneten [On determining the temperature of an oscillating magnet]: Zeitschr. Geophysik, vol. 16, No. 3/4, pp. 125–126, Brunswick, 1940.

The usual method of measuring the temperature of an oscillating magnet is sufficiently accurate for work in observatories but requires improvements for field work. The writer describes a new method that uses a second thermometer, summarizes in a table the results of 368 temperature observations made with the two thermometers, and shows the temperature differences between these thermometers. He concludes that in order to obtain more accurate data in field work the method of two thermometers should be applied.—*W. A.*

5762. Chapman, S., and Miller, J. C. P., The statistical determination of lunar daily variations in geomagnetic and meteorological elements: Royal Astron. Soc. Monthly Notices, Geophys. Suppl., vol. 4, No. 9, pp. 649–669, London, 1940.

In paragraphs 3–17, this paper gives the mathematical theory which underlies the method we have developed for the determination of lunar daily harmonic component variations in meteorological and geomagnetic elements; in such data the lunar variations are overlain by much larger solar daily and irregular variations. In paragraph 18, the theoretical formulae, which for brevity have been expressed largely in terms of complex plane vectors, are interpreted in real terms, and a brief outline is given of the actual computations by which the amplitudes and phases of the lunar daily component variations are obtained from the data; paragraphs 19 and 20 determine certain phase corrections to the results, and paragraph 21 gives a list of the principal symbols used, in the order of their introduction.—*Authors' abstract.*

5763. Éblé, Louis, Gibault, Gaston, and Tabesse, Émile, Sur la perturbation magnétique du 24 mars, 1940 [The magnetic disturbance of March 24, 1940]: Acad. sci. Paris Comptes rendus, vol. 210, No. 15, pp. 542–543, Apr. 8, 1940.

Details are given of the changes in declination and horizontal and vertical intensity at Chambon and Nantes during this intense magnetic storm. At Mascart the magnitudes have been exceeded only three times since 1883. The magnetic storm occurred simultaneously over several regions with difficulties in signaling and a most exceptional auroral display. This magnitude is rarely attained in these latitudes, and it was of remarkable duration. It was followed 4 days later by another prolonged magnetic storm.—*R. S. R., Sci. Abstracts, vol. 43, No. 510, 1940.*

5764. Fanselau, G., Vorläufige Ergebnisse der erdmagnetischen Beobachtungen in Niemegk im Jahre 1939 [Preliminary results of terrestrial magnetic observations in Niemegk in 1939]: Zeitschr. Geophysik, vol. 16, No. 3/4, pp. 181–185, Brunswick, 1940.

The results of observations in Niemegk are summarized in four tables, which show (1) preliminary average monthly values for 1939; (2) normal values 1934.0–1941.0; (3) secular variations; and (4) magnetic activity 1937–39.—*W. A.*

5765. Fox, E. F., The geophysical and geological investigation of the Far East Rand: Geol. Soc. of South Africa Trans., vol. 42, January–December 1939, pp. 83–182, Johannesburg, 1940.

Subsurface exploration of the Far East Rand from 1933 to the end of 1936 is discussed. The area under discussion lies, generally speaking, between Springs and Bethal, in the Transvaal. The magnetic method of geophysical prospecting, together with core drilling as an auxiliary phase, was used. The vertical magnetic balances used in the field were built on the principle advocated by A. Schmidt. The area was systematically explored by parallel straight-line traverses, which were run 1,000 to 2,000 feet apart, with the interval between stations normally 100 feet. The intensity was plotted as usual, but the finished curve was smoothed; then isanomalies were drawn through points of equal intensity at intervals of 200 gammas. The results are shown on two plates. A map shows the position of boreholes and magnetic anomalies. The subsurface geology, as revealed by drilling and geophysical data, is described in detail.—*W. A.*

5766. French, C. A., and Madill, R. G., Magnetic results 1927–37: Pubs. of the Dominion Observatory, vol. 11, No. 7, pp. 261–326, Ottawa, Canada, 1940.

The magnetic survey of 1927–37 was devoted mostly to obtaining secular-change data in order to reduce the results to that period. Some progress was made, however, in extending the survey to include new areas, notably in the regions of the Hudson Bay, Hudson Strait, James Bay, and eastern Arctic. The author summarizes in a table the field operations of the survey during the above-mentioned period and describes the instrumental equipment that was used.—*W. A.*

5767. Geophysical Section, United States Geological Survey: Scales for evaluating components of magnetic attraction, released October 5, 1940.

A set of scales has been developed by the Geophysical Section of the Geological Survey, United States Department of the Interior, by means of which magnetic anomalies caused by geologic bodies of any size or shape or any known or assumed distribution of magnetization may be evaluated.

Although these scales were originally constructed for evaluating magnetic anomalies, they are equally useful for solving problems involving all fields that follow the inverse square law, such as gravitational attraction, electric fields, and intensity of illumination.

A set of 39 scales, drawn on a scale modulus of 1 in. equals 1 unit, on two sheets (ser. 1, pts. 1 and 2) suitable for mounting, has been photolithographed from a master set prepared by the Section of Geophysics. The set contains one scale for each multiple of half a unit from 1 to 20 units inclusive. The scale values are computed for a point source of pole strength of 1,000 magnetic units.

The charts are purchasable from the Director, Geological Survey, Washington, D. C., for 25 cents each (50 cents a set).

5768. Hiphsich, Adolf, Magnetische Störungen der steirischen Grauwackenzone [Magnetic disturbances in the Styrian graywacke area]: Berg- u. hüttenm. Monatsh., vol. 87, No. 11, pp. 193–202, Leoben, 1939.

Magnetic disturbances that appear irregularly in the Alpine graywacke area are predominantly restricted to sharply inclined layers. They can be attributed to rock masses of small extent and of distinct mag-

netic properties. The central points of most of these disturbances are at small depths. The complicated geologic structure makes accurate quantitative interpretation difficult.—*Author's abstract, translated by W. A.*

5769. Inglis, D. R., and Teller, E., On a proposed thermoelectric origin of the earth's magnetism: Phys. Rev., vol. 57, No. 12, pp. 1154–1155, Lancaster, Pa., 1940.

It has been suggested that the earth's magnetism might arise from thermoelectric forces within the earth, the asymmetrical thermal distribution being due to material convection guided by Coriolis forces from the earth's rotation. The observed heat flow through the crust so limits the possible velocities and temperature differences that the Coriolis force seems to be inadequate by about a factor of 10^6.—*Authors' abstract.*

5770. McNish, A. G., Physical representation of the geomagnetic field [abstract]: Phys. Rev., vol. 57, No. 11, p. 1088, Lancaster, Pa., 1940.

The general magnetic field of the earth may be represented to within the reliability of the observations by a dipole near the center (moment 8×10^{25} c. g. s. units), giving rise to about 80 percent of the field, and 14 secondary radially directed dipoles (average moment 0.1×10^{25} c. g. s. units) located at specified positions midway between the surface of the earth and its center, giving rise to the remainder of residual field. Secular change can be represented by the yearly addition of 13 dipoles of equal strength (moment 1.4×10^{22} c. g. s. units) at the same depth as the dipoles of the residual field. Continuance of secular change at the present rate for 100 years would thus build up a new residual field. Interpretation of this model leads to the belief that (1) at least a considerable portion of the earth's magnetism (the residual field) originates at a lesser depth than the central core revealed by seismological evidence, and (2) secular change involves this residual field and therefore is due to changes taking place between the surface of the earth and the surface of the central core.

5771. Medovsky, I. G., Survey of the Poltavski coal fields by geophysical methods [in Russian]: Razvedka Nedr, vol. 11, No. 2/3, pp. 35–40, Moscow, 1940.

The resistivity method, the natural-potential method, and the magnetic method were applied in a survey of the Poltavski coal fields. A geologic interpretation of the results of the survey was made by obtaining data from each of the three methods and plotting the data on the same geologic map of the region—a map on which each geophysical method was represented by different shading. Figures obtained from this map serve as the key for a general interpretation of the results, which the writer gives on a complex map. Coal-bearing zones of varying importance were traced.—*W. A.*

5772. Nagata, Takesi, Some physical properties of the lavas of the Volcanoes Asama and Mihara—Magnetic susceptibility: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 18, No. 1, pp. 102–134, 1940.

Magnetic surveys and continuous observations of geomagnetic variations have been made recently on several active volcanoes. The values of the magnetic susceptibility of the lavas and ashes ejected from these volcanoes and the remanent of magnetism in them may be useful in interpreting the results of the magnetic surveys. The author presents

in this paper the results of his studies on the magnetic susceptibility of rocks ejected from the Volcanoes Asama and Mihara, which are discussed, as much as possible, from the chemist's and the petrologist's point of view. The instruments used are described. The following facts have been established: (1) The specific susceptibility of rocks is, roughly, proportional to the amount of magnetite in them; (2) the degree of susceptibility may depend on the chemical composition of the rocks, as well as on the size of the ferromagnetic minerals in them; (3) the value of susceptibility increases with increase in intensity of the external magnetic field; (4) the intensity of the remanent magnetization is closely related to the rate of change of susceptibility in various magnetic fields. Further quantitative results from a larger number of samples will be reported in the near future.—*W. A.*

Pentz, H. H., Formulas and curves for the interpretation of certain two-dimensional magnetic and gravitational anomalies. *See* Geophys. Abstract 5751.

5773. Turtzev, A. A., Magnetic properties of brown iron ores of the Kerch Peninsula [in Russian]: Trudy Inst. Geol. Nauk, Akad. Sci. U. S. S. R., vol. 21, No. 7, pp. 23–28, Moscow, 1940.

A study of the magnetism of the brown iron ores of the Kerch Peninsula was undertaken to determine the effects of the manganese in the ore on the magnetic susceptibility and to ascertain whether it would be possible to apply the magnetic method for the quantitative determination of manganese in the ore. Values of μ are given in tables. The dependence of μ on the manganese content of the ore has been established only in specimens that contain much manganese. The application of the magnetic method to quantitative determination of manganese in the brown iron ores investigated gave negative results. The magnetic susceptibility is probably proportional to the content of manganese in the same deposit, and where this is so the writer considers it possible to apply the magnetic method.—*W. A.*

5774. Tzu-Chang-Wang, Eine einfache Methode zur Bestimmung der magnetischen Suszeptibilitäten von Gesteinen in schwachen Feldern [A simple method for determining the magnetic susceptibilities of rocks in weak fields]: Zeitschr. Geophysik, vol. 16, No. 3/4, pp. 160–181, Brunswick, 1940.

To obtain a hysteresis curve a rock sample is secured in a swinging position within a magnetizing coil, and different field intensities are applied. Periods of oscillation are measured with a stop watch, or by photographic registration if greater accuracy is desired. If only slight accuracy is required, the torsion method or the deflection method may be used.—*Author's abstract, translated by W. A.*

5775. Valle, G., and Tribulato, G., New magnetometric apparatus for measuring the vertical component of the earth's field: Nuovo Cimento, vol. 16, No. 11, pp. 441–446, Pisa, November 1939.

An apparatus is described for determining the vertical component of the earth's field by compensating it exactly with an opposing auxiliary magnetic field. The attainment of exact neutralization is determined by the absence of movement in a ferromagnetic wire carrying an alternating current. The method is capable of considerable accuracy.—*S. J. G., Sci. Abstracts, vol. 43, No. 509, 1940.*

5776. Wasserfall, K. F., Variation of magnetic character numbers of Dombas Observatory: Terres. Magn. and Atmos. Electr., vol. 45, No. 1, pp. 1–4, Baltimore, Md., 1940.

The character number for Dombas is based on absolute storminess for *D*. This is the sum of the deflections in gammas of the 24 hourly means of the day from a normal line representing undisturbed conditions. A table shows the good agreement between the monthly mean values for 1937 of character figures *D* at Dombas and the international character figure *C*. The two 11-year periods, 1917–27 and 1928–38, show also a good agreement for the mean monthly values but not so good in the mean annual variation from year to year. The departures are small from 1926–38, but considerably greater from 1917–25. To obtain parallelism with sunspot values the scale has to be displaced 2 years.—*R. S. R., Sci. Abstracts, vol. 43, No. 510, 1940.*

3. SEISMIC METHODS

5777. Balensiefer, E., Büttner, Kurt, Pfleiderer, H., and Wetzel, W. W., Untersuchungen über die Bodenunruhe auf Sylt [Investigations concerning ground disturbance at Sylt]: Zeitschr. Geophysik, vol. 15, No. 7/8, pp. 337–364, Brunswick, 1939.

