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UNITED STATES DEPARTMENT OF THE INTERIOR.

Oscar L. Chapman, *Secretary*

GEOLOGICAL SURVEY

W. E. Wrather, *Director*

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By V. L. SKITSKY *and* S. T. VESSELOWSKY

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*Abstracts of world literature
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CONTENTS

NOTE.—For a greater differentiation of contents section 8 of previous reports is replaced by section 0 and section 9, and the former section 9 is replaced by section 10 and section 11. An additional section on drill-hole methods, section 8, is introduced. A double dagger (‡) after an entry indicates that the publication was reproduced by other means than ordinary printing.
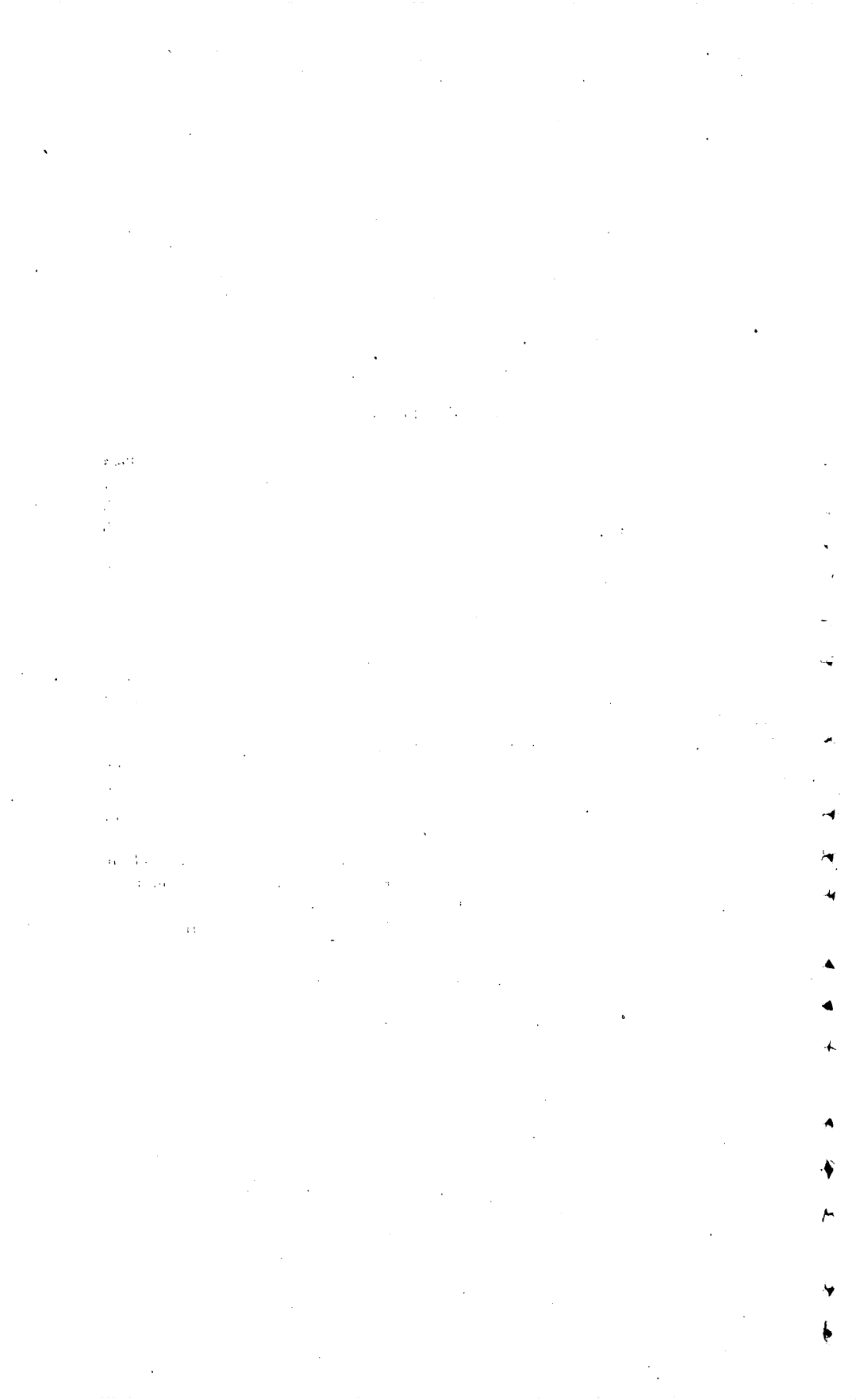
GEOPHYSICAL ABSTRACTS 136, JANUARY-MARCH 1949

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

FOREWORD

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

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

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0. GENERAL GEOPHYSICAL SUBJECTS

10737. Alvarez, Manuel. Los metodos geofísicos [Geophysical methods]: Petroleos Mexicanos, no. 62, pp. 27–29, Mexico City, 1948.

Geophysical prospecting probably had its beginning in the year 1640, when the magnetic compass was used for the first time to locate iron deposits in Sweden. Geomagnetic prospecting received a powerful impetus when a field magnetometer was built by Schmidt in 1915. A similar instrument was used for the first time in Mexico in 1926 for the exploration of the Furbero iron deposits. The electric method of prospecting for nonmagnetic metals was first employed by C. Schlumberger in 1913 in Bor, Yugoslavia, but because of the First World War, the results of his pioneering work did not become known until 1920. This method was first applied in Mexico in 1925 to the exploration of the ore deposits in the Pachuca region.

What is now known as the seismic method of exploration was suggested in 1849 by Robert Mallet in a paper presented before the Royal Irish Academy. It was used first in Mexico in 1923.

Baron von Eötvös was the first to apply the gravitational method to the study of subsoil when in 1888, he constructed torsion balance. In Mexico it was first used in 1922. Some years later the gravimeter, which is now the generally adopted instrument for gravitational prospecting, was introduced.—*S. T. V.*

10738. Armstrong, L. C., and Davidson, D. M. The practical view in geophysical exploration for metallic ores [abstract]: Geophysics, vol. 13, no. 3, p. 506, Tulsa, Okla., 1948.

The biggest hurdles to overcome before geophysics can reach a fuller measure of its true potentialities in ore finding are: first, the development of techniques for mitigating or eliminating the anomalous effects of overburden; second, development of methods for detection of disseminated metallic sulfide deposits; third, perfection of techniques for investigating the rocks surrounding bore holes for an appreciable distance; fourth, the improvement of techniques for geophysical prospecting underground; fifth, preliminary consultation on the chances of a survey's success, and checks of its results by the repetition of traverses and readings; sixth, reduction in costs for all methods; and seventh, modification and improvement in efficiency of equipment with special attention to increasing the depth range.

Finally, there is a critical need for research both long-range indirect fundamental research and direct research on known ore deposits which have not been disturbed too much by development or mining. This latter research will be most profitably carried out if undertaken by private mining companies on their own properties with the cooperation of their geological staffs.—*Condensed by V. S.*

10739. Bartels, Julius, and others. Geophysics, part 1, 237 pp., Office of Military Government for Germany, Wiesbaden, Germany, 1948.

The Military Government of the British, French, and United States zones of Germany present this volume of the review of German science 1939–46 with the hope that it will assist in informing scientists of research done in Germany during the war years. This special volume is devoted to geophysics, and consists of the following sections: a general introduction by Julius Bartels; an article on the earth as a planet, the earth's shape, the earth's interior, and gravity by Karl Jung; an article on geomagnetic instruments and methods of Friedrich Errulat; an article on geomagnetic disturbances, their relation to solar activity and other phases by Julius Bartels; articles on the ionosphere by Walter Dieminger and on atmospheric electricity by H. Israel. Applied geophysics is covered by Anton Graf, Hermann Reich, and Erich Bederke in articles on instruments and methods, on geophysical prospecting, and on geophysics in general geology respectively.

An extensive bibliography covering the related German literature of the war period is included.—*S. T. V.*

10740. Brant, A. A. Geophysics, a tool for mining exploration: Min. Eng., vol. 1, no. 1, pp. 28-32, New York, 1949.

A comparison is made between geophysical exploration for oil and for ore, and the methods applied in the latter work are examined to find ways of increasing their effectiveness. These methods include magnetic, self-potential, resistivity, ratiometer, equipotential, electromagnetic, gravitational, geothermal, radioactive, geochemical, and seismic techniques, characterized for the most part by their dependence on physical-property contrasts. Their limitations arise largely from the insufficiency of such contrasts, the decrease of effects with distance to deposits, the existence of contrasts due to surficial features, and uncertainties of geologic interpretations. The force-field methods particularly suffer from the indirectness of their approach to ore detection and from the restrictedness of their effective depth, which is about 500 feet of cover over large and broadly spread deposits.

These limitations result in a considerable uncertainty of geophysical interpretation. Even if the subsurface masses are correctly reconstructed by physico-mathematical analysis, it is still necessary to translate them into geological terms and to make conclusions as to the existence and location of ore deposits. Limitations can be reduced by improving physical, mathematical, and engineering techniques, by developing geophysical measurements in underground workings and diamond-drill holes, by expanding the use of geophysical instruments from the air, by investigating possibilities of new methods based on fundamental physical-property contrasts, and by promoting geophysical and geological research on ways of delimiting potential ore-bearing areas.—*V. S.*

10741. Fu, C. Y. Methods and problems of geophysics: Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp. 1–15, Nanking, 1948.

