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BY

V. L. SKITSKY

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Beginning with 128, Geophysical Abstracts are again being published as Bulletins of the Geological Survey.

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GEOPHYSICAL ABSTRACTS 128, JANUARY–MARCH 1947

Compiled by V. L. SKITSKY

FOREWORD

Geophysical Abstracts are published by the Section of Geophysics of the U. S. Geological Survey as an aid to those engaged in geophysical research and exploration. The publication covers world literature on geophysics contained in periodicals, books, and patents. It deals with exploration by gravitational, magnetic, seismic, electrical, radioactive, geothermal, and geochemical methods and with underlying geophysical theory and research and related subjects.

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

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

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Author's reprints.—The Geological Survey will appreciate receiving reprints of publications and patent specifications from authors and inventors. These will be filed for reference after being abstracted. Foreign publications and patents with little circulation in the United States are especially desired. Such reprints, and all correspondence other than orders for copies, should be addressed to the Director, Geological Survey, U. S. Department of the Interior, Washington 25, D. C.

1. GRAVITATIONAL METHODS

8963. Ansel, E. A. Über die Anziehung sphärisch begrentzer Massen auf der Kugel unter dem Gesichtspunkt der Isostasie [Concerning the attraction of spherical masses on the globe viewed from the isostatic standpoint]: Gerlands Beitr. Geophysik, vol. 59, pp. 363–376, Leipzig, 1943

Generally, the isostatic theory is supported by observations, but certain anomalies, particularly those associated with islands, appear to offer conflicting evidence. The author examines mathematically the problem of the gravitational attraction involved in such instances, reducing it to the simplified case of a spherically bounded continent located on a globe otherwise covered with a motionless medium of the density of water. Analysis shows that, in the case of isostatic equilibrium, every such land mass must experience an additional attraction dependent in magnitude upon the spherical radius of its surface. This additional attraction increases as the radius decreases and attains its maximum value for islands with a radius close to 0.5°. Accordingly, the existence of a large gravity anomaly on an island does not in itself prove the absence of isostatic equilibrium. The underlying mathematics are presented.—*V. S.*

8964. Aquilina, C. Sulle possibilita di prospeczione del sottosuolo con le deviazioni della verticale [On the possibility of prospecting the subsoil by using the deviations of the vertical]: Ricerca Sci., vol. 12, pp. 1126–1134, Rome, 1941.

The gravitational conceptions of Eötvös are reviewed, and a method for measuring the deviation of the vertical, directly related to the distribution of masses in the subsoil, is described.—*Cent. Nat. Rech. Sci., Bull. Anal., vol. 7, no. 9, pt. 1, p. 1739, Paris, 1946, translated by V.S.*

8965. Charczenko, Pierre. Note sur certaines formules de géophysique employées dans la prospection gravimétrique [Note on certain geophysical formulas employed in gravimetric prospecting]: Ann. Géophys., vol. 2, no. 1, pp. 93–96, Paris, 1946.

In 1929 H. Haalck developed useful formulas for calculating the anomalous gravitational effect of subterranean masses having a density different from that of the surrounding medium. However, these formulas cannot be utilized because no distinction was made between the coordinates of the mass and the coordinates of the station, and the formation angle employed had no definite physical meaning. Neither can the formulas be corrected with the use of Haalck's calculation. Accordingly, the author deduces by a new method two formulas applicable to the same geologic cases but free of the shortcomings indicated. The mathematical derivations presented employ the conventional terms $(d^2U/dx.dz)$ and (d^2U/dx^2) and deal with the particular instances of a horizontal layer and an inclined layer characterized by certain angles as to shape and position, respectively.—*V. S.*

8966. Fedynskii, V. V. The barometric effect in gravimeters [in Russian]: Acad. Sci. U. R. S. S. Bull. (Izvestiia), Sér. Géog. et Geophys., vol 10, no. 2, pp. 108–111, Moscow, 1946.

The effect of barometric pressure on measurements of gravity is analyzed mathematically for static gravimeters. A calculation of the

correction for the density of the air leads to the formula $\delta g = K(\rho/\rho_0)$, in which K is the coefficient of proportionality, ρ the density of the air, and ρ_0 the average density of the load-mass of the gravimeter. The application of this formula to the Bolidens gravimeter gave a barometric coefficient of 0.18 mgl./mm. and to the Ising gravimeter a coefficient of 0.65 mgl./mm. Such figures prove the need of an air tight and thermostatic housing for the instrument if a precision of the order of 0.10 mgl. is to be attained.

A special static gravimeter could be constructed for measuring both gravity and barometric pressure. This gravimeter-altimeter would have to be equipped with two load masses possessing different average densities and exposed to the atmosphere. Requirements for such construction and measurements are discussed in application to gravimetric exploration.—*V. S.*

8967. Frost, A., McIntire, R., Papenfus, E., and Weiss, O. The discovery and prospecting of a potential gold field near Odendaalsrust in the Orange Free State, Union of South Africa: Chem., Met. Min. Soc. South Africa Jour., vol. 47, no. 3, pp. 107–141, Johannesburg, 1946; also South African Min. and Eng. Jour., vol. 57, pt. 2, no. 2802, pp. 177–182, no. 2803, pp. 223–226, and no. 2804, pp. 255–256, Johannesburg, 1946.

Western Holdings, Ltd., discovered gold deposits in the Odendaalsrust area, Orange Free State, by means of geophysical exploration and drilling. The torsion balance was used in 1937 for finding areas where Upper Witwatersrand quartzites and conglomerates could be expected to occur at relatively shallow depths. The promising gravity indications later were checked by a magnetic survey, which detected a zone of anomalies in their vicinity. Drilling confirmed geologic predictions based on the combined data and led to the discovery of pay values at a depth of 991 feet on the gravity anomaly at St. Helena.

Thereupon, the whole optioned area was covered by a detailed torsion-balance survey, which successfully delineated the main local structure and assisted in tracing the continuity and the correlation of paying gold-reef horizons. The local geology, geophysical findings, and drilling operations are discussed.—*V. S.* (A review appeared in South African Min. and Eng. Jour., vol. 57, pt. 2, no. 2800, pp. 127–129, Johannesburg, 1946.)

8968. Geyer, R. A. Heiskanen's paper on the structure and figure of the earth, a review: Geophysics, vol. 11, no. 4, pp. 560–562, Tulsa, Okla., 1946.

Attention again is called to this paper, previously reviewed, because of the current gravity exploration of continental shelf zones. Of special interest in this connection are the sections of the paper dealing with the rapid anomaly changes along oceanic coast lines, marine gravity anomalies, and similar anomalies on islands such as the Philippines, Hawaii, Cyprus, and others.—*V. S.* (*See also* Geophys. Abstracts 106, no. 6130.)

8969. Graaff Hunter, J., de. Report on the deviations of the vertical: Assoc. Internat. Géod. Trav., vol. 16, Rept. 3, 73 pp., Paris, 1940.

The use of deviations of the vertical for geoid determination is discussed, and a method is developed for uniform treatment of different types of observations. Attention then is devoted to correcting the na-

nural geoid for topography and compensation. Where the number of stations is sufficient to represent the general trend of deviations, the simplest procedure is to compute the isostatic correction to the geoidal elevation. The concrete cases of determination of the geoid in North Africa and of the Cyprus and Tahiti anomalies receive particular attention. In the light of these considerations the precision of geoidal determination is further analyzed with regard to the curvature of the vertical and the errors of observation and of quadrature, and determination from deviations is compared with that computed from gravity by the Stokes method. Reports of observations from British India, Canada, Czechoslovakia, Switzerland, the United States, and Yugoslavia are appended.—*V. S.*

8970. Heiskanen, W. The gravity anomalies on the Japanese Islands and in the waters east of them: Isostat. Inst. Internat. Assoc. Geod. Pub. 13, 22 pp., Helsinki, 1945.

The author discusses the Pacific gravity picture in the light of measurements on the Japanese Islands and in the Nippon Trench. In the greater part of Honshu, in Hokkaido, and east of the islands, large positive anomalies are found on the coast and large negative anomalies over the sea. These become much smaller through isostatic reduction but in a considerable part cannot be explained isostatically. Clarifying calculations based on the results of various reductions and on the work of Vening Meinesz, Niskanen, and Schwinner are offered.

It is found that there is a granitic layer about 15 kilometers thick under the Asiatic and American continents, which is absent under the ocean between them. Below this granitic layer is the intermediate layer about 25 kilometers thick, and below the latter the under layer begins. The isostatic compensation of the continental edges occurs locally, partly in the depths of 5 to 15 kilometers, and partly in the depths of 35 to 40 kilometers, so that the mean depth of compensation must be 20 to 28 kilometers. The calculations are presented, and some results are tabulated.—*V. S.*

8971. Liustikh, E. N. The treatment of gravity data in preparation for geological interpretation [abstract, in Russian]: Akad. Nauk S. S. S. R., Otd. Fiz.-Mat., Referaty za 1943–44, p. 125, Moscow, 1945.

An inquiry is made into the geologic connotation of the standard formula and the various reductions of the force of gravity. The analysis demonstrates the advantages of the topographic reduction and, to a less extent, of the statistical and the Bouguer reductions for purposes of geologic application. Consideration is given also to the means of differentiating between the gravity effects of deep and superficial formations. It is found that isostatic reduction is unsuitable for this purpose, and superior methods are offered. Research was done at the Institute of Theoretical Geophysics, Moscow.—*Translated by V. S.*

8972. Luoma, N. Gravity formulas derived by the aid of latitude and longitude zones: Isostat. Inst. Internat. Assoc. Geod. Pub. 9, 19 pp., Helsinki 1941.

The problem of the triaxiality of the equator has been investigated by dividing the gravity anomalies into longitude zones and latitude zones, both 10° in breadth, and determining the gravity formula by the aid of every zone. The data were derived from more than 700 gravity

stations unevenly distributed over the earth's surface and considered insufficient for accurate calculation.

The results are conflicting. If, however, the doubtful areas are ignored, the observed gravity anomalies appear to be in rather good agreement with the triaxiality of the equator. The difference between the long and short equatorial axes approximates 150 to 250 meters, and the long equatorial axis lies near 0° to 20° west of Greenwich. The gravity formulas deduced by other investigators are reviewed.—*V. S.*

8973. Niskanen, E. Gravity formulas derived by the aid of the level land stations: Ann. Acad. Sci. Fenn., ser. A, vol. 3, no. 10, pp. 1–16, Helsinki, 1945.

The author used isostatically reduced anomalies of the Northern Hemisphere and only those at stations in "plain" area and less than 300 meters in height. He also deduced triaxiality for the sea-level figure of the earth, the long equatorial axis exceeding the short axis by 293 meters and emerging about 4° west of the Greenwich meridian. In his summary he attributes the triaxiality to overcompensation of the continents and oceans. A final conclusion regarding the ellipticity of the equator is considered impossible until thousands of new, well-distributed measurements are made in the Southern Hemisphere.—*R. A. Daly, Jour. Geology, vol. 54, no. 6, p. 405, Chicago, 1946, condensed by V. S.*

8974. Pauwen, L. J. Sur un appareil statique pour la mesure de la valeur de la pesanteur [On a static instrument for measuring the value of gravity]: Soc. Roy. Sci. Liége, Bull., vol. 11, pp. 646–651, 1942.

A static gravimeter constructed on the spring principle is offered for use in photogrammetric and geophysical surveys. In mapping work it can provide gravity data for calculating the deflection of the vertical, necessary for determining the longitudes and latitudes of the ground points serving as reference network for aerial photographs. The precision of the gravimeter is given as 1.0 milligal—*V. S.*

8975. Petroleum Times. Bahamas oil search by Standard Oil (N. J.): Vol. 50, no. 1283, pp. 1026–1027, London, 1946; also California Oil World, vol. 39, no. 18, p. 22, Los Angeles, 1946.

About 2,000 square miles of ocean floor north of Grand Bahama Island are being surveyed with a gravimeter-carrying diving chamber by the Bahamas subsidiary of the Standard Oil Co. of New Jersey. The exploration ship is equipped with radar for determining the location of stations, and radar targets are anchored at strategic points over the surveyed area.—*V. S.* (*See also* Geophys. Abstract 127, no. 8815.)

8976. Sitter, L. U., de. Geological and geophysical studies during the war on behalf of the Associated Collieries of the Netherlands: Nature, vol. 158, no. 4002, pp. 48–50, London, 1946.

During World War II, the Associated Collieries of the Netherlands established a special organization for scientific research in colliery work. The ensuing investigations have included an extensive gravimetric survey of the southeastern part of the Netherlands, as well as tectonic, stratigraphic, sedimentary, and other studies. This work is outlined briefly in the present account and is more fully described in "Mededeelingen van de Geologische Stichting, Serie C." The gravimetric survey has delineated successfully the large faults forming the boundaries of

the South Limburg coal field and the Peel area farther north. Detailed traverses were run over the more important faults, with stations only 50 meters apart. As a result, new extensions of the coal field were proved and former errors of the fault pattern were corrected.—*V. S.*

8977. Sneddon, Richard. Submarine prospecting: Petroleum Engineer, vol. 17, no. 8, pp. 222–226, Dallas, Tex., 1946.

J. J. Jakosky, consultant, and B. Bauers, engineer, have designed for the Union Oil Co. a diving bell for under-water gravity prospecting. The vessel is 3 feet in diameter and 5 feet high. It consists of ½-inch galvanized plate, weighs 1,500 pounds, and withstands pressure at a depth of 100 feet. Its base is weighted with a detachable load of 1,250 pounds, which can be released by the operator in emergency, allowing the bell to rise to the surface. The interior equipment includes an oxygen tank, a meter for measuring the oxygen content of the air, an air purifier, a safety belt, a telephone, and instruments for gravity measurements. Tests of the bell were conducted in the Los Angeles harbor and proved satisfactory. The Union Oil Co. intends to explore for oil along the shores of Texas and Louisiana.—*V. S.*

8978. Tikhonov, A. N., and Bulanzhe, Iu. D. On the integration of gravitational fields [in Russian]: Acad. Sci. U. R. S. S. Bull. (Izvestiia), Sér. Géog. et Géophys., vol. 9, no. 3, pp. 240–260, Moscow, 1946.

The integration of gravitational fields by means of various master charts is discussed mathematically with a view to clarifying the physical meaning of the process and the geologic connotation of local and regional fields. The point chart, the circular chart, and the elliptic chart are applied to general and to special theoretical cases. Consideration is given to integrating maps of potential, of local anomalies and densities, and of anomalies produced by bodies of different shape, as well as to characteristics of regional and local fields and related problems. Mathematical derivations are presented.

Separation of regional and local fields is further illustrated by an area in the Ishimbai oil region, U. S. S. R., which was investigated gravimetrically, electrically, and by drilling. The main gravity problem of isolating local anomalies and determining their origin was resolved here by integrating with a circular chart. The separate maps showing the resulting local and regional fields are analyzed in the light of both the theory of integration and the data of the electrical map and are found to correspond to known local geophysical and geological characteristics.—*V. S.*

8979. Vening Meinesz, F. A. Gravity in the East Indies and its interpretation [abstract]: Am. Assoc. Petroleum Geologists Bull., vol. 30, no. 5, pp. 743–744, Tulsa, Okla., 1946.

The author explains the belt of strong negative gravity anomalies in the East Indies by the effects of downward buckling of the rigid crust and formation of a bulge of crustal material at the lower boundary of the crust. This stage of mountain formation reached in the East Indies furnishes the facts from which the history of the development of geosynclines is inferred. A unified explanation is thereby achieved for local seismic activity, earthquake centers, the presence of deep basins within the volcanic area, and positive anomalies in these basins. Similar

phenomena found in the West Indies also may be explained in terms of the postulated geosyncline history.—*V. S.*

8980. Zahradnicek, Josef. Energetika torsnich kyvadel [Undamped oscillations of a system of coupled torsion pendulums]: Spisy Masarykovy Univ., no. 277, 18 pp., Brno, Czechoslovakia, 1946.

The author gives a solution of the problem of N (=1, 2, 3, 4) undamped torsion pendulums coupled one with another. In the energy equations employed, the pendulums are supposed to be suspended in one and the same vertical plane by an elastic thread, the lower end of which also is fixed. Calculation is made of oscillation frequencies in the general case and in certain special cases where the frequencies of different pendulums become identical.

Photographic records have been taken of the interrelated oscillations in some of the instances considered. For several cases of two torsion-pendulums, in which the coefficient of coupling remained the same while the frequencies proper were changed, the results of calculations were verified experimentally. The experiments confirmed the theoretical deductions.—*Author's abstract, translated by V. S.*

2. MAGNETIC METHODS

8981. Baranov, V. Sur un nouvel abaque pour le calcul de l'influence des couches planes magnétiques minces [Concerning a new master chart for calculating the effect of thin and plane magnetic layers]: Ann. Géophys., vol. 2, no. 1, pp. 25–30, Paris, 1946.

In magnetic prospecting a common problem is the delineation of thin and plane deposits. The magnetic effect of such layers is proportional to the product of their thickness and magnetic susceptibility and also depends upon their inclination, expansion, and magnetic orientation, as well as upon general topography. Accordingly, the plotting of the anomalies produced by these deposits usually requires the calculation of an entire family of curves for the successive values of typical parameters.

To facilitate such calculations, the author offers a rapid method applicable to any thin and plane layer in any topography. This method is based on the determination of the constant magnetic values which the anomaly must have on certain cyindrical surfaces dependent on the position of the layer and centered on axes located in one and the same plane. A vertical cross section of these cylinders perpendicular to the layer gives a family of circles each having a constant value inversely proportional to the diameter. These circles can be plotted on a master chart which greatly simplifies the calculation and interpretation of the anomaly. The underlying mathematical theory is presented, and the construction and use of the master chart are described, with illustration by drawings.—*V. S.*

8982. Buss, K. A. H. Nota sôbre o método de Tiberg de medidas magnéticas subterrâneas e do uso do paralelogramo de fôrças [Note on Tiberg's method of subterranean magnetic measurements and on the use of a parallelogram of forces]: Estudos, Notas e Trabalhos do Serviço de Fomento Mineiro, vol. 1, nos. 3–4, pp. 293–295, Porto, Portugal, 1946.