This is a joint work by geophysicists, meteorologists, geologists, and bioclimaticists. The Bioclimatic Research Station in Westerland was headquarters for the investigation. Several types of seismic apparatus recently developed were used for conducting the experiments. Ground movements were registered by a galvanometer after amplifying them by special circuits in order to make it possible to record these movements electromagnetically. The main records were of disturbances of the ground caused by surf at a distance of 100 to 200 m. from the shore line. Frequencies corresponded to the number of waves within a time interval of about 7 sec. One superimposed vibration of about a 3-min. interval was assigned to the oscillation of a sandbank. The causes of different frequencies recorded by seismograms are discussed in order to establish whether in each seismogram the oscillations of the shore are involved or whether the differences should be assigned to stratification or oscillations produced directly. The amplitudes depended mainly on underwater profiles of the part of the coast investigated. The disturbance of the ground increased with the angle of slope of the coast and decreased with the distance at which sand bars occur in front of the coast. A strong increase of the disturbance was observed when squally winds arose. The distance reached by the disturbance of the ground was only about 2 km. The authors are therefore in doubt whether the general disturbance of the ground of the European mainland can be attributed to the surf.—*Schmerwitz's abstract in Physikal. Ber., vol. 21, No. 8, 1940, translated by W. A.*

Brockamp, B., Application of geophysics in the Salzgitter region. *See* Geophys. Abstract 5743.

5778. Bullard, E. C., Geophysical study of submarine geology: Nature, vol. 145, No. 3681, pp. 764–766, London, 1940.

The basic problem of submarine geology is to devise methods of making maps of the ocean that are comparable in detail and accuracy with maps of land areas. To devise such methods, it is essential to determine (1)

the depth of the sea, and (2) the geographic position at which the depth is measured. Measuring the depth is easy and rapid with an echo sounder; determining the position of a ship when a sounding is made is difficult, especially if the ship is out of sight of land. The writer describes the method of "radio acoustic ranging," which was developed by the United States Coast and Geodetic Survey and which obviates this difficulty. Coring (by firing a tube into the sea bottom from a gun lowered from a ship), seismic methods, and measurements of gravity are means by which useful information about the geology of shallow seas may be obtained. The writer hopes that the problem of accurate surveys in mid-ocean will eventually be solved by developing a variation of the seismic method that can be used in deep water.—*W. A.*

5779. Bullen, K. E., The Wairarapa earthquake of August 5, 1917: New Zealand Jour. Sci. Technology, vol. 21, No. 6b, pp. 296b–301b, Wellington, 1940.

It is shown that the epicenter of the Wairarapa earthquake of 1917, August 5 dy. 15 hr. 50 min. (G. M. C. T.) was near the point 40.8° S., 176.0° E., within an uncertainty of about half a degree. This constitutes a shift of an order approaching 200 miles from the originally assigned epicenter of this earthquake, and the various implications of this rather large shift are discussed.—*Author's abstract.*

5780. Fryxell, F. M., The earthquakes of 1934 and 1935 in northwestern Illinois and adjacent parts of Iowa: Seismol. Soc. America Bull., vol. 30, No. 3, pp. 213–218, Berkeley, Calif., 1940.

The writer gives an account of the earthquakes of November 12, 1934, and January 5, 1935, which he compares with the earlier earthquakes of May 26, 1909, and January 12, 1912. He concludes that although the earthquakes of 1934 and 1935 involved an area that overlaps the seismic areas of the earthquakes of 1909 and 1912, their epicenters are quite distinct. The recent earthquakes are therefore probably not related genetically to the earlier ones. Some genetic connection between the earthquakes of 1934 and 1935 may be assumed; possibly they both originated as a result of two slight movements on a deep-seated fault within the epicentral area.—*W. A.*

5781. Hayes, R. C., Report for the year ending December 31, 1939 [Extract from the annual report of the Department of Scientific and Industrial Research, 1939–40]: Dominion Observatory Bull. R 25, 6 pp., Wellington, 1940.

This report contains information on the work of the Dominion Observatory concerning (1) time service, (2) astronomy, (3) seismology, (4) workshop, (5) centennial exhibits, and (6) publications. It also contains a map of epicenters of earthquakes that were determined in 1939.—*W. A.*

5782. Hodgson, E. A., Committee on vault construction, first report: Eastern Section, Seismol. Soc. America, 18 pp., 1940.

The summary of the report, written by E. A. Hodgson, chairman of the committee, and presented at the fifteenth annual meeting, Cincinnati, Ohio, 1940, reads as follows: "It seems difficult, if not impossible, to draft a set of optimum specifications for building a seismograph vault. The problem of which of several possible sites to select at any particular new station is one which must be considered by itself. There are a few general observations which may be made, however, on the basis of the

experience summed up in this report. These are selected and stated by the writer and may be said to reflect his opinion of the deductions which may be drawn from the investigation. They should be examined critically, with a view to their amendment by the other members of the Committee, by those collaborating in the study, and by the Eastern Section, at the session of the Cincinnati Meeting devoted to this phase of the program."

5783. Honnell, P. M., Production testing of seismometers: Oil and Gas Jour., vol. 39, No. 14, pp. 57–58, Tulsa, Okla., 1940.

The writer describes in detail the procedure in testing seismometers on a quantity-production basis. He classifies seismometer tests as follows: *Mechanical tests:* (1) Over-all physical dimensions; (2) weight of seismometer suspended mass; (3) spring constant; (4) free damping due to mechanical hysteresis; (5) natural period. *Electrical tests:* (1) Insulation resistance; (2) resistance and impedance of winding; (3) gap-flux density. *Transducing tests:* (1) Damping; (2) e. m. f. response for applied velocity drive as a function of frequency; (3) seismometer-phase response against a standard as a function of frequency.—*W. A.*

5784. Iida, Kumizi, Velocity of elastic waves in a granular substance: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 17, No. 4, pp. 783–808, 1939.

In the present experiments, the elastic properties of certain kinds of granular masses are studied. The relations between the wave velocity and the elements, such as grain size, closeness of packing, water content, and binding material held by the grains, were studied. It was ascertained that the wave velocity through a granular mass is proportional to the sixth root of its height, to the cube root of the ratio of the elastic constant to the density of the grains, and to the constant due to the condition of packing. It was obtained by simple theory that the wave velocity is independent of the diameter of the individual grains. There is a tendency, however, for the measured velocity to increase slightly with increase in the diameter of the grains, but its value may be considered almost constant. The elastic constants of a grain are comparable with those of a solid block of material as deduced by simple theory and experiments. The wave velocities through a granular mass are much smaller than those through a column that is a solid block. It was found that the velocities decrease either with increase in the water content or with increase in porosity. Empirical formulas showing the relation between these two elements were derived. Model aggregates of the grains and paraffin and mizuame (millet jelly) were prepared to represent the conditions under which substances are deposited by nature on the earth's surface. The wave velocity in these model aggregates exceeds not only that obtained by the mass of the grains alone, but also the mean value of that in each component substance. It was proved, however, that the velocity depends greatly on the ratio of the volume of one substance to another.—*Author's abstract.*

5785. Jeffreys, Harold, On *P* up to 20° in North America: Seismol. Soc. America Bull., vol. 30, No. 3, pp. 225–234, Berkeley, Calif., 1940.

A search was made for earthquakes observed at several stations within 20°, preferably about the same azimuth or with well-determined epicenters. The author found it sufficient to use the "International Seismological Summary" residuals against the Jeffreys-Bullen table. The

chief change from the Jeffreys-Bullen table is the application of the ellipticity correction, which seldom exceeds 0.2 sec. within 20° and which will be nearly the same for these shocks as for the European and Japanese ones because the mean latitude of the epicenters is about the same, and hence direct comparison in this range with the Jeffreys-Bullen table is practically equivalent to the theoretically better method of applying correction and then comparing with the corrected table. The author concludes the article as follows: "In the comparison of mean residuals by ranges of distance for European and North American earthquakes I found that from 20° to 70° the differences American-European showed a systematic decrease, which was what would be expected if increasing distance in American earthquakes implied increasing angle of descent through a region of somewhat lower velocity. Also the American residuals within 20° show signs of an increase with distance, which is what should be expected on this hypothesis. The standard errors were such that neither phenomenon could be asserted on those data alone, but so far as the data go they support the present suggestion. On the whole the conclusion is that there is some evidence for a slightly lower velocity of P in North America than in Europe and Japan, but the amount of the difference is seriously uncertain, and the data used here are not enough to provide times of transit for North American earthquakes comparable in accuracy with those for European and Japanese ones; and the comparison between short and large distances is also not yet satisfactorily determined."—*W. A.*

5786. Kanai, Kiyoshi, Theory of the aseismic properties of the brace strut (sudikai) in a Japanese-style building, part 4—The effect of material inner damping: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 17, No. 4, pp. 695–712, 1939.

In his previous paper (see Geophys. Abstracts 101, No. 5495) the author studies wave scattering of the vibrational energy into the ground as affecting the aseismic properties of the brace strut. The present investigation shows that the effect of the inner damping of the material on the aseismic properties of a braced structure is quite similar to that on wave scattering.—*W. A.*

5787. Kanai, Kiyoshi, Theory of the aseismic properties of the brace strut (sudikai) in a Japanese-style building, part 5—Model experiment confirmations: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 17, No. 4, pp. 713–721, 1939.

In his previous paper (see abstract 5786) the author ascertained mathematically that if damping of inner resistance or wave scattering exists in a structure, the brace struts used in the same structure will be effective both in reducing the resonance amplitudes and in increasing the natural frequency of the structure. In the present paper the author describes the model experiments—made specially for horizontal motion—that confirm the theory. He describes the methods used in the experiments and shows the results in diagrams and tables.—*W. A.*

5788. Lecornu, Léon, Sur la propagation des ondes sphériques [On the propagation of spherical waves]: Acad. sci. Paris Comptes rendus, vol. 208, No. 16, pp. 1185–1188; No. 18, p. 1444; and No. 19, p. 1540, 1939.

This is a contribution to the theory of propagation of waves in solid media. The writer considers a homogeneous, isotropic, elastic, and boundless body, inside of which a disturbance originates, and he inves-

tigates the spherical waves that appear at great distances, R, from the center of the disturbance. He shows that if R is of great value, longitudinal waves can never become parallel. He further shows that to produce transversal waves the disturbances cannot have a symmetrical center. He finally compares the results with those of the Fresnel elastic-ether theory.—*W. A.*

5789. Lee, F. W., Farnham, F. C., and Raspet, A., The seismic method for determining depths to bedrock as applied in the Lowell quadrangle, Massachusetts: Massachusetts Dept. Public Works, U. S. Dept. Interior, Geol. Survey, Cooperative geologic project, Special paper 3, 46 pp., Boston, Mass., 1940.

An introductory description of the geology of the Lowell quadrangle is given by L. W. Currier. The purpose of the seismic survey was to provide additional information that might serve in solving problems, particularly of water supply, disposal of objectionable fluids, dam sites, bridgeheads, and public roads. In their conclusion the authors say: "The results of the survey indicate clearly that a bedrock channel now filled with glacial drift exists beneath the terrace plain of the broad valley between Lowell and Chelmsford and that, contrary to earlier theories, this channel does not continue southeasterly to the Boston Basin but bends to the northeast just south of the city limits of Lowell. Its course from that position cannot be interpreted without further work. The probable existence of smaller gravel-filled rock channels as tributaries to the larger channel is indicated by seismic profiles. Such channels, as well as the main channel, may be potential sources of ground water. The general lithologic character of the underlying beds can be rationally interpreted in some places when the seismic data are considered, together with the areal geology as known from observations of exposures in the surrounding areas. Such geologic control of geophysical interpretations is an important and vital part of geophysical investigations. No particular difficulties of technique are involved, except that wherever possible the central observation and recording apparatus should be housed on a truck. The ordinary microphone type of pick-up has sufficient sensitivity and is to be preferred to the more complicated amplifier types for this class of work. The seismic method can be operated in densely populated areas without causing any serious property damage."

Maps and diagrams illustrate the paper.—*W. A.*

5790. McCready, H. J., Interpretation of seismograms: Mines Mag., vol. 30, No. 8, pp. 439–443, 462, Denver, Colo., 1940.

The writer discusses some factors involved in the quantitative and qualitative interpretation of seismograms, but he does not consider the final reduction of the interpreted data to contour maps. He concludes that the solution of any problem in correlation entails a background of practical experience and knowledge and a logical application of theory. He supplies a bibliography referring to articles that are more detailed than this article is.—*W. A.*

5791. New Zealand seismological reports: Dominion Observatory, Provisional Bulls. 101, 102, 2 pp. each, Wellington, July and August 1940.

The bulletins are divided into two parts: Part 1 gives the principal phases recorded from distant earthquakes, and part 2 gives a summary

of local earthquakes. Whenever they are definitely indicated, the trace amplitude and the direction of the vertical component of P are given. A list of provisional epicenters in the southwest Pacific (outside the New Zealand region) is also given.—*W. A.*

5792. Savarenski, E., Heterogeneity of the earth's structure according to seismic data: Acad. U. R. S. S. Comptes rendus (Doklady), vol. 27, No. 1, pp. 17–21, Moscow, 1940.