Geophysics is viewed by the author as a border-line science in which the observable data of geology are correlated and interpreted in terms

of the principles of mathematical physics with the aid of facts and methods from other sciences. In the paper attention is given to the scope of geophysical subject matter and to the various aspects of the relationship between geophysics and geology on the one hand, and between geophysics, physics, and applied mathematics on the other hand. Problems of the origin of the solar system, the core of the earth, and the movements of the earth's crust are discussed briefly as illustrations of the accessory role of various sciences in geophysics.

The utility of applied geophysics is recognized, but it is stressed that methods of practical exploration must be closely investigated with respect to their theoretical foundations before they can be used with full advantage. Examples of the need of critical scrutiny are given from the established practices of electrical, gravitational, and seismic prospecting.—*V. S.*

10742. Heiland, C. A., and Heiland Research Corp. · How can geophysics be of better service to the mining industry? [abstract] : Geophysics, vol. 13, no. 3, pp. 505–506, Tulsa, Okla., 1948.

By comparison with geophysical oil exploration, geophysical prospecting in mining is of limited scope, both areawise and dollarwise. Exploration targets are usually so small in relation to the promising area that blanket exploration becomes too costly if not impossible, geophysicists are handicapped by difficult transportation and difficult topography, and geophysical data are difficult to interpret because of geologic complexities. Moreover, the methods most applicable in oil exploration, such as seismic and gravimetric, are frequently of limited usefulness.

A geophysicist undertaking a mining project must keep these limitations well in mind. He should not recommend the application of geophysics where no better data than existing geologic information can be anticipated. If possible, he should limit the size of prospecting territory by geologic reasoning and test his methods under known conditions. Above all, he should have not only sufficient geologic training, but good geologic imagination as well, when analyzing his findings.

The mining industry can help by supplying freely, rather than withholding, all geologic data available and by assisting in the financing of industrial research aimed at the development and perfection of new methods. Organizations specializing in geophysical mine exploration are rarely in a position to do so. With a better understanding of the industry's problems by the geophysicist, and the geophysicist's problems by the industry, there is no reason why the use of geophysics in mining cannot be extended.—*Condensed by V. S.*

10743. Macelwane, J. B. The structure of the interior of the earth: Kansas Acad. Sci. Trans., vol. 51, no. 2, pp. 143–161, Lawrence, Kansas, 1948.

This paper is an address on our present knowledge of the structure of the earth delivered at the annual meeting of the Kansas Academy by J. B. Macelwane. The author states that reliable scientific knowledge on this subject has been accumulated only during the last hundred years. At present we have a provisional picture of the interior of the earth which permits certain definite conclusions concerning its structure. The study of near earthquakes has permitted an extension of this knowledge

to the base of the earth's crust. What we call the crust is a rigid outer shell separated from a solid interior by a relatively sudden change in properties which is known as the Mohorovičić discontinuity.

The data on which this extremely tentative identification rests are derived almost entirely from studies of elastic waves generated by earthquakes and observed by seismographs. We can measure with fair precision the apparent velocity of emergence along the surface of the earth up to a distance of about 100°, or 7,140 miles from the origin. The results so far obtained seem to suggest an inner core in which there is an increase in wave velocity.

In summary it is possible to say that the earth consists of: an outer mantle 600 miles thick, where velocity increases rapidly with depth; an intermediate shell 1,100 miles thick, where velocity increases slowly with depth; and finally of a core, about half of the globe's diameter, that reflects elastic waves.

Our knowledge of temperature in the earth's interior is even more limited. We know that the pressure at the center is about three and a half million atmospheres. We know nothing about the physico-chemical state of matter in the core.—*S. T. V.*

10744. Slotnick, M. M. Recent and current highlights of geophysical exploration [abstract]: Geophysics, vol. 13, no. 3, p. 500, Tulsa, Okla., 1948.

Some of the newer techniques of geophysical exploration, such as the offshore work in the Gulf of Mexico, the work on the Edwards Plateau, and the use of the airborne magnetometer, are discussed. Of the newer ideas the use of telluric currents, acoustic-impedance, and well logging are mentioned as examples. A brief résumé of a nonstatistical nature of world-wide geophysical activity is presented.

1. GRAVITATIONAL METHODS

10745. Andreev, B. A. Some problems of exploratory geophysics related to Dirichlet's problem [in Russian]: Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz., no. 13, pp. 57–71, Moscow, 1948.

The author emphasizes the possibility of obtaining solutions of many important problems of geophysics by a purely analytical study of the theory of potential, and applies this method to several variations of the second boundary value problem (Dirichlet problem) of this theory. The solutions given can be of value in the interpretation of geophysical anomalies obtained in gravitational or magnetic surveys. The following examples are treated in the article: a set of values of the potential function for the earth's surface is given to determine the corresponding values for the points lying at a certain altitude over the ground or forming a plane layer at a certain depth beneath the earth's surface. Solutions are given in the form of a series, usually rapidly convergent and convenient for numerical work. The author derives the integral equation controlling the problem and solves it by successive approximations. Another problem treated by the author is that of the reduction of the values of the potential function obtained over a rugged terrain to a selected reference plane, a problem analogous to the Fayé reduction in gravitational measurements. In conclusion the author derives a formula

for the determination of the upper boundary surface of a disturbing magnetic or gravitational body, buried in the ground.

Solutions given are applied to several problems met with in practical surveys and the numerical results obtained are found to be sufficiently accurate.—*S. T. V.*

10746. Barnes, V. E., and Romberg, Frederick. Observations of relative gravity at Paricutin Volcano: Geol. Soc. America Bull., vol. 59, no. 10, pp. 1019–1026, Baltimore, Md., 1948.

A set of observations of the relative gravitational force was made in the vicinity of the volcano Paricutin, Michoacán, Mexico. Most of the observations were made to the north of the volcano. The data are given on a map, showing the location and residual force for each observation and the contours of the force. No connection between the observed gravitational field and the volcano itself was found. A correlation between the observed fore and the geology of the area is suggested.— *Authors' abstract.*

10747. Burg, K. E. A new light-weight portable gravity meter [abstract]: Geophysics, vol. 13, no. 3, p. 499, Tulsa, Okla., 1948.

A new light-weight, portable gravity-meter of unique design is described, wherein many limitations previously encountered in such an instrument have been overcome. The basic requirements of such an instrument are outlined, and the design methods used to meet these requirements are disclosed. Test and performance data are presented.

10748. Clark, G. L. The gravitational field on a rotating nearly spherical body : Philos. Mag., vol. 39, no. 297, pp. 747-778, London, 1948.

This paper is a discussion of the external and internal fields of a nearly spherical body rotating with small angular velocities about the principal axes, so cubes and higher powers (of the angular velocity) may be neglected. Equations of motion of classical dynamics for the general case were derived in the relativity theory (*see* Geophys. Abstracts 129, no. 9140). By making $g_{m\mu}$ and their derivatives continuous on the boundary, the form of the energy tensor in the interior is determined. It consists of two parts, one representing the mass motion, the other the internal stress which vanishes at the boundary. The solutions for the rotating sphere are then easily obtained from the general solution. In all cases the coordinate system is assumed to be Galilean at infinity.—*S. T. V.*

10749. Cunietti, Mariano. Natura ed entità degli errori nelle riduzioni topografiche ed isostatiche dei valori della gravita. [The nature and the importance of topographic and isostatic reductions of gravity values] : Annali Geofis., vol. 1, no. 4, pp. 525–546, Rome, 1948.

Gravimetric anomalies disclosed by precise measurements are a source of important information on the geology of the area surveyed. However, readings of gravity made with instruments must be corrected for a number of factors. Some of these corrections are determined by the position of the observer on the earth's surface and by the surrounding topography. Others are based on the hypothesis that topographic masses rising above the ground are compensated by a corresponding

deficiency of mass in the terrestrial crust. The accuracy of the corrections to be applied is determined by the precision of the measurements made. When using modern instruments, the error in a measurement made on land is less than one milligal; when measurements are made over the sea this error rises to 4–5 milligals.

Isostatic reductions usually have the greatest absolute values. They also have many elements of uncertainty. This makes superfluous calculations of high degree of accuracy. The author considers 3 milligals as the limit of attainable accuracy.

The isostatic reduction methods of Hayford, Heiskanen, Vening Meinesz, Bullard, and Lejay are discussed. Auxiliary tables, facilitating the computations, are described.

The author suggests the introduction of some generally accepted method of reduction, which would eliminate the individual estimates of different factors that often result in discrepancies in the final values.—S. T. V.

10750. Garland, G. D. Gravity anomalies of northern Ontario [abstract]: Royal Soc. Canada Proc., ser. 3, vol. 42, p. 147, Ottawa, Ontario, 1948.

The Bouguer anomalies, obtained from gravity traverses over the Ontario section of the Canadian Shield during 1946 and 1947, have been separated into local and regional effects. It is shown that irregularities in the thickness of the "intermediate" and "granitic" layers of the crust could produce the latter type of anomaly. Gravity lows, possibly indicative of a thickened granitic layer, occur according to geologic evidence along certain lines that were once pre-Cambrian mountain ranges. It is suggested that a remnant of the mountain roots may exist long after the topography has been levelled.