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Tiberg's method of magnetic prospecting for minerals, employed in Switzerland and other countries, consists of measuring the horizontal geomagnetic component by the Tiberg-Thalen magnetometer, with the use of Lamont's technique of sines. Further calculation is based on the formula $R=H\ (\sin\alpha_0/\sin\alpha)$, where R is the total horizontal intensity composed of the geomagnetic component H and of the deposit's component F, α_0 is the neutral-angle constant of the magnetometer's needle, and α is the angle registered by the needle over mineralization. Whenever the magnitude and the direction of R are measured, a parallelogram of forces can be drawn for R, H, and F, providing a graphic determination of F.

Eight observations in a mine illustrate the construction of the respective parallelograms. The eight vectors obtained, representing F at the different stations, converge toward the area of greatest mineralization and serve to locate the deposit. The station where F attains its highest value is usually nearest to the deposit; a drawing shows the eight parallelograms plotted. This method can also serve for surface investigations.—*V. S.*

8983. Diday, Marcel. Représentations graphiques des variations de la déclinaison en Suisse [Graphic presentation of the variations of magnetic declination in Switzerland]: Schweiz. Zeitschr. Vermessungswes, vol. 40, pp. 158–166. 1942.

In 1935, Brückmann published a map of magnetic declination in Switzerland plotted according to artillery requirements. It is of little use, however, for other purposes. The author employs Brückmann's data and additional derived values for a new map of declination designed particularly for practical geodesy. The method of plotting, the scale adopted, and the calculation of the additional values are discussed. This map gives a comprehensive picture of the distribution of declination and of numerous strong anomalies.—*V. S.* (A review appeared in Zentralb. Geophys., Meteorol. u. Geod., vol. 11, no. 2, pp. 79–80, Berlin, 1943.)

8984. Dougherty, E. Y., and Fitzhugh, E. F., Jr. Magnetic reconnaissance in north-central Minnesota in 1945: U. S. Bur. Mines, Rept. Inv. 3919, 7 pp., Washington, D. C., August 1946.

The U. S. Bureau of Mines conducted a reconnaissance magnetic survey in north-central Minnesota in 1945 to obtain data helpful in exploration for iron ore in this region. A Hotchkiss superdip was used for general work, and a Schmidt-type magnetometer served for calibration and comparison. The normal distance between observation points was 0.10 mile, and readings were corrected for fluctuations of temperature and for diurnal and day-to-day changes in the earth's magnetic field. The results showed that the ore formation on the Mesabi range is less magnetic near Grand Rapids than near Takanite and Bovey and weakly magnetic southwest of Grand Rapids. Very strong anomalies were found north of Deer River and less strong anomalies north, west, and southwest of Remer. Other findings are reported. The magnetic profiles obtained along the traverses are shown, and the traverses are described.—*V. S.* (A summary appeared in Montana Oil and Min Jour., vol. 26, no. 30, p. 8, Great Falls, Mont., 1946.)

8985. Duffin, R. J. Measurement of magnetic susceptibility with the Hughes induction balance: Terres. Magn. and Atmos. Electr., vol. 51, no. 3 pp. 419–426, Baltimore, Md., 1946.

In this paper two methods of measuring magnetic susceptibility with the Hughes induction balance are described that are especially convenient for geophysical work. The paper also includes a simple approximate theory concerning the use of the Hughes induction balance for detecting buried objects.

The first method described here is used for measuring the magnetic susceptibility of the ground and is a field method. The operation consists of holding the exploring coils over the ground and measuring the height for standard response. The second method is for use with small samples of material in bottles, and the operation consists of inserting the bottle in a coil and reading a meter.

An instrument is described that can make use of either method. This device seems to be more portable and convenient than the previous instruments for measuring susceptibility outlined in Heiland's "Geophysical exploration." The U. S. Geological Survey has found the device described here useful in correlating the magnetic properties of soils with the geological structure.—*Author's abstract.*

Frost, A., McIntire, R. Papenfuş, E., and Weiss, O. The discovery and prospecting of a potential gold field near Odendaalsrust in the Orange Free State, Union of South Africa: Chem., Met. Min. Soc. South Africa Jour., vol. 47, no. 3, pp. 107–141, Johannesburg, 1946; also South African Min. and Eng. Jour., vol. 57, pt. 2, no. 2802, pp. 177–182, no. 2803, pp. 223–226, and no. 2804, pp. 255–256, Johannesburg, 1946. *See* Geophys. Abstract 8967.

8986. Gassmann, F., Weber, E. K., and Niggli, E. Magnetische Messungen des Instituts für Geophysik der E. T. H. im Tessin [Magnetic measurements of the Institute of Geophysics, E. T. H., Tessin]: Soc. helvétique sci. nat. Actes, 125th sess., pp. 118–119, Aarau, Switzerland, 1945.

In 1944–45 the Institute of Geophysics in Ticino (Tessin), an affiliate of the Eidgenossische Technische Hochschule in Zurich, conducted a survey of the Ticino magnetic anomaly indicated on Brückmann's magnetic map of Switzerland. The measurements were made with the horizontal magnetometer of LaCour and the vertical balance of Schmidt. They revealed an elongated anomalous area with a maximum at the northern edge of a stretch of basic rocks—diorite, peridotite, and other rocks—in the Ivrea zone. The magnetic properties of the rocks are being investigated. At this stage of the measurements it appears that the magnetic anomaly corresponds closely with a local gravity anomaly and that the Ivrea zone extends eastward under the overburden.—*V. S.*

8987. Grenet, Gaston. Quelques mesures d'aimantation permanente de roches du Massif Central et remarques sur les méthodes de determination de la valeur du champ magnétique terrestre dans le passé [Some measurements of the permanent magnétization of rocks of the Massif Central and remarks on methods of determining the intensity of the geomagnetic field in the past]: Ann. Géophys., vol. 1, no. 3, pp. 256–263, Paris, 1945.

The author describes the results of his magnetic measurements and the highly sensitive induction apparatus employed. The rocks, sampled

from the Massif Central, France, were found to be characterized by stable magnetization. The very recent lava flows of Tartaret and Volvic gave magnetizations with a very definite direction. Other measured rocks had a variable direction of magnetization, and the magnetic measurements seemed to be less significant. The Tertiary basalts of the Massif du Mont Dore produced an entirely unstable magnetization which possessed no significance. Results on terra cotta and related materials also are given. Consideration then is devoted to the effects of the alteration of rocks upon their magnetic properties and the direction of magnetization.—*V. S.*

8988. Hawkes, H. E., Balsley, J. R., and others. Geophysical investigations, preliminary aeromagnetic maps 1 and 2: U. S. Geol. Survey, Washington, D. C., 1946.

The section of geophysics, U. S. Geological Survey, has published two aeromagnetic maps. Map 1, of the Oswegatchie quadrangle, New York, shows topographic features in black, geologic patterns in green, and magnetic characteristics in red. The striking correlations between known magnetite deposits and magnetic anomalies measured with an airborne magnetometer are indicated. Map 2, of Benson Mines, St. Lawrence County, New York, shows isogams, magnetic profile curves, and surface features.—*V. S.*

Heiland, C. A., Tripp, R. M., and Wantland, D. Geophysical surveys at the Malachite mine, Jefferson County, Colorado: Am. Inst. Min. Met. Eng. Trans., vol. 164, pp. 142–154, New York, 1946. *See* Geophys. Abstract 9040.

8989. Jenny, W. P. Structural correlation of micromagnetic and reflection data: Oil Weekly, vol. 124, no. 3, pp. 32–33, Houston, Tex., 1946.

When local conditions of sedimentation cannot be determined by the seismic reflection method alone, the micromagnetic method may be of assistance. Recently, oriented cores have shown that magnetic properties are relatively common to sedimentary rocks, and sedimentary beds have served successfully as key horizons for micromagnetic surveys. These horizons may occupy advantageous positions with reference to reflecting horizons, as in the case when changes in the sedimentation above local structure affect the magnetic properties of a series of beds in a way different from the reflecting properties of these beds. Examples of such complementary micromagnetic and reflection profiles are discussed for the Wilcox structure and for two structures of Frio age, with illustration by diagrams.—*V. S.*

8990. Jensen, Homer. Operational procedure for the airborne magnetometer: Oil and Gas Jour., vol. 45, no. 10, pp. 80–83, Tulsa, Okla., 1946.

Suitable operational procedures have been worked out in the course of airborne magnetometer surveys made jointly by the U. S. Geological Survey and the Naval Ordnance Laboratory during the last 2½ years. A base station or base line serves for orientation. Records are made continuously and so rapidly that particular profiles need only minor corrections for diurnal variation and instrument drift. Flight controls consist of visual or radar observation, depending upon the availability of maps and photographs of the explored terrain.

In visually controlled flights, the navigator reads the map, makes notations, and operates a serial counter stamping identification numbers on the records. The operator tends to the magnetometer, camera, radio altimeter, and subsidiary equipment. For flights at 1,000 feet, the Sonné strip camera can give a correlation with the ground retraceable with an error within 25 feet. In flights controlled by Shoran radar, the coordinates of distance from two base stations are registered continuously on the record.

To illustrate the details of field procedures, a sample survey is discussed with respect to flight traverses, error corrections, drift effects, and contour-map tracing, with examples of magnetic-intensity maps and a profile.—*V. S.*

8991. Jones, R. H. B. Geologic interpretation of magnetic exploration on the Mesabi range, Minnesota: Min. Technology, vol. 10, no. 4, Tech. paper 2038, 13 pp., New York, 1946.

Abstracts appeared in Econ. Geology, vol. 40, no. 1, p. 88, Lancaster, Pennsylvania, 1945, and in Skillings' Min. Rev., vol. 33, no. 40, p. 2, Duluth, Minnesota, 1945. *See* Geophys. Abstracts 121, no. 7954.—*V. S.*

8992. Lundberg, Hans. Mining Geophysics, (airborne magnetometer): Mining and Metallurgy, vol. 28, no. 482 (annual review), pp. 94–95, New York, 1947.

At present, four different types of airborne magnetometers are used or constructed for exploration: Magnetic Air Detector (MAD), adapted by the U. S. Geological Survey and the U. S. Navy; MAD modified by the Gulf Research and Development Corp.; the magnetometer developed by C. Heiland for the Heiland Research Corp. and the Geophysical Exploration Co.; and the helicopter-borne magnetometer built by Hans Lundberg.

The first two types have pick-up units carried a considerable distance away from the disturbing influence of the airplane. The Heiland apparatus, on the other hand, is mounted on the tip of one of the plane's wings, being reduced in size and weight and compensated for the plane's permanent and induced magnetic fields. The readings are rendered independent of heading, roll, and pitch, and use is made of an integrated radar triangulator, a radar altimeter, and a photographic recording device. The recording device takes simultaneous pictures of the terrain below, radar position fix, magnetic values, terrain clearance, magnetic record numbers, time, and barometric altitude.

The Lundberg instrument is designed for detailed surveys and is flown close to the ground. The maneuverability of the helicopter allows it to hover, alight, ascend, and descend, so that it is possible to study magnetic intensity variations in detail and gain information on the vertical dimensions of a magnetic body.—*V. S.*

8993. Magnée, I., and Evrard, P. La valeur de l'interpretation géologique de profils magnétiques [The value of geological interpretation of magnetic profiles]: Soc. géol. Belgique Annales, vol. 69, nos. 1–3, pp. B35–B45, Liége, 1945.

The authors discuss the distinctive exploratory possibilities of the magnetic method. They examine the simple case of thin layers, after showing how to proceed in the field in choosing interpretable profiles. Two practical examples are presented, and consideration is given to ob-

taining the necessary precision of interpretation by determining simultaneously anomalies of the horizontal and the vertical magnetic component over the same profile; in the examples, Askania balances Gf 6 and Gf 7 were used. In the case of thin layers, there exists theoretically a simple relationship between the trends of both curves of anomalies. Steps are taken to ascertain whether the two curves obtained by actual measurements showed this relation.—*Authors' abstract, translated by V. S.*

8994. Mining and Metallurgy. Magnetometer surveys made from helicopters: Vol. 27, no. 477, p. 474, New York, 1946.

Hans Lundberg has developed a new magnetometer for surveying from helicopters. In contrast to the Navy airborne magnetometer, which measures the total magnetic intensity of the earth's field, the Lundberg instrument sets up a compensating field to balance that of the earth and to account for diurnal variations, so that recordings are made only of the anomalies due to variations in the earth's crust. The results have proved to be as accurate as those of ground measurements. Test surveys are being conducted in the Sudbury area and at Amos, Quebec.

The use of a helicopter permits a detailed study of any point on the ground, because the craft can be held motionless. Measurements are usually made at altitudes ranging from 150 to 250 feet, and special markers are dropped down over anomalies for subsequent photographic mapping. Helicopter surveys have been found far more rapid and less expensive than ground surveys.—*V. S.*

8995. Mining Congress Journal. The airborne magnetometer: Vol. 32, no. 7, pp. 48–50, 55, Washington, D. C., 1946.

The airborne magnetometer, adapted for magnetic exploration by the U. S. Geological Survey, is based on the principle of the fluxgate operated by the effect of alternating magnetic fields on magnetic materials. Fluxgates consist of three coils wound on lucite spools containing a core or thin sheet of magnetic material. They are mounted rigidly perpendicular to one another and carry an alternating current inducing magnetic fields in them. When the axis of one of the coils is alined with the magnetic field of the earth, changes induced in that coil's field register on a continuously recording cylinder synchronized with a continuous-strip camera photographing corresponding ground positions. The magnetometer is housed in a nonmagnetic shell towed by the plane on a cable; it actuates the instruments installed within the plane for recording position, time, altitude, and other data.

The flight techniques resemble those of photographic surveys. The area explored is traversed back and forth until completely covered. The spacing of traverses ranges from a quarter of a mile to a mile, depending upon the problem, and an altitude of less than 1,000 feet is necessary for an accuracy within 50 feet. An average of 400 miles of traverse can be covered during a 4-hour flight. Other particulars are given. The methods used in test surveys are illustrated by an example of exploration over Iron County, Michigan.—*V. S.*

8996. Morelli, Carlo. Campo normale della componente verticale del campo magnetico terrestre in Italia [The normal field of the vertical component of the geomagnetic field in Italy]: Riv. Geominer., vol. 4, no. 4, pp. 102–108, Milan, 1943.

On the basis of the absolute measurements taken at 278 stations of the first-order magnetic net in Italy, the author calculates the numerical values of the coefficients in a power-series development of the geographical coordinates, where only the terms up to the second order are considered. With the equation thus obtained the normal field for the vertical component in Italy at 1942.0 can be computed. The general trend of the field is dealt with and represented graphically. The values of the latitude and longitude corrections, which are to be applied by variometer measurements for mapping magnetic anomalies, are derived therefrom.—*Terres. Magn. and Atmos. Electr., vol. 51, no. 3, p. 464, Baltimore, Md., 1946.*

8997. Puranen, Mauna. The calculation of the strength of the anomaly of a magnetic ore body at a given distance above the surface of the earth: Comm. géol. Finlande Bull., no. 138, pp. 21–26, Helsinki, 1946.

In the present paper are deduced the formulas with which one can calculate the strength of the magnetic field associated with an ore body, at points above the surface of the earth, when there is given a map of the vertical magnetic intensity at the surface.—*Author's abstract.*

8998. Roman, Irwin. The resolving power of magnetic observations: Min. Technol., vol. 10, no. 6, Tech. Paper 2097, 18 pp., New York, 1946.

The theoretical resolving power of magnetic observations is discussed with regard to variations both in total magnetic intensity and in each of the two components usually measured. The relative diagnostic value of the total-intensity anomaly and of the vertical anomaly in geophysical prospecting also is considered. It is found principally that the resolving power decreases rapidly with the depth of the disturbing body, that the horizontal anomaly has little value in locating this body, and that the total-intensity anomaly in the northern magnetic hemisphere is offset to the south of the vertical anomaly, for a positive anomaly.

These theoretical deductions are supported by a mathematical analysis of typical cases illustrated by anomaly curves. The offsetting of the total anomaly to the south of the disturbing body is given special attention and is clarified by computation of numerical examples.—*V. S.*

8999. Shapley, A. H., and Roberts, W. O. The correlation of magnetic disturbances with intense emission regions of the solar corona: Astrophys. Jour., vol 103, no. 3, pp. 257–274, Chicago, 1946.

Correlation analyses of coronal and magnetic data, during the period August 1942 to July 1944, show that, on the average, magnetic disturbances occurred when intense emission regions of the solar corona were situated in the eastern hemisphere of the visible solar disk. Some specific comparisons are cited with regard to the correspondence of coronal-emission regions and magnetic disturbance regions. Although there are some valid criticisms of the methods of correlation used thus far, the results demonstrate that a correlation does exist and that more refined and complete analysis is indicated to realize fully the value of coronal observations as applied to short-term forecasts of disturbance. The observing procedure used at the Coronograph Station of the Harvard College Observatory at Climax, Colo., and the uncertainties of observation are detailed in the appendix.—*Authors' abstract.*

9000. Skillings' Mining Review. Magnetometer survey to use airplane: Vol. 35, no. 9, p. 4, Duluth, Minn., 1946; Oil News, vol. 22, no. 6, p. 3, Albuquerque, N. Mex., 1946; Min. Cong. Jour., vol. 32, no. 6, p. 25, Washington, D. C., 1946.

In 1943 the U. S. Geological Survey made arrangements with the U. S. Navy Department and the Bell Telephone Co. for adapting the Navy airborne detector of submarines to exploration of mineral deposits. The work was successful, and test surveys of oil and iron deposits were made over more than 40,000 square miles of territory from Alaska to the Gulf of Mexico. The height of flying ranged from 150 to 14,000 feet, and ground position was registered by means of electronic and photographic equipment. Since then, the adapted Naval-Ordnance laboratory magnetometer has proved itself suitable for a wide variety of geologic mapping on land and water. It possesses high precision, makes surveying of impassable regions possible, works 100 times faster than ground magnetometers, and reduces markedly the cost of exploration.—*V. S.*

9001. Vestine, E. H., Laporte, L., and Cooper, C. Geomagnetic secular change during past epochs: Am. Geophys. Union Trans., vol. 27, no. 6, pp. 814–822, Washington, D. C., 1946.

This paper concerns the description of geomagnetic secular change during the past four decades and its preliminary interpretation in relation to the origin of the earth's main field and its secular change. The work is based mainly on extensive magnetic surveys over land and sea during the past 40 years, carried out by or in cooperation with the Department of Terrestrial Magnetism, Carnegie Institution of Washington, with final reduction calculations financed by the United States Navy.—*Authors' abstract.*

9002. Visser, S. W. Tensions in the earth's crust resulting from pole shift and the terrestrial magnetic field [in Dutch]: Adak. Wet. Amsterdam, Afd. Natuurk., Versl., vol. 52, no. 8, pp. 497–502, Amsterdam, 1943.