The writer attempts to give the results of investigations of regional traveltime curves for large areas of the globe. He uses the data of seismic stations and earthquake foci in these areas in an effort to construct the boundaries between areas on various parts of the globe under which the properties of matter are different. The data, grouped for three regions and shown on a map, were taken mainly from the "International Seismological Summary" for the period 1923–33. Data from 90 stations and 34 earthquakes were taken to obtain 1,031 points for use in plotting the Eurasian traveltime curve; data from 44 stations and 77 earthquakes to obtain 615 points for the Pacific traveltime curve; and data from 67 stations and 31 earthquakes to obtain 610 points for the American traveltime curve.

He represents in two tables the results of this treatment of the traveltime curves. He makes the following hypothetical statements: (1) The existence of foci for deep earthquakes and the very intensive transverse waves radiated by them testify in all probability to the existence of a layer possessing the properties of a solid body and extending down to the first boundary of decrease in velocity increments; (2) the decrease in velocity beginning at the boundary mentioned may be explained by the assumption that the rocks above the boundary are crystalline and those below it vitreous; (3) the transition from one crystalline phase to another is accompanied by liberation or absorption of energy, as well as by changes in volume, which changes in volume may possibly be the cause of deep-focus earthquakes; (4) crystallization inside the earth may result from slow cooling.

He points out that the former conception of the earth's structure, under which it was supposed to be subdivided into a solid part and a viscous mantle with a "quiet" boundary between, is highly schematic and contradicts the fact that deep earthquakes exist. Moreover, it disagrees with the conclusions reached in the present work.—*W. A.*

5793. Schmerwitz, Gerhard, Ausgleichung der $\overline{P}$-Wellen Einsätze des Bebens vom 11 Juni 1938 in Belgien [Evaluation of the arrival times of the $\overline{P}$-wave in the earthquake of June 11, 1938, in Belgium]: Zeitschr. Geophysik, vol. 16, No. 3/4, pp. 119–125, Brunswick, 1940.

A new method of evaluating the arrival times of $\overline{P}$-waves of the earthquake in Belgium is applied for the reevaluation of these motions, published recently by Somville. The existence of a comparatively great focal depth is proved. The velocity of waves propagated from this depth is smaller than the mean value previously assumed. It is shown that the new fundamental values agree with the times determined at the stations, and the probable error, as determined from the squares of the residuals, is only half as large.—*Author's abstract, translated by W. A.*

5794. Schmerwitz, Gerhard, Die Bedeutung des Ausgleichungsverfahrens für die Auswertung von Nahbeben-Seismogrammen [The importance of the compensation method for evaluating near-earthquake seismograms]: Zeitschr. Geophysik, vol. 15, No. 7/8, pp. 365–371, Brunswick, 1939.

The author rectifies erroneous opinions about the value and effectiveness of the compensation method as applied to the evaluation of seismograms from nearby earthquakes. By means of a numerical example, calculated in all details, he proves that the reliability of data on focal depths and other elements obtained by this method is greater than that attainable by any other method.—*Author's abstract, translated by W. A.*

5795. Sezawa, Katsutada, and Kanai, Kiyoshi, Dispersive Rayleigh waves of positive or negative orbital motion and allied problems: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 18, No. 1, pp. 1–10, 1940.

From mathematical investigation it is ascertained that the two known kinds of dispersive Rayleigh waves differ entirely in the nature of their orbital motions. The waves corresponding to the first dispersion curve are transmitted with an orbit of sense opposite to that of gravitational waves, whereas those corresponding to the second dispersion curve do so with an orbit of the same sense as that of gravitational waves. That there is such a fundamental difference between the two kinds of dispersive Rayleigh waves is also confirmed by treating the orbital motion of Rayleigh waves in a semi-infinite body on which concentrated masses are distributed. It is shown that, in the latter condition of the body, there are two dispersion curves for Rayleigh waves, one curve being in the range from zero to infinity in wave length and the other in a narrow range, namely, that of relatively small wave lengths. The orbital motion of the waves corresponding to the second dispersion curve is of the same sense as that of gravitational waves, whereas the orbital motion of waves corresponding to the first dispersion curve is reversed. These features agree well with those of dispersive Rayleigh waves that are transmitted through a stratified body.

After treating the problem of Love waves in a semi-infinite body on which concentrated masses are distributed, it was found that the velocity of the Love-type waves in question is intermediate between the velocities of the two kinds of Rayleigh waves indicated by the two dispersion curves, as a result of which it may be that transverse body waves partly contain Rayleigh waves (of orbital motion of the same sense as that of gravitational waves) that correspond to the second dispersion curve.—*Authors' abstract.*

5796. Soske, J. L., Requirements of a modern seismograph service: Mines Mag., vol. 30, No. 8, pp. 429–434, Denver, Colo., 1940.

The author points out that those parts of the country that are favorable for seismological prospecting have already been investigated. Future reflection work will therefore require the best equipment available, combined with a highly developed technique. Desirable improvements are discussed for (1) recording units, (2) seismometers, (3) amplifiers, (4) amplitude control, (5) automatic gain expander, (6) galvanometers, (7) number of recording channels, (8) recording systems, (9) computing methods, (10) research and development, (11) drilling equipment, and (12) survey progress. In the last part of the article the author gives some figures on the cost of seismograph exploration, discusses the general differences between various seismograph services, and directs

attention to the necessity of examining the experience record of the personnel of a seismological party.—*W. A.*

5797. The earth's interior (editorial note): Nature, vol. 145, No. 3676, p. 599, London, 1940.

K. E. Bullen has examined the recent developments in knowledge of the earth's interior (Acta astron., vol. 4, April 1939). The most recent estimate of Gutenberg and Richter shows a radius of the core of 2,920 km., and work on near earthquakes suggests the existence of various crustal layers extending to a depth of the order of 30 km. from the surface of the earth. According to Bullen, if the variation of density between the earth's crustal layers and the central core were continuous, the moment of inertia of the central core would have to be 0.57 Ma^2, where M is mass of core and a is radius of core. This being in excess of the value 0.40 Ma^2, which would hold for a homogeneous sphere, it would appear to indicate a virtually impossible distribution of matter inside the central core. Thus, some assumption made in obtaining these estimates appeared to need amendment. The amendment suggested by Bullen is that there is a change of material at a depth of the order of several hundred kilometers.

On account of the 20° discontinuity in the traveltime graph of P waves from earthquakes, which appears to be fairly well established, Jeffreys has suggested either an abrupt change at a depth of 474 km. (uncertainty 20 km.) or an appreciable variation from 300 to 700 km. below the earth's surface. Incidentally, 700 km. gives the depth of focus of the deepest focus earthquake yet recorded. Price and Lahiri have recently suggested a change of material at a depth of approximately 700 km. in the earth on the evidence of variation of electrical conductivity. Following work by Olczak, Jeffreys, Bernal, Benfield, and himself, Bullen suggests the following distribution of matter within the earth:

	Depth	*Density range*
Normal olivine layer	30–474 km.	3.32– 3.69 gm. cm.$^{-3}$
Cubic olivine layer	474–2920 km.	4.24– 5.57 gm. cm.$^{-3}$
Central core	2920–6361 km.	9.77–12.29 gm. cm.$^{-3}$

Concerning further density changes within the earth, Gutenberg and Richter have recently directed attention to the possibility of variation within the core itself.—*Reprint of the note.*

5798. Ulrich, F. P., Seismological work of the Coast and Geodetic Survey during 1938 in the region adjoining the Pacific coast of the United States: Seismol. Soc. America Bull., vol. 30, No. 3, pp. 261–272, Berkeley, Calif., 1940.

The work of the Coast and Geodetic Survey during 1938 in the part of the United States adjoining the Pacific coast included that of the Seismological Field Survey. The primary purpose was to obtain as completely as possible both instrumental and observed data on earthquakes in the western part of the United States. This article contains a summary of the following work during 1938: *Questionnaire program:* 2,692 questionnaire cards relating to 339 earthquakes were received. *Seismic field investigations* were made of the earthquake of February 12 in the Santa Cruz region, the earthquake of September 11 in the Humboldt Bay region, and the earthquake of September 27 in the Salinas Valley region. *Teleseismic work:* From the middle of February to the end of December 515 shocks were recorded. The hydrograph chart for 1938 from Boulder

Dam is shown. The Coast and Geodetic Survey continued the operation of teleseismic instruments at Tucson, Ariz.; at Ukiah, Calif.; and cooperatively at Bozeman, Mont. *Strong-motion work:* The Coast and Geodetic Survey now operates in the western United States 42 accelerographs, 6 displacement meters, and 11 Weed strong-motion seismographs; 24 records were obtained from 9 shocks. *Tiltmeter work:* During the year 3 tiltmeters were kept in operation at Berkeley. The tiltgrams for 1938 are shown. *Seismic acoustics:* The work consists in placing delicate microphones in deep wells and recording the noises picked up. So far no definite conclusions on the preliminary results obtained could be drawn. *Vibration work:* Ground-vibration observations, 60; building-vibration observations, 75; combined building and ground observations, 22; shaking-table observations, about 700. Special efforts were made to study the characteristics of the various instruments. For that reason, shaking-table tests were numerous. *Instrumental developments:* Intensive studies have been made of shaking-machine tests on several instruments. Some time has been spent in developing magnetic damping for the present displacement meters. A brief description is given of a new ground-vibrating machine, designed and constructed by Lieutenant Commander Patterson, and of 3 new vibration meters of the Neumann-Labarre type that have been built. *Washington office:* This office cooperated with the Massachusetts Institute of Technology in connection with shaking-table work in appraising strong-motion records and testing the differential analyzer as a means of making the double integration computations. The "Earthquake history of the United States," a publication of the Coast and Geodetic Survey, was completed and released in 1938.—*W. A.*

5799. Weatherby, B. B., The history and development of seismic prospecting: Geophysics, vol. 5, No. 3, pt. 1, pp. 215–230, Menasha, Wis., 1940.

An historical outline of the development of modern seismic-prospecting methods is presented. Particular attention is given to a review of the very early work, which laid the foundations upon which a rapid growth of the art took place when the facilities for adequate instrumentation became available.—*Author's abstract.*

5800. Westland, A. J., and Heinrich, R. R., A macroseismic study of the Ohio earthquakes of March 1937: Seismol. Soc. America Bull., vol. 30, No. 3, pp. 251–260, Berkeley, Calif., 1940.

On March 2 and March 9, 1937, earthquakes of destructive intensity occurred near the town of Anna, some 90 miles north of Cincinnati, in western Ohio. These earthquakes are of seismological interest for two reasons: (1) Because of their intensities in a region that was considered relatively free from destructive seismic shocks; and (2) because they were so well recorded by the seismograph stations of the United States and Canada as to enable accurate determinations of their epicenters. The present paper summarizes the results of the study. Two isoseismal maps of the earthquakes and three tables show: (1) Examples of damage done by the earthquake of March 2, 1937; (2) rotation effects of the earthquakes of March 1937; and (3) an incomplete list of earthquakes of western Ohio. In conclusion the authors say: "While all the macroseismic evidence suggests that the immediate origin of the earthquakes of western Ohio is probably tectonic, their ultimate cause or causes may be most complex. Geologic evidences of tectonic folding and faulting

are lacking in the region. There is, in fact, every possibility of a connection between the seismic activity and the regional structural pattern which is expressed near the surface by the Lima axis of the Cincinnati arch. If such is the fact, the ultimate cause may be the same as that which operated to produce this geologic feature."—*W. A.*

5801. Wilson, J. T., The Love waves of the South Atlantic earthquake of August 28, 1933: Seismol. Soc. America Bull., vol. 30, No. 3, pp. 273–301, Berkeley, Calif., 1940.

The epicenter of the South Atlantic earthquake of August 28, 1933, was located at 58°56'S., 24°54'W., and the time of occurrence fixed as $22^h19^m38^s$ U. T. A study was made of the first motion of *P*. On the assumption that the earthquake was caused by a fault movement, the strike of the fault was determined as between N. 33° W. and N. 1° E., and the dip as between 63° E. and 76° E. By integration of the seismograms the earth motion during the *G* (Love-waves) phase was determined at 17 stations. This was found to agree with the theoretical surface wave of Love. A study of the dispersion of *G* yielded the following conclusions. The crustal structure of the Atlantic Ocean region is very similar to that of the Indian and Pacific regions, and is characterized by having material with a high velocity for shear waves much nearer the surface than is observed in the continental regions. The thickness of the crustal structure in continental regions is about 30 to 40 km.—*Author's abstract.*

5802. Yosiyama, Ryoiti, Elastic waves from a point in an isotropic heterogeneous sphere, part 2: Tokyo Imp. Univ., Earthquake Research Inst., Bull., vol. 18, No. 1, pp. 41–56, 1940.