10751. Griffin, W. R. Residual gravity in theory and practice. Geophysics, vol. 14, no. 1, pp. 39–56, Tulsa, Okla., 1949.

A precise definition of residual gravity is given in a form most suitable for numerical application. Some pains are taken to show that the residual gravity picture depends on the method used in obtaining it and that there are many ways in which this may be done. Several examples from actual work on developed oil fields are given in the form of figures and maps to bear out the above statement. Conclusions are drawn as to the relative order of sensitivity of several factors entering into the computations in determining a given residual picture. The factors considered are size of unit figure; kind (or shape) of unit figure; density of reference net, that is, number of reference points per unit area; and sensitivity of reference points to lateral displacement on gravity map.—Author's abstract.

10752. Kunz, Bruno. Die Bestimmung des vertikalen Schweregradienten [The determination of the vertical gravity gradient]: Oesterr. Ing. Archiv., vol. 2, pp. 1–17, Vienna, 1947.

The author reviews various attempts to design an instrument for the measurement of the vertical gravity gradient and emphasizes the progress toward the solution of this problem made in Germany during the last World War. This is followed by a description of a new instrument, specially adapted to the measurement of the vertical-gravity gradient

called a vertical gradiometer. A theoretical analysis of its operation shows that it is not influenced by temperature or barometric variations.

The method of Evjen and the computation of the vertical-gravity gradient was discussed and a new method of computation is presented. The latter makes use of the second derivative of the gravitational potential, measured by the Eötvös torsion balance, and makes possible the computation of the gravitational potential and of all its first and second derivatives. Differences and discrepancies in the results obtained from measurements made with gravimeters and with torsion balances are discussed.—*S. T. V.*

10753. Liustikh, E. N. The gravimetric method of investigating the causes of oscillatory movements in the earth's crust and some results of its application [in Russian] : Akad. Nauk SSSR Izvestiia, Ser. Geol., 1948, no. 6, pp. 113–123, Moscow, 1948.

The author compares large-scale gravity anomalies, detected on the geologic plateaus of Europe, western Siberia, northern America, India, and eastern Africa, and concludes that protracted vertical movements of plateaus are caused essentially by a horizontal displacement of deep masses in the earth's interior, whereas the plateaus' relatively brief oscillatory movements are apparently produced by changes in the volume of these masses.—*Author's abstract, translated by V. S.* (For a preliminary report on this investigation *see* Geophys. Abstracts 135, no. 10489.)

10754. Lozano Calvo, Luis. Las anomalías isostáticas en España según la teoría de Airy [Isostatic anomalies in Spain according to Airy's theory] : Rev. Geofis., vol. 7, no. 27, pp. 254–273, Madrid, 1948.

Up to 1948 the results of the gravitational surveys of Spain either were not reduced isostatically, or this reduction has been made following the method of Hayford-Bowie with an assumed depth of compensation of 113.7 kilometers. In the present study isostatic reductions are calculated following the method of Heiskanen for all the stations for which the Hayford-Bowie reductions have been previously computed. The author also presents a critical analysis of each method of isostatic reduction. In his calculations the author follows closely the "Isostatic tables for the reduction of gravimetric observations."

Calculations are made for 48 stations in Spain with four different values for depth of compensation, namely 40, 60, 80, and 100 kilometers. The results are presented in tables containing the anomalies of gravity for each station. From these data a map of Spain has been constructed to show the isoanomalies for a 40-kilometer depth of compensation.

The last section of the study contains a discussion of the observed anomalies which the author relates to the geological features of the Iberian Peninsula.—*S. T. V.*

10755. Magnitskii, V. A. The investigation of broad geoidal undulations by means of a joint utilization of geodetic and gravitational data [in Russian] : Akad. Nauk SSSR Izvestiia, Ser. Geog. i Geofiz., vol. 12, no. 3, pp. 213–216, Moscow, 1948.

In 1938 N. Migal' proposed a method of determining geoidal elevations and corresponding broad undulations on the basis of gravity

anomalies calculated for unexplored regions from the astronomic-geodetic data on plumb-line deflections. With a view to increasing the precision and reducing the computations of such determinations, the author has developed the simpler method of calculating broad undulations directly from combined gravitational and astronomic-geodetic data. Mathematical derivations are presented. The astronomic-geodetic values of geoidal elevations, used for areas not surveyed gravitationally are computed relatively to a certain reference ellipsoid adopted for the reduction of all geodetic observations. The analysis yields a system of equations solvable for elevations which are measured from the reference ellipsoid and are considered to be reasonable approximations to actual terrestrial dimensions. Though the solution characterizes only broad geoidal undulations and is valid only if the nets of all the employed astronomic-geodetic observations are tied together, it has the advantage of involving no assumptions about the structure of the earth's crust.—*V. S.*

10756. Morelli, Carlo. Su una correzione per i valori della gravità (On a correction to be applied to gravity values) : Accad. Naz. Lincei Rend., ser. 8, vol. 2, no. 6, pp. 781–782, Rome, 1947.

A systematic error in the Potsdam value of gravity ($g = 981.274$ cm. sec.$^{-2}$) that affects the whole international system made imperative the determination of the necessary corrections. Analysis made by the author of data obtained by Italian, American, British, and German scientists resulted in a correction of (-0.016 ± 0.002) cm. sec.$^{-2}$, to be applied to the Potsdam value of gravity, making the latter equal to 981.258 cm. sec.$^{-2}$

Meanwhile, the same comparison of gravity data was made by H. L. Dryden of the Bureau of Standards of Washington and independently by a special committee of Italian physicists; recommendations were made to accept the value of g for Washington as 980.083 cm. sec.$^{-2}$

This figure will change the author's correction of the Potsdam g-value from -0.016 to -0.017, which is a very close agreement.

The author emphasizes the necessity of a confirmation of the new value of gravity by an international official body.—*S. T. V.*

10757. Romberg, Frederick, and Barnes, V. E. Correlation of gravity observations with the geology of the Coal Creek serpentine mass, Blanco and Gillespie Counties, Texas [abstract] : Geophysics, vol. 13, no. 3, p. 499, Tulsa, Okla., 1948.

Gravitational observations were made of the pre-Cambrian Coal Creek serpentine mass in Blanco and Gillespie Counties, Texas, the geology of which had been mapped previously. The observed gravitational anomalies indicate roughly the depth of the serpentine mass, below which it may possibly grade into its parent peridotite rock. Probable small-scale correlation between the gravitational map and the geology of the area is indicated.

10758. Skeels, D. C., and Watson, R. J. Derivation of magnetic and gravitational quantities by surface integration [abstract] : Geophysics, vol. 13, no. 3, p. 500, Tulsa, Okla., 1948.

In an earlier paper by one of the authors it was pointed out that if the vertical component of a gravitational or magnetic field is known over a

horizontal plane surface of sufficient extent, all other components and derivatives of the field can theoretically be calculated by surface integration of the vertical component. In this paper examples are given to show that within certain limits such calculations are not only theoretically possible but practically so. Examples are given of the calculations of curvatures from observed gradients, and of horizontal magnetic intensity from observed vertical intensity, the calculated values being compared with those obtained by observations. They also include examples based on artificial data, of the calculation of plumb-line deflections from gravity and of the calculations of magnetic anomalies at a given elevation above the earth from data obtained at the surface. The purpose of these calculations is to demonstrate the nonindependence of the various derivatives of gravitational and magnetic potential.

10759. Smith, Cecil. Exploration of tidelands pays off in July: World Oil, vol. 128, no. 5, pp. 60–68, Houston, Tex., 1948. .

A review of the year's search for new oil and gas reserves in the United States is given. Special emphasis is placed on the exploration activity in tidelands, where during July 1948 two more producing wells were completed in the Gulf of Mexico off the coast of Louisiana. Several tables present the results of exploratory drilling and new oil fields discovered in the United States in July 1948. For each field the tables give the location ; name of the company ; total depth ; completion horizon ; name, character, and age of producing formation ; initial-production method ; and gravity of oil.—*S. T. V.*

10760. Solaini, Luigi, Cunnietti, Mariano, Mazzon, Cozzado, Radica, Bianca. Misure di gravità relativa eseguite lungo la linea di livellazione Genova-Piacenza nel 1947 [Relative gravity measurements made along the Genoa-Piacenza level line in 1947] : Ricerca Sci., vol. 18, no. 8–9, pp. 1044–1046. Rome, 1948.

Gravitational measurements were made in 1947 by the Italian Center of Studies of Gravimetry and Isostasy along the Genoa-Piacenza level line previously covered during a high-precision topographic survey. A radio communication established along this route made possible a very precise observation of the pendular instruments employed. These were a Mioni bipendulum and Cunningham field instruments with three pendulums. Measurements were also made with the Boliden gravimeter.

The least satisfactory was the Cunningham instrument, which has shown variations of its period of oscillations amounting to over 20×10^{-7} sec. The "pilgrim step" procedure was followed in making measurements. Measurements were made first at stations 1, 2, 3, 4; then at stations 2, 3, 4, 5, subsequently at 3, 4, 5, 6, and so on. This schedule gave four measurements per station and contributed much to the precision of the final determinations. The probable error of individual measurements is less than ± 1.7 milligals.