The net of shears derived by Vening Meinesz from the stresses caused by a movement of the axis of rotation shows remarkable correlations with the earth's magnetic field. The net of shears and the primary magnetic field have an equal and equally directed skewness. The net of shears and the secondary magnetic field may be divided into four sectors.—*Physics Abstracts, vol. 49, no. 587, p. 331, London, 1946.* (*See also* Geophys. Abstract 9090.)

3. SEISMIC METHODS

9003. Agamennone, Giovanni. Ill terremoto delle Prealpi Carniche dell's giugno 1934 e sua profondita' ipocentrale [The earthquake of June 1934 in the Carnic Forealps and its hypocentral depth]: Geofis. Pura e Appl., vol. 8, nos. 1–2, pp. 43–72, Milan, 1946.

The methods for estimating the depth of an earthquake are reexamined by the author, who arrives at the conclusion that some procedures are unreliable. This unreliability is illustrated by the findings for the earthquake of June 8, 1934 (Veneto), for which P. Caloi found a depth of 37 kilometer by means of elements deduced solely from seismological diagrams. The author uses a method based on the decrease of intensity with distance and obtains a depth of 10 kilometers. The analysis of the

discrepancy between these results shows that some methods, such as that of the angle of emergence, should be applied with prudence and within certain limits to assure reliable findings.—*Authors' abstract.*

9004. Baird, H. F. Old fallacies and new facts about earthquakes [abstract]: Roy. Soc. New Zealand Trans. and Proc., vol. 75, 1945–46, appendix, p. XLII, Wellington.

In an address to the Canterbury branch of the Royal Society of New Zealand, H. F. Baird outlined briefly the present knowledge on earthquakes and earthquake destruction and discussed popular fallacies. Among other topics, he dealt with the types of elastic waves that traverse the earth; modern views of the interior of the earth; the distribution of earthquake zones, their connection with mountain systems and their geologic age; volcanic areas, past and present; and continental shelves.—*V. S.*

9005. Berson, I. S. Kinematic possibilities of the existence of Mintrop waves in certain continuously discrete media [in Russian]: Acad. Sci. U. R. S. S. Bull. (Izvestiia) Sér. Géog. et Géophys., vol. 9, no. 2, pp. 122–134, Moscow, 1946.

The conditions of generation of Mintrop waves are studied kinematically for a two-layer medium when velocity is variable in the first layer and constant in the second layer. Two methods of analysis, both concerned with the boundary between the layers, are employed: examination of the change of apparent wave velocity and determination of trajectories of a whole family of waves. It is shown that two or several independent Mintrop waves can exist at the same boundary in some cases. The resulting features of seismograms and hodographs are discussed and found essential for a correct understanding of structures in seismic prospecting.—*V. S.*

9006. Bonchkovskii, V. F. The thickness of the earth's crust [in Russian]: Priroda, no. 5, pp. 17–20, Moscow, 1945.

The author employs a seismic method for determining the thickness of the earth's crust. Calculation is based on the study of transverse surface (Love) waves propagating under conditions of a limited layer superimposed on a practically unlimited layer. Both layers are homogeneous but possess different densities and different velocities of wave propagation.

The crust is identified with the upper layer, and a dispersion curve is constructed showing the dependence of the velocity of waves on their length and on the thickness of the crust for the known values of density and of velocity in the crust and in the subcrust. With the aid of this curve and the data on the seismic stations, the thickness of the crust is calculated as being, on the average, 30 kilometers under continents and 18 kilometers under oceans. These figures coincide with those obtained by the conventional method used in calculating the thickness of the crust of floating continents. The procedure is explained, and the results for various parts of the crust are tabulated.—*V. S.*

9007. Cantos, J. Investigacion hidrologica por el metodo sismico de prospeccion en Castellon [Hydrological investigations by the method of seismic prospecting in the Province of Castellon]: Rev. Geofis., vol. 4, pp. 1–16, Madrid, Jan.–Mar. 1945.

The application of the seismic method of prospecting to locating natural conduits of subterranean waters in faulted terrain is described, as employed in the Castellon Province, Spain. Impermeable geologic layers were identified.—*Cent. Nat. Rech. Sci., Bull. Anal., vol. 7, no. 6, pt. 1, pp. 1053–1054, Paris, 1946, translated by V. S.*

9008. Cody, C., and Cody, M. Seismograph exploration in Venezuela, part 2: Petroleo Interamericano, vol. 4, no. 12, pp. 58–60, 82–89, Tulsa, Okla., 1946.

The type and amount of seismic equipment required for oil exploration in Venezuela depend on the area surveyed, season of the year, kind of survey, availability of labor, ease of supply, and financing. These factors are discussed for the four regions investigated: Southwestern Venezuela, including Barinas and Apure; cental Venezuela comprising Guarico; the Mesa region of eastern Venezuela; and the Delta Amacuro region of eastern Venezuela. The difficult operating conditions are outlined. Generally equipment for a survey includes 1 recording truck, 1 shooting truck, 1 to 4 drill trucks, 1 to 4 water trucks per drill, and 2 to 4 service trucks. The cost of a party ranges from $30,000 to $40,000 a month, as compared with the average cost of $9,500 in the United States.—*V. S.* (For part 1 *see* Geophys. Abstracts 127, no. 8841.)

9009. Cronshaw, H. B. Oil geologists meet in California: Petroleum, vol. 10 no. 1, pp. 16–17, London, 1947.

Brief mention is made of T. P. Ellsworth's report on the results of a study of multiple seismic reflections conducted in an area underlain by a basalt sill and a basement. His analysis covered the basalt and basement reflections, the effects of dip, the surface zone of weathering, and the contact between Miocene and Eocene strata below the basalt. The conclusion reached recognized the existence of multiple reflections in the zone under consideration but disclaimed an important role for them elsewhere.—*V. S.*

9010. Daly, R. A. Use of rock "norms" in geophysical investigations: Am Jour. Sci., vol. 244, no. 10, pp. 697–709, New Haven, Conn., 1946.

The velocities of seismic waves often are used to deduce the lithologic character of the earth shells. In this work it is necessary to know for each depth the velocity of the longitudinal wave, the velocity of the transverse wave, the value of Poisson's ratio, and the density and cubic compressibility of the material. Regarding density and compressibility, close calculation can be made from the norms derived from a chemical analysis of igneous rock. This norm method is reported to have been used for obtaining the density and compressibility data on a pre-Cambrian basement complex and on 18 principal types of eruptive rock. The results of the computations are presented in tables and discussed with respect to the procedure of investigation, rocks of concern to geophysicists, and application of the data.—*V. S.*

9011. Dix, C. H. The interpretation of well shot data, III: Geophysics, vol. 11, no. 4, pp. 457–461, Tulsa, Okla. 1946.

The present paper is an attempt to take account of the lateral variations in velocity that are found usually by shooting a number of wells. More particularly, it is shown how, by tilting the linear distribution of

velocity with depth in the proper way, one can tie the various wells together, accounting approximately (and usually to a sufficient extent) for all lateral variations of velocity. The problem arising when three wells are shot is discussed in some detail. It is also shown that the lateral change of velocity can be determined approximately by shooting one well alone, and an approximate method of determining the tilt of the datum plane is discussed.—*Author's abstract.* (For the preceding papers *see* Geophys. Abstracts, 122, no. 8089, and 124, no. 8366.)

9012. Draper, C. S., and Wrigley, Walter. An instrument for measuring low frequency accelerations in flight: Jour. Aeronaut. Sci., vol. 7, no. 9, pp. 388–401, Easton, Pa., 1940.

The seismographic system offered for measuring vibration in aircraft consists of a mass connected to the vibrating member by means of an elastic coupling and a damper. Frequency ranges for the satisfactory operation of instruments that measure vibration displacements, velocities, and accelerations can be quantitatively determined by means of nondimensional curves for various degrees of damping. An accelerometer is shown to be the most suitable type of equipment when it is necessary to measure low-frequency, high-amplitude vibrations.

The experimental accelerometer developed by the author employs an oil-damped seismographic system with an effective natural frequency of about 50 cycles per second; the particulars are described. The accelerometer operates with substantially constant sensitivity from zero frequency up to some high-frequency limit which depends upon the damping medium and may be as high as 30 cycles per second under proper conditions.—*Author's abstract, condensed by V. S.*

9013. Epinat'eva, A. M. On average seismic velocity in conditions of the eastern Apsheron syncline [Abstract in Russian]: Akad. Nauk S. S. S. R., Otd. Fiz.-Mat., Referaty za 1943–44, p. 121, Moscow, 1945.

A study was made of the hodographs of reflected seismic waves obtained over the Baku syncline in eastern Apsheron, U. S. S. R. The results proved the need of recognizing the effect of the vertical gradient of velocity in cases where there is a curvilinear reflecting boundary. They also showed that substituting, in interpretation, an approximate medium with a constant average velocity for the actual medium where average velocity is a linear function of the coordinate may lead to grave errors in the conditions of the eastern Apsheron. These errors are analyzed, and certain methods of interpretation taking account of the change of average velocity with depth are examined. Research was done at the Institute of Theoretical Geophysics, Moscow.—*Translated by V. S.*

9014. Gamburtsev, G. A. Correlation of refraction shooting [condensed by L. W. Gardner]: Geophysics, vol. 11, no. 1, pp. 59–65, Tulsa, Okla., 1946.

The theme of this paper is that refraction seismograph investigations making use of techniques and equipment similar to those used for reflection operations can be carried out much more effectively than the older refraction techinque of using only first arrivals. The original text contains a background of theoretical considerations, previous experience, and conceptions leading up to experiments and conclusions which are described, as well as discussions of the merits of the new developments in technique as compared with old technique. Only the essential features

of the experiments, conclusions, and pertinent considerations are given in the present condensation, without following the order or general arrangement of the original.

In summary, the method of correlation by phases suffices to yield useful results. By it, improper correlations of strong first arrivals can be avoided, and numerous refraction events later than the first can be used to great advantage. Similarity of technique to that used in reflection work is emphasized.—*Abstract by L. W. Gardner.* (*See also* Geophys. Abstracts 113, no. 6900.)

9015. Gamburtsev, G. A., and others. Experimental work on the correlation refraction method in the Ishimbai region [abstract, in Russian]: Akad. Nauk S.S.S.R., Otd. Fiz.-Mat., Referaty za 1943–44, p. 117, Moscow, 1945.

Field experiments were made in the Ishimbai oil region, U. S. S. R., to test the applicability of the seimsic correlation-refraction method to prospecting for Artinskian limestone structures. At first the work centered in the area of the Karagan limestone formation, the geology of which is known; then exploration was extended southward to the gravity anomaly at Malyi Shihan.

Areal surveys gave tne following results: 1, Seismic waves underwent marked modifications in frequency and intensity over the Karagan limestone, and the area of such modifications roughly corresponded with the location of the limestone; and 2, modifications of seimsic waves also were found over the Malyi Shihan limestone, revealing a new seismic anomaly. A profiling survey generally failed to give data sufficient for geologic conclusions because of the complexity of the local relief. The findings will be tested by drilling. Research was done at the Institute of Theoretical Geophysics, Moscow.—*V. S.*

Gowanloch, J. N., and McDougall, J. E. Exploration can be harmless to aquatic life: Oil weekly, vol. 119, no. 8, pp. 34–35, Houston, Tex., 1945. *See* Geophys. Abstract 9099.

9016. Hansen, Raul. Reflexiones multiples [Multiple reflections]: Bol. Inform. Petrol., vol. 23, no. 261, pp. 345–360, Buenos Aires, 1946.

The principles of geometrical optics are applied to explain the formation of multiple reflections in the propagation of seismic waves. Consideration is given to the properties of these reflections in the general cases of propagation between a reflecting horizon and the earth's surface, and between two reflecting horizons. In the light of these deductions a study is then made of actual multiple reflections observed in the course of seismic exploration in Argentina, particularly in the basins of the Colorado and Salado Rivers; individual and composite graphs of velocity are given. The inquiry serves to develop two experimental methods for obtaining deep subsurface data by means of multiple reflections. The underlying theory and application of these methods are discussed.—*V. S.*

Jenny, W. P. Structural correlation of micromagnetic and reflection data: Oil Weekly, vol. 124, no. 3, pp. 32–33, Houston, Tex., 1946. *See* Geophys. Abstract 8989.

9017. Keller, F. Response of electronic earthquake recorder: Am. Geophys. Union Trans., vol. 27, no. 5, pp. 636–640, Washington, D. C., 1946.

Preliminary tests made to determine the response characteristics of an electronic earthquake recorder are described. These tests were conducted with a Wenner instrument and a special seismometer, as well as with a Neumann-LaBarre vibration meter. Simultaneous recordings on both smoked paper and photographic paper, which were made on the same drum and from the same seismometer mirror, are shown. The electronic recorder appears to respond satisfactorily to earthquake waves 1 to 30 seconds or longer in duration.—*Author's abstract.* (*See also* Geophys. Abstracts 121, no. 7975.)

9018. Kirillov, F. A. The seismic effect of explosion [abstract, in Russian]: Akad. Nauk S. S. S. R., Otd. Fiz.-Mat., Referaty za 1943–44, pp. 97–98, Moscow, 1945.

Empirical relationships were formerly established between the intensity of the ground's oscillation and the distance to the explosion, weight of the explosive, and related factors (see Geophys. Abs. 120, no. 7835). The data then obtained are now expressed in a generalized formula for determining the displacement of a particle of the ground, or its velocity of oscillation. In the analysis, consideration is given to the dependence of the recorded oscillations of a horizon upon the location of the observation point, the depth of the explosive charge, the kind of explosive, and other factors. The period of the principal phase of oscillation is formulated as a function of distance. For practical application, estimates are offered of the amount of energy used by seismic waves in dry and humid ground, and the method of energy streams developed at the Seismological Institute is used to calculate the maximum depth of penetration of surface waves. Computation also is made of the coefficient of the damping of ground oscillations. The research was done at the Seismological Institute, Moscow.—*V. S.*

9019. Koning, L. P. G. On the determination of the faultplanes in the hypocenter of the deepfocus earthquake of June 29, 1934, in the Netherlands East Indies: Akad. Wet. Amsterdam Proc., vol. 45, pp. 636–642, 1942.

In a previous paper the author has shown how to determine boundary curves for the zones of dilatation and compression in direct longitudinal waves of a deep-focus earthquake. It was assumed that the curves are cut out by the rays that leave the focus in two planes perpendicular to each other. For the earthquake of June 29, 1934, which had its focus at a depth of 700 kilometers, the boundary curves were determined for a certain orientation of the two planes. They were found to separate the zones of dilatation and compression as determined by observation of direct waves and, under certain assumptions, also by observation of reflected waves.

In the present study, the positions of the planes are altered, separately or together. Three distinct movements are considered: The rotation of one plane about the straight line through the focus perpendicular to the other; the rotation of the line of intersection of the two planes about the earth's radius through the focus; and the rotation of the line of intersection about the line perpendicular to it and to the radius. The three kinds of movement are combined and limits to the angles of rotation are found, as agreement with observation has to be preserved.

No great importance, though, is attached to the results obtained, because the observations available were few and partly uncertain. The

chief object of the author is to develop a new method of investigation.—*I. Lehman, Zentralb. Geophys., Meteorol., u. Geod., vol. 11, no. 2, p. 77, Berlin, 1943.* (*See also* Geophys. Abstracts 127, no. 8850.)

9020. Leet, L. D. The velocity of *P* in the granitic layer: Am. Geophys. Union Trans., vol. 27, no. 5, pp. 631–635, Washington, D. C., 1946.

Determinations of the velocity of P_1, the direct longitudinal wave through the outermost or granitic layer, have been made by a number of investigators from studies of earthquake records and from timed artificial explosions. In general, the velocity of P_1 has been reported as about 5.5 km./sec. from the former and 6.0 km./sec. from the latter. Gutenberg recently discussed this difference to explain his belief that explosion waves do not give the correct picture.

Gutenberg's suggestions are analyzed, and the entire problem is reviewed in the light of new evidence showing that personal factors of interpretation have been leading to divergence of results which is more apparent than real.

It is concluded that Gutenberg's P_v, for which velocities have been found between 5.92 and 6.14 km./sec., actually meets the criteria for P_1 and is the phase observed from 0–110 km. as the first arrival on explosion records. Such an interpretation fuses earthquake studies and explosion results into a strong unified body of data establishing the velocity of P_1 as in the neighborhood of 6.0 km./sec.—*Author's abstract.*

9021. Lyons, P. L. The low velocity layer in seismic exploration, parts 1–2: Mines Mag., vol. 36, no. 11, pp. 501–508, Denver, Colo., 1946.

The low-velocity layer (lvl) is discussed with respect to its elements, properties, and problems in exploration seismology (*see also* Geophys. Abs. 124, no. 8378). To remedy its variable effects in seismograms, consideration is given to corrections effected by uphole times, short-distance geophones, and summation, as well as to the underlying principles of Fermat and Snell.

Special corrections are required in cases of several layers of low-velocity material, when the usual lvl layer rests on beds of intermediate velocity, such as glacial drift, thin Tertiary beds, or thick alluvium. These cases lend themselves to solution by the graphic, intercept, chart, Rutherford, analytic, and other methods, as well as by the methods assuming a linear or an exponential velocity increase with depth; the various approaches are outlined. As the lvl layer is present universally, a possible reduction of its effects is important.—*V. S.*

9022. Medsger, H. O. Seismograph prospecting for oil: Canadian Min. Met. Bull., no. 414, pp. 612–616, Montreal, Quebec, 1946

In Alberta, Canada, seismic exploration for oil began in the early thirties and has been limited essentially to the southern half of the Province. The geology of this part is outlined briefly to clarify the problems of the seismic reflection surveys currently conducted. Two areas are distinguished, the foothills and the plains, and an account is given of the nature, development, and field procedures of the seismic reflection method and of the physical properties utilized in obtaining seismic records. In conclusion, successful exploration is regarded as dependent upon a close cooperation of geophysicists and geologists.—*V. S.*

9023. Murphy, L. M. Microseisms, the unknown: Am. Geophys. Union Trans., vol. 27, no. 6, pp. 777–780, Washington, D. C., 1946.