In his previous paper (see Geophys. Abstracts 51, No. 1468) the author studied theoretically the waves propagated through a heterogeneous medium. There he worked out a general solution in special coordinates (t, β, φ), the origin of which coincides with the center of the disturbance. In this paper he discusses the waves propagated through another particular heterogeneous medium in which rigidity $\mu=0$, whereas λ (elastic constant) and ρ (density) vary with r (distance). He shows analytically the propriety of interpreting t as traveltime of disturbance. The solution of waves thus obtained he considers to be helpful in elucidating the question not only of the nature of the waves in the earth's core as usually accepted, but also of sound waves in the atmosphere and of atmospheric oscillations.—*W. A.*

4. ELECTRICAL METHODS

5803. Bashlykin, I. I., and Perkov, N. A., Results of electrical logging in the coal fields of Dombarovsk and Bredinsk [in Russian]: Razvedka Nedr, vol. 11, No. 4, pp. 39–43, Moscow, 1940.

Diagrams of electrical logs from several boreholes drilled in the coal fields of Dombarovsk are given. More than a hundred coal layers that were missed by observations during the drilling were disclosed by electrical logging.—*W. A.*

Brant, A. A., Geophysical work at Steeprock Lake, 1938–39. *See* Geophys. Abstract 5759.

Brockamp, B., Application of geophysics in the Salzgitter region. *See* Geophys. Abstract 5743.

5804. Dakhnov, V. N., On the nature of the natural electric fields in coal deposits [in Russian]: Razvedka Nedr, vol. 10, No. 5, pp. 48–52, Moscow, 1940.

The oxidation-reduction hypothesis of the origin of electric fields in coal deposits is discussed from many data obtained in the electrical logging of boreholes and other field work. The author suggests that this hypothesis be accepted, as it explains the origin of natural potentials in coal layers by oxidation of the coal or of pyrite. Also, he shows that the intensity of anomalies of *SP* (spontaneous polarization) increases in steep deposits and becomes greater with increase of carbonization and electrical conductivity of coals. Further investigations are, of course, necessary to confirm this hypothesis.—*W. A.*

5805. Diakonov, D. I., Conditions for rational application of logging in oil fields and methods of interpreting the diagrams obtained by logging [in Russian]: Neftianoe Khoziaistvo, vol. 21, No. 4/5, pp. 20–26, Moscow, 1940.

The writer enumerates requirements for making the work of electrical logging of boreholes successful. He discusses the following stages in interpreting the results of logging: (1) Interpreting each diagram individually; (2) systematizing data according to different deposits; (3) correlating diagrams; and (4) combining diagrams obtained by logging.—*W. A.*

5806. Fritsch, Volker, Die Bedeutung geoelektrischer Faktoren bei der Uberprüfung von Blitzableitererden [The importance of geoelectric factors in testing lightning arresters]: Zeitschr. Geophysik, vol. 16, No. 3/4, pp. 149–160, Brunswick, 1940.

The writer shows by an example that the results of measurements for the installation of lightning rods may be greatly distorted if the geoelectric factors affecting the ability of the ground to conduct lightning discharges are not taken into consideration. He discusses the application of geophysical measurements.—*W. A.*

5807. Gilbert, R. D., Interpretable method of electrical prospecting: Min. Jour., vol. 24, No. 4, pp. 5–7, Phoenix, Ariz., 1940.

The author describes a successful application of an electrical method of prospecting as employed in the Philippine Islands by a mining geologist who had had no formal training in geophysical prospecting. The method, which is simple and cheap, is based on the "Single leapfrog method" (see Eve and Keys "Applied Geophysics," 1929, pp. 80, 81). The author describes in detail the equipment used and the field procedure developed by himself. He recommends the method for mine scouting if good floats or relatively obscure outcrops are found.—*W. A.*

Medovsky, I. G., Survey of the Poltavski coal fields by geophysical methods. *See* Geophys. Abstract 5771.

5808. Petrucci, Giuseppe, Su un nuovo modo d'impiego delle onde elettriche per la prospezione dei giacimenti buoni conduttori [A new method of applying electric waves in prospecting for deposits of good conductivity]: Industria min. d'Italia e d'Oltremare, vol. 14, No. 3, pp. 49–52, Rome, 1940.

The writer describes an appartus that contains transmitting and receiving units and that is suitable both for measuring the intensity of secondary waves and for determining the change in the direction of

the magnetic vector of the primary waves. The apparatus is applicable in prospecting for deposits of good conductivity at shallow depths.—*W. A.*

5809. Rayner, J. M., and Nye, P. B., The southern extension of the Pine Creek gold field, Pine Creek district: Aerial, Geol., and Geophys. Survey of Northern Australia, Rept. 25, pp. 11–16, Canberra, 1937.

A brief summary is given of the main geophysical lay-out on the southern extension of Pine Creek and the southeast end of the line of ridges that form the Pine Creek gold field. The area surveyed was 99 acres. The total length of traverses was 32,800 ft., and the average length of traverse surveyed per working day was 2,050 ft. The main problem of the geophysical survey was to trace the extensions of the reefs under the alluvial flats at the southeast end of the Pine Creek gold field. The potential-ratio (or Racom) method was applied satisfactorily. Final results of the survey are shown on several plates that give profiles of potential ratios, profiles of logarithms of potential gradients, a contour map of equal values of the logarithms of the potential gradients, and indication plans. The indications are based on anomalies that reveal low electrical conductivity, and they correspond to poor conductors, such as quartz reefs and silicified zones.—*W. A.*

5810. Rust, W. M., Typical electrical-prospecting methods: Geophysics, vol. 5, No. 3, pt. 1, pp. 243–249, Menasha, Wis., 1940.

A very general review and discussion of electrical-prospecting methods, particularly as applied to petroleum prospecting, is given. It is pointed out that while the electrical methods have not received the widespread acceptance in this field that other methods enjoy, continued interest may well be justified. The opinion is expressed that the most optimistic sign of a brighter future for electrical prospecting for petroleum is the evidence being accumulated to support the theory of secondary effects in relatively shallow strata overlying deposits of oil and gas.—*Author's abstract.*

5811. Tsekov, G. D., Utilization of the mirror galvanometer in field measurements [in Russian]: Razvedka Nedr, vol. 11, No. 2/3, pp. 54–55, Moscow, 1940.

As a means for increasing the sensitivity of field measurements, the author suggests the utilization of the mirror galvanometer. Such a galvanometer, developed in the Physical Institute of Leningrad University, has a current sensitivity equal to 5×10^{-9} a./mm. and a voltage sensitivity equal to 2.5×10^{-6} v./mm. By use of this mirror galvanometer the sensitivity of the measuring installation was increased about 10 times. In regions with conductive overburden a value of potential difference between two points equal to 0.01 m. v. was measured; in regions with high ground resistance (about 20,000 ohm/m.) it was possible to measure a potential difference equal to 0.1 m. v.—*W. A.*

5812. Zaba, Joseph, Limitations of electrical logging: Am. Petroleum Inst., Production Div., 15 pp., Houston, Tex., March 1940.

The basic value of electrical logging is that certain formational characteristics of great importance in oil-field exploration appear in an electrical log in the form of easily recognizable patterns. The basic limitation of the method, on the other hand, is that the electrical log also measures and records several factors that usually have no direct relation to those formational characteristics that are of primary interest in

surveying a prospective oil well. Some of these factors are obvious, and their effect may be easily explained by proper analysis of conditions of the survey. But other factors are not so easily interpreted, and they represent the inherent limitations of the method in its present stage of development. The author discusses the following disturbing factors: (1) The effect of saline mud may completely mask the details of the profile; (2) the weight of the mud will affect the amplitude of the anomalies of the self-potential curve; (3) where the multiple-electrode method is used the spacing of the electrodes will affect the pattern of the resistivity curve; (4) formation pressures that are abnormally high for the depth, by reversing filtration, may obliterate the normal effect of a porous formation on the self-potential curve; (5) formational characteristics such as hardness will have an effect on the curve pattern and give false indications of a porous, oil-bearing sand; (6) connate water in oil-bearing strata is another confusing circumstance.—*Abstract in World Petroleum, vol. 11, No. 7, 1940, condensed by W. A.*

5. RADIOACTIVE METHODS

5813. Bell, K. G., Goodman, Clark, and Whitehead, W. L., Radioactivity of sedimentary rocks and associated petroleum: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 9, pp. 1529–1547, Tulsa, Okla., 1940.

Determinations of the radioactivity of 21 sedimentary rocks and 7 associated crude oils have been made by the precision method developed by R. D. Evans. The specimens consisted of cuttings and cores from wells in the Bartlesville, Cromwell, Frio, Woodbine, and Viola-Simpson formations. Considerable variability in radioactivity was found in the sandstone (1.4 to 0.19×10^{-12} gm. Ra/gm.) and limestone (1.3 to 0.18×10^{-12} gm. Ra/gm.). The radium content of limestones decreases with increasing purity. The shales were uniform (1.2 to 1.0×10^{-12} gm. Ra/gm.). Apparently, discrete mineral particles in sandstone and impurities in limestone account for their occasional high radioactivity. The radon content of the crude oils (0.47 to 0.05×10^{-12} curies/gm. of oil) was in one sample 38 times, and averaged 10 times the amount in equilibrium with the radium present. The results corroborate the inferences of former investigators that radon tends to concentrate in crude oils. Maximum radon content and maximum ratio of radon to radium were found in petroleum produced from a permeable Oligocene (Frio) sandstone of high radioactivity. Cracking of hydrocarbons with generation of hydrogen has been proved by S. C. Lind to result from bombardment with alpha rays. The amounts of radioactivity found in these crude oils are quantitatively sufficient to cause appreciable cracking by alpha radiation during geologic time. These reactions, together with subsequent hydrogenation, may account for important changes in petroleum. This hypothesis would also explain the presence of hydrogen in some natural gases. The hydrogen content of soil gases is suggested as a possible method of geochemical prospecting for oil fields.—*Authors' abstract.*

5814. Goos, F., and Ehmann, O., Geiger-counter amplifier with high resolving power: Phys. Zeitschr., vol. 41, No. 7, pp. 107–109, Leipzig, March 1, 1940.

The Neher-Harper circuit is used for the amplification of the current from coincidence counters. The high voltage is directly connected with the amplifying valve, a screened grid valve of the normal type. Details

of the arrangement and adjustment are given. The resolving power could be increased to 1.2×10^{-6} sec. for double coincidences.—*L. K., Sci. Abstracts, vol. 43, No. 511, 1940.*

5815. Green, W. G., and Fearon, R. E., Well logging by radioactivity: Geophysics, vol. 5, No. 3, pt. 1, pp. 272–283, Menasha, Wis., 1940.

A discussion of the relation of radioactivity curves to physical properties of strata studied, including the influence of the history of the rocks involved. Comparisons are made between the probable areal extent of correlatable horizons in various types of formations, and the ability of various logging methods to distinguish these layers is considered as an index of the geological usefulness of the various logging methods. The possibility of distinguishing altered zones which do not show marked physical differences from the neighboring rocks (such as faults and unconformities) is discussed, and its bearing on the usefulness of radioactivity logging is considered. Illustrations of the correlating power of radioactivity logs are given. Comparisons with electrical logs and with geological sample logs are shown to illustrate the points discussed. A brief discussion of the development of the radioactivity logging method and of the technique of carrying out field operations is also given.—*Authors' abstract.*

5816. Jorgensen, D. L., An experimental study of the sensitivity of a Geiger-Müller counter to a narrow beam of gamma rays: Rev. Sci. Instruments, vol. 10, No. 1, pp. 34–36, Lancaster, Pa., 1939.

Most of the studies for developing the Geiger-Müller counter have been made with the intention of producing a counter that would have a minimum background or zero count and a long, level plateau. Progress has been so great that present-day counters can consistently have a low zero count and a plateau of over 500 v. Never, however, is the plateau level. The author undertook this study to determine the causes producing the slope of the counting plateau. He describes the experimental arrangement, the experimental procedure, and the results.—*W. A.*

5817. Lifschutz, Harold, A complete Geiger-Müller counting system: Rev. Sci. Instruments, vol. 10, No. 1, pp. 21–26, Lancaster, Pa., 1939.

Constructional details are given of a complete Geiger-Müller counting system consisting of a stabilized high-voltage supply, Neher-Harper coupling circuit, and vacuum tube scale-of-eight feeding a Cenco caunter stage. The system is entirely A. C. operated. Its resolution time of 6.5×10^{-6} sec. allows it to follow the G–M circuit without counting losses. The counting losses in the Cenco counter stage are negligible for random input rates to the system up to 20,000–30,000 counts a minute.—*Author's abstract.*

5818. Nikitin, B. A., and Gerling, E. K., On the emanation of radon from uranium minerals [in Russian]: Trav. Inst. Etat Radium, vol. 4, pp. 318–322, Moscow, 1938.