The determinations made with the gravimeter and with the pendular instruments are in excellent agreement. The high accuracy of the modern gravitational methods makes it evident that such surveys ought to be preceded by the high-precision topographic survey necessary for subsequent reduction of observed values.—*S. T. V.*

10761. Tsuboi, Chuji. Dependence of the oscillation period of gravity pendulums on amplitude [in Japanese] : Tokyo Imp. Univ., Earthquake Res. Inst. Bull., vol. 21, no. 2, pp. 236–242, Tokyo, 1943.

The oscillation period T (a) of a gravity pendulum swinging with an amplitude a is usually expressed by the formula: $T(a) = T(0) \cdot (1 + a^2/16)$. The results of the author's experiments with four pendulums, which had a carefully polished steel knife-edge resting on an agate seat, have not followed this law. They became consistent when the coefficient 1/16 in the formula was changed to a value of about 1/10. These findings point to the finite radius of curvature of the knife-edge, which is as large as a few centimeters.—*Author's abstract, revised by V. S.*

10762. Urban, M. A. Geophysikalische Unterwassermessungen [Underwater measurements in geophysics] : B. B. Z. [Bergbau-Bohrtechniker-und Erdoel Zeitung], vol. 64, no. 11, pp. 5–7, Vienna, 1948.

Some very promising petroleum sources in different parts of the globe are found in areas covered with shallow water. Such are the regions around the Gulf Coast of the United States, many sites in the East Indian Archipelago, the Caspian Sea, the Persian Gulf, and the north coast of Germany. Several methods were suggested for making gravitational surveys of these areas. Special tripods, supporting small platforms on which the instruments were installed, were used in making measurements in very shallow water. To complete one measurement by this procedure would take about 10 hours. If the depth of the water is not more than 50–80 feet, diving bells are used. These are of such dimensions, that the observer could operate his instruments in them.

Submarines were used by Russian geophysicists for exploration of different areas on the Caspian Sea. The most recent method employs a small diving bell containing only the gravimeter or the torsion balance, provided with a photographic recording or an electrical remote-reading arrangement.

Seismic surveys were made over water-covered areas, shooting explosives either placed on the bottom or suspended at a selected depth from a boat. The hydrophones for observation of the seismic waves can be either tied to a special cable and stretched on the bottom or suspended from floats on the surface of the water.—*S. T. V.*

10763. Vening Meinesz, F. A. Gravity surveys in submarines : Endeavour, vol. 7, no. 28, pp. 170–173, London, 1948.

In problems of the figure of the earth and the distribution of subsurface densities the gravity method has an advantage over the astronomical-geodetic method in that it makes possible measurements in ocean regions constituting 70 percent of the earth's surface. At first, such measurements were made by the author on a surface vessel with the use of a set of pendulums which permitted the elimination of the main component of the disturbance from the ship's movement while the other smaller effects could be computed. Later it was found preferable to make observations with the apparatus mounted on gimbals in a submarine submerged to a depth of at least 30 meters, where disturbance from movement is much reduced and the accuracy of measurements can

approach 1 part in 200,000, especially with crystal-controlled clocks as time recorders.

The ocean cruises of the author and of other investigators, particularly those in the Indonesian Archipelago and the West Indies, are listed, and their findings on the flattening of the equator, the negative anomalies in island-arc areas, and the thinning of the upper crustal layers under the ocean are discussed in the light of isostasy.—*V. S.*

10764. Weng, W. P. A note on some gravity anomalies: Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp. 59–67, Nanking, 1948.

A brief account is given of gravity surveys made in China since 1938, and their results are discussed with respect to isostasy, regional and local anomalies, and topographic effects. The principal project was a gravimeter survey begun in 1945 in the region between 39° and 41° N. latitude along the Kansu corridor and later extended to other areas. The data provide only relative values for local base stations, which are not tied together into a single net. The probable error is believed to be less than 1.0 milligal for the early measurements and less than 0.2 milligal for recent surveys made with superior instruments.

The results show isostatic equilibrium in the area in front of the Nan Shan but lack of compensation in the Mongolian steppes and on Taiwan. In northwestern China, where the distribution of rock density is favorable for exploration, gravitational anomalies corrected for regional effects correspond to local structures, as is also true in the Laochun-miao oilfield formation and for five other structures in the same region. The mountain ranges of the Gobi Desert, formed of huge blocks of metamorphic or igneous rocks, have no effect on Bouguer contours so that these mountains appear to have no roots. On the other hand, even mild topographic undulations on Taiwan are accompanied by strong Bouguer anomalies and must reflect underground structures.— *V. S.*

10765. Woollard, G. P. Recent regional gravity surveys: Am. Geophys. Union Trans., vol. 29, no. 5, pp. 727–738, Washington, D. C., 1948.

This paper calls attention to the vast improvements in design of gravity instruments, states that we are now in position to consider the feasibility of developing a nation-wide gravity network, and examines the value of such a network. It mentions that gravity data may be secured from oil-company surveys for studies from a geodetic standpoint and discusses the progress made and the future work on gravity determinations planned by government agencies and university groups.— *Author's abstract.*

2. MAGNETIC METHODS

10766. Barber, N. F. The magnetic field produced by earth currents flowing in an estuary or sea channel: Royal Astron. Soc. Monthly Notices, Geophys. Suppl., vol. 5, no. 7, pp. 258–269, London, 1948.

Records made in the Clyde estuary of fluctuations of the earth's magnetic field and of simultaneous fluctuations in the horizontal potential

gradients in the water give a clear indication that the fluctuations in vertical magnetic intensity are largely due to a varying flow of electric current in the sea. Variations in the earth current in the English Channel appear to produce appreciable fluctuations in vertical intensity at the magnetic observatory at Abinger.—*Author's abstract.*

10767. Beers, R. F. Some problems of magnetometer surveys [abstract]: Geophysics, vol. 13, no. 3, p. 495, Tulsa, Okla., 1948.

The development of the continuously recording mobile magnetometer presents new factors in geophysical operations. The characteristics of these new instruments are described together with features which adapt themselves to new exploration planning. It is observed that new spheres of application have been uncovered by virtue of the economies of mobile operations. Comparisons are made between airborne and surface operations.

10768. Bell Telephone Laboratories. Magnetic airborne detector, investigation of magnetic noise; with supplemental report: U. S. Office Sci. Res. and Devel. Repts. 2084, 47 pp., October 1943, and 3148, 20 pp., January 1944, Washington, D. C. (Library of Congress, OTS PB Repts. 27540 and 27541.)

The first, and principal, report distinguishes between two main types of circuits used in the magnetic airborne detector (MAD): the peak type, exemplified by the Mark VI equipment, and the 2d harmonic type, exemplified by the Mark X. The source of residual noise in MAD is found to be the magnetic core material, and a method of increasing the signal-to-noise ratio of the 2d harmonic type of element is described. The experimental evidence given indicates that the magnetic material does not follow exactly the same hysteresis curve in successive cycles. Other factors investigated in their effects on noise are the length, width, and thickness of the core; the methods of mounting the core; the core material; the temperature; the detecting methods; and circuit details. The experiments are outlined.

The supplementary report describes the overdriven peak-type detector and the biased fluxgate detector. A noise level of ±0.03 gamma was obtained experimentally when operating at a fundamental frequency of 10 kilocycles. An appendix to the supplementary report outlines the circuits and recording techniques used in the experiments, as well as the principles of operation of the 2d harmonic system. Both the main and the supplementary reports include graphs, block diagrams, and schematic drawings.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, pp. 107–108, Washington, D. C., 1946, condensed by V. S.*

10769. Bemrose, John, Heggblom, J. C., Holt, T. C., Richards, T. C., and Watson, R. J. The Bahamas airborne magnetometer survey [abstract]: Geophysics, vol 13, no. 3, 495, Tulsa, Okla., 1948.

This paper presents some of the background prior to the actual survey, the work of the participants of the "Technical Committee", and the committee's relationship to the contractors. A brief outline is also presented covering the various technical phases of the operation together with some of the inherent hazards of the area and how they were

handled, and a summary of recommended changes in equipment and procedure for any future project of the same type.

10770. Bersudskii, L. D. Magnetic properties of rocks as determined by their content of ferromagnetic substances [in Russian] : Vses. Nauch.-Issled. Geol. Inst. Mater., Geofiz., no. 13, pp. 85–97, Moscow, 1948.

This is a study of the relationship between the mineralogical composition of a rock and its magnetic properties. Some 300 samples of rocks were analyzed mineralogically and their magnetic susceptibility and remanent magnetism determined with an astatic magnetometer. The results of the tests are summarized by the author in the following manner: The magnetic susceptibility of the rocks is primarily influenced by their content of magnetite, chromite, pyrrhotite, and to a lesser extent by the presence of spinel, martite, and limonite; other frequently met metallic components, such as chalcopyrite, pentlandite (iron-nickel sulfide), do not show a measurable magnetic susceptibility. Nonmetallic components of the peridotites experimented upon do not show observable magnetic properties in the geomagnetic field. Empirical correlations between the magnetic properties and the mineral composition of a certain rock cannot be extended to the same rock under different genetic conditions involving a different process of cooling and crystallization.