A review is given of the theories on microseims as to their origins, causes, and characteristics, and the results obtained by the investigations of various seismologists. The demand for more experimental data is emphasized, together with many suggestions for obtaining a better understanding of microseisms.—*Author's abstract.*

9024. Murray, H. W. Submarine relief of the Aleutian Trench: Am. Geophys. Union Trans., vol. 27, no. 6, pp. 871–875, Washington, D. C., 1946.

The Gulf of Alaska and the Aleutian Trench have been explored with echo-sounding equipment; a total of about 45,000 soundings was made over 60 traverses at intervals of 15 nautical miles. The relief of the trench mapped from the findings is found to consist of three principal parts: The north face of the trench, which is likewise the continental slope, and which is adjacent to the Continental Shelf bordering the mainland and the island arc to the north; the bottom or axis of the trench; and the outer slope or south face of the trench. These parts are described and are illustrated by maps and profiles.—*V. S.*

9025. Ravignani, G. Sulla risoluzione delle riflessioni nell' esplorazione sismica [Regarding the resolution of reflections in seismic exploration]: Riv. Geominer., vol. 4, no. 1, pp. 10–19, Milan, 1943.

After a short review of the theoretical fundamentals of exploration by seismic reflection, a graphical method is described for mapping reflecting interfaces with a three-dimensional control for any velocity-depth regularity. A universal chart is given for the numerical computation of magnitude and direction of total dips. Mention is made also of a method for the approximate mapping of reflecting planes when the velocity distribution is unknown.—*Author's abstract.*

9026. Riznichenko, Iu. V. Development of the theory of the interpretation of seismic hodographs [abstract, in Russian]: Akad. Nauk S.S.S.R., Otd. Fiz.-Mat., Referaty za 1943–44, p. 122, Moscow, 1945.

The interpretation of hodographs of stratified media usually consists in locating their reflecting or refracting horizons. The author applies to such problems a single, unified treatment by means of the method of temporal fields. This novel approach makes it possible to broaden considerably the range of solvable problems. The usefulness of the method is exemplified for cases of an isotropic medium, important in practical work, but the method can be used likewise in the general case of anisotropic media. The analysis of surfaces of separation in problems where velocities are known is amplified by an inquiry into the determination of the velocities themselves.

Consideration is given also to the physical foundations of geometrical seismic methods. Two methods for establishing the continuity of traces of seismic waves are examined, namely, the use of first arrivals and the correlation by means of wave phases. The latter method is regarded as gaining increasing application in prospecting practice.—*V. S.* (Complete paper to be published in the Transactions of the Institute of Theoretical Geophysics, Moscow.)

9027. Riznichenko, Iu. V. On the determination of average velocities in conditions of poor correlation between seismic reflections [abstract, in Russian]: Akad. Nauk S. S. S. R., Otd. Fiz.-Mat., Referaty za 1943–44, pp. 123–124, Moscow, 1945.

In the Baku oil region and in some other localities of the U. S. S. R. it is rarely possible to obtain a long and continuous reflection hodograph ensuring a reliable determination of average velocities. Dependable results, however, are obtained by using in combination two relatively short converging hodographs, or a series of short hodographs for a single shotpoint, or two or more series in cases of consistent stratification. This success led the author to develop methods for deriving average seismic velocities from combined series of hodographs in the case of one, two, and several shotpoints. The treatment makes use of theoretical hodographs of reflected waves. The research was done at the Institute of Theoretical Geophysics, Moscow.—*V. S.*

9028. Robson, W. T. Rock burst incidence, research, and control measures at Lake Shore mines: Canadian Min. Met. Bull., no. 411, pp. 347–374, Montreal, Quebec, July 1946.

This study of rock burst at Lake Shore mines includes an account of the seismic investigations initiated in 1938 for developing a method of rock-burst prediction. The first experiments employed seismograph installations on the surface and at a depth of 3,075 feet, seismic prospecting equipment, other instruments for recording vibration frequencies, oscillographs, sagmeters, and microgauges. In part, they measured variations in the velocity of seismic waves passing through rock undergoing increasing strain. All the approaches failed to give warnings of rock burst.

Tests were then made by the microseismic method, the underlying principles of which are outlined. During the operation of this equipment 33 local bursts occurred in the region under observation, but in no case did the instruments give warning. The conclusion is reached that an absence of signs of growing stress may prove a better warning of rock burst than their presence, inasmuch as absence points to a lag in the processes of stress absorption effecting gradual adjustments.—*V. S.*
(A review appeared in Mining Mag., vol. 75, no. 3, pp. 189–196, London, 1946.)

9029. Rothé, J. P. La méthode séismique de prospection et la recherche scientifique, possibilités d'application en France [The seismic method of prospecting and scientific research, possibilities of application in France]: Ann. Géophys., vol. 2, no. 1, pp. 90–92, Paris, 1946.

The success of seismic exploration in the United States is outlined with a view to stimulating a similar development in France. As a first requirement, purely scientific research is advocated, and examples of such work in different countries are cited. The geologic problems inviting a seismic approach in France primarily concern the Paris basin, the Rhine Valley, and the Limagnes region. These problems are examined. The various French institutes devoted to the physics of the globe offer good possibilities for such work.—*V. S.*

9030. Storm, L. W. Limit of accuracy of seismic work in Alberta: Mines Mag., vol. 36, no. 11, pp. 536–538, 573, Denver, Colo., 1946.

In the Province of Alberta, Canada, the seismic reflection method has encountered difficulties both in the plains and in the foothills. In the plains, errors of mapping are believed to result from the varying depth of glacial drift, abrupt changes in surface topography, influence of the relief of the Madison limestone, chnages in the regional velocity gradient, and local variations in the facies of the sedimentary beds. These factors are discussed. The main handicap is the flatness of the local structures, which possess a relief not much different from the size of the error.

In the foothills, where the greater part of the reflection work is done, the rugged terrain, the woods, and the marshes offer difficuties. The sources of error appear to include poor records, numerous interference patterns, uncertainties of thrust faults, and velocity changes as large as 700 feet per second over a distance of 1 mile. However, the Madison and Banff limestones here give outstanding reflections, the surface geology is well known, and considerable errors are tolerable because as much as 4,000 feet of structural relief is not unusual.—*V. S.*

9031. Swan, B. G. Index of wells shot for velocity: Geophysics, vol. 11, no. 4, pp. 538–546, Tulsa, Okla., 1946.

The information listed on velocity surveys in 167 wells is in the nature of a supplement to the "Index of wells shot for velocity" published in the October 1944 issue of Geophysics. In addition to the new surveys listed, corrections and information missing on many of the surveys of the original index are tabulated.—*Author's abstract.* (For original index *see* Geophys Abstracts 119, no. 7696.)

9032. Valle, P. E. Nuovo metodo per la determinazione delle coordinate ipocentrali di un terremoto lontano [New method for determining the hypocentral coordinates of a distant earthquake]: Accad. Italia, Atti, Cl. Sci., Rend., vol. 3, pp. 656–662, 1942.

The author discusses the determination of hypocentral coordinates of distant earthquakes by a method based on time differences between the arrival of *P* and *S* seismic waves at different stations. The data on time differences for a series developed from travel-time curves collected at Brunn are tabulated, and errors are expressed as functions of epicentral distance and focal coordinates. The principles of the method are illustrated by computations for the Alaska earthquake of July 22, 1937.—*V. S.* (A summary appeared in Zentralb. Geophys., Meteorol., u. Geod., vol. 11, no. 2, p. 76), Berlin, 1943.

9033. Veitsman, P. S. An experiment in two types of areal survey by the correlation-refraction method [abstract, in Russian]: Akad. Nauk S.S.S.R., Otd. Fiz.-Mat., Referaty za 1943–44, pp. 116–117, Moscow, 1945.

In 1943 the seismic crew of the Institute of Theoretical Geophysics, Moscow, made two kinds of areal surveys by the correlation-refraction method, exploring the same area at Karaganovo in the Ishimbai oil region, U. S. S. R. The problem consisted particularly in identifying a superficially disposed refracting horizon. In the first type of survey the area was covered with a system of profiles based on a single shot-point; in the second type, with short longitudinal profiles. In both cases the results served for plotting isotime maps, which had, however, different geological meanings. The operational techniques and distinctive features of interpretation are discussed.

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The results of both types of surveys proved to be qualitatively consistent. Certain quantitative discrepancies are analyzed. The findings can be useful in choosing a procedure for exploring a superficial horizon. Research was done at the Institute of Theoretical Geophysics, Moscow.—*V. S.*

9034. Visser, S. W. Seismologie [Seismology], 151 pp., Gorinchem, Nederland, J. Noorduyn en Zoon N. V., 1943.

This book contains seven chapters: 1, Earthquakes; 2, The distribution of earthquakes as to place and time; 3, Seismic instruments; 4, Seismic waves; 5, The seismogram and the indication of the epicenter; 6, Applied seismology; and 7, The interior of the earth. The appendix gives an account of earthquakes in the Netherlands.—*J. F. S., Dominion Observatory, Ottawa, Biblio. Seismology, no. 19, p. 329, 1946.*

9035. Williams, F. J. Notes on shot point procedure: Geophysics, vol. 11, no. 4, pp. 443–456, Tulsa, Oklahoma, 1946.

An abstract appeared in Oil and Gas Jour., vol. 44, no. 48, p. 101, Tulsa, Okla., 1946. *See* Geophys. Abstracts 125, no. 8547.—*V. S.*

4. ELECTRICAL METHODS

9036. Belluigi, A. Sulle valutazioni grafico-analitiche di campi elettromagnetici dei giacimenti minerari [Concerning the graphic-analytical evaluation of the electromagnetic fields of mineral deposits]: Riv. Geominer., vol. 2, no. 2, pp. 14–19, Milan, 1941.

The author presents a theory for the interpretation of electromagnetic measurements made in ore prospecting by alternating currents of audio-frequency. Consideration is given to the common cases of ore bodies in the form of lenses, lodes, and other masses generally having a horizontal extension greater than the vertical. In connection with the theory, the author uses an electromagnetic diagram constructed by him and a suitable interpretation of some studies of Stefanescu concerning a finite layout.—*Author's abstract.*

9037. Clark, A. R. Geophysical devices as an aid to prospecting: Western Miner, vol. 19, no. 11, pp. 59–60, Vancouver, British Columbia, 1946.

This paper presents a description of a geophysical method that has proved useful in prospecting for certain types of ores. The method is based on the fact that when some types of sulfides become oxidized they act as a source of electrical potential and cause small currents to flow through the surrounding materials. In other words, the sulfide body acts as a battery of low voltage. The negative pole of this "battery" is found to occur near the upper end of the body, the positive pole being located somewhere along the body. If the electrical currents thus produced in the materials adjacent to the body can be detected, the location of the body may be found. In practice, it has been found better to measure the small electrical potential differences caused by these currents than to measure the currents themselves. These potentials are referred to as "self potentials," and the method of making use of them is known as the "Self Potential Method."

The Self Potential Method gives a rapid and inexpensive reconnaissance method in the search for sulfide ores or ores that may be associated

with sulfides. It is useful in tracing certain types of veins under shallow overburden and may be used to decrease drilling costs by checking the anomalies obtained by magnetic or other geophysical methods.—*Author's abstract.*

9038. Fritsch, V. Die Tiefenwirkung der Funkmutung [The efficacy of radio prospecting in depth]: Riv. Geominer., vol. 3, no. 2, pp. 3–12, Milan, 1942.

Radio prospecting detects geologic conductors and discovers water occurrence, mineral deposits, and tectonic disturbances. The procedures are similar in part to those previously developed for low-frequency electrical prospecting, and in part they are new. Generally, radio prospecting is suited for exploration at shallow depth, but in some cases it is possible to obtain information on deeper features indirectly. Over dry rocks, a depth range of 300 to 500 meters, and even more, may be possible; greater depths are rarely attained by means of radio techniques. Though the fundamental theory of radio prospecting is substantially formulated, practical application is difficult because the electrical properties of geologic conductors at high frequencies have not been sufficiently investigated. Further experimental data are necessary.—*V. S.*

9039. Gibbon, A. Electronic principles used in the discovery of oil: Oil Weekly, vol. 120, no. 7, p. 33, Houston, Tex., 1946.

F. S. Craver has devised an instrument which is stated to detect subsurface oil by recording electronic emanations on a series of sensitive screens. The locations of 145 oil pools are said thereby to have been predicted before drilling the discovery wells. The device is claimed to show the area of saturation, the approximate depth of one or more producing horizons, the relative recovery of oil per acre, and whether the oil is of high or low gravity. Of 1,569 wildcat prospects surveyed and later drilled, 1,333 were correctly predicted as showing noncommercial saturation, and there were 5 errors, whereas 148 were correctly predicted to have commercial saturation, and there were 83 errors.

It is assumed that all substances give off emanations, and a screen has been constructed to record these emanations. The main emanations appear to diffuse almost vertically, while the secondary diffusion is in all directions. Depths are determinable only at the edge of the deposit. The emanation intensities associated with commercial accumulations vary in different areas. Natural gas gives no recording, but a highly gas-saturated oil gives a higher recording than one with less gas.—*G. D. H., Inst. Petrol. Jour., vol. 32, no. 270, p. 161A, London, 1946.*

9040. Heiland, C. A., Tripp, R. M., and Wantland, D. Geophysical surveys at the Malachite mine, Jefferson County, Colorado: Am. Inst. Min. Met. Eng. Trans., vol. 164, pp. 142–154, New York, 1946.

A copper ore body was discovered at the Malachite mine, Colorado, by means of magnetic and electrical surveys conducted in 1937–39. The surveys are discussed in the light of local geology.

The magnetic surveys covered 800 vertical-intensity stations and 100 horizontal-intensity stations with Schmidt instruments. Pyrrhotite pro-

duced strong anomalies in the immediate vicinity of the ore. Some of these anomalies lent themselves readily to depth calculation.

The electrical surveys included self-potential, resistivity, and equipotential measurements. The self-potential values showed a definite relation to the strike of the mineralized zone; a depth calculation was made by assuming the effects to be due to a polarized doublet. The resistivity values, obtained by a Wenner electrode arrangement, conformed to the magnetic and self-potential data; Tagg's method indicated a depth of 27 feet to the conductive zone. The equipotential-line values agreed with the other results. No topographic effect was observed.

The electromagnetic observations were made with a dual-coil ratiometer along two profiles across the mineralized zone to determine ratios of vertical intensity and phase difference. Both types of measurements indicated distinct anomalies closely related to the magnetic and spontaneous-polarization anomalies. Sketch maps and profiles illustrate the observations.—*V. S.*

9041. Horton, C. W. On the use of electromagnetic waves in geophysical prospecting: Geophysics, vol. 11, no. 4, pp. 505–517, Tulsa, Okla., 1946.

An approximate analysis of the behavior of electromagnetic waves in a conducting medium is given. The approximations consist of replacing pairs of electrodes by dipoles and of using only the first-order images in the case of a layered earth. It is shown that under typical conditions one can measure the depth of an electrical interface 6,000 feet deep by means of electromagnetic waves. It is further shown that even a thin layer of salt water or oil-bearing sand at a depth of 6,000 feet gives an effect that is easily measurable.

The response of the earth to a direct current step function is analyzed for the case in which the displacement currents are negligible. This approximation is valid for all geologic formations. The shape of a commutated direct current is shown as a function of the distance of travel.—*Author's abstract.*

9042. Logan, K. H. Recent progress in the mitigation of underground corrosion: Oil and Gas Jour., vol. 43, no. 36, pp. 78–84, Tulsa, Okla., 1945.

The paper describes briefly the progress in the mitigation of corrosion during the past 2 years. Methods and apparatus for scientifically determining the amount of current required for cathodic protection have been developed. Field investigation shows that zinc anodes remain effective throughout their life. Tests of coatings on 1-year-old pipe lines indicate that it is possible to lay coated lines with less than one holiday per mile. A new and more effective holiday detector has been developed.—*Corrosion, vol. 1, no. 3, Abstracts p. 22, Pittsburgh, Pa., 1945.*

9043. Nordström, A. Confronto tra i resultati di alcune prospezioni geoeletriche e dei successivi lavori minerari di controllo [Comparison between the results of some electrical surveys and subsequent mining work]: Riv. Geominer., vol. 3, no. 1, pp. 3–11, Milan, 1942.

This article describes a few examples of ore prospecting by electrical methods carried out by the Aktiebolaget Elektrisk Malmletning of Stockholm during the past few years in different parts of the world. The results of the geophysical surveys are compared with those obtained from mechanical drilling performed later for checking purposes. A

normalized method of geoelectrical prospecting has proved useful in solving many different problems and has brought about a substantial reduction in the cost of surveying.—*Author's abstract.*

9044. Norelius, R. G. Electrical logging in oil-base drilling fluid: Tomorrow's Tools Today, vol. 12, no. 3, pp. 4–9, Lane-Wells Co., Los Angeles, Calif., 1946.

A comparison of the problems of electrical logging in oil-base fluids and mud-base fluids shows that the differences are minor, except for the magnitude of the resistance changes at the electrodes and the intermittent nature of the contact in the oil-base fluid. As an illustration, the two-electrode system of resistivity measurements is discussed with reference to the electrical equivalence of mud and oil, jaggedness of curves caused by intermittance, high contact-resistance to formation current, and the smoothing out of the oil-base curves by means of electrical filters.

The electrical filter is inserted at the recording meter in order to average out the abrupt potential changes originating at the electrodes. It operates with a time-delay calculated to make the meter move 90 percent of its full swing in 1 foot of electrode travel, as illustrated in diagrams. As a result, the smoothed oil-base curves become more reliable and easier to read, and problems of correlation and interpretation are simplified. Samples of electrologs show both the earlier unfiltered and the present filtered curves.—*V. S.*

9045. Patty, E. N., and Kelly, S. F. A geological and geophysical study of the Chelan nickel deposit near Winesap, Wash.: Am. Inst. Min. Met. Eng. Trans., vol. 164, pp. 155–163, New York, 1946.

In 1944 a spontaneous polarization survey was made at the Chelan nickel prospect near Winesap, Wash., with a view to delineating the mineralized zone. Readings were taken at 50-foot intervals along traverses spaced 100 feet apart, over a total area of 1,500 feet by 1,000 feet. The results, plotted as profiles and equipotential curves, revealed three zones of electrical activity.