Emanation of Rn from uraninite was investigated in vacuum at temperatures from 100° to 900° C. No influence on the degree of separation of the mineral could be observed. If the uran mineral was heated twice, a considerably smaller amount of Rn emanated during the second heating; but the same amount of Rn accumulated in the mineral after a lapse of 1 month between the two tests. It is concluded that the emanation of Rn during the first heating is greatly promoted by the escape of

a great amount of other gases, especially of H_2.—*Gerasimoff's abstract in Physikal. Ber., vol. 21, No. 7, 1940, translated by W. A.*

6. GEOTHERMAL METHODS

5819. Amirkhanov, K. I., Thermoelectric thermometer for measuring at great depths [in Russian]: Razvedka Nedr, vol. 10, No. 5, p. 65, Moscow, 1940.

Measurements of temperature are made in boreholes with maximum and minimum thermometers, as well as with the Schlumberger thermometer, which is a resistance thermometer with a compensating apparatus. Although the thermoelectric method gives less accuracy than the resistance thermometer, nevertheless the greater simplicity of the thermoelectric method makes its use often preferable. The writer briefly describes the construction of a special thermometer designed for this method.—*W. A.*

5820. Birch, Francis, and Clark, Harry, The thermal conductivity of rocks and its dependence upon temperature and composition: Am. Jour. Sci., vol. 238, No. 8, pp. 529–558, and No. 9, pp. 613–635, New Haven, Conn., 1940.

An apparatus for the measurement of absolute thermal conductivity between 0 and 500° C. is described. Results are given for 18 igneous rocks, 7 sedimentary and metamorphic rocks, 3 single crystals, and 4 glasses. At 0° C., the conductivities of all of the rocks lie between 0.014 and 0.004 cal./cm. sec. deg.; at 200° C. all lie between 0.009 and 0.004. The conductivities of the poorest conductors—the glasses and the feldspar aggregates—increase with the temperature; the conductivities of all of the other materials decrease as the temperature increases. The aggregates having the highest conductivities are the ultrabasic rocks. The results are discussed in the light of theories of heat conduction in crystals. A simple method of computation is shown to account for the conductivities of fresh igneous rocks in terms of their mineral compositions and the measured conductivities of approximately monomineral aggregates.—*Authors' abstract.*

5821. Niven, C. D., Thermal conductivity of some sedimentary rocks: Canadian Jour. Research, vol. 18, No. 7, pp. 132–137, Ottawa, 1940.

The thermal conductivity of some Canadian limestones and slate has been measured. The results are in satisfactory agreement with those of other experimenters, but there was evidence of changes in the stone, even at temperatures below 700° F.; this vitiates the value, from a geophysical standpoint, of these and other determinations.—*Author's abstract.*

5822. Sawdon, W. A., Temperature log reveals gas-oil contact plane: Petroleum Engineer, vol. 11, No. 13, pp. 83–84, Dallas, Tex., 1940.

The author describes the possibility of locating by temperature measurements the point of contact in a well between the gas- and oil-bearing strata of a producing zone, and thus the possibility of shutting off the upper gas so indicated to reduce the gas-oil ratio while the well is being completed. The equipment employed is a newly designed instrument that is run into the well on piano wire with a conventional measuring-line hoist. The temperature record is made on film moving at a constant speed, which provides synchronization with depth measurements by means of a stop watch started at the same time as the mechanism of the instrument. Graphs that give temperature readings of a well in

the Belridge field, California, show the location of the plane of contact between the oil and gas strata.—*W. A.*

7. GEOCHEMICAL METHODS

5823. Howard, W. V., Analysis of some factors involved in geochemical prospecting: Oil and Gas Jour., vol. 39, No. 8, pp. 33–34, and No. 10, pp. 50–54, Tulsa, Okla., 1940.

This paper is an attempt to summarize the present knowledge of pertinent theoretical data on geochemical prospecting and thus to encourage the reduction of this method of prospecting to some basis other than an empirical one. The elements to be considered in geochemical prospecting are discussed in detail. The author concludes: "In the absence of a definite theoretical basis, geochemical prospecting must rest upon an empirical basis. If it outlines oil fields, these results are of much more importance than a theoretical statement that it cannot do so. At the same time, in the absence of a well-founded theory, anomalous determinations and occasional failures cannot be explained. If the relationships of upward-migrating vapors and the accumulation of hydrocarbons at the surface were thoroughly understood, the cause of these misleading results would also be known and the expense of drilling undertaken as a result would be minimized."—*W. A.*

5824. Mogilevsky, G. A., Investigation of gas content of rocks by methods of logging and circulating gasometry of boreholes [in Russian]: Razvedka Nedr, vol. 11, No. 4, pp. 32–39, Moscow, 1940.

An apparatus that is used to investigate the gas content of rocks and also the arrangement of the apparatus during the different operations are shown in a series of diagrams. The method of operation, which is described in detail, permits two possibilities: (1) The determination of insignificant horizons of gas, and (2) the inference—by observing a constant increase in the concentration of gas in solution or in cores—that a large accumulation of gas is being approached. In the second possibility the increase in readings indicated by the gasometric apparatus may serve as a basis (1) for determining whether the borehole should be deepened, and (2) for taking action to prevent the eruption of gas. A further development of the apparatus to make it automatic is suggested.—*W. A.*

5825. Pirson, S. J., Critical survey of recent developments in geochemical prospecting: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 8, pp. 1464–1474, Tulsa, Okla., 1940.

A critical study of the respective advantages and disadvantages of the two current geochemical-prospecting procedures is presented. It is particularly pointed out that soil analysis has as an advantage only a relatively simple field procedure, but in view of the complexity of the material analyzed it is difficult, if not impossible, to reduce results to a common basis of comparison. Further limitations placed on soil-analysis prospecting are the persistence of the halo patterns and the shielding effect of shallow beds bearing oil or gas or both. Soil-air sampling is not affected by these limitations to as high a degree as soil sampling, and it is therefore recommended that it should be given further serious trials regardless of the fact that it requires a more complex field procedure.—*Author's abstract.*

5826. Ransone, W. R., Geochemical exploration comes of age: World Petroleum, vol. 11, No. 7, pp. 72–75, New York, 1940.

The three main research problems in geochemical exploration for oil are as follows: (1) To discover whether any distinct leakage pattern occurs in the surface material, and whether or not this pattern can be used to locate accumulations of oil or gas. The solution of this problem is illustrated by referring to a hydrocarbon map of the Cedar Lake area, Gaines County, Tex., which exhibits the halo pattern where the high hydrocarbon content occurs directly over the margin of the oil body. (2) To test soil samples for all possible elements in an effort to find which elements are most abundant, and to select the samples that can be subjected to routine analysis. This problem has also been solved, and routine-analysis techniques have been put into use. (3) To determine which analyses are high enough to be significant and, therefore, pattern-forming. The determining factors in the solution of this problem are experience and the application of the statistical theory. The author believes that the geochemical method, the first valid direct method of oil finding, has come of age and is taking its place with other exploration methods.—*W. A.*

5827. Rosaire, E. E., Geochemical prospecting for petroleum [Symposium on geochemical exploration]: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 8, pp. 1400–1433, Tulsa, Okla., 1940.

Case treatments are presented or pointed to in the literature, which include examples of prospecting by refraction fans, a geoelectrical method (Eltran), and chemical analyses of soils, soil gases, and ground waters. These type geophysical and geochemical anomalies are associated with producing structures, which, in several cases, display only low relief at considerable depths, where the anomalous data represent modifications of shallow sediments undeformed by the underlying structure. These illustrations indicate that the column of sediments over a petroleum accumulation displays properties which differ from those of the adjacent sediments of the same geologic age. As a result of these differences in properties, observed even where no observable structural deformation has taken place in the affected sediments, a dynamic rather than a static conception of a petroleum accumulation is indicated. A description and a discussion follow a working hypothesis which has been proposed to account for these geochemical manifestations of a petroleum accumulation. Geochemical prospecting takes for its objectives the recognition of the geochemical manifestations of a petroleum accumulation, and their interpretation in terms of their origin, of the petroleum accumulation itself, by means of the local and regional geology.—*Author's abstract.*

5828. Rosaire, E. E., McDermott, Eugene, Fash, R. H., and others, Discussion of geochemical exploration (soil analysis): Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 8, pp. 1434–1463, Tulsa, Okla., 1940.

The questions and answers of the two symposia (New ideas in petroleum exploration and Geochemical exploration) sponsored by the research committee of the American Association of Petroleum Geologists during the time of the annual meeting at Chicago, April 9 and 10, 1940, insofar as they pertain to geochemical exploration, are brought together in this article. Some of these questions were answered orally at the time of the evening symposium, while others were submitted to the speakers later;

and all have been edited by the participants in the discussion. The contribution to the symposium by Eugene McDermott was published in the Bulletin, vol. 24, No. 5, pp. 859–881 (see Geophys. Abstracts 102, No. 5674), to which the reader is referred.—*A. I. L., Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 8, 1940.*

5829. Sanderson, R. T., Some neglected aspects of chemical exploration: Geophysics, vol. 5, No. 3, pt. 1, pp. 284–294, Menasha, Wis., 1940.

In a general discussion of geochemical exploration for petroleum, some of the problems particularly related to the soil-analysis method are considered in detail. It is suggested that with technique now available for gas analysis the older method of soil-gas sampling may avoid some of the difficulties inherent in the soil-sampling method.—*Author's abstract.*

8. UNCLASSIFIED METHODS AND TOPICS RELATED TO GEOPHYSICS

5830. Barnes, R. M., Twenty years of petroleum geology in California: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 10, pp. 1705–1721, Tulsa, Okla., 1940.

The writer summarizes geological employment and geophysical activity from 1920 to 1939, inclusive, and correlates them with such results as new fields discovered, producing wells completed, reserves proved, and dry holes drilled. He traces the progress of geologic thought and changing exploration methods, and he outlines new developments that have been made possible by deep drilling.—*W. A.*

5831. DeGolyer, Everette, Future position of petroleum geology in the oil industry: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 8, pp. 1389–1399, Tulsa, Okla., 1940.

The geologist will continue to be of fundamental importance in the petroleum industry. His function, however, has changed from that of the recorder of facts as observed in the field to that of the interpreter of facts as brought to him by several exploratory specialists. His future depends on his ability to interpret facts in order to find oil. The industry is interested in the geologist insofar as he can find oil. The geologist's ability to find oil is the ability of geologic speculation, the reasonable application of all observed facts of earth science in the attempt to find oil. The greatest simple source of oil finding has been that of drilling on oil seepages, or oil and gas showings. Perhaps random drilling has been of equal importance. Geologic speculation is next in importance, followed by the combined geophysical techniques. Surface geology ranks near the end of the list. But the contribution of the geologist through speculative geology has been of high value in the past, and the demand for it will become greater in the future. Therefore, the future of petroleum geology lies in better geologic training for the men who have to make the geologic speculation. They must have more exact knowledge of geologic history, geologic processes, of stratigraphy, and sedimentation.—*Author's abstract.*

5832. Eckhardt, E. A., Geophysics: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 8, pp. 1377–1385, Tulsa, Okla., 1940.

The paper points out that near-term progress in geophysical prospecting is more likely to come from further evolution of existing methods than from revolutionary new developments. Better utilization of geo-

physical results is likely to follow from more effective cooperation between geologists and geophysicists. For the most effective use of geophysical data, geologists will require a greater familiarity with the background and basic facts of geophysical techniques. The paper points out that in addition to localizing acres to lease and prospects to drill, substantial contributions to general geology can and do result from geophysical work. Reference is made to a series of simultaneous observations of the tidal variation of gravity and to the bearing of such observations on our knowledge of the general geology of the earth.—*Author's abstract.*

5833. Eckhardt, E. A., Partnership between geology and geophysics in prospecting for oil: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 7, pp. 1204–1208, Tulsa, Okla., 1940.

After discussing and enumerating some of the factors on which the success of geophysical prospecting depends, the author concludes: "The normal conduct of geophysical operations involves a complex series of compromises between considerations of geology, geography, geophysics, finance, law, and related management policies. In order that the subject may be viewed objectively and in perspective, it is necessary that the representative of each specialty have some working knowledge of the other matters which are involved, and that some machinery exist for developing a composite picture to which each factor contributes no more and no less than its appropriate part. This is a fallow field for partnership of geology and geophysics."—*W. A.*

5834. Heiland, C. A., Equipment and laboratories, Department of Geophysics at "Mines": Mines Mag., vol. 30, No. 8, pp. 401–405, Denver, Colo., 1940.

The author gives a description of the new equipment and laboratories of the Department of Geophysics at the Colorado School of Mines, which is considered to be the largest and best-equipped department of this kind in any educational institution in the world. He shows plans of the two floors of the building and pictures of the geophysics wing and of the interior of all the laboratories.—*W. A.*

5835. Levorsen, A. I., Petroleum geology [Symposium on new ideas in petroleum exploration]: Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 8, pp. 1355–1360, Tulsa, Okla., 1940.