The article contains several tables that give the results of the tests and the mineralogical data about the investigated rocks.—*S. T. V.*

10771. Boletin Minero. Levantamentos magneticos [Magnetic surveying] : Vol. 58, no. 555, p. 342, Santiago, Chile, 1946.

The article describes the air-borne magnetic detector developed at the beginning of World War II in the United States for the detection of submarines. This instrument is now being adapted for peacetime utilization, for the surveying of oil-bearing structures and other mineral deposits. The detector employed for measuring and recording magnetic intensity is flown in an airplane along a chosen profile. Magnetic anomalies recorded by the apparatus may indicate the presence of iron ores, or geological conditions favorable for oil accumulation. The article includes a diagram reproducing the geological conditions usually found in either case.—*S. T. V.*

10772. Bruckshaw, J. M. The application of geophysics to geology: Geologists' Assoc. Proc., vol. 59, no. 3, pp. 113–130, Colchester, England, 1948.

The use of geophysical-prospecting methods for the investigation of problems of academic geology is found practicable especially in the case of the magnetic, gravitational, and electrical techniques, because their field procedures are easily grasped and their equipment is simple to operate and relatively inexpensive. The principles of the magnetic and electrical resistivity methods are described, and the application of each method is illustrated by a field example.

The magnetic method was used to trace the course of the Armathwaite dike in Cumberland, England, and to determine whether this formation is a continuous body. The dike is andesite and cuts sandstones and shales of Triassic age; in the area investigated it is intrusive into sandstones bordering on Carboniferous limestone. Two standard vertical

magnetometers having a sensitivity of 20 gammas per scale division were employed over 10 traverses. The results, shown in profiles and discussed, indicate that the dike possesses permanent magnetization opposite in direction to the earth's field, which more than compensates the induced magnetism. The evidence points to a continuity of the dike over most of the area investigated and at one end of the dike to complications not clearly indicated by present measurements. The other example, of an electrical resistivity survey, deals with an investigation of a buried preglacial drainage channel in Yorkshire, England.—*V. S.*

10773. Burgaud, Maurice, editor. Observations magnétiques faites à la station Zô-Sè [Magnetic observations made at the Zô-Sè station]: Zi-Ka-Wei Observatoire, vol. 25, 1941–45, 21 pp., Zi-Ka-Wei near Shanghai, 1948.

Observations of geomagnetic elements, made at the Zô-Sè station in China during 1941–45, are reported together with monthly and annual averages, magnetic variations, and principal data for 1930–40. Information on the time and intensity of sudden commencements and of hook-like irregularities (crochets) on magnetograms is included. The accompanying text describes the instruments and procedures used for observations.—*V. S.*

10774. Burmeister, F. Der voraussichtliche Säkularverlauf der magnetischen Deklination im mittleren Europa während der nächsten Jahre [Anticipated secular change of magnetic declination in central Europe during the coming years]: Gerlands Beitr. Geophysik, vol. 60, no. 1–2, pp. 147–156, Leipzig, 1943.

The annual mean values of magnetic declination at ten European observatories for the years 1930–42, given in tables, are reduced by a method which is described and are extrapolated to obtain anticipated annual values until 1947.0. The geographic distribution of the predicted values of the change of declination, determined beginning with 1940.0, is presented in map form and by formulas for each of the seven years 1941–47.—*Author's abstract, translated by V. S.*

10775. Chen, P. C., and Liu, C. L. Preliminary report on the results of geomagnetic survey in China, 1946–47: Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp. 78–79, Nanking, 1948.

During 1946–47 a magnetic survey was made in China by a field party of the Academia Sinica. The work consisted in absolute determinations of declination, inclination, and horizontal component, made with the Askania portable theodolite magnetometer. Sixteen stations were occupied in Szechwan, 21 stations along the Yangtze River, and 10 stations on islands in the South Sea and at ports along the southeastern coast; 32 among them were repeat stations. The accuracy of measurements is considered to be within 5 gammas. Preliminary mean values computed without correction for diurnal variation are tabulated.—*V. S.*

10776. Columbia University, Airborne Instruments Laboratory. A study of short-time fluctuations in the magnetic field of the earth, project NA–120:

U. S. Office Sci. Res. and Devel. Rept. 4790, 20 pp., Washington, D. C., February 1945. (Library of Congress, OTS PB Rept. 27552.)

In any investigation, in which the magnetic field of the earth must be taken into consideration, a variation in that field is of potential significance. For that reason a study of short-time fluctuations of the magnetic field of the earth, particularly those in a frequency range from 0.1 to 1.0 cycle per second, was begun at the Airborne Instruments Laboratory in the fall of 1942. The progress of that work, the improvement in methods and equipment for studying these fluctuations, and the results observed before the laboratory's share in the project was completed, are discussed briefly in this report. Illustrations, graphs, and a circuit diagram are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 109, Washington, D. C., 1946.*

10777. Columbia University, Airborne Instruments Laboratory. Magnetometer suspensions: U. S. Office Sci. Res. and Devel. Rept. 5051, 28 pp., New York, May 1945. (Library of Congress, OTS PB Rept. 27553.)

Successful operation of the magnetic airborne detector (MAD) requires an accurate and continuous alinement of a magnetometer element with the direction of the magnetic field of the earth. To attain this alinement during aircraft flight the arrangement of the element must allow movement that counteracts maneuvers of the aircraft and variations in dip angle as the latitude of operation changes. The development of such an arrangement is discussed. Three systems of two-axis mountings are described, all with serious limitations when used in latitudes other than those for which the mounting was designed. These limitations led to the design of the "universal head" with three axes of freedom, permitting operation in any magnetic latitude. The design and mechanical parts are explained and illustrated. Graphs, drawings, and tables are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 108, Washington, D. C., 1946.*

10778. Columbia University, Airborne Instruments Laboratory. Saturated-core magnetometers, HA–120: U. S. Office Sci. Res. and Devel. Rept. 5314, 40 pp., New York, May 1945. (Library of Congress, OTS PB Rept. 27554.)

The saturated-core magnetometer consists of a coil wound around a strip of ferromagnetic material of high permeability. In use, a pair of magnetometers is coupled by a bridge in such a way that the magnetic fields within the coils have opposite poles. The bridge is described, and the fundamental research and calculations, conducted as a part of the work on the magnetic airborne detector (MAD) at the Airborne Instruments Laboratory, are presented in four papers.

The 1st paper, by W. H. Brattain, is a study of the behavior of the magnetometer under various conditions of drive, configuration, material, and field; it includes the results of research on the magnetometer operating as an isolated detector. The 2nd paper, also by Brattain, discusses the operation of the magnetometer as it depends upon the impedance unbalance within the bridge employed together with the magnetometer. The 3rd paper, by A. C. Weid, is a statistical study of

the variations in permalloy strips of varying sizes. The 4th paper, by K. S. Packard, is an investigation into the sources of noise in the magnetic-detection equipment. Graphs, diagrams, and a bibliography are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, pp. 108–109, Washington, D. C., 1946, revised by V. S.* (*See* also Geophys. abstract 10788.)

10779. Coze, P. Troubles magnétiques et telluriques à Tananarive en mars 1946 [Magnetic and telluric disturbances in Tananarive in March 1946] : Acad. Malgache Bull., vol. 27, pp. 79–81, Tananarive, Madagascar, 1946.

Certain phenomena of interest to geophysicists were observed during the month of March 1946 on the island of Madagascar. The unusual behavior of numerous mineral springs that come to the surface around the Tritrive Lac was observed. These springs started to give off an enormous amount of gas, and the lake itself, occupying an old crater, appeared to boil. On several days during that month extreme magnetic disturbances were registered. On the 28th of March when the variation of the magnetic declination reached a value of 41′, the declination being normally about 10°30′ W. these disturbances were especially violent. Simultaneously ΔH reached a value of 500 gammas, which is excessive, the normal H value being 21,000 γ.

Several telegraph companies announced a great increase in telluric currents, making normal operation impossible in many places. Telluric currents reached peaks of 35 volts over a distance of 248 kilometers.— *S. T. V.*

10780. Due Rojo, Antonio. La prospección magnética por avion en EE.UU. [Airborne magnetic prospecting in the United States of America]: Rev. Geofis., vol. 7, no. 26, pp. 211–215, Madrid, 1948.

Aeromagnetic measurements for geophysical prospecting were first employed in U. S. S. R., in 1936. In the United States during the last ten years, improvements in surveying techniques, as well as in the design of the instruments employed, gave this method of magnetic surveying its present important position. The author describes the construction of the measuring and recording equipment and emphasizes the use of shoran and the radio altimeter for the exact determination of airplane position. Magnetic surveying is especially important in the exploration of inaccessible regions, such as those in South America, where recently in Venezuela over 200,000 sq. miles have been explored magnetically from the air.—*S. T. V.*

10781. Eblé, Louis, and Thellier, Emile. Observations magnétiques faites à Chambon-la-Forêt pendant les années 1942, 1943 et 1944 [Magnetic observations made at Chambon-la-Forêt during the years 1942–44] : Inst. Phys. du Globe, Univ. Paris Annales, vol. 23, pp. 1–70, Paris, 1948.