None of these zones gave indication of a commercial deposit, but the data illustrated clearly different types of sulfide occurrence. The first zone had weak negative potentials and a low average supfide content compatible with small pockets of stronger mineralization. The second zone was marked with weak positive potentials and carried only weakly disseminated sulfides. The third zone registered high positive potentials possibly indicative of two bands of sulfide mineralization, with some extension in depth. The various results are discussed. Drilling by the U. S. Bureau of Mines detected no ore of commercial value.—*V. S.*

9046. Tiurkisher, R. I. Electrical coring in an anisotropic medium [in Russian]: Acad. Sci. U. S. S. R. Bull. (Izvestiia), Sér. Géog. et Géophys., vol. 9, no. 3, pp. 279–287, Moscow, 1945.

The author generalizes the mathematical theory of V. Fok dealing with the determination of the electrical resistivity of rocks by means of electrical coring. Calculation is made of the apparent resistivity of anisotropic rocks, which conduct current perpendicular to the borehole axis more readily than parallel to it, and the values obtained are compared with Fok's values of apparent resistivity of isotropic rocks. The

difference is found to be so small as to make impracticable any determination of the coefficient of anisotropy for rocks encountered in electrical coring. The steps of mathematical analysis, the compared values of rock resistivity, and the theoretical curves of isotropic and anistropic coefficients are presented.—*V. S.*

9047. West, T. S., and Beacham, C. C. A resistolog survey of the Loma Alto-Seven Sisters area of McMullen and Duval Counties, Texas: Geophysics, vol. 11, no. 4, pp. 491–504, Tulsa, Okla., 1946.

Additional resistolog field data are presented. This survey was made in the Loma Alto and Seven Sisters area of McMullen and Duval Counties, Texas. The subsurface geology of this area also is shown along with an electric log cross section to which resistologs have been added. Four of the apparent resitivity curves employed for calculating resistologs are included to demonstrate the relatively great extent to which apparent resitivity may be influenced by shallow inhomogeneities along a traverse of electrodes which are moved to secure a variation in electrode separation. Several cases of direct detection of oil and gas saturation and of successful structural correlations are presented.—*Authors' abstract.* (*See also* Geophys. Abstracts 124, no. 8394.)

9048. Westinghouse Electric & Manufacturing Co. Corrosion ratings of metals: Steel, vol. 116, no. 4, pp. 98–104, Celveland, Ohio, 1945.

Recommended corrosion ratings for various commercial metals and alloys are tabulated for rural, urban, and marine atmospheres and for five industrial atmospheres, including ammonia, hydrogen sulfide, hydrogen chloride, sulfur dioxide, and chlorine. Provisional sea-water ratings are given for aluminum and magnesium alloys, copper and copper alloys, and iron, nickel, and chromium alloys. A brief discussion of galvanic corrosion is included, with a special arrangement of the electrochemical series. The tabulations are presented as guides in the selection of metals for use under various corrosive conditions.—*Corrosion, vol. 1, no. 3, Abstracts, p. 23, Pittsburgh, Pa., 1945.*

9049. Wolf, Alfred. Electric field of an oscillating dipole on the surface of a two-layer earth. Geophysics, vol. 11, no. 4, pp. 518–537, Tulsa, Okla., 1946.

The electric field of a low-frequency oscillator placed on the surface of a two-layer earth is determined in two special cases, namely, the case in which the conductivities of the two layers are nearly equal, and the case in which the lower layer is a perfect insulator; in the latter case, only terms of zero and first order in frequency are considered. It is shown that, when the upper layer is sufficiently thin or is very thick, the mutual inductance of two wire elements on the surface of a two-layer earth has the same value as for a homogeneous earth. In the case of an insulated layer, it is shown that the maximum departure of the value of mutual inductance of two collinear wire elements from the corresponding value on a homogeneous earth is 35 percent.—*Author's abstract.*

9050. Zabelli, A. Esplorazioni geofisiche per riserche di sabbie ferrifere, effettuate specialmente sul fondo del mare (Geophysical surveys in quest of ferriferous sands, made particularly on the ocean floor): Ricerca Sci., vol. 12, pp. 908–910, Rome, 1941.

A description of electromagnetic sounding procedures applied to under-water deposits and to submerged ships is given.—*Cent. Nat. Rech. Sci., Bull. Anal., vol. 7, no. 9, pt. 1, p. 1569, Paris, 1946, translated by V. S.* (*See also* Geophys. Abstracts 115, no. 7249.)

5. RADIOACTIVE METHODS

9051. Billings, M. P., and Keevil, N. B. Petrography and radioactivity of four Paleozoic magma series in New Hampshire: Geol. Soc. America Bull., vol. 57, no. 9, pp. 797–828, Baltimore, Md., 1946.

Although individual specimens from a rock type within a single magma series commonly show a considerable range in radioactivity, the average values show a progressive increase in radioactivity toward the granitic end of the series, which is three to four times as radioactive as the gabbro-diorite end of the series. The reason for this increase toward the granitic end of the series is not always clear, but in the White Mountain magma series this appears to be due to an increase in the amount of allanite and probably zircon. This magma series is twice as radioactive as the other three magma series and considerably more radioactive than similar rocks elsewhere in North America. It is suggested that the parental basaltic magma from which the White Mountain magma series was differentiated was more radioactive than the primary magmas from which the older magma series were derived.—*Authors' abstract, condensed by V. S.*

9052. Chalard, J. Application du compteur de Geiger-Müller à la stratigraphie dans le bassin houiller du Nord de la France [Application of the Geiger-Müller counter to the stratigraphy of the Coal Basin in the north of France]: Compt. Rend., vol. 222, pp. 506–508. Paris, Feb. 25, 1946.

Extensive marine layers serving as good stratigraphic landmarks are considered to be the ones possessing radioactive properties. A discussion is given of the utilization of the Geiger-Müller counter and the extension of its application to other formations.—*Cent. Nat. Rech. Sci., Bull. Anal., vol. 7, no. 6, pt. 1, p. 1052, Paris, 1946, translated by V. S.*

9053. Curie, Marie. Radioactivité [Radioactivity], 2 vols., 558 pp., Hermann & Co., Paris, 1935.

This textbook gives a general outline of the knowledge of radioactivity as of 1934. The first part is a brief exposition of principal concepts of the ions formed in gases, the electrons, and the rays produced in gases of low density and traversed by electric current. The second and principal part is devoted to radioelements and the rays emitted by them. Detailed consideration is given to the families of uranium, radium, actinium, and thorium. The related tabulations are assembled in an appendix.—*V. S.*

9054. DeMent, Jack, and Dake, H. C. Prospecting for uranium minerals, in the book by the same authors, Uranium and atomic power, pp. 43–48, Brooklyn, N. Y., Chemical Publishing Co., 1945.

The major part of the world's supply of uranium is derived from pitchblende and carnotite, which are closely associated with granitic rocks and pegmatites. The methods applicable in prospecting include the use of Geiger-Müller counters, electroscopes, and ultraviolet light

The Geiger-Müller counter detects radiations from the radium present in all uranium minerals. It has been used successfully for surface prospecting of ore-bearing veins in the pitchblende mines at Great Bear Lake, Canada. The electroscope also responds to uranium minerals by virtue of their radioactivity, which accelerates the rate of discharge of static electricity from a charged body. Ultraviolet light serves to detect fluorescent outcrops of secondary uranium minerals that may be associated with deposits of pitchblende or other primary uranium minerals, which never fluoresce themselves but are often coated with secondary minerals which do fluoresce. Other methods of identifying uranium minerals are discussed.—*V. S.*

9055. Kip, A., Bousquet, A., Evans, R., and Tuttle, W. Design and operation of an improved counting rate meter: Rev. Sci. Instrument, vol. 17, no. 9, pp. 323–333, Lancaster, Pa., 1946.

The counting-rate meter is an electronic amplifier and computing circuit whose output is a direct current or volatge proportional to the number of pulses fed into the circuit. The input pulses may be either uniformly spaced or distributed randomly in time, as in the most common use of the instrument as an amplifier and recorder for use with Geiger-Müller counters. The electronic design and operation is discussed for each of the following circuit components: amplifiers, pulse equalizer, integrating circuit, degenerative vacuum-tube voltmeter, and the stabilized high-voltage and low-voltage supplies.

The statistical interpretation of the counting-rate meter output readings due to the randomly distributed pulses from radioactive sources requires a special statistical theory, because an integrating and averaging circuit produces an exponential interdependence of successive observations on all preceding observations. Practical methods using curves are developed for determining the mean counting rate and the probable error of the mean rate directly from the output records.—*Authors' abstract.*

9056. Lauterjung, K. H., and Neuert, H. After effect with counter tubes [in German]: Zeitschr. Phys., vol. 122, pp. 266–268, Berlin, 1944.

After intensive irradiation of a counter tube with ultraviolet light or gamma rays, the "background" is considerably increased. The normal background is restored after a few minutes. The effect depends largely on the nature of the cathode material, being greatest for substances such as magnesium with a high photoelectric sensitivity.—*B. A., Physics Abstracts, vol. 49, no. 584, p. 232, London, 1946.*

9057. Milatz, J. M. W., and ten Kate, H. The quantitativity of the Geiger-Müller counter, the spectrum of RaE: Physica, vol. 7, pp. 779–92, The Hague, Oct. 1940.

Tests were made by projecting a beam of electrons of a given velocity into the counter by means of a beta-spectograph and determining the kicks per second as a function of the pressure of gas. In this way a "counting curve" was obtained, from which the coefficient of primary ionization could be determined. For high pressures, the number of discharges in the counter reaches a saturation value, and the indication of the counter is quantitative. It is thus possible to correct the results of a

counter if it does not indicate quantitatively. The method is applied to the spectrum of RaE.—*Physics Abstracts, vol. 49, no. 587, p. 319, London, 1946.*

9058. Rothé, E., and Hée, A. Etudes géoradiologiques sur les roches d'Alsace et des Vosges [Georadiological studies of the rocks of Alsace and the Vosges]: Inst. Phys. Globe, Ann. 1936, new ser., vol. 1, pt. 3, Mende, France, 1939.

Radioactive prospecting in nine areas of Alsace and the Vosges Mountains conducted with a Kolhörster ionization chamber is reported. Preliminary studies are described, the construction of the apparatus and local geology are indicated briefly, and the results are stated.—*V. S.*

9059. South African Mining and Engineering Journal. Fluorescent lamps, effects of impurities. Vol. 57, no. 2774, p. 155, Johannesburg, 1946.

C. Kenty and J. R. Cooper have investigated the deterioration of fluorescent lamps. One of the causes is known to be the penetration of gaseous impurities. The investigators introduced into lamps various impurities and reached the following conclusions: Oxygen and carbon monoxide have little effect; carbon dioxide gives diffuse darkening; nitrogen causes a deposition that explodes when a certain thickness is reached; and hydrogen and water vapor produce a marked rise in voltage and a quivering of the discharge. The effects of other gases are cited. The investigation is being continued.—*V. S.*

9060. Spicer, H. C. Gamma-ray studies of potassium salts and associated geologic formations: U. S. Geol. Survey, Bull. 950, pp. 143–162, Washington, D. C., 1946.

Experimental studies have been made of the radioactivity of potassium salts and the geologic formations associated with the saline deposits of southeastern New Mexico. They dealt with gamma-ray activity measured by an improved counting-rate meter that gives a rapid and accurate count of the penetrating gamma radiation emitted by the K^{40} isotope of potassium. The investigations show that the method can be used to determine potassium with an accuracy that is a function of the time and the quantity of material used. Determinations of potassium were compared with those of uranium and were found to agree with the generally accepted ratio of activities within the limits of experimental error. The results also were expressed in terms of the radium equivalent in grams of radium per grain of sample.—*Author's abstract.*

6. GEOTHERMAL METHODS

9061. Birch, F., and Clark, H. An estimate of the surface flow of heat in the West Texas Permian Basin: Am. Jour Sci., vol. 243-A, pp. 69–74, New Haven, Conn., 1945.

Laboratory measurements of the effect of compression and of wetting on the thermal conductivity of a set of formation samples from wells in the West Texas Permian Basin are combined with Hawtof's measurements of temperature in the Big Lake well No. 1–B with a view to obtaining estimates of the flow of heat to the surface in this region. The average value found, 2.0×10^{-6} calories per cm.^{2} per second, is higher than the published figures for England and South Africa.—*Physics Abstracts, vol. 49, no. 577, p. 31, London, 1946.*

9062. Guyod, Hubert. Temperature well logging—salt intrusions: Oil Weekly, vol. 123, no. 9, pp. 33–42, Houston, Tex., 1946.

The geothermal method of electrolytic scale models is discussed in its application to temperature anomalies caused by salt intrusions. Experiments were conducted with models simulating a deep-seated dome, a deep piercement-type dome, a shallow piercement-type dome, and a mushroom-type dome. The purpose was to determine the shape of isogeotherms and the temperature profiles for these conditions. The experiments presupposed thermal measurements made in several vertical wells drilled above and near the salt intrusion and through the overhang.

The results, illustrated by graphs of isogeotherms, show that the sediments associated with salt intrusions are warmer than normal, except near the lower part of the domes, where temperatures fall slightly below normal. The rate of temperature increase is greater above and near shallow domes than near deeper plugs. Generally, a conductive intrusion modifies the temperature distribution of the ground in an area included within a vertical cylinder centered at the intrusion and having a radius about four times that of the intrusion. Other results are given, and the accuracy of the method and special applications are discussed.—*V. S.* (For a description of the method *see* Geophys. Abstracts 127, no. 8889.)

9063. Guyod, Hubert. Temperature well logging—temperature distribution in the ground: Oil Weekly, vol. 123, no. 10, pp. 32–39, Houston, Tex., 1946.

The gradient of the isotherm is investigated for two types of monoclinal structure by analogy with fluid flow and electric flow. The method of electrolytic scale models, calculations, and simplified graphic solutions are used to aid deductions. It is found that the temperature distribution in the ground is determined primarily by the heat conductivity and the geometry of the formations. These factors are further discussed for typical cases of topographic relief, dip angle, anisotropy, anticlines, synclines, petroleum reservoirs, ore deposits, faulting, and shallow formations. Diagrams of typical isotherm patterns and related temperature graphs are presented. The treatment deals with simplified conditions.—*V. S.*

9064. Landsberg, H. Note on the frequency distribution of geothermal gradients: Am. Geophys. Union Trans., vol. 27, no. 4, pp. 549–551, Washington, D. C., 1946.

H. C. Spicer's tabulations of geothermal gradients in the earth's crust are analyzed statistically. It is found that frequency distributions plotted at intervals of 2° C./km. for gradients through three intervals of depth, and also for all gradients irrespective of depth, give bimodal curves. The further analysis of the data in terms of cumulative percentage frequencies shows these bimodal distributions to be reducible to two overlapping normal curves. Such composition can be explained by the presence of two basic types of heat conductivity in the earth's crust, with random variations around them according to pressure, density of rocks, and the proportion of each type in the strata measured. This hypothesis is supported by calculations based on the formula

$dQ = -kG$ expressing the dependence of heat flow on the geothermal gradient and on conductivity. The statistical graphs are presented.—*V. S.*

9065. Ver Steeg, Karl. Temperatures in some deep wells in Pennsylvania and West Virginia: Science, new ser., vol. 102, no. 2648, pp. 334–335, Lancaster, Pa., 1945.

The author has compiled the results of temperature measurements at various depths reported for the deep wells of Pennsylvania and West Virginia by R. C. Tucker in 1944. The figures obtained show that the average increase in temperature per 100 feet in depth, from the 4,250-foot to the 8,080-foot level, is 2.77° F., with considerable variation and irregular rates of increase. The results are tabulated.—*V. S.*

7. GEOCHEMICAL METHODS

9066. Montana Oil and Mining Journal. Geological Survey trying out geochemical methods: Vol. 26, no. 35, p. 8, Great Falls, Mont., 1946.

The U. S. Geological Survey is testing the application of geochemical principles to prospecting for metals. The approach consists of analyzing the content of ore metals in soils, plants, and natural waters near known oxidizing ore deposits with a view to developing diagnostic criteria. Several problems are under investigation.

One of the test areas selected is near Clarendon, western New York, where a number of peat bogs have shown a toxicity to plants because of a high concentration of zinc. The area is underlain by a thickness of Lockport dolomite containing small amounts of sphalerite, and some of the toxic localities are found to be directly associated with portions of sphalerite-bearing dolomite. The geochemical data collected will be analyzed to determine the distribution of zinc and to map relative concentration.—*V. S.*

9067. Sloss, L. L., and Cooke, S. R. B. Spectrochemical sample logging of limestones: Am. Assoc. Petroleum Geologists Bull., vol. 30, no. 11, pp. 1888–1898, Tulsa, Okla., 1946.

Visual examination and insoluble-residue analysis have not yielded uniformly satisfactory data for detailed differentiation and correlation of thick and unbroken sequences of carbonate rocks. The method here presented is an attempt to utilize a quantitative spectrographic analysis for this purpose.

An external-standard method which gave results reproducible within the inherent sample error was used. Ca, Mg, Sr, Ba, Al, Ti, Fe, and Si were present in all samples, and Mn and V in some. For practical reasons, S, P, Na, and K, undoubtedly present, could not be determined. The most useful elements appear to be Mg, Fe, Al, and Sr. When analyses of both surface samples and well cuttings are plotted against stratigraphic interval or well depth, the curves may be interpreted in terms of stratigraphic correlation and differentiation.

Standardization of the method is easy, and the results are not dependent on the personal equation. Apart from initial expenditure for equipment, the costs and time consumption should be less than those required for foraminiferal and insoluble-residue analyses.—*Authors' abstract.*

8. UNCLASSIFIED GEOPHYSICAL SUBJECTS

9068. Bridgman, P. W. Recent work in the field of high pressures: Rev. Mod. Phys., vol. 18, no. 1, pp. 1–93. Lancaster, Pa., 1946.

This summary of work in the field of high pressures deals with the physical properties of substances buried deeply in the earth, as treated in the literature published within the period 1930–45. The subjects covered include the mechanical, thermal, electrical, magnetic, and chemical effects of high pressure. A bibliography of 674 references is appended.—*V. S.* (A review appeared in Geophysics, vol. 11, no. 4, pp. 562–563, Tulsa, Okla., 1946.)

9069. Bullen, K. E. An hypothesis on compressibility at pressures of the order of a million atmospheres: Nature, vol. 157, p. 405, London, Mar. 30, 1946.