This symposium was designed to discuss some of the elements that must be considered in attempting to answer the problems of discovery methods and exploration methods in petroleum geology. The dominant trend seems to be toward a more intensive and detailed study of stratigraphy, sedimentation, reservoir rocks, geologic history, and varying environments of deposition.—*W. A.*

5836. Macelwane, J. B., Fifteen years of geophysics—A chapter in the exploration of the United States and Canada, 1924–39: Geophysics, vol. 5, No. 3, pt. 1, pp. 250–258, Menasha, Wis., 1940.

Knowledge of geophysical methods of prospecting was not wide-spread in America before March 1924, when the Nash salt dome was discovered by the torsion-balance method. Hence it may be said that a new era of geophysics began in 1924. The writer of this article appeals to all commercial companies, both producing and consulting, for comprehensive data that will permit him to construct composite maps indicating the

areas that have been explored by the several methods. He shows nine such maps of areas in the United States and Canada that had been prospected by (1) the refraction method of seismic prospecting prior to 1929, (2) seismic methods between 1924 and 1939, (3) geomagnetic methods prior to 1929, (4) geomagnetic methods between 1924 and 1939, (5) the torsion balance prior to 1929, (6) the torsion balance between 1924 and 1939, (7) gravimetrical methods to the end of 1939, (8) electrical methods prior to 1929, and (9) electrical methods between 1924 and 1939.—*W. A.*

5837. Milstein, Mark, The search for oil and minerals: Ind. Australian and Min. Standard, vol. 45, No. 2455, pp. 237–240, and No. 2456, pp. 251–254, Melbourne, 1940.

This is a general discussion of the principles of geophysical methods of prospecting (magnetic, gravitational, electrical, seismic, and others), their application, interpretation of field data, and some results attained in various countries.—*W. A.*

5838. Rosaire, E. E., A perspective of exploration for petroleum: Geophysics, vol. 5, No. 3, pt. 1, pp. 259–271, Menasha, Wis., 1940.

In this article the writer deals with geochemical prospecting. Geochemical prospecting depends on the chemical and physical measurements of one or more of the geochemical manifestations of a petroleum deposit, and on the interpretation of resulting data in terms of local geology. As structure is a necessary but insufficient condition for the accumulation of petroleum, geochemical prospecting is a rational and direct approach to exploration for petroleum.—*W. A.*

5839. Shaskolski, V. V., New serial instruments of 1940 for industrial geophysics [in Russian]: Razvedka Nedr, vol. 11, No. 2/3, pp. 56–61, Moscow, 1940.

The following new instruments, developed by the Government Geophysical Laboratory during 1939 and designed for field work, are briefly described:

1. Separable electrical thermometer, type T–4, filled with oil. Its construction is illustrated.

2. Switch-coupling for lateral coring. With the aid of this coupling the distance between the electrodes may be changed without hoisting the cable to the surface.

3. Stuffing box for coring. This serves to carry on the coring at different pressures inside the borehole.

4. Kenotron rectifier for inclinometer type VK–2. A diagram of the rectifier circuit is given.—*W. A.*

5840. Stoneley, R., Interior of the earth: Royal Astron. Soc. Occ. Notes, No. 8, pp. 103–116, London, March 1940.

A connected summary of the deductions as to the internal structure of the earth, based on observations (and calculations therefrom) of (1) the shape of the earth, (2) gravity, (3) nature and rates of propagation of various earthquake waves, (4) the earth's viscosity, plasticity, and magnetic properties, and their variations with temperature, whether resulting from the gradual dissipation of initial heat or from the presence of radioactive material.—*C. A. S., Sci. Abstracts, vol. 43, No. 511, 1940.*

5841. Thamm, N., Certain methods of mapping faults in the Pretoria and dolomite series on the West Witwatersrand areas, Ltd.: Geol. Soc. South Africa Trans., vol. 42, pp. 1–14, January to December 1939, Johannesburg, 1940.

Faults in the Pretoria series can be determined in the usual manner by observation of displacements of certain distinctive horizons. The absence of such markers in the dolomite series necessitates the application of more indirect methods for the mapping of faults in areas underlain by this formation. Such methods include interruptions of outcrops, detailed observation of bends and drags, and, in the absence of outcrops, the distribution of quartz veins (parallelisms of quartz veins to faults and also the difference in the number of quartz veins in separated fault blocks). The trend of a fault can also be determined by careful mapping of the frequency of joints accompanying the fault. These various methods are explained, and their application is illustrated by examples.—*Author's abstract.*

5842. Umbgrove, J. H. F., Periodicity in terrestrial processes: Am. Jour. Sci., vol. 238, No. 8, pp. 573–576, New Haven, Conn., 1940.

This paper is a condensed synopsis of various lines of research, all giving converging evidence toward the idea of periodicity in the earth. Several groups of periodic phenomena on the earth's surface, although widely differing in nature, appear to be correlated in time and point to a common, deep-rooted condition of the earth.—*Author's abstract.*

9. NEW PUBLICATIONS

5843. Canadian polar-year expeditions, 1932–33—Terrestrial magnetism, earth currents, aurora borealis, vol. 2, 185 pp., Ottawa, J. O. Patenaude, 1939.

This comprehensive report, issued by the Division of Meteorological Services of Canada, gives in detail the results of the magnetic, earth-current, and auroral observations at the three Canadian polar-year stations.

W. J. Rooney has reviewed this book in detail (see Terres. Magn. and Atmos. Electr., vol. 45, No. 3, pp. 368–370, 1940).—*W. A.*

5844. Heiland, C. A., Geophysical exploration, 1,013 pp., 510 illus., New York, Prentice-Hall, Inc., 1940. Price, $10.

This book is intended as a comprehensive survey of the entire field of geophysical exploration. The author has endeavored to present the subject in broad perspective by emphasizing the relations, differences, common features, and, above all, the fundamentals of geophysical methods.

The following is an outline of the contents, by chapters: (1) Introduction; (2) Review of geophysical methods; (3) Procedures of measurement in geophysical exploration; (4) Geophysical methods in oil exploration; (5) Geophysical methods in mining; (6) Application of geophysics in engineering; (7) Gravitational methods; (8) Magnetic methods; (9) Seismic methods; (10) Electrical methods; (11) Geophysical well testing; (12) Miscellaneous geophysical methods: Radioactivity measurements, hydrocarbon (soil and gas) analysis, vibration recording, dynamic testing, strain gauging, acoustic methods.—*W. A.*

5845. Kemp, J. F., A handbook of rocks, revised and edited by F. F. Grout, 6th ed., 300 pp., illus., New York, D. Van Nostrand Co., 1940. Price, $3.

In general plan the volume begins with the igneous rocks, classified into clans. Along with the descriptive portions are discussions of the petrological aspects of the rocks; the section closes with general remarks on the igneous rocks, including chemical composition, structures, textures, and the like. The sedimentary section follows the igneous section. The third part of the book concerns metamorphism and metamorphic rocks.—*From W. C. Krumbein's review in the Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 8, 1940.*

5846. National Research Council, Transactions of the American Geophysical Union, twenty-first annual meeting April 24–27, 1940.

Part 1 (pp. 1–144): Joint regional meeting, Section of hydrology and Western Interstate Snow Survey Conference, South Pacific coast area, Stanford University, Calif., January 12–13, 1940. Preface, pp. 2–4; Part I (A) Section of hydrology, reports and papers, pp. 5–94; Part I (B) Western Interstate Snow Survey Conference, reports and papers, pp. 95–144.

Part 2 (pp. 145–779): Introduction, by J. A. Fleming (pp. 147–149); General assembly; Symposium on tectonophysics of the crust (pp. 153–177), papers: (1) Seismology and the first hundred kilometers of the earth, by J. B. Macelwane; (2) Thermal measurements and their bearing on crustal problems, by A. E. Benfield; (3) Deformation of rocks in the laboratory, by D. T. Griggs; (4) The mountain-building cycle, by W. H. Bucher; (5) Discussion.

Section of geodesy, pp. 179–224, reports and papers: (1) The Washington meeting of the International Union of Geodesy and Geophysics, September 1939, by W. D. Lambert; (2) Some problems concerning basic-gravity data, by C. L. Garner; (3) Geologic interpretation of gravity anomalies in southeastern Oklahoma, by T. A. Hendricks; (4) Gravity in sedimentary basins, by D. C. Skeels; (5) Theory and operation of the photographic reflex zenith-tube, by Paul Sollenberger; (6) Effect of the moon in the determination of latitude in Washington, by Wm. Markowitz and S. M. Bestul; (7) Analysis of circle graduation errors, by C. A. Whitten; (8) Annual report of progress of geodetic work of the United States Coast and Geodetic Survey, by H. W. Hemple; (9) Notes on tides in wells, by C. L. Pekeris; (10) Basic-gravity survey of Cuba, by R. E. Dickerson; (11) Progress of geodetic work in Mexico during the year 1939, by Manuel Medina.

Section of seismology, pp. 225–248, reports and papers: (1) Seasonal pressure changes and earthquake occurrence, by H. Landsberg; (2) Earthquakes in the West Indian region, by Daniel Linehan; (3) The Vieques, P. R., seismographic record of the destructive earthquake of 1918 as a clue to local crustal structure, by Frank Neumann; (4) Some points of geophysical interest revealed in the mass analysis of teleseismic records, by R. R. Bodle; (5) The stereographic projection with primitive radius of 50 centimeters, by F. W. Sohon; (6) A dynamic tester for galvanometric seismographs, by H. E. McComb and J. H. Nelson; (7) Some seismic contributions to knowledge of the earth's crust, by N. H. Heck; (8) A new method for determining the epicenter of a near earthquake, by H. F. Birkenhauer; (9) Longitudinal wave

velocities in the Mississippi Valley, by E. J. Walter; (10) Geological seismography, by R. M. Field; (11) Jesuit Seismological Association for 1939, by J. B. Macelwane; (12) University of California Seismographic Station for year ending April 30, 1940, by Perry Byerly; (13) Pasadena Seismological Laboratory; (14) Northeastern Seismological Association for 1939, by L. C. Langguth; (15) United States Coast and Geodetic Survey, January 1, 1939, to March 31, 1940, by F. Neumann.

Section of meteorology, pp. 249–270, reports and papers: (1) Hubert on the African origin of the hurricane of September 1938, by C. F. Brooks; (2) A note on the distortion of the hurricane San Felipe by the mountains of Puerto Rico, by R. G. Stone; (3) New problems and the results of recent radiosonde work on shipboard in the North Atlantic, by H. W. Rahmlow; (4) Some remarks on the technique of preparing 5-day weather forecasts at the Massachusetts Institute of Technology, by H. C. Willett; (5) Contributions to the theory of the general circulation, by C. G. Rossby; (6) Atmospheric disturbances on the rotating earth, by B. Haurwitz; (7) Comparison of observed and computed outgoing radiation intensities, by H. Wexler; (8) Further remarks upon the influence of altitude on the annual course of air pressure, by V. Conrad; (9) Progress report on development of a procedure for the study of solar variability by ultraviolet measurements in the stratosphere, by Brian O'Brien, H. S. Stewart, Jr., L. T. Steadman, and H. W. French, Jr.

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Section of oceanography, pp. 331–354, reports and papers: (1) Oceanographic activities of the Hydrographic Office and the United States Navy during 1939, by G. S. Bryan; (2) Oceanographic work of the United States Coast Guard in the western North Atlantic in 1939 and plans for 1940, by R. R. Waesche; (3) Oceanographic activities of the United States Coast and Geodetic Survey, by L. O. Colbert; (4) Research within physical oceanography and submarine geology at the Scripps Institution of Oceanography during April 1939 to April 1940, by H. U. Sverdrup; (5) The necessity of a new approach to the study

of the circulation on the continental shelf, by C. O. Iselin; (6) Floor of the North Pacific Ocean, by F. Betz, Jr., and H. H. Hess; (7) Preliminary results of measurements of temperature and salinity variations in the Gulf Stream, March 1940, by H. R. Seiwell; (8) The Much-Peterson formula for the so-called "coastal transportation force," by Paul Nemenyi.

Section of volcanology, pp. 355–364, reports and papers: (1) Crater Lake and the caldera problem, by Howell Williams; (2) Velocity of basaltic flows indicated by lava trees, by R. L. Nichols; (3) A lava fan near Bend, Oreg., by R. L. Nichols; (4) Crystallization of pyroxenes and the pigeonite problem, by H. H. Hess; (5) Silicification and local granitization in the Reading Hills, by D. M. Fraser; (6) Genesis of the Blank Range tin deposits, New Mexico, by Carl Fries, Jr.; (7) Water with some alkali-silicate systems up to 3,000 pounds pressure, by G. W. Morrey and Earl Ingerson; (8) Phase relations in the system tellurium-silver, by F. C. Kracek and C. J. Ksanda; (9) The system albite-anorthite-sphene, by A. T. Prince; (10) The system albite-wollastonite-nepheline, by W. R. Foster.