This paper contains the results of observations made by the Magnetic Observatory of Chambon-la-Forêt, France, during the years 1942–44. Declination, and horizontal and vertical components have been measured every hour during these years and the results of these measurements are presented in tables. In addition the following data are presented: deviations of the hour's reading from the month's mean and from the annual mean; the yearly mean values of *D*, *H*, and *Z* for the

years 1942–44; and the main magnetic disturbances which took place during the years of observations.—*S. T. V.*

10782. Errulat, Fritz. Ein erdmagnetisches Profil über die Daciabank im Atlantischen Ozean [A geomagnetic profile across the Dacia Bank in the Atlantic Ocean]: Deutsche Hydrograph. Zeitschr., vol. 1, no. 1, pp. 30–32, Hamburg, Germany, 1948.

When the survey ship "Meteor" crossed the Dacia Bank in the Atlantic Ocean (31°10′ N., 13°39′W.) in 1937, measurements of the vertical intensity of the geomagnetic field and of echo-soundings were made simultaneously. For the magnetic determinations an instrument with a coil rotating on a horizontal axis was used, and the compensated magnetic-field component was measured by the current in a Helmholtz coil. A remarkable positive anomaly was found on the Dacia Bank, the maximum of which registered 980 gammas and coincided with the greatest elevation of the bank, equalling 425 meters. This result supports the view of Schott that the Dacia Bank has a core of eruptive rocks.—*Author's abstract, condensed by V. S.*

10783. Franselau, G. Über die Bedeutung der aus lokal begrenzten Beobachtungs-material berechneten Parameter des Magnetfeldes der Erde, 1 Teil [Concerning the significance of the parameters of the geomagnetic field computed from data of local observations, part 1]: Zeitschr. Meteorol., vol. 1, no. 2–3, pp. 55–62, Potsdam, Germany, 1946.

The analytical expression of geomagnetic observations is usually achieved, for the whole earth, by a series of spherical harmonics or, when dealing with the limited area of a magnetic survey, by a simple Taylor series. The author shows that the coefficients (parameter) of the general expansion by spherical harmonics can be deduced from the coefficients of a Taylor series and thus from regionally limited observations. The physical interpretation of the results will be given in part 2.—*H. G. Macht, Terres. Magn. and Atmos. Electr., vol. 53, no. 2, pp. 163–165, Baltimore Md., 1948, condensed by V. S.*

10784. Gimmelfarb, B. N. On the magnetism of cosmic bodies [in Russian]: Priroda, vol. 37, no. 11, pp. 12–20, Moscow, 1948.

The development of knowledge on the magnetism of cosmic bodies is traced from its inception in the studies of solar corona in the 19th century, through investigations of the magnetic field of sun spots and of the dipole field of the sun, to the present work on the magnetism of stars and the relation between the magnetic and the mechanical properties of rotating masses. The problems and methods of research are clarified, the difficulties encountered are discussed, and cosmogonic deductions are outlined briefly. The evidence accumulated in support of a proportionality between the magnetic moment and the angular momentum of rotating bodies is as yet insufficient to consider this relation a general law.—*V. S.*

10785. Giu, C. L., and Lee, S. P. Geomagnetic survey in southwestern China, 1940–43: Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp 68–71, Nanking, 1948.

In 1940–43 a magnetic survey was carried out by the National Geological Survey in China in the provinces of Szechwan, Sikang, Kweichow.

and Yünnan, and also on the western border of the Hunan and Kwangsi provinces. Measurements were made of declination, inclination, and horizontal intensity with the Askania portable theodolite magnetometer at 66 stations. The precision attained is considered to be 1 minute of arc for declination and inclination and 5 gammas for horizontal intensity. The work is described, the results are tabulated, and a map showing the location of stations is given.—*V. S.*

10786. Harada, Y., Hatakeyama, T., and Obayasi, T. The results of geomagnetic study of the latest eruption of Sakura-jima and magnetic properties of the new ejecta [in Japanese, with English summary] : Tokyo Imp. Univ., Earthquake Res. Inst. Bull., vol. 24, no. 1–4, pp. 207–216, Tokyo, 1946.

The eruption of March 9, 1946, on the volcanic Sakurajima was studied during March 23–April 17 to determine its effects on the local geomagnetic field and the magnetic properties of its lava. No changes were discovered in the declination and the horizontal component. According to the accumulated data on the island's anomaly in declination, local magnetization coincided in direction with the present meridian and was caused in part by the natural remanent magnetism of rocks. The average specific magnetic susceptibility of the new lava was 0.98×10^{-3}, and its average natural residual magnetization, 6.0×10^{-3} e. m. u., both values being smaller than those for basaltic rocks.

The lack of any notable magnetic changes, comparable to those accompanying the eruptions of the volcanoes Asama-yama and Mihara-yama, is attributed by the authors to an absence of the special local conditions essential for them—possibly the lack of basalts which have high susceptibility to magnetization.—*V. S.*

10787. Instituto Geofisico Coimbra, Portugal. Observações meteorológicas, magnéticas e sismologicas. no ano de 1941, 2a parte—Magnetismo terrestre [Meteorological, magnetic and seismological observations for the year 1941 ; Part 2, terrestrial magnetism] : Vol. 80, 31 pp., Coimbra, 1944.

This issue of the publication of the Geophysical Institute of Portugal contains the results of magnetic observations made during the year 1941. The instruments used were the Elliot Brothers unifilar magnetometer no. 40, and the J. Dover inclinometer no. 31. These instruments were calibrated in 1922 against similar instruments of the Carnegie Institution of Washington and the differences in readings have been found negligible. Magnetic declination and inclination were measured, as were the components of the geomagnetic vector. The horizontal component and the declination were measured every hour. Other characteristic data of the geomagnetic field were determined at intervals of seven days during the year. Tables of the results of the measurements are given.—*S. T. V.*

10788. Jensen, Homer. Geophysical surveying with the magnetic airborne detector AN/ASQ–3A : U. S. Naval Ordnance Lab. Rept. 937, 63 pp., Washington, D. C., May 1945. (Library of Congress, OTS PB Rept. 27267.)

The AN/ASQ–3A magnetic airborne detector is a fluxgate magnetometer employed originally for detecting submarines, but later modified for use in geophysical magnetic surveys by airplane. Results of surveys conducted over magnetic anomalies of widely varying magnitude and

intensity show that the instrument supplies accurate and consistent data which are more detailed and better related to geological structure than similar data obtained by surveys with standard ground magnetometers. Details are given of the installation put in a single-engine Beech biplane and later in a twin-engine SNB–1 plane, as well as of an aerial-camera arrangement which employs a split-image optical system to indicate instrument readings on photographs of the terrain so as to make possible the accurate correlation of magnetic data with aerial maps of the surveyed data. The component parts of the detector, principles of operation, and electronic circuits are described, and drawings, graphs, illustrations, and a bibliography are given.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 95, Washington, D. C., 1946.*

10789. Kalashnikov, A. G. Modification of the residual induction of magnets in different media [in Russian]: Akad. Nauk. SSSR Doklady, vol. 62, no. 6, pp. 771–774, Moscow, 1948.

The dependence of the residual induction of a permanent magnet upon the magnetic susceptibility of the surrounding medium can have a considerable effect on the results of geophysical surveys. To determine whether such a dependence exists a coil of 2,000 turns was placed in an elliptic case made of nonmagnetizable material, and a powder mixture containing selected proportions of magnetite was spread evenly inside to produce a medium of various magnetic susceptibility. Variations in the flux of the magnet's residual induction accompanying increases of magnetite content in the mixture were measured with a fluxmeter connected with the coil. The results showed a linear relationship between the induction readings in maxwells and the percentages of magnetite.

The explanation given is that the field of a magnet placed in a medium possessing a certain magnetic susceptibility induces a secondary field in the space about the magnet. The proportionality existing between the flux of induction and the magnetic susceptibility of the surrounding medium is deduced mathematically. This relationship can be utilized for magnetic logging of wells with a fluxmeter. Such a log of magnetic susceptibilities of formations, obtained in a laboratory experiment, is illustrated by the curve obtained.—*V. S.*

10790. Kodanda Rao, P. Report on technical education and industrial development in America, section 11, Airborne magnetometer; pp. 44–47, Nagpur, India, Govt. Printing, 1948.

The development of the airborne magnetometer in the United States, its advantages in exploration of mineral resources, the recent improvements in its construction and application, and the surveys made with it in various countries are noted briefly, and a tentative estimate is given of personnel requirements for an aeromagnetic unit for the Central Provinces Government, India, as prepared by the Geophysics Branch, U. S. Geological Survey, in January 1947. The unit can consist of two field parties, each composed of two pilots and two geophysicists operating the magnetometer, and of a computing staff made up of a chief, ten operators, and a clerk. Each field party would be charged with conducting surveys during half a year and would work on interpreting the data

during the other half. The computing staff would prepare the magnetic maps. Recommendations are made for inaugurating such work and other types of geophysical exploration in India.—*V. S.*

10791. Kozik, S. M. The statistical distribution of diurnal characteristics of geomagnetic activity [in Russian]: Akad. Nauk SSSR Izvestiia, Ser. Geog. i Geofiz., vol. 12, no. 2, pp. 147–154, Moscow, 1948.