The hypotheses on the state of materials at the center of the earth are examined with a view to estimating conditions in the core. The compressibility of the materials serves to explain terrestrial magnetism, inasmuch as the temperature of the Curie point of iron rises with pressure. It also provides an explanation of the rapid changes of gradients of velocity P and S at the depth of 410 kilometers. These explanations result from the hypothesis that compressibility at high pressures ceases to depend on the chemical constitution of the substances involved.—*V. S.*

9070. Campbell, O. E. Principal uses of fluorologs: Oil Weekly, vol. 124, no. 5, pp. 41–45, Houston, Tex., 1946.

A fluorolog is a set of curves drawn by plotting the fluorescent intensities of well samples against their depth. Fluorologs serve to detect and measure the effect that an accumulation of petroleum produces in the surrounding rocks. As rocks overlying an oil reservoir generally begin to fluoresce at or near the surface, fluorologs can help determine the advisability of further drilling before a great depth is attained. Fluorologs also assist in developing multisand fields and aid in core drilling, drilling control, drilling near oil areas, slime-hole drilling, evaluation of shows, and electrical logging. The compilation of fluorologs and the necessary systematic sampling of cuttings are discussed, and they are illustrated by examples of logs.—*V. S.*

9071. Carnegie Institution of Washington. Year Book No. 43, July 1, 1943–June 30, 1944, 206 pp., Washington, D. C., 1944.

This yearbook includes two reports on geophysical work.

Geophysical laboratory, by L. H. Adams. The program of war research, begun in 1941 for the National Defense Research Committee and under governmental contracts, was continued. The ordinary work receded to the background, but a few papers on previous investigations were published.

Department of terrestrial magnetism, by J. A. Fleming. The progress of geomagnetic work was substantial, because many of the war problems under study required research utilizing the material of previous investigations. The year's activities in the fields of geomagnetism, terrestrial electricity, ionosphere, nuclear physics, observatory studies, and field work are reviewed.—*V. S.*

9072. Chemical Engineering and Mining Review. Bureau of Mineral Resources, Geology, and Geophysics: Vol. 38, no. 453, pp. 321-322, Melbourne, Australia, 1946.

A Bureau of Mineral Resources, Geology, and Geophysics has been established within the Australian Ministry of Supplies and Shipping, Melbourne. The work of the geophysical division is to comprise exploration for metals, petroleum, coal, and other minerals, regional magnetic and gravity surveys, and laboratory research. Plans call for use of magnetic, gravitational, electrical, seismic, and radioactive methods, with the employment of latest instruments.

Immediate activities will include an intensive search for oil in the Kimberley region of Western Australia, oil prospecting in the Oiapu area on the Gulf of Papua, and special investigations of the Collie and Leigh-Creek coal fields, the Noresman shears and auriferous veins, the Broken Hill silver-lead-zinc lode, and the Broken Hill-Lake Frome natural gas.—*V. S.*

9073. Critz, J. S. Oil possibilities of the Gulf coast Continental Shelf: Oil Weekly, vol. 124, no. 6, pp. 17–21, Houston, Tex., 1947.

The Continental Shelf of the Gulf coast is being surveyed extensively by gravimetric, magnetic, and seismic methods for mapping the structure of the sediments. Diving chambers, airborne magnetometers, and seismic reflection and refraction techniques are employed. In all, the shelf off the coast of Texas and Louisiana covers an area of more than 56,000 square miles extending out into the Gulf as far as 125 miles; a water depth of more than 60 feet is rare up to the 35-mile limit. Within the 5,000-square mile area bordered by the 30-foot water-depth contour from the Sabine River to the Mississippi, geophysical work has indicated at least 30 structures, as reported by DeGolyer. The geology of the Continental Shelf is discussed.— *V. S.*

9074. Fekete, Eugene. Report on the activities of the Royal Hungarian Baron Roland Eötvös Geophysical Institute during the period 1936–38: Assoc. Internat. Géod. Trav., vol. 15, pt. 2, Rept. no. 5c, 30 pp., Paris, 1940.

The various geophysical methods applied by the Eötvös Institute during 1936–38 are discussed from the standpoint of underlying theory, instruments, and interpretation of results. The work reviewed includes torsion balance, gravity meter, magnetic, seismic, electrical, and electrical coring surveys. Results are embodied in tabulations and maps.— *V. S.*

9075. Gassmann, Fritz. Zur numerischen Behandlung von Potentialfeldern in der Geophysik [Concerning the numerical treatment of potential fields in geophysics]: Soc. helvètique sci. nat. Actes, 125th sess., pp. 117–118, Aarau, Switzerland, 1945.

In physics, a number of vector fields constant in time possess potentials and lend themselves to a unified mathematical treatment; such are the gravitational, magnetic, electrostatic, thermal, and other fields. The author uses Poisson's equation to deduce an expression for the potential in terms of linear, plane, and spatial values of the distribution of sources. As a result, he obtains a formula and a related equation by means of which the distribution of subterranean sources can be calculated from measurements of surface vector fields. Graphical and numerical methods, developed for the application of this formula, have been used in magnetic

and gravitational surveys made by the Institute of Geophysics of Ticino (Tessin), Switzerland, an affiliate of the Eidgenossische Technische Hochschule, Zurich.—*V. S.*

9076. Guyod, Hubert. Well logging methods: Petroleum Engineer, vol. 17, no. 12, pp. 62–66, Dallas, Tex., 1946.

Brief descriptions are given of various logging methods, illustrated by the curves obtained. Geochemical logging comprises collecting and analyzing samples of well cuttings for each 30 to 100 feet of drilling; hydrocarbon concentration often indicates an oil or gas accumulation in advance of the drill. Caliper logging shows the average hole diameter in terms of depth; it has proved that shales overlying a petroleum reservoir cave appreciably and may indicate the existence of oil below. Mechanical logging measures the rate of drilling as an indication of the hardness of the formation traversed; the drilling time registers on the geolograph. Mud logging traces the hydrocarbon content found in the drilling fluid by continuous analysis for oil and gas. Temperature logging in cable-tool wells shows the drop of temperature caused by the expansion of free or dissolved gas from the formations drilled and may indicate oil or gas accumulations. Formation dip can be determined in a well by correlating 3 graphs recorded simultaneously by a potential dipmeter at different points of the borehole.—*V. S.* (For descriptions of other logging methods *see* Geophys. Abstracts 126, no. 8744.)

9077. Hagen, C., and Cantrell, R. Development trends in salt dome exploration: Oil Weekly, vol. 123, no. 3, pp. 87–88, Houston, Tex., 1946.

Developments in the study of salt domes in coastal areas are outlined briefly, with a view to furthering exploration for oil.

Recent investigations of reservoirs have shown that very young sands can be productive on domes, as witnessed in Louisiana. Other sands, dating back to certain ages not known to be productive, likewise have yielded oil, such as the Vicksburg sand and the Hackberry series of Frio age. Not only the overlying and immediate flank sands adjacent to a salt plug but also the wedge types of reservoir can be productive on domes.

Seismic exploration has located both the main and the minor overhangs and irregularities associated with salt plugs, and it has charted the shape of the plugs to a considerable depth. In Texas, successful delineation was made of small overhangs, long ridgelike plugs, and fault blocks. Electrical logging identified unconformities along the flanks of several plugs, such as the Nash dome, Texas. Radioactive and neutron logging combined resulted in locating passed-over production in many old fields. Throughout the text references are made to concrete examples.—*V. S.*

9078. Hedstrom, Helmer. Några fysikaliska hjälpmedel för geologien [On geophysical methods in geology]: Geol. fören. Stockholm Förh., vol. 68, pp. 21–46, Stockholm, Jan.-Feb. 1946.

A brief description of modern methods of geophysical exploration is given, illustrated by concrete examples of practical application. Consideration is given to suitable means for the development of new prospecting techniques. A bibliography is appended.—*Cent. Nat. Rech. Sci., Bull. Anal., vol. 7, pt. 1, nos. 7–8, p. 1282, Paris, 1946, translated by V. S.*

9079. Laycock, G. F. Mineral exploration and the outlook for metal supplies: Min. Met. Inst. Bull., no. 479, pp. 9–23, London, 1946; also South African Min. and Eng. Jour., vol. 57, pt. 2, no. 2800, pp. 131–132, no. 2801, pp. 153–155, Johannesburg, 1946.

In his presidential address to the Institution of Mining and Metallurgy, London, the author emphasized the vital need for intensive mineral exploration and reviewed briefly the various prospecting methods in use at the present time, such as aerial reconnaissance, surface prospecting, geological surveying and mapping, geophysical and geochemical methods, diamond drilling, and subsurface studies. Current limitations and future possibilities for the geophysical and geochemical methods were discussed.—*V. S.*

9080. Lundberg, Hans. Mining geophysics: Mining and Metallurgy, vol. 28, no. 482 (annual review), pp. 91–95, New York, 1947.

Geophysical exploration for ore has been increasingly active during 1946. The developments in prospecting and research are reported for the United States, Canada, and Sweden. Surveys in Africa, South America, and India are mentioned.

Prospecting was conducted mainly by electrical and magnetic methods. The electrical surveys employed the resistivity, self-potential, spontaneous polarization, and electromagnetic techniques. Magnetic methods were applied particularly in Canada and Sweden. The ores explored included lead, fluorspar, peridotite, sphalerite, and nickel deposits. For detailed work, gravity and radioactivity measurements were used in Sweden.

Instrumental research produced a new type of light, accurate gravimeter permitting the close computation and correction of drift errors, a prospecting magnetometer of the Schmidt type incorporating several improvements, an airborne magnetometer carried on the wing, portable equipment for rapid electrical reconnaissance, apparatus of the ratiograph type, and small radioactivity instruments for field work. Electrical methods were perfected for reaching considerable depths, identifying rock types, and applying electromagnetic and "transient" principles.—*V. S.* (For summary on the airborne magnetometer *see* Geophys. abstract 8992.)

9081. Myers, G. N. Battle for Arctic oil: Science Illustrated, vol. 1, no. 8, pp. 38–39, 88, Louisville, Ky., 1946.

The Naval Petroleum Reserve No. 4 near Point Barrow, Alaska, is being surveyed with an airborne magnetometer by the U. S. Geological Survey and the Naval Ordnance Laboratory. The magnetometer crew uses a Navy patrol bomber and can be expected soon to complete the preliminary reconnaissance of the entire 35,000 square miles of the reserve. On the basis of the magnetic data already obtained, the United Geophysical Co. of Pasadena, Calif., is conducting seismic and gravity surveys. At Cape Simpson, 50 miles east of Point Barrow, an application has been made of the seismic method, and in the Meade River Basin, 65 miles south of Point Barrow, the gravity method has been

employed. The work is facilitated by the use of an Army M–29 airplane carrier and a small airplane cruiser, both adapted for service on snow and water.—*V. S.*

9082. National Oil Scouts and Landmen's Association. Oil and gas field development in the United States, 1945: Yearbook 1946, vol. 16, 964 pp., Austin, Tex.

This symposium of reports by district-association editorial staffs and individual contributors outlines oil-field and gas-field developments during 1945 in 30 States and the United States as a whole. It presents reviews and statistical data on geological and geophysical prospecting, land and leasing activities, wildcat exploration, proven-field development, oil and gas production, pipe lines, and refineries. The text is prefaced by a general summary contributed by W. L. Baker, contains numerous maps and cross sections, and has an appendix of statistics on every branch of the petroleum industry. The scope of geophysical prospecting is indicated in the data for most of the States, and the relative success of geophysical and other methods in locating productive holes is given in a review of exploratory drilling by F. H. Lahee.—*V. S.*

9083. Nature. Geophysical prospecting and English oilfields: Vol. 158, no. 4026, pp. 931–934, London, 1946.

An account is given of the discussion on English oil fields held in London in November 1946, introduced by a general report of J. Phemister on petroleum geology and exploration.

A gravitational and magnetic survey in progress at present in the region between Bristol and London was described by L. H. Tarrant. About 2,000 square miles have been covered by nearly 4,000 gravity stations and 850 magnetic stations. The most significant feature detected is a deep trough of low gravity values extending in a south-north direction through Cirencester, with gravity increasing rapidly eastward and a plateau of high values around Oxford. Magnetic anomalies show a similar areal disposition, but the maxima are considerably displaced from the gravity highs.

A seismic refraction survey in northeastern Yorkshire was outlined by J. E. R. Wood. The time contours constructed from the results of arc shooting revealed a dome in the magnesian limestone below the southern outskirts of Redcar. In the two wells drilled, the difference in the depth of the limestone deviated from that calculated from seismic results by only 40 feet, a length representing 0.003 seconds.

The local failure of the seismic reflection method was discussed by W. G. Fearnsides, D. T. Jones, and Wyrobek. The explanations offered pointed to the existence of a transition zone of interbedded limestones and shales between the Millstone grit strata and the massive limestone and to the absorption of a high portion of the energy by the massive limestone.—*V. S.*

9084. Oil. Gulf pioneered in exploration and drilling in south Louisiana: Vol. 6, no. 9, pp. 17–18, New Orleans, La., 1946.

This brief account of exploration by the Gulf Refining Co. in southern Louisiana includes a description of the marsh buggies employed to carry men and geophysical equipment for surveys. The buggies have 120-inch

by 33.5-inch rubber tires mounted on aluminum-alloy airtight drums serving as buoyant wheels. With the wheels, the vehicles weigh approximately 7,500 pounds, and measure 22.5 feet in length and 12 feet in width. They can reach a speed of 30 miles per hour on land and about 5 miles per hour on water.—*V. S.*

9085. Parker, F. S. California petroleum exploration and discoveries in 1945: Petroleum World, Ann. Rev., pp. 65–78, Los Angeles, Calif., 1946.

This review of California oil exploration in 1945 includes remarks on developments in geophysical methods.

Seismic exploration has become more rapid and economical owing to improvements in recording and shooting equipment. Some of the difficulties in marine application were overcome by the redesign of apparatus which resulted in expansion of exploration. Generally, the number of prospects located by seismograph alone has decreased from 1944, but the number located by a combination of seismograph and subsurface geology has increased.

Gravity reconnaissance has decreased from 1943–44, as exploration of new areas progressed. Considerable research is being made on underwater equipment. Tests have been conducted on the effectiveness of closely spaced observations for detailing known structures; so far the evidence remains inconclusive.

Geochemical methods are being broadened by the inclusion of fluorescent light for detecting hydrocarbons, but the former difficulties in locating oil fields remain.

Radioactivity logging is being aided by research on the radioactivity of rocks and its relation to the origin of oil.—*V. S.*

9086. Prishletsov, V. I. Geophysics [in Russian], Izd. GUGK, Moscow, 320 pp. 1946.

This textbook of geophysics deals primarily with atmospheric phenomena. As secondary subjects, the age of the earth, the development of the crust, the structure of the globe, terrestrial magnetism, and seismic phenomena are considered.—*V. S.*

9087. Rankine, A. O. Developments of geophysical prospecting in Germany during the war: British Intelligence Objectives Subcomm., Final Rept. 334, item 30, 5 pp., London, 1946; also Petroleum Times, vol. 50, no. 1281, p. 908, London, 1946.

The author reports on improvements in instruments used in geophysical prospecting for oil, made in Germany during the war. The information was gathered by interrogation of inventors, makers, and users during a trip to Germany in 1945.

The Graf gravimeter has superseded the Thyssen gravimeter in the extensive surveys carried out in Germany and the neighboring countries. It is based on the use of springs to balance gravity and has a photoelectric device for showing deflections caused by gravity changes. This gravimeter is superior to the Thyssen but inferior to the Gulf and LaCoste gravimeters manufactured in the United States.

The Mintrop seismometer developed 25 years ago is still used for refraction shooting. New apparatus have been introduced for reflection shooting by the Seismos Co. and the Siemens Co., which are about equal in performance to the American prewar Magnolia equipment.

The Schmidt vertical and horizontal magnetic variometers of Askania Co. for magnetic surveying have been rendered more free from fluctuations of temperature.

Electrical prospecting and logging equipment has undergone no changes; the Schlumberger Co. has supplied the logging apparatus from Paris.

The compilation of geophysical data is being carried out in a comprehensive and systematic way deserving commendation. Complete gravitational and seismic maps of Germany and some neighboring countries will be available soon.—*V. S.*

9088. South African Mining and Engineering Journal. Locating mineral wealth: Vol. 57, pt. 2, no. 2800, pp. 137–139, Johannesburg, 1946.

The brief account of the nature and value of gravitational, seismic, and geochemical methods of exploration, recently broadcast by E. S. Hill from London, is reproduced.—*V. S.*

9089. Todd, J. D. What is wrong with the eastern Gulf coast?: Oil Weekly, vol. 123, no. 3, pp. 89–91, Houston, Tex., 1946.

Usually, the oil-producing section of the Gulf coast is considered as limited to the western side of the coastal area, from New Orleans, La., to Brownsville, Tex. The author doubts that one part of the coast is underlain by oil and the other is not and inquires into the oil possibilities of the eastern side of the coastal area.

The history of the Gulf points to a geologic similarity of the two parts; the main difference is the absence of salt domes in the eastern part, but domes help localize oil rather than create it. Actually, no fair trial has been given to the eastern part through application of geophysical methods which proved so successful on the western side. Yet, the absence of piercement-type salt domes, of good surface markers, and of a broad coastal plain indicates that scientific methods are needed here even more than on the western side.

At present, application is being made of seismic refraction, gravimetry, and magnetic surveying. Seismic reflection surveys encounter difficulties because of acute velocity variations, insufficient reflections, and surface complications. Chief reliance is placed on gravity work recently successful in Mississippi; gravity and magnetic maps indicate sufficient folding to assure many closed traps. A generalized geologic map of the eastern Gulf coast is given.—*V. S.*

9090. Vening Meinesz, F. A. Tensions in the earth's crust as a consequence of pole-shifting [in Dutch]: Nederl. Akad. Wetens., Afd. Natuurk., Verslag, vol. 52, no. 5, pp. 185–196, Amsterdam, 1943.

The stresses brought about by a change in position of the rigid earth's crust with regard to the axis of rotation of the earth are investigaged; the crust is assumed to have uniform thickness and to behave as an elastic body. Equations are given for the conditions of equilibrium and the relations between stresses and strain, ignoring the bending stresses in the crust. If the vertical component of the crustal displacement is supposed to be known over the whole surface, the stresses and the other components of the displacments can be derived from these equations.