Section of hydrology, pp. 365–692, reports: (1) Annual reports of permanent research committees for 1939–40 (pp. 369–455), papers: (1) Salt-water intrusion in the Connecticut River, by C. S. Howard; (2) Salinity movement and its causes in the Delaware River estuary, by W. D. Mason and W. H. Pietsch; (3) Salinity of the lower Savannah River in relation to stream flow and tidal action, by W. L. Lamar; (4) Corrosion of ferrous and nonferrous metals and the behavior of metallic coatings in tidal marsh, by I. A. Denison; (5) The contamination of ground water by salt water near Parlin, N. J., by H. C. Barksdale; (6) Report on exploratory study of rain-gage shields and enclosures at Coshocton, Ohio, by H. S. Riesbol; (7) Further experience with shielded precipitation gages on Blue Hill and Mount Washington, by C. F. Brooks; (8) Predicting headwater river stages directly from rainfall, by F. F. Snyder; (9) On the statistical analysis of rainfall data, by H. C. T. Thom; (10) Erosional land-slope profile shape in terms of the erosive power of rainfall run-off, by J. M. Little; (11) The effect of contour cultivation on run-off, by H. C. Knoblauch and J. L. Haynes; (12) Report on deficiencies in hydrologic research, by Thorndike Saville; (13) The influence of a lodgepole-pine forest on storage and melting of snow, by H. G. Wilm and M. H. Collet; (14) Recession of glaciers in Glacier National Park, Mont., by J. L. Dyson; (15) A year of evaporation from a natural land surface, by C. W. Thornthwaite and Benjamin Holzman; (16) The evaporation energy equations and their practical application, by N. W. Cummings; (17) Infiltration-capacity values as determined from a study of an 18-month record at Edwardsville, Ill., by W. W. Horner and C. L. Lloyd; (18) The infiltration theory of surface run-off, by R. E. Horton; (19) Derivation of infiltration capacity from average loss rates, by L. K. Sherman; (20) Sprinkled plat run-off and infiltration experiments on Arizona desert soils, by E. L. Beutner, R. R. Gaebe, and R. E. Horton; (21) A graphical method of analysis of sprinkled plat hydrographs, by A. L. Sharp and H. N. Holtan; (22) Ground-water recharge in areas on deep water table in the Great Plains, by R. C. Cady; (23) On the flow of water in an elastic artesian aquifer, by C. E. Jacob; (24) Artificial drainage of land: Stream-line experiments—The artesian basin, by Don Kirkham; (25) A criterion for

instability of flow in steep channels, by G. H. Keulegan and G. W. Patterson; (26) Graphical integration of the flood-wave equations, by H. A. Thomas; (27) A rating-curve method for determining silt discharge of streams, by F. B. Campbell and H. A. Bauder; (28) A study of sedimentation in a Miami conservancy district reservoir, by E. W. Lane and J. C. Kennedy; (29) Suspended-material transportation under non-equilibrium conditions, by A. A. Kalinske; (30) Determination of Manning's n from vertical velocity curves, by W. B. Langbein; (31) Channel-storage and unit-hydrograph studies, by W. B. Langbein; (32) A distinction between bed load and suspended load in natural streams, by H. A. Einstein, A. G. Anderson, and J. W. Johnson; (33) The different approaches to the study of propulsion of granular materials and the value of their coordination, by Paul Nemenyi; (34) The theory of ground-water motion, by M. K. Hubbert; (35) Present status of our knowledge regarding the hydraulics of ground water, by O. E. Meinzer and L. K. Wenzel; (36) Synthetic unit hydrographs, distribution graphs, and flood routing in the upper Ohio River Basin, by N. R. Laden, T. L. Reilly, and J. S. Minnotte; (37) New curve-fitting method for analysis of flood records, by J. C. Geyer; (38) Recent movement of North Atlantic ice and a proposed Coast Guard expedition to the west Greenland glaciers, by E. D. Smith; (39) The distribution of the average depth of snow on ground in New York and New England—Curves of average depth and variability, by R. G. Stone.

Section of tectonophysics, pp. 693–720, reports and papers: (1) New measurements of the rigidity of rocks at high pressure, by Francis Birch and Dennison Bancroft; (2) An electronic interval timer for laboratory seismometry, by Dennison Bancroft; (3) Variation of elastic constants with moisture in soapstone, by J. P. Delaney; (4) Fracture and flow in stressed solids, by R. W. Goranson; (5) Plastodynamics as indicated by geologic structure, by C. W. Washburne.

Minutes of the General Assembly and Sections, pp. 721–750. Addendum to report of Committee on Snow, 1939–40; list of current publications on snow and ice, pp. 750–756. Appendix A—List of latest publications of the Union of Soviet Socialist Republics on ice and snow, by B. P. Weinberg, pp. 757–779. Index of names and index of subjects.

Copies of Transactions may be purchased by nonmembers of the Union as follows: Orders, with check payable to the American Geophysical Union, should be addressed to the General Secretary, American Geophysical Union, 5241 Broad Branch Road, N. W., Washington, D. C., U. S. A. Price, Part 1, $1.25; part 2, $3.75.

5847. Nettleton, L. L., Geophysical prospecting for oil, 444 pp., 177 illus., New York, McGraw-Hill Book Co., 1940. Price, $5.

This book, which offers a concise introduction in one volume to the four principal methods of geophysical prospecting (gravitational, magnetic, seismic, and electrical), covers the theory, apparatus, field work, and calculations of each method and emphasizes the practical interpretation of results in the light of the oil prospector's need. The book also includes information on some lesser methods of prospecting (soil-analysis or geochemical prospecting, geothermal prospecting, radioactive prospecting), discussion of well logging and operations in wells; hand reference tables, and other material.—*W. A.*

5848. Oil- and gas-field development in the United States, by National Oil Scouts and Landmen's Association (Yearbook 1940, review of 1939), edited by

H. L. Eversberg, 611 pp., maps, tables, cloth, 8 by 10¾ in., Austin, Tex., Nat. Oil Scouts and Landsmen's Assoc. Price, $7.50.

This volume is a review of all drilling activity in the United States, all new fields discovered and their depth and producing formation, all completions—dry or as producers—all wildcat drilling, and all pertinent facts connected with each State and its experience during 1939.

Leasing information in both producing and nonproducing States, geophysical exploration in each State, and maps that show new development and pipe-line facilities are included. A discussion of well spacing and unitization in various pools is also included under the States where it is of present interest.—*W. A.*

5849. Rice, C. M., Dictionary of geological terms, 461 pp., Ann Arbor, Mich., Edwards Bros., Inc., 1940. Price, $6. Address Miss C. M. Rice, 14 Vandeventer Ave., Princeton, N. J.

This is a compilation of about 17,000 geologic terms, exclusive of those pertaining to stratigraphic formations and paleontologic genera and species. The compiler's object "has been to bring together in one convenient volume the definitions of terms in use in the several branches of geology."—*W. A.*

5850. Sokolov, V. A., Gas surveying, 269 pp., 61 illus., 16 tables, A. A. Boehtlingk, 2022 Cedar Street, Berkeley, Calif. Price, $25.

Translated from Russian into English by A. A. Boehtlingk. Describes the gas-surveying method of prospecting for crude oil and natural-gas deposits, which involves the determination of minute quantities of hydrocarbon vapors in the gases which permeate by diffusion from petroleum and natural-gas deposits into the surface layers of the overlying soil.—*Am. Assoc. Petroleum Geologists Bull., vol. 24, No. 7, p. 1341, 1940.*

5851. Tables of sines and cosines for radian arguments, prepared by the Federal Works Agency, Work Projects Administration for the city of New York, 280 pp., New York, 1940.

After an introduction and a brief discussion of the method of computation, the following six tables are given: (1) Values of sin X and cos X to 8 decimal places at intervals of 0.001 from 0.000 to 25,000; (2) Values of sin X and cos X to 8 decimal places at intervals of unity from 0 to 100; (3) Values of sin X and cos X to 15 decimal places at decimal intervals from 1×10^{-5} to 9×10^{-1}; (4) Conversion table; (5) Values of sin X and cos X to 12 decimal places at intervals of 0.00001 from 0.00000 to 0.01000; and (6) Values of $p(1-p)$.—*W. A.*

10. PATENTS

5852. Two-well method of electrical logging and apparatus therefor; Paul F. Hawley, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,183,565, issued December 19, 1939.

This invention relates to a method of electrical logging comprising establishing a current flow between a point in one well and a point in another well, and adjusting the vertical position of at least one of said points while measuring the current flow through a circuit including said points and the geological stratum or strata therebetween to determine at least one position of said points for minimum or maximum current flow between said two points. Claims allowed, 6.

5853. Method of and apparatus for locating water leakages into wells; George H. Ennis, Long Beach, Calif., assignor of one-half to Robert V. Funk, Long Beach, Calif.: U. S. patent 2,184,338, issued December 26, 1939.

This invention relates to a method of locating the point of entrance of water into a well, which method includes the steps of: Testing the electrochemical qualities of the residual material in the well at different levels in the well without the addition of any substance to the material in the well; causing an ingress of connate fluid into the well; and again testing the electrochemical qualities of the material in the well at different levels to determine the point of entrance of said connate fluid. Claims allowed, 17.

5854. Time-lines recording apparatus: Andrew B. Bryan, Tulsa, Okla., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,184,953, issued December 26, 1939.

This invention relates to a device for obtaining time lines on a record for approximately 2 sec. during the unsustained vibrations only of a tuning fork, comprising a tuning fork having a cycle of approximately 50 vibrations per second; a shutter carried by each prong of the fork, the shutters overlapping and having alined slits when in rest position; means for starting the prongs in vibration to give unsustained vibrations only; a light sensitive film on one side of the shutters movable at a constant speed transversely of the slits; a stationary point of light on an opposite side of the shutters whereby a gradually widening beam of light passes through the slits of the shutters when they are in alinement; and a cylindrical lens having its long axis parallel with the slits disposed between the shutters and film and relatively close to the film to focus the beam of light upon the film whereby successive time lines are recorded on the film at intervals of about 1/100 of a second. Claims allowed, 1.

5855. Mineral exploration; Louis Byrne Slichter, Belmont, Mass., assignor to Schlumberger Well Surveying Corporation, Houston, Tex., a corporation of Delaware: U. S. patent 2,190,686, issued February 20, 1940.

This invention relates to an apparatus for exploring a drill hole in the earth, having in combination means for producing periodic acoustic impulses; means for receiving the impulses at predetermined points of the drill hole; means for indicating the intensity of the impulses; means comprising the acoustic impulse producing means for creating a magnetic field in the drill hole; and means for measuring the electromagnetic field for determining an electromagnetic property of the strata surrounding the drill hole at the predetermined points. Claims allowed, 33.

5856. Attenuator; Raymond T. Cloud, Los Angeles, Calif., assignor by mesne assignments to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,193,620, issued March 12, 1940.

This invention relates to an apparatus for recording seismic waves, comprising a plurality of spaced seismometers for converting seismic waves into electrical waves; a plurality of channels for amplifying and transmitting said electrical waves to a recorder; a recorder arranged to record the waves from the respective channels on a single record for comparison; and attenuation control means in each of said channels for reducing the strength of the high-energy waves, said attenuation

control means being operative to reduce gradually the degree of attenuation as the input wave energy becomes less, said attenuation control means comprising a shunt resistance across each of said channels, a second resistance in series with one side of each of said channels, and means for increasing the value of each of said shunt resistances while at the same time reducing the value of each of said series resistances. Claims allowed, 3.

5857. Electrical-prospecting apparatus; Lacoste G. Ellis and John W. Millington, Beaumont, Tex., assignors to Sperry-Sun Well Surveying Co., Philadelphia, Pa., a corporation of Delaware: U. S. patent 2,197,493, issued April 16, 1940.

In combination with a protective casing adapted to be lowered into a borehole and having an opening therein, means for closing said opening against high pressures and for permitting the passage of electrical current, and a wrapping of plastic material about the joints of the assembly to prevent leakage therethrough. Claims allowed, 7.

5858. Means and method for locating oil-bearing sands; Alonzo L. Smith, Houston, Tex., assignor of 20 percent to Starr Thayer, Houston, Tex.: U. S. patent 2,206,922, issued July 9, 1940.

This invention relates to an apparatus for detecting the presence of oil in drilling mud, comprising means to apply ultraviolet light to the drilling mud so that the rays change the wave-length spectrum of any oil that is carried by the mud, and means to record the fluorescence in such spectrum as an indication of the presence of oil in the mud. Claims allowed, 9.

5859. Magnetic analysis; Theodor Zuschlag, West Englewood, N. J., assignor to Magnetic Analysis Corporation, Long Island City, N. Y., a corporation of New York: U. S. patent 2,208,145, issued July 16, 1940.