The annual statistical distribution of diurnal characteristics of geomagnetic activity is analyzed for the years 1941–45, and a study is made of the variation in such distribution from year to year during this period.—*Author's abstract, translated by V. S.*

10792. Lee, F. W., Kuehn, H. E., and Dent, G. E. A magnetic survey of the Boyertown magnetite deposit located in Berks County, Pennsylvania, U. S. Bur. Mines, Geophysical Investigation, 12 pp., 4 figs., Washington, D. C., September 1943.‡

A survey was made with an Askania vertical magnetometer in the area of the abandoned Boyertown iron mines in Colebrookdale Township, Berks County, Pennsylvania, to trace possible extensions of the mined-out magnetite ore beds. The deposit lies in a zone of Triassic sediments characterized by an extension of diabase intrusives into the underlying Paleozoic limestones. Apparently the iron-bearing solutions had their origin in the diabase magmas, and the main ore body was formed by replacement of limestone. The traverses were generally spaced 100 feet apart, with measurements at 25 foot intervals, and the magnetometer had a sensitivity of 11.08 gammas per scale division. The results indicated 4 areas of possible extensions of the main ore body, disposed either on its immediate periphery, or as continuations toward the adjoining diabase, or as a detached bed. The total range of magnetic variation was 1,884 gammas. The findings generally agreed with previous geological studies made by J. R. Corbin and A. C. Spencer, but gave greater details and revealed an additional promising area.— *V. S.*

10793. Macelwane, J. B., and Sprengnether, W. F., Jr. The Macelwane-Sprengnether magnetometer: Am. Geophys. Union Trans., vol. 29, no. 5, pp. 638–639, Washington, D. C., 1948.

A special magnetometer has been developed by the authors to meet the needs for instruction of beginners The instrument is a Schmidt balance of simple type, sufficiently sensitive to illustrate field work, rugged to withstand inexperienced handling, easily adjusted and repaired, and moderately priced. Accordingly, it can serve for training students in habits of care and precision without much risk of costly damage. A horizontal and a vertical component model of the balance, each having an attainable sensitivity of about 75 gammas per scale division, were used at the Institute of Geophysical Technology, University of St. Louis for several years but showed defects in their clamping and releasing mechanism, orienting arrangement, and controls. These defects have been remedied in a new model of the magnetometer.— *V. S.*

10794. Madill, R. G. The present location of the north magnetic pole, parts 1–2 [abstracts] : Royal Soc. Canada Proc., ser. 3, vol. 41, pp. 165–166, 1947, vol. 42, pp. 141–142, 1948, Ottawa, Ontario.

An analysis is made of observations conducted prior to and in October 1946 to determine the location of the north magnetic pole, and data are given on magnetic declination north of latitude 60°, as measured during 1938–47. The evidence from former repeat observations, confirmed by measurements in 1945 and 1946, indicated a shift of the pole in a northward direction from its former position on Somerset Island. On the basis of this preliminary determination, 18 new magnetic base stations were established by two expeditions in 1947 in the area extending from Yellowknife to northern Ellesmere Island. The new determination, made on the basis of the additional data, locates the pole's present position in Northern Prince of Wales Island.—*V. S.*

10795. Medi, Enrico. Sull'origine del campo magnetico terrestre [On the origin of the terrestrial magnetic field] : Annali Geofis., vol. 1, no. 3, pp. 344–349, Rome, 1948.

The author presents a hypothesis explaining the generation of the terrestrial magnetic field. As a result of previous cosmogonic processes a circular band of electrons rotates around the earth. The moving electrons are equivalent to an electric current circulating around the globe, and generate a primary magnetic field which determines the intensity of magnetization of our planet. The stability of the motion of these electrons is conditioned by the equality of two acting forces— the Lorentz force tending to deflect the electrons toward the earth's surface and an electrostatic force caused by the presence of a negative electric charge spread over the earth's surface. A third force, the centrifugal force acting on the electrons, can be neglected because it is very small as compared with the first two. This picture explains the basic phenomena of terrestrial magnetism.—*S. T. V.*

10796. Morelli, Carlo. Sui fenomeni di magnetismo terrestre in dipendenza da quelli solari [Geomagnetic phenomena in their relation to solar phenomena] : Istit. Geofis. Trieste Publ., no. 240, 20 pp., Trieste, 1948.

Certain variations and periodicity of the terrestrial magnetic field are correlated with or, are caused by different manifestations of solar activity. Similarly geomagnetic disturbances of irregular periods can also be traced to solar influences. The author discusses research recently carried out in Italy on secular, diurnal, and other variations of the geomagnetic field and on related phenomena, such as aurora borealis, telluric currents, propagation of radio waves. The concluding section contains certain predictions by the author as to the solar activity during the period 1948–1957.—*S. T. V.*

10797. Nagata, Takesi, and others. The natural remanent magnetism of sedimentary rocks, preliminary note [in English] and part 2 [in Japanese, with English summary] : Tokyo Imp. Univ., Earthquake Res. Inst. Bull., vol 21, no. 2, pp. 276–297, 1943, vol. 23, no. 1–4, pp. 79–95, 1945, Tokyo.

To advance the investigation of secular geomagnetic variation by studies of rock samples, a laboratory test was made of the underlying

assumption that the direction of remanent magnetization of horizontally laid sedimentary beds coincides with the direction of the geomagnetic field that affected the sediments during their deposition. The procedure consisted in crushing a piece of volcanic rock into small fragments, heating the latter to 700° C., cooling them in a magnetic field of 4.0 oersteds, and dropping the particles—now having a remanent magnetization of 0.065 e. m. u.—through a long tube filled with water into a receptacle, on which was marked the geomagnetic meridian. The mean direction of magnetization in the resulting coagulated mass, measured with an astatic magnetometer, was found to coincide with that of the geomagnetic field. A mathematical analysis of the motion of particles in actual sedimentation is given.

On the basis of this evidence the intensity and direction of natural remanent magnetization were measured by the McNish and Johnson method in samples of sand collected at various depths from the Narita bed, a horizontal Quaternary stratum in the Kwanto District, Japan. The findings are presented. A calculation of their mathematical probability shows that the magnetization detected is the effect of an arrangement of magnetized particles that is not random but the result of a sustained external force. Apparently, this force could only be the geomagnetic field at the time of the deposition of the bed.—*V. S.*

10798. Ol', A. I. Geomagnetic disturbances and solar activity [in Russian]; Priroda, vol. 37, no. 7, pp. 3–10, Moscow, 1948.

Evidence is presented to demonstrate that geomagnetic disturbances are related to corpuscular radiations of the sun, and attention is given to the body-angle of corpuscular radiation. Recent investigations tend to show more particularly that magnetic disturbances can be separated into strong and moderate storms. The strong storms are closely connected with large sun spots and especially with radiations from the most intense chromospherical eruptions that usually occur in the vicinity of these spots. Moderate storms have 27-day sequences and bear no relation to sun spots, eruptions, or other solar activity. The dependence of the moderate storms on special solar M regions emitting a magnetically potent radiation is discussed, and the investigations aimed at the identification of these regions are outlined. Studies of the solar corona by means of systematic coronagraph recordings are believed to offer much promise.—*V. S.*

10799. Petrova, G. N. Ideal magnetization as one of the causes of high remanent magnetism in rocks [in Russian]: Akad. Nauk SSSR Izvestiia, Ser. Geog. Geofiz., vol. 12, no. 5, pp. 475–487, Moscow, 1948.

A study was made to determine whether the high remanent magnetism of rocks *in situ* can be produced in some cases by their magnetization by the effects of tectonic and seismic processes rather than by thermo-remanent magnetization, to which it is usually attributed. The evidence obtained by an experimental investigation of the hysteresis-free magnetization curves for magnetite samples, subjected to the "ideal" simultaneous action of a permanent field and a field of decreasing amplitude, showed that such a magnetization in the earth's field would result in a remanent magnetism of the same order as that found in rocks under

natural conditions. The procedure and equipment employed are described, and the results are tabulated and plotted in graphs. Data are also given on the magnetic properties of magnetite as a type of rock, independently of the shape of samples, and on the internal demagnetization factors of the magnetite from the deposit of Gora Vysokaya in the Nizhne-Tagil'skiy District, U. S. S. R.—*Author's abstract, translated and amplified by V. S.*

10800. Rothé, J. P. Tremblements de terre et anomalies magnétiques [Earthquakes and magnetic anomalies] : Geofis. Pura e Appl., vol. 12, no. 3–4, pp. 1-12, Milan, 1948.

It has often been reported that seismic disturbances cause changes in the geomagnetic field. In support of such observations, examples are cited of magnetic anomalies in Japan recently investigated by Y. Kato after major earthquakes. The magnetic anomaly of the Paris Basin is known to undergo modifications for a certain time, possibly in connection with magmatic displacements and seismic activity. The earthquake of June 11, 1938, in Belgium has given evidence of an interesting relation to the magnetic anomaly near Brussels. According to G. C. Omer the isoporic maps of the world show a certain correlation with maps of seismic activity. The author supposes that earthquakes and changes of the geomagnetic field are related and that an atomic chain reaction may possibly explain orogenic earthquakes and their aftershocks.—*Author's abstract, translated by V. S.* (A bibliography is appended.)

10801. Sauter, A. and F. Die Erzeugung von möglichst homogenen Magnetfeldern durch Stromsysteme [Production of homogeneous magnetic fields using combinations of electrical currents] : Zeitschr. Phys., vol. 122, no. 1–4, pp. 120–136, Berlin, 1944.