Using the theories of Huber-Hencky and Bylaard for the origin of plastic deformation in elastic media, the writer has determined the

resulting curves of shear over the earth's surface. It is suggested that the earth's crust at some moment of its history has shifted with regard to the poles and that the crust has undergone a corresponding block shearing.—*Physics Abstracts, vol. 49, no. 587, p. 331, London, 1946.*

9091. Weaver, Paul. Petroleum geophysics, 1946: Mining and Metallurgy, vol. 28, no. 482, pp. 104–105, New York, 1947.

During 1946 exploration for structures productive of oil was made principally by gravitational and seismic methods, as was done also in 1945. Gravimeter surveys totaled 1,600 party-months in 1946, as against 1,900 in 1945, and seismic reflection surveys totaled 4,400 party-months in 1946, as against 4,100 in 1945. The reduction in gravity work occurred because many parts of oil-producing regions had been covered in past years; seismic exploration increased partly because the findings by the gravimeter justified detailed work. Special effort was devoted to surveying the coastal waters of Louisiana, Florida, and the Bahama Islands; exploration sometimes extended as far as 30 miles off shore. The diving bell and the airborne magnetometer received application for the first time in 1946, the latter instrument being used over both water-covered and impassable terrain.—*V. S.*

9092. Westby, G. H. Geophysics in the mid-continent, past results and future application [abstract]: Oil and Gas Jour., vol. 45, no. 36, p. 43, Tulsa, Okla., 1947.

In the midcontinent area of the United States only three geophysical methods have won recognition—the magnetic, the gravitational, and the seismic. The magnetic method has provided reasonably good general information on structures in areas of shallow basement rocks, leading to the tracing of the Amarillo ridge and the Arbuckle Mountains, the establishment of structural graining in Kansas, and other determinations. The gravitational method has indicated certain large structural patterns, such as regional trends in Kansas, Nebraska, and the Dakotas, and some prominent individual structures, but most midcontinent structures are not of suitable size or type to produce marked gravity anomalies. The seismic method served for reflection and refraction work. Reflection correlation was successful in areas of low dip, simple structure, and good reflection, such as those in western Kansas, Colorado, and Nebraska; present reflection work in Oklahoma utilizes continuous-profile three-dimensional shooting. Refraction is used in the Texas Panhandle and parts of the Anadarko Basin and southern Kansas for exploring large structures. The future applications of the magnetic, gravitational, and seismic methods are discussed.—*V. S.*

9093. World Petroleum. Continental Shelf stirs interest in submarine drilling: Vol. 17, no. 3, pp. 36–41, New York, 1946.

The petroleum possibilities of the Continental Shelf are discussed from different angles. Geologic information points to the Gulf of Mexico as the most promising section. The shallowness and the moderate climate of the Gulf also facilitate exploration. The use of geophysical methods from submarines has been investigated by F. W. Lee and his associates, who reported that the same methods can be applied under water as are employed on land, but the instruments and techniques would require considerable adjustment.

The quickest results in the Gulf should be obtained by seismic refraction surveys of salt domes at depths of not more than 3,000 feet; alterations in the land instruments would be minor. Reflection seismic measurements should prove effective in the Gulf and in the Atlantic and Arctic Oceans. Magnetic surveys from airplanes would map the relief of the crystalline basement favorable for oil accumulation. Geochemical surveys could utilize differences in salinity due to buried salt domes and also trace floating oil to bottom seeps. The gravimetric method likewise is applicable.—*V. S.* (*See also* Geophys. abstracts 125, no. 8586.)

9. RELATED NONGEOPHYSICAL SUBJECTS

9094. Cooper, H. J., editor. Scientific instruments, 304 pp., Brooklyn, N. Y., Chemical Publishing Co., 1946.

This book discusses a wide range of instruments designed for making physical measurements, such as optical instruments, measuring instruments, navigational and surveying instruments, liquid-testing instruments, and miscellaneous instruments. The material covers apparatus used in laboratory, field, industry, commerce, and manufacturing. Besides a description of each instrument and the method of measurement, much attention is devoted to the principles upon which the apparatus is constructed. Many illustrations are given.—*Mines Mag., vol. 36, no. 10, p. 464, Denver, Colo., 1946, condensed by V. S.*

9095. Cusset, Francis. English-French and French-English technical dictionary, Brooklyn, N. Y., Chemical Publishing Co., 1946.

This dictionary contains approximately 16,000 words and phrases. It covers adequately the fields of metallurgy, mining, chemistry, electrical engineering and physics, in that order of thoroughness. French equivalents of English expressions, and vice versa, are chosen with competence and accuracy. The book is highly recommended to all workers in natural science, librarians, and translators. It seems surprisingly up-to-date in most aspects of applied science, although some terms having reference to recent developments in atomic physics are missing.—*H. Margenau, Am. Jour. Sci., vol. 244, no. 10, p. 742, New Haven, Conn., 1946.*

9096. De Vries, Louis. German-English science dictionary, 2 ed., 558 pp., New York, McGraw-Hill Co., 1946.

The second edition of this dictionary has been revised to include more terms in chemistry, biology, physics, mathematics, geology, and related sciences. The following new technical information is added in an appendix: Conversion table, Atomic table, Thermodynamic symbols, Electric units of measure, Abbreviations of periodicals, List of measurements, and Geographic names.—*V. S.*

9097. Disney, R. W. Trimetrogon aerial photography—oil industry's newest surveying tool: Oil and Gas Jour., vol. 45, no. 24, pp. 112–115, Tulsa, Okla., 1946.

During World War II, photogrammetric surveys were improved by the use of trimetrogon photography. The latter is carried out by three cameras mounted in an airplane, one for taking vertical photographs and the other two for shooting oblique photographs simultaneously. The

resulting photographs in combination give a bird's eye view from one horizon to another. Such a triple picture is shot along lines of flight at predetermined intervals, so that a strip of land about 35 miles wide and several hundred miles long is photographed in detail. The flight technique employed does not differ materially from that of the usual photogrammetric survey, except that a much smaller number of parallel flight lines is required to cover an area.

The trimetrogon method was used to photograph more than 18,000,000 square miles during the war. In combination with radar it may develop into the most effective method of surveying unknown territory. Questions of overlap photography, processing technique, resulting maps, and geologic interpretation are discussed.—*V. S.*

9098. Esseling, C. J. Drilling with counterflush continuous coring: Mining Mag., vol. 75, no. 3, pp. 145-149, London, 1946.

A novel system of rotary core drilling has been introduced by Bataafsche Petroleum Maatschappij for oil-field prospecting. It is intended exclusively for the geologic study of formations and uses boreholes 1.5 to 4 inches in diameter with counterflush continuous coring. The equipment and methods are described. The advantages include obtaining 100 percent cores and cuttings in continuous succession, bringing them up so rapidly that they have no time to disintegrate, drilling to depths of 1,000 to 2,000 feet with a single string of casing, and using small and light equipment transportable by airplane. The footage made in 24 hours ranges from 200 to 300 feet.—*V. S.*

9099. Gowanloch, J. N., and McDougall, J. E. Exploration can be harmless to aquatic life: Oil Weekly, vol. 119, no. 8, pp. 34–35, Houston, Tex., 1945.

A series of experiments has demonstrated that seismic explosions on the ocean floor are harmless to aquatic life. Previous experiments with fish, shrimp, and oysters are summarized; they show that charges of dynamite up to 800 pounds fired on the ocean floor failed to damage in any way shrimp at a distance of only 50 feet or to kill fish at a distance of only 200 feet. New experiments are described with oyster beds, in which the explosion of dynamite charges up to 400 pounds, carried out with the top sticks placed only 25 feet below the oyster bed, caused no mortality in that bed. The conclusion is reached that seismic exploration for oil can be made on the continental shelf without harming aquatic resources.—*V. S.*

9100. Kissam, P., and others. Radar shows promise in mapping, A symposium: Civil Eng., vol. 16, no. 7, pp. 294–299, New York, 1946.

The surveying and mapping division of the American Society of Civil Engineers held a conference on precision radar-mapping in New York, inviting experts from the Army, the Navy, and civilian organizations. The contributions published in the present symposium deal with the subjects of charting position by radar, application of radar equipment to electronic surveying, position determination by shoran in hydrographic surveys, mechanics of operating shoran, precision of shoran surveys made by the Army, the new long-range (Loran) aid to navigation, and determination of range with radar. Loran in its present form furnishes valuable assistance in marine surveying but is inferior to radar and shoran on land.—*V. S.*

9101. Knebel, G. M. Progress report on A. P. I. Research project 43, The transformation of organix material into petroleum: Am. Assoc. Petroleum Geologists Bull., vol. 30, no. 11, pp. 1935–1950, Tulsa, Okla., 1946.

A brief history of American Petroleum Institute Research Project 43 is presented, showing its origin as an outgrowth of the Parker Trask project (No. 4). The so-called Geological Fence, prepared as a guide to the fundamental studies of Project 43, is briefly outlined. Progress and results obtained by the three coordinated subprojects (43a, b, and c) are summarized, and comments on each are made. The more important unsolved problems are indicated, and the future research work of Project 43 will be largely directed toward solving them. Theories of the origin of oil are discussed, and the need for other research work on the origin of oil, in addition to A. P. I. Project 43, is emphasized.—*Author's abstract.*

9102. Lahee, F. H. Exploratory drilling in 1945: National Oil Scouts and Landmen's Assoc. Yearbook, 1946, pp. 898–910, Austin, Tex.

During 1945, 3,613 exploratory holes were drilled in the United States. Of these, 3,036 were new-field wildcats, 1,364 were new-pool tests, and 1,213 were outposts. Of the new-field wildcats, 351 were successful; of the new-pool tests, 383 were successful; and of the outposts, 480 were successful.

Although the number of holes drilled, the footage drilled, and the number of successful exploratory holes completed all show an increase over 1944 and earlier years, the degree of success, measured in barrels of oil discovered, again has declined. From these facts it is evident, as stated in previous reports on this subject, that all phases of the exploration program for petroleum must be aggressively continued.—*Author's abstract, condensed by V. S.*

9103. Obert, L., Windes, S., and Duval, W. Standardized tests for determining the physical properties of mine rock: U. S. Bur. Mines, Rept. Inv. 3891, 67 pp., Washington, D. C., August 1946.

A program of investigation has been inaugurated by the U. S. Bureau of Mines to determine the petrographic and physical properties of mine rocks. To attain these objectives, suitable methods were developed to measure the characteristics of specimens secured from diamond-drill core. The report describes the investigations, recommends standard procedures, and presents preliminary results on selected quarried rocks. The physical constants obtained include the compressive strength, modulus of rupture, tensile strength, Young's modulus, Poisson's ratio, modulus of rigidity, specific damping capacity, longitudinal velocity of sound, torsional velocity of sound, apparent specific gravity, apparent porosity, impact toughness, scleroscope hardness, abrasive hardness, and ball-mill grindability.—*V. S.*

9104. Oil and Gas Journal. Miniature models aid mapping of salt-dome areas: Vol. 45, no. 27, p. 85, Tulsa, Okla., 1946.

The exploration department of the Humble Oil and Refining Co. is mapping all known salt domes in the Gulf coast by means of miniature scale models cemented in position and duplicating exact shapes and sizes. The resulting salt-dome peg map gives the illusion that the first 20,000 feet of the earth have been stripped away leaving only the salt domes standing. In addition to salt deposits, surface geologic forma-

tions are indicated on the map by different colors. As a result, a mass of factual detail is presented in simplified form easily grasped from the over-all viewpoint.—*V. S.*

9105. Osnitskaia, L. K. On petroleum genesis [in Russian]: Priroda, no. 4, pp. 13–19, Moscow, 1946.

The various theories advanced since 1763 by scientists of different countries to explain petroleum genesis are reviewed briefly. Attention is devoted to the work of Lomonosov, Pallas, Abich, Mendeleev, Engler, Mikhailovskii, Arkhangelskii, Stadnikov, Berl, Zelinskii, Frost, and others, which resulted in the hypotheses of mineral genesis, distillation, bacterial action, cellulose hydrolysis, catalytic agents, and other explanations. A bibliography is appended.—*V. S.*

9106. Parejas, Edouard. La tectonique transversale et les gisements de petrole [Transverse tectonics and petroleum deposits]: Archives sci. phys. nat., vol. 27, pp. 79–92, Geneva, Mar.–Apr. 1945.

Transverse tectonics deals with geologic structures that are transverse to the axis of folding. This work has revealed the existence of orthogonal folds, elevated or depressed, which interfere with ordinary folds. By their general outlines such transverse folds determine hydrographic basins and coastal boundaries, as illustrated by the configuration of the Black Sea and eastern Mediterranean basins in ancient times. The principal petroleum deposits are found in depressed transverse folds, as is the case of by the deposits of Iran, Irak, Russia, Rumania, Poland, and Czechoslovakia. Apparently, large hydrocarbon accumulations were collected in the ancient transverse depressions of the great mountain chains, particularly at the extremities of such folds where they opened into the surrounding country.—*V. S.*

9107. Reed, Paul. Guarico's 1946 exploration program is most extensive in Venezuela: Oil and Gas Jour., vol. 44, no. 45, pp. 66–77, Tulsa, Okla., 1946.

The exploration program of 1946 for the State of Guarico, Venezuela, is considered to be one of the largest in the world. The problem is to determine whether the rich oil areas of the neighboring States of Anzoategui and Monagas extend westward into Guarico. The author deals mainly with the practices of exploratory drilling and production employed in the Las Mercedes area, the local geology, conditions of work, roads, camps, and costs of exploration.—*V. S.*

9108. Rosazza Ferraris, M. L' Italia e i suoi giacimenti di idrocarburi— Il petrolio [Italy and its hydrocarbon deposits—petroleum]: Riv. Geominer., vol. 2, nos. 3–4, pp. 19–55, Milan, 1941.

This paper summarizes a collection of reports and notes on the different hydrocarbon deposits of Italy. A short review of the various theories concerning the genesis of petroleum is given. Geosynclines are considered to be the determining spatial factors favoring both the accumulation and transformation of the original material and the preservation of petroleum. The author broadly delineates the Italian zones that offer possibilities of petroleum discoveries and illustrates them by several sketch maps. Further, some regions are indicated which not only answer the general requirements specified but also possess locally favorable conditions. Finally, the most suitable procedures which

should be adopted when prospecting for petroleum in Italy are described. —*Author's abstract.*

9109. Shepard, F. P., and Emery, K. O. Submarine photography off the California coast: Jour. Geology, vol. 54, no. 5, pp. 306–321, Chicago, 1946.

Bottom photography with the Ewing submarine camera was employed during the war to determine the bottom character of various areas off southern California and Mexico. The photographs provide information on the appearance of the sea floor on the Continental Shelf, on the submerged banks, and on the walls of submarine canyons. These pictures indicate the rocky nature of extensive portions of the sea bottom. An abundance of rounded boulders and cobbles is also shown, but growth of delicate organisms on these rocks implies that rolling is now slight. Ripple marks are present on sand in areas particularly exposed to waves and currents. Finally, the smoothness of most sediment surfaces is impressive, although the surfaces of muddy sediments usually have small depressions.—*Authors' abstract.*

9110. Thomas, H. F. Oil in Alaska: Oil Weekly, vol. 120, no. 10, Internat. section, pp. 39–48, Houston, Tex., 1946.

In Alaska the first oil indications were found in 1859. The early search and drilling are outlined. The recent expedition detected seeps in the areas of Umiat Mountain, Ungoon Point, Humphrey Point, Manning Point, Fish River, Cape Simpson, and Fort Yukon. Because of the limited character of the exposures, geological data are lacking, and exploration will require geophysical work combined with drilling. Maps are given of the sites of seepages and possible productive areas.—*V. S.* (A review appeared in Inst. Petrol. Jour., vol. 32, no. 272, p. 233A, London, 1946.)

9111. Veber, V. V. The presence of oil in the Miocene of the southeastern Caucasus [in Russian]: Acad. Sci. U. R. S. S. Bull. (Izvestiia), Sér. Géol., no. 4, pp. 47–59, Moscow, 1946.

The question of oil in the Miocene of the southeastern Caucasus is closely related to the general problem of oil in the Baku district. The Miocene includes here sediments from the Tarkhan to the Maeotic series, and some of their facies show definite indications of oil. Moreover, the strata underlying the Miocene have yielded oil in commercial quantity in the Maikop area. The author inquires into the local geologic possibilities of Miocene oil and compares the different conditions of its known occurrence in order to delimit the areas justifying exploration. Consideration is given to correlation of strata, changes in facies, processes of sedimentation, and traces of oil. A map shows the distribution of pre-Miocene, Miocene, and post-Miocene sediments.—*V. S.*

9112. White, W. S. A cotangent ruler for simplifying the graphic solution of problems in structural geology: Econ. Geology, vol. 41, no. 5, pp. 539–545, Lancaster, Pa., 1946.

The cotangent ruler is a device for measuring directly the dip of contoured surfaces or, conversely, for constructing contours that represent planes of known dip. It greatly simplifies the graphic solution of problems in structural geology and has several specialized applications to problems commonly encountered in mining geology and areal geologic mapping.—*Author's abstract.*

10. PATENTS

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

9113. (1) Zwaartekrachtmeter, waarbij de verticale verplaatsing van een door veer gedragen massa bepaald ist werd [Gravimeter determining the vertical displacement of a mass supported by a spring]. Askania-Werke A.-G., vormals Centralwerkstadt, Dessau, and Carl Bamberg, Friedenau: Dutch patent 49,880, issued Feb. 15, 1941.

The device is characterized by a light-sensitive electrical system serving for the transformation of mass displacements into index values. When the mass moves, the source of light, the light-sensitive system, and one or more screens undergo a mutual displacement. Claims allowed.

9114. (2) Magnetic deflection corrected compass. F. D. Braddon, Babylon, N. Y., assignor to Sperry Gyroscope Co., Inc., Brooklyn, N. Y., a corporation of New York: U. S. patent 2,411,866, issued Dec. 3, 1946.

A compass and error-correcting means therefor comprising a sensitive element affected by the earth's magnetic field and having a longitudinal axis normally positioned in a horizontal plane when arranged for azimuth indication purposes, supporting means for said sensitive element having an axis in fixed perpendicular relation to the longitudinal axis of said sensitive element, a universal mounting providing normally horizontal mutually perpendicular axes about which said supporting means may be pivoted to arrange the said axis thereof substantially vertical and to position said sensitive element substantially horizontally, and means for positioning and maintaining said supporting means in a position with its said axis inclined with relation to the vertical to a predetermined degree and in such a direction that said sensitive element is subjected to an effective vertical component of the earth's field to correct for deviation of said sensitive element due to local attraction. Claims allowed, 12.