This invention relates to an apparatus for magnetic analysis, which comprises a plurality of transformers having primary and secondary coils and adapted to induce two currents, proportional to the vector sum and the vector difference, respectively, of two alternating potentials being investigated; a coil disposable in inductive relationship with a magnetizable body; means for introducing an alternating potential to be investigated from said coil into a primary coil of at least one of the transformers; means for introducing another alternating potential into a primary coil of at least one other transformer; a bridge net work each side of which is connected with the secondary coils of the transformers and contains a rectifier; and current indicating means connected to said bridge net work. Claims allowed, 18.

5860. Electric seismograph; John P. Minton, Dallas, Tex., assignor by mesne assignments to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,209,100, issued July 23, 1940.

In a method of seismic prospecting that comprises generating seismic waves, detecting said seismic waves at a distant point, and reducing them to corresponding electrical waves, amplifying said waves, and recording the resultant waves, the improvement that comprises electrically emphasizing selected high frequencies and at the same time highly attenuating other frequencies; adjusting the phase characteristics of the selected high frequencies to correct for phase distortion thereof; and recording the emphasized selected frequencies in a manner such

that waves corresponding to seismic waves that have been reflected from closely adjacent substrata can be distinguished. Claims allowed, 1.

5861. Method and apparatus for electrical logging; Raymond T. Cloud, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,210,795, issued August 6, 1940.

This invention relates to the method of logging earth formations traversed by a well, which comprises producing a direct electric current responsive to the potential difference existing between a moving point in said well and a point in electrical contact with the earth; producing electrical variations having amplitudes responsive to the rate of change of said electric current with respect to time; and measuring a function of said electrical variations. Claims allowed, 17.

5862. Method for continuously exploring boreholes; John Jay Jakosky, Los Angeles, Calif.: U. S. patent 2,211,124, issued August 13, 1940.

In a method for determining variations in the inclination of strata traversed by a borehole during the drilling thereof, the steps which comprise: Operating a drilling apparatus extending within a borehole, to extend the borehole to successively greater depths; passing a unidirectional electric current through the earth between said drilling apparatus, as one electrode, and a fixed electrode connected to the earth at a position removed from the borehole; taking a series of measurements during the flow of said current, indicative of variations in resistance of the path of said current through the earth, as the drilling apparatus is extended to successively greater depths; passing a unidirectional current through the earth between said drilling apparatus, as one electrode, and another fixed electrode connected to the earth at a position removed from the borehole in a different direction than the first-mentioned fixed electrode; and taking a series of measurements during the last-mentioned flow of current, indicative of variations in resistance of the path of said current through the earth, as the drilling apparatus is extended to substantially the same successively greater depths as in the first series of measurements. Claims allowed, 1.

5863. Method and apparatus for the electrical exploration of the subsurface; John Jay Jakosky, Los Angeles, Calif.: U. S. patent 2,211,125, issued August 13, 1940.

In a method of electrical exploration of the subsurface, the steps which comprise: (1) Conducting a survey to determine variations in the subsurface at different depths by passing an electric current through the earth between one electrode connected to the earth at a substantially fixed position and another electrode spaced from said one electrode; moving said one electrode to a plurality of different positions along an interval of distance on the earth's surface; and taking a series of measurements which are indicative of variations in a quantity created at a fixed position on the earth's surface by the flow of said current through the earth as said other electrode is moved to said different positions; and (2) conducting another such survey by passing an electric current through the earth between one electrode connected to the earth at a substantially fixed position different from the fixed position of the one electrode in the first-mentioned survey and another electrode spaced from the second-mentioned one electrode; moving the second-mentioned other electrode to a plurality of different positions along an interval of distance

on the earth's surface partially overlapping and partially extending beyond one end of the interval along which the first-mentioned other electrode was moved in the first survey; and taking a series of measurements which are indicative of variations in a quantity created at a fixed position on the earth's surface by the flow of said current through the earth as the second-mentioned other electrode is moved to said different positions, a plurality of said measurements of the second survey being taken when the second-mentioned other electrode is located at the same positions at which the first-mentioned other electrode was located while taking a plurality of the measurements of the first survey. Claims allowed, 13.

5864. Method for orienting cores; John M. Pearson, Swarthmore, Pa., assignor to Sperry-Sun Well Surveying Co., Philadelphia, Pa., a corporation of Delaware: U. S. patent 2,211,158, issued August 13, 1940.

This invention relates to the method of determining the magnetic properties of cores from boreholes, comprising rotating a core about its axis adjacent a suspended magnetic system with at least one end of said core adjacent to one pole of the magnetic system; noting the deflections of said system during rotation of the core; again rotating the core about its axis adjacent to and similarly placed with respect to the suspended magnetic system but with said end of said core adjacent an opposite pole of the magnetic system; and again noting the deflections of said system during rotation of the core. Claims allowed, 6.

5865. Arrangement for measuring the local specific resistance of borehole strata; Oscar Martienssen, Kiel, Germany: U. S. patent 2,212,273, issued August 20, 1940.

In an arrangement for measuring in boreholes the variation of the contact resistance of an electrode disposed in the borehole, an electrode in the form of a cylindrical body of lead, surrounded by insulating material at both of its ends so as to expose a central cylindrical contact surface whose height is substantially equal to the cylinder diameter. Claims allowed, 3.

5866. Method of exploring the porosity of geologic strata traversed by boreholes; Oscar Martienssen, Kiel, Germany: U. S. patent 2,212,274, issued August 20, 1940.

This invention relates to a method of exploring the porosity of strata traversed by a borehole, consisting of freely suspending in the borehole a plummet electrode from an insulated cable; supplying by means of the electrode through the liquid in the borehole and the adjacent ground a direct current of a constant potential of not more than 2 volts and in the same order of magnitude as the electro-osmotic flow potentials due to the porosity of the adjacent strata; and observing the changes of intensity of the direct current as a measure of the porosity to be determined while the electrode travels by the strata. Claims allowed, 2.

5867. Apparatus for depth measurement by echo-reception methods; Arthur Joseph Hughes, Chigwell Row, England, assignor of one-half to Henry Hughes & Son, Ltd., London, England, a corporation of Great Britain: U. S. patent 2,212,604, issued August 27, 1940.

This invention relates to a casing for containing a sound generator and receiver, comprising a hood open at the bottom and curved trans-

versely and tapering longitudinally, transverse partitions secured across the inside of said hood, a flat plate secured over the open bottom of the hood to close it, and sealing means interposed between the bottom edge of the hood and said plate. Claims allowed, 5.

5868. Soil-gas analysis; Thomas H. Dunn, Tulsa, Okla., assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,212,681, issued August 27, 1940.

In a method of soil-gas analysis for minute traces of hydrocarbons heavier than methane present together with methane in said soil gas, the steps which comprise condensing at least a substantial part of said methane together with substantially all of said heavier hydrocarbons at approximately liquid-air temperature; quantitatively removing said methane from said condensed hydrocarbons in a single operation while at approximately liquid-air temperature, without removing any substantial amount of said heavier hydrocarbons, by maintaining the pressure on said condensed hydrocarbons at a value less than about 0.1 micron for a substantial period of time; and determining the amount of the residual heavier hydrocarbons. Claims allowed, 5.

5869. Method and apparatus for detecting oil in well drilling; John T. Hayward, Tulsa, Okla.: U. S. patent 2,213,138, issued August 27, 1940.

This invention relates to the method of detecting minute and normally invisible quantities of crude petroleum oil in the drilling mud return from an oil well, comprising subjecting the return to a fluorescence-exciting ray to render the oil in the field visible by fluorescence and subjecting the same field to a visible light ray in order to check for the presence of the oil in the field. Claims allowed, 9.

5870. Seismic-prospecting apparatus; Serge A. Scherbatskoy and Jacob Neufeld, coinventors, both of Tulsa, Okla., United States of America: Canadian patent 389,668, issued June 25, 1940.

This invention relates to the method of seismic surveying, which comprises creating a disturbance below the earth's surface; receiving the several waves thus formed; translating these waves into electrical vibrations; producing an electric effect dependent upon the magnitude of the electrical vibrations; producing an electric effect dependent upon the time derivative of the said magnitude; adding the two effects. Claims allowed, 64.

5871. Gravity-measuring apparatus; Bolidens Gruvaktiebolag, Stockholm, assignee of Axel Rudolf Lindblad, Stockholm, and Johan David Malmquist, Boliden, coinventors, both in Sweden: Canadian patent 390,487, issued August 6, 1940.

This invention relates to a measuring apparatus of the gravimetric type, comprising a movable body whose weight is balanced by spring tension and a thermoregulator in which there is a thermostat adjusted at a minimum temperature higher than the temperature gradient of the surrounding atmosphere—an apparatus for conducting a (stratum) survey of the earth's subsurface for metalliferous bodies of strata that permits measuring small increments of gravitational force from one location to another and that comprises in combination a mass; resilient means for supporting said mass; means in combination with said mass

and resilient means for forming one plate of an electric condenser; stationary means cooperating with said first-mentioned means adapted to serve as another plate of said condenser, whereby a change in the gravitational force will effect a change in the capacity of the variable condenser that will be directly indicative of a variation in the change in gravitational force affecting said mass; and an electrical thermoregulator, whereby the variable condenser is maintained at a temperature which is greater than the ambient temperature. Claims allowed, 2.

5872. Seismic well-logging method; Stanolind Oil & Gas Co., Tulsa, Okla., assignee of Henri Salvatori, Hollywood, Calif., both in the United States of America: Canadian patent 390,568, issued August 6, 1940.

This invention relates to a method of logging a well by means of seismic waves, comprising disposing a group of at least two vertically spaced seismic-wave detectors in a well, the spacing between adjacent detectors being not substantially greater than the thickness of individual major geologic beds traversed by said well; generating seismic waves at a point substantially vertically alined with said detectors; recording the times of arrival of seismic waves at each of said detectors on a common record in a single operation; determining the differences between said arrival times; and preparing therefrom a seismic log of said well yielding information concerning abrupt changes in the lithologic character of the geologic formation opposite said detectors. Claims allowed, 10.

5873. Geophysical-exploration method; Shell Development Co., San Francisco, Calif., assignee of Haakon Muus Evjen, Houston, Tex., both in the United States of America: Canadian patent 390,989, issued August 27, 1940.

In a method of geophysical exploration by means of a circuit comprising a source of electric current having one terminal connected to the ground at least at one point and the other terminal connected to the ground at a plurality of points through a plurality of variable impedances, the steps of passing an electric current through the ground between said first- and said second-named points in a plurality of noncrossing streams having different depths of penetration; adjusting the intensity of each stream by means of the variable impedances to a desired relative value different from that of the other streams; and determining the electrical properties of the ground at various depths by indicating the characteristics of the current in each of said streams. Claims allowed, 9.

5874. Geophysical-exploration method; Shell Development Co., San Francisco, Calif., assignee of Haakon Muus Evjen, Houston, Tex., both in the United States of America: Canadian patent 390,990, issued August 27, 1940.

In a method of geophysical exploration, the steps of forcing an electric current from a single electromotive source to flow through the ground in a plurality of streams through a plurality of current electrodes; varying the relative intensities of said current streams; registering said relative intensities; and measuring the potential difference generated by the flow of said streams between two grounded potential electrodes for different intensities of said streams. Claims allowed, 11.

5875. Perfectionnements aux méthodes et appareils pour la prospection électrique du sous sol [Improvements of methods and apparatus for electrical prospecting of subsoil]; Compagnie Générale de Géophysique, residing in France (Seine): French patent 850,501, issued December 19, 1939.

This invention relates to the improvements of the method and apparatus of electrical prospecting of subsoil. It consists of measuring the difference of potential created between two points on the surface of the ground by sending artificial electric current into the ground and of measuring separately and at the same moment the difference of potential caused by terrestrial field between two other points disposed so that this latter difference of potential be not influenced by the said current and be in a known relation with the difference of potential caused by terrestrial field between the first two points; the two measurements are compared to correct the errors of the first measurement constituted by the differences of the potential caused by the terrestrial field. Claims allowed, 1.

5876. Method of electrical logging of tubed boreholes; V. V. Mikhailov: Russian patent 56,589, issued February 29, 1940.

This invention relates to the method of electrical logging of tubed boreholes, characterized in that a high-frequency current is conducted to two points selected on the inner surface of the iron tube; the electric resistivity between these two points is then changed, and from the data thus obtained (taking into consideration the distortions caused by the tube) the nature of the rocks surrounding the borehole is determined. Claims allowed, 1.

INDEX TO GEOPHYSICAL ABSTRACTS 103

OCTOBER–DECEMBER 1940

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

INDEX TO GEOPHYSICAL ABSTRACTS 100–103

JANUARY–DECEMBER 1940

Compiled by V. E. CLEVER

A

B

K

O

P

S

T

U

V

Y

Z