9115. (2) Resonant circuit saturable core measurement apparatus. S. C. Hoare, Manchester, Mass., assignor to General Electric Co., a corporation of New York: U. S. patent 2,412,046, issued Dec. 3, 1946.

Undirectional flux responsive apparatus subject to magnetic fields comprising a pair of elongated magnetic core parts mounted parallel to each other, direct current winding means on said core parts for producing reverse unidirectional flux biases in said core parts such that when in line with a unidirectional magnetic field such field, with the biasing flux, will substantially saturate one core part and substantially demagnetize the other core part, alternating current windings on said core parts, means for connecting said windings in parallel circuits to an alternating current source of supply, means including said windings for tuning said parallel circuits such that said circuits operate on similar slopes of their resonant curves and have substantially equal currents when the core parts are in neutral positions relative to the field, and means responsive to the current flow in said parallel circuits to give a signal in accordance with the ratio of the currents in said parallel circuits. Claims allowed, 4.

9116. (2) System of compass compensation. Howard Jenkins, Arlington, Va.: U. S. patent 2,412,617, issued Dec. 17, 1946.

In a system for automatically compensating a magnetic compass for

errors produced by the degaussing field of a vessel upon which the compass is mounted, the combination including at least a pair of degaussing coils disposed in a predetermined space relation on said vessel, a pair of compensating coils each having at least a pair of separate and coaxial windings, the axes of said coils being substantially coplanar and horizontally disposed relative to said vessel, means securing each of said compensating coils to said vessel in a fixed predetermined space relation closely adjacent to said compass, a source of direct current electrical potential, means connecting each degaussing coil to said source, and means connecting a separate winding of each of said compensating coils in circuit with a separate degaussing coil so that the current magnitude in each of said windings may be separately adjusted in suitable proportion to the current magnitude in their respective degaussing coils to automatically compensate for the horizontal component of said degaussing field. Claims allowed, 10.

9117. (2) Well surveying instrument. G. A. Smith, Philadelphia, Pa., assignor to Sperry-Sun Well Surveying Co., Philadelphia, Pa., a corporation of Delaware: U. S. patent 2,413,005, issued Dec. 24, 1946.

A well surveying instrument comprising a casing adapted to enter a borehole, means for supporting a sensitized record member within said casing, a compass within said casing, luminescent indicia carried by said compass, and a lens movable in accordance with inclination of said casing for projecting an image of said indicia upon said record member. Claims allowed, 3.

9118. (2) Inrichting voor het bepalen van de magnetische polariteit van een uit zwakgemagnetiseered materiaal bestaand cylindrisch proefstuk (boormonster) [Device for the determination of the magnetic polarity of a cylindrical weakly magnetized borehole sample]. Standard Oil Co. of California: Dutch patent 48,792, issued July 15, 1940.

The device has a vertical magnetic axis and a system of known magnetic properties with a horizontal magnetic axis. The system serves to rotate a core sample about the latter's axis disposed parallel to the axis of the system. The sample is shaped into a cylinder, is marked in correspondence with marks on the recording strip, and is placed into the device mounted in an artificially lighted chamber. The marks on the sample and the strip are set in position, the lamp is lit, and the motor is started so as to rotate the sample. The sample, having a very low polarity, influences the magnetic system and causes a slight rotation of the vertical axis formed by a torsion thread. The direction of rotation depends on the mounting and the magnetic forces applied. Claims allowed, 1.

9119. (3) Seismic surveying. O. S. Petty, San Antonio, Tex.: U. S. patent 2,410,303, issued Oct. 29, 1946.

In apparatus for use in seismic surveying, the combination with a seismometer for converting incoming seismic energy into electrical waveform signals, and means for amplifying and recording such signals, of means operable in response to increase in signal energy above a predetermined amplitude for decreasing the gain of said amplifying means, said last named means including a device for initiating operation of said means to decrease the gain, said device affording filtering action

favoring the higher frequencies within the usable range, whereby the gain at all frequencies is decreased in greater degree by signals of large amplitude and predominantly high frequency than by signals of comparable amplitude and predominantly low frequency. Claims allowed, 4.

9120. (3) Seismometer. S. A. Scherbatskoy, Tulsa, Okla., assignor to Seismic Engineering Co., Dallas, Tex.: U. S. patent 2,411,117, issued Nov. 12, 1946.

A geophone for translating the earth vibrations into corresponding electrical oscillations, said geophone comprising an outer casing adapted to be subjected to the earth vibrations, an inertia member within said casing, a ringlike elastic membrane having its outer periphery secured to the inner walls of said casing and having its inner periphery secured to said inertia member, a flexible bellowslike container located within said casing and below said membrane a conductive liquid within said container, electrodes immersed in said liquid and suitably positioned within said container in a definite special relationship one to another, connecting elements between said electrodes and said outer casing and said inertia member, respectively, whereby variation in the spacing between said electrodes is produced in response to said vibration and the resistance of said liquid between said electrodes varies in accordance with the variation in said spacing. Claims allowed, 1.

9121. (3) Well sounding apparatus. Alexander Wolf and L. G. Cowles, Houston, Tex., assignors to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,411,311, issued Nov. 19, 1946.

The combination with a well casing, of means for receiving and recording pressure impulses from the well comprising a plurality of Bourdon tubes mounted upon a common support with their open ends in communication with the well and oppositely disposed upon said support to reduce vibrationally induced voltages, means connecting the closed ends of each of said Bourdon tubes with a pressure-sensitive pickup device to actuate said device in response to changes in the curvature of said tubes resulting from changes in pressure therein, means for balancing the amplitudes of the voltages emanating from said pickup devices to overcome differences in the sensitivity of said devices, and a recording device operatively connected to said balancing means for recording impulses transmitted to it from said well by said pickup devices. Claims allowed, 3.

9122. (3) System for geophysical exploration. E. M. Shook and R. W. Olson, Washington, D. C., assignors, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,413,116, issued Dec. 24, 1946.

In a system for geophysical exploration in which seismic waves are created below the earth's surface and their travel time through the earth measured, the combination of a single radio transmitter for radiating a carrier from a sending location, means for producing a single electrical impulse coincidentally with the instant of creation of said seismic waves, means including an amplifier operable by said single impulse for frequency modulating said carrier substantially during the period of said impulse, means including an uphole geophone for producing an electrical signal indicative of the arrival at the earth's surface of seismic waves which have traveled through at least a part of the weathered layer of the

earth's surface, means including said amplifier for applying said signal to said frequency modulating means to produce frequency modulation of said carrier substantially during the period of said signal, a second amplifier, sound responsive means including said second amplifier and concurrently operable for producing amplitude modulation of said carrier, means including a seismic recorder at a receiving location for recording said impulse and said seismic waves after travel through the earth, demodulating means responsive to the frequency modulated carrier for actuating said recorder to record said impulse and said signal, said demodulating means including signal-limiting means for preventing operation of said recording means by amplitude modulation of said carrier, means operable immediately after said geophone signal produces said frequency modulation for so biasing said amplifiers as to prevent further frequency and amplitude modulation of said carrier during the period of recording of said seismic waves, and manually operable means for rendering said biasing means ineffective thereby to render effective said frequency and amplitude modulating means for subsequent modulation of said carrier. Claims allowed, 5.

9123. (3) Akustisk spaningsapparat [Acoustic detecting apparatus]. Svenska Instrument Aktiebolaget, Stockholm: Swedish patent 104,908, issued June 30, 1942.

The device is characterized by a tube, in which is placed an acoustic lens provided with surfaces of elastic material and a gas of such nature that the speed of propagation of the sound therein is less than in the air. The lens is arranged to break down the sound waves striking it by a diaphragm with an opening in or near the focus of the objective and by a microphone on the other side of the objective. The mircophone is connected with a listening telephone. Claims allowed, 4.

9124. (4) Compensating means for electrical borehole apparatus. C. B. Aiken, North Plainfield, N. J., assignor to Schlumberger Well Surveying Corp., Houston, Tex., a corporation of Delaware: U. S. patent 2,411,843, issued Dec. 3, 1946.

Electrical borehole apparatus comprising investigating means adapted to be lowered into a borehole for exploring subterranean formations and having an output indicative of the formations traversed by said borehole, said investigating means being responsive to variations in the temperature in the borehole that cause undesirable variations in said output, a source of electrical energy at the surface for energizing said investigating means, indicating means responsive to the output of said investigating means, a generating means disposed in the borehole with said investigating means and energized from said source of electrical energy for providing a signal at the surface of substantially constant magnitude that is distinguishable from the output of said investigating means and which varies in response to temperature in substantially the same manner as the undesirable variations in the output of said investigating means, and means for controlling in unison the electrical energy supplied to said investigating means and said generating means to adjust said signal to said constant magnitude and simultaneously nullifying the undesired variations in the output of said investigating means. Claims allowed, 6.

9125. (4) Well logging. Daniel Silverman, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,412,363, issued Dec. 10, 1946.

In apparatus for detecting the location and character of produced well fluids, a circuit comprising a plurality of uniformly spaced electrodes adapted to be vertically disposed within a region of investigation, the said electrodes including a top electrode, a bottom electrode, and at least two intermediate electrodes, a current generator directly connected to said top and bottom electrodes, each of said intermediate electrodes being connected to said current generator only through a means for indicating, as a function of time, the potential drop across each of a plurality of contiguous uniform increments of said region defined by alternate pairs of electrodes, and rheostat means for controlling the current output of the generator across the top and bottom electrodes. Claims allowed, 4.

9126. (4) Well logging. Alex Frosch, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,412,575, issued Dec. 17, 1946.

An apparatus for simultaneously measuring along a borehole two physical properties of formations traversed thereby comprising a bomb adapted to be lowered in said borehole, a cable for suspending said bomb carrying an electrical conductor, a generator of a carrier wave arranged in said bomb having its output connected to said conductor, means adapted to be disposed at the surface and connected to said conductor for recording the output of said generator, means carried by said bomb responsive to one of the physical properties to be measured and connected to said generator to control the frequency of its carrier wave, and separate means carried by said bomb and responsive to the other physical property to be measured and connected to said generator to control the amplitude of its carrier wave. Claims allowed, 4.

9127. (4) Method of and apparatus for locating formations in cased wells. G. H. Ennis, Long Beach, Calif., assignor of one-half to R. V. Funk, Long Beach, Calif.: U. S. patent 2,414,194, issued Jan. 14, 1947.

In an electrical process for determining the nature of geological formations traversed by a drill hole, the said drill hole being provided with a metallic casing, the step of transmitting an electrical current from the said casing into the said formations, and determining the distribution of the electrical field resulting from the said current within the drill hole as a function of the depth of the drill hole at points adjacent to the said casing as a measure of the varying character of the formations traversed by the drill hole. Claims allowed, 10.

9128. (5) Method and apparatus for direct recording of borehole radioactivity. Shelley Krasnow, New York, N. Y., and L. F. Curtiss, Montgomery County, Md., assignors to Geophysical Development Corp., Washington, D. C., a corporation of Delaware: U. S. patent 2,409,436, issued Oct. 15, 1946.

In an apparatus for measuring radioactivity in a deep narrow borehole, a long narrow element sensitive to radioactivity, means to indicate the radioactive intensity of rays impinging on the element, and a filter, the filter serving to absorb a portion of the rays impinging upon the element sensitive to radioactivity. Claims allowed, 15.

9129. (5) Geiger-Müller counter. A. S. Keston, New York, N. Y.: U. S. patent 2,409,498, issued Oct. 15, 1946.

A Geiger-Müller counter tube filled with a vapor comprising an organometallic compound consisting of an alkyl compound of a nonradioactive metal of series 9 of the periodic system and having an atomic weight of at least 200. Claims allowed, 4.

9130. (6) Well surveying apparatus. R. E. Fearon, Tulsa, Okla., assignor to Well Surveys, Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,414,862, issued Jan. 28, 1947.

Apparatus for geophysical prospecting that comprises a casing adapted to be lowered into a drill hole, a cable adapted to support said casing in the drill hole and connect the mechanism in said casing electrically with the surface of the earth, means to lower said cable into the earth and withdraw it therefrom, means to measure the amount of cable lowered into the earth, an elongated heater element suspended below said casing in the drill hole, means on the surface of the earth for generating electrical current for said heater element, a circuit connecting said generating means with said supporting cable at the surface of the earth, a circuit connecting said heater element with said cable at the casing, means at the surface of the earth for periodically imposing an alternating current of a frequency different from that supplied to the heater element to the supporting cable at its upper end, means in the casing for receiving said alternating current from said supporting cable, a selector switch in said casing adapted to be advanced by said receiving means in response to said alternating current, a series of temperature responsive elements suspended below said casing at various depths alongside of said heating element and connected through said selector switch in sequence, an amplifier in said casing to which said temperature responsive elements are sequentially connected, a generator of a fixed frequency carrier wave different from the frequencies of the alternating current and heater currents already mentioned and modulated by the output of said amplifier, means for imposing the output of said carrier wave generator on said supporting cable, means on the surface of the earth for receiving and amplifying said carrier frequency to the exclusion of the alternating current and heater current already mentioned, and means, also on the surface of the earth, for recording the temperature indications superimposed on said carrier frequencies in correlation with time. Claims allowed, 3.

9131. (7) Method of logging wells. W. E. Winn, Dallas, Tex., and P. F. Dougherty, Chester, Pa., assignors to Sun Oil Co., Philadelphia, Pa., a corporation of New Jersey: U. S. patent 2,408,964, issued Oct. 8, 1946.

The method of logging oil and gas wells that are drilled with the aid of a circulating drilling fluid in order to determine a light hydrocarbon content of the drilling mud emerging from the well indicative of the nature of the formation penetrated regardless of variations during drilling in the properties of the mud causing variations in its ability to retain hydrocarbons, which comprises diverting a minor portion of the circulating drilling fluid from the main stream, subjecting said minor portion to a treatment which comprises the addition thereto of materials which will impart uniform hydrocarbon-retentive properties to the minor portion under the same fixed standard external conditions of stripping,

subjecting the thus treated drilling fluid to the stripping action of a gas to remove hydrocarbons, separating the mixture of stripping gas and hydrocarbons from the drilling fluid and subjecting said mixture to further treatment including an analysis to determine the amount of removed hydrocarbons. Claims allowed, 3.

9132. (7) Method of logging wells. W. E. Winn, Dallas, Tex., and P. F. Dougherty, Chester, Pa., assignors to Sun Oil Co., Philadelphia, Pa., a corporation of New Jersey: U. S. patent 2,408,965, issued Oct. 8, 1946.

The method of logging oil wells which comprises treating the drilling mud delivered from the well to separate therefrom the drilling fluid and the cuttings, intimately mixing said cuttings with gaseous carbon dioxide at a superatmospheric pressure effective to cause the carbon dioxide to permeate said cuttings, lowering the pressure on the cuttings to remove therefrom carbon dioxide and any hydrocarbons admixed therewith and subjecting the mixture to a treatment including an analysis to determine the amount of hydrocarbons, thereby ascertaining the content of such hydrocarbons in the formation from which the cuttings were obtained. Claims allowed, 2.

9133. (7) Werkwijze von het aantoonen van de aanwezigheid van olie of aardgassen in den grond door gasanalyse van grondmonsters [Method of indicating the presence of oil or earth gases in the ground by the analysis of samples). Standard Oil Development Co., New Jersey: Dutch patent 48,410, issued May 15, 1940.

Samples are taken from different points and before their analysis are excluded from contact with the air. Sample thus can be studied at a place remote from source. Claim allowed, 1.

9134. (8) Well logging. P. S. Williams, Tulsa, Okla., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,408,012, issued Sept. 24, 1946.

A method of logging formations traversed by a borehole, which comprises delivering sharp hammerlike blows directly against said formations along the wall of said borehole, generating in the borehole electrical impulses which are a function of the resistance of said formations to said blows, transmitting said electrical impulses to the surface, segregating high frequency components of said impulses, and recording them as a function of the resistance of said formations to said blows. Claims allowed, 8.

9135. (8) Well surveying instrument. W. H. Emerson, Long Beach, Calif., and Donald Hering, South Gate, Calif., assignors to Sperry-Sun Well Surveying Co., Philadelphia, Pa., a corporation of Delaware: U. S. patent 2,412,976, issued Dec. 24, 1946.

A well-surveying instrument comprising a casing adapted to enter a borehole, means for supporting a record member within said casing, means, comprising an electrical circuit, for effecting marking of said record member in accordance with the position of said casing, and means for controlling flow of current in said circuit, said means comprising devices responsive to rotation of said casing to effect said control. Claims allowed, 6.

9136. (9) Determining permeability of subsurface formations. J. W. Graybeal, Midland, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,409,674, issued Oct. 22, 1946.

In the logging of a borehole penetrating formations having sufficient permeability to allow appreciable amounts of liquid to be forced therein, the steps of determining adjacent the face of a formation the shut-in pressure of the borehole, introducing a body of liquid into the bore of the well, forcing portions of said body of liquid into a plurality of formations and the remainder of the body of liquid downward through the bore of the well, determining the rate at which a portion of the body of liquid is forced into the selected formation and simultaneously with the forcing of liquid therein determining the pressure in the borehole adjacent the face of said formation. Claims allowed, 3.

9137. (9) Obstacle detection system. C. H. Brown, Baldwin, N. Y., assignor to Radio Corporation of America, a corporation of Delaware: U. S. patent 2,410,424, issued Nov. 5, 1946.

The method of detecting an obstacle by ultra short radio waves which comprises directively radiating ultra short radio wave pulses which are short compared to the time intervals between them, automatically scanning a field uniformly at a very low audio frequency rate while radiating said pulses, receiving wave pulses reflected from an obstacle in the scanning field at time intervals lying between the periods of pulse radiation, utilizing the received pulses to stop the scanning, and audibly indicating the reception of said wave pulses. Claims allowed, 25.

9138. (9) Navigational method and apparatus. Jacob Neufeld, Tulsa, Okla.: U. S. patent 2,412,003, issued Dec. 3, 1946.

The method of investigating surroundings comprising wave reflecting objects in the neighborhood of a reference point, comprising the step of projecting radiant energy in selected directions from said point to said surroundings, receiving the energy reflected by said objects, producing signals representing respectively distances from said point to said objects along said selected directions, and combining said signals in order to produce a current the magnitude of which represents a relationship between said signals. Claims allowed, 14.

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