The author indicates the possibility of creating magnetic fields more homogeneous than those produced by the ordinary Helmholtz coils. Based on the Biot-Savart law, a theoretical analysis is presented of the electromagnetic field created by a system of circular coaxial energized coils. The intensity of the resultant field is expressed in the form of a series, and conditions are deduced for the greatest degree of homogeneity for this field. The problem is of importance in designing instruments and in arrangements for precise magnetic measurements.—*S. T. V.*

10802. Seaton, John. Ship-model magnetometers, description and operating instructions (12D) : U. S. Naval Ordnance Lab. Rept. 793, 28 pp., Washington, D. C., September 1944. (Library of Congress, OTS PB Rept. 33516.)

The component parts of two fluxgate magnetometers, one for low-gradient and the other for high-gradient measurements of ship-model fields, are described in detail, and a few fundamental principles of second-harmonic fluxgate operation are reviewed. Two control units for the low-gradient magnetometer are also described, one for high-precision manual use and the other for use with an automatic Speedomax recorder. Operating instructions, including maintenance and servicing

are given for all instruments. Photographs and schematic, block, and circuit diagrams illustrate the text.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 11, pp. 803–804, Washington, D. C., 1946.*

10803. Slaucitajs, Leonids. Magnetic maps of Latvia: Baltic Univ. Contr. no. 52, 2 pp., 5 maps, Pinneberg, Germany, 1947.

Isomagnetic maps of Latvia for the elements of declination, inclination, horizontal intensity, vertical intensity, and total intensity, reduced to epoch 1940.5, are plotted on the basis of the data of the magnetic surveys of 1927-1928, 1932, and, 1937-43, published previously (Geophys. Abstract 133, no. 10012). The features common to these maps are the complexity of isoline patterns, the belt of intense anomalies between meridian 24° and 26° extending north beyond Latvian boundaries, and a belt of weaker anomalies about meridian 20°. Some distinctive features of the separate maps are noted.—*V. S.* (Preliminary maps of Latvia were given by the author in Baltic Univ. Contr. 18, Hamburg, 1946.)

10804. Stupochenko, E. V. On the origin of terrestrial magnetism [in Russian]: Akad. Nauk SSSR Doklady, vol. 62, no. 4 pp. 477–480, Moscow, 1948.

The formula for expressing the relationship between the magnetic moment and the angular momentum of rotating spherical masses, which P. M. S. Blackett found to hold true for the earth, the sun, and the star 78 Virginis, is valid when the angular momentum is calculated on the assumption of a uniform distribution of density in the rotating mass. The author deduces a similar formula which holds for a nonuniform density of mass and is based on the assumption that matter has the capacity to become highly polarized at the interior of rotating masses. The mathematical derivation is presented.

The new formula gives reasonably close values of the studied relationship for the earth and the sun but less close for the star 78 Virginis. The latter discrepancy is attributed to the uncertainty of the data on the size, mass, and angular velocity of 78 Virginis, calculated from the averaged statistics on all the stars of spectral type A–2.—*V. S.* (For Blackett's paper *see* Geophys. Abstracts 132, no. 9746.)

10805. U. S. Coast and Geodetic Survey. Magnetograms, Cheltenham, Maryland. July–December, 1947: Serial MG–C47.2, 63 pp., Washington, D. C., 1948.

This is a regular semiannual issue of magnetograms of the records of Cheltenham Magnetic Observatory covering the period July–December, 1947. Most of the magnetograms reproduced are from the Eschenhagen instrument, consisting of D, H, and Z variometers of high sensitivity, with one recorder for all three.

For the days when the Eschenhagen magnetograms were obscured or lost the La Cour and Adie magnetograms are given. This happened during severe magnetic storms.

Tables of monthly and annual means are also given in this issue. Standard corrections applied to these means are explained.—*S. T. V.*

10806. U. S. Navy Department. AN/ASQ equipment—General specification, Electronic equipment type specification (instructions for preparation) : Navy Aeronautical Specifications M570, 8 pp., and M571, 4 pp., Washington, D. C., February 1943. (Library of Congress, OTS PB Repts. 27320 and 27321.)

The general specification for AN/ASQ magnetic airborne detectors (MAD) gives requirements and methods of sampling, inspection, testing, packaging, and packing and marking for shipment. The performance tests described include calibration of field strengths by a moving magnet and the flight tests for background noise. Construction and material requirements are indicated, and provisions are given for design and construction changes.

The electronic type specification is intended to be used by contractors, designers, and manufacturers in the preparation of equipment specifications applicable to a definite type of AN/ASQ equipment. The headings and numberings in this specification correspond very closely to those of the general specification.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 96, Washington, D. C., 1946, condensed by V. S.*

10807. U. S. Navy Department. Installation specifications, Models AN/ASQ–1 and AN/ASQ–1A airborne detection equipment: Navy Aeronautical Specifications EI–145, 19 pp., and EI–146, 21 pp., Washington, D. C., February 1945. (Library of Congress, OTS PB Repts. 27325 and 27326.)

These specifications give in detail the space requirements, location of the units, and all information necessary for an installation of the models AN/ASQ–1 and AN/ASQ–1A of magnetic airborne detection equipment (MAD). The mounting procedures, mounting brackets, bonding, clearance for shock-mounted units, shielding, and power requirements are described. Instructions are given for the unpacking and inspection of the units, with a table of the parts furnished. Installation drawings and wiring diagrams are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 96, Washington, D. C., 1946, condensed by V. S.*

10808. U. S. Navy Department. Test specifications for models AN/ASQ–1 and AN/ASQ–1A airborne detection installations: Navy Aeronautical Specifications ET–140, 4 pp., and ET–141, 4 pp., Washington, D. C., February 1945. (Library of Congress, OTS PB Repts. 27327 and 27328.)

These specifications list the equipment necessary for testing the models AN/ASQ–1 and AN/ASQ–1A of magnetic airborne detection equipment (MAD) and supplementary publications furnishing information applicable to these models. Pre-installation tests and adjustments are indicated, including the location of bench-testing installations, the essential bench tests, and the flight tests to be performed after installation.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2 no. 2, pp. 96–97, Washington, D. C., 1946, condensed by V. S.*

10809. **U. S. War Department, U. S. Navy Department, and Air Council of the United Kingdom.** Handbook of maintenance instructions for AN/ASQ–1 and AN/ASQ–1A equipment: Army-Navy 16–30ASQ1–3, 302 pp., Washington, D. C., September 1943. (Library of Congress, OTS PB Rept. 27564.)

The purpose of the AN/ASQ apparatus is to enable the crew of a patrol aircraft to discover the presence of submerged or surfaced submarines by detecting their magnetic fields. The equipment consists of three mutually perpendicular sets of magnetometer elements. If the detector is held in alinement with the earth's field, the two orienters will be in the zero field. If this system is forced out of alinement, the field measured by the detector will be the total field present times the cosine of the angle of displacement. The equipment consists of an amplifier, oscillator, dynamotor, junction box, and their mountings and fittings.

In handbook are given the magnetic fundamentals, a general description of the apparatus and its parts, and instructions for the installation, adjustment, operation, maintenance, and testing of the equipment. Photographs, charts, graphs, diagrams, tables, oscillograms, and a parts-list are included.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 2, p. 98, Washington, D. C., 1946.*

3. SEISMIC METHODS

10810. **Allen, T. L.** Problems in marine seismic exploration [abstract]: Geophysics, vol. 13, no. 3, p. 494, Tulsa, Okla., 1948.

Seismic exploration conducted in the coastal waters of the Gulf of Mexico off the States of Mississippi, Louisiana, and Texas has met with several problems not ordinarily encountered in comparable work on land. The matter of public relations is probably the most unusual. Protests of commercial fishermen and, to a limited extent, of sports fishermen have had to be considered. The problem of surveying, particularly when the work is several miles offshore, has been partially solved by the adaptation of electronic instruments used during the war for aerial navigation or air-raid warning devices. Conversion of seismic instruments, which were developed for use on land or shallow inland waters, into satisfactory marine equipment is also a problem that has not been completely solved.

10811. **Bartels, Julius.** Geophysik [Geophysics], 197 pp., Heidelberg, Germany, 1944.

This book on geophysics contains chapters on pure and applied seismology and on the general organization of seismological investigations throughout Germany and the world.—*Based on E. T., Dominion Observatory, Bibliog. Seismology, No. 3, January-June, 1948, p. 53, Ottawa, Ontario, 1948.*

10812. **Beers, R. F., and Shugart, T. R.** Seismic velocities at Bikini [abstract]: Geophysics, vol. 13, no. 3, p. 498, Tulsa, Okla., 1948.

Under contract with the Office of Naval Research at Bikini Atoll average vertical velocities were measured in a borehole to depths of

1,800 feet. The measurements are of value in confirming many of the seismic results previously obtained at Bikini. They are also of value in the interpretation of related problems of sedimentology and seismology. Good agreement was observed between seismic velocities and geologic data gathered in drilling.

10813. Behrmann, R. B. Geophysical history of the Reitbrook salt dome and oil field near Hamburg, northwest Germany, in Geophysical case histories, vol. 1, 1948, pp. 619–626, Menasha, Wis., Soc. Expl. Geophysicists, 1949.

The attention of the oil industry was first directed to the Reitbrook area by the discovery of large quantities of natural gas in a shallow water well in 1910. This was followed by torsion-balance and seismograph surveys through 1918–21 in order to explore the structural features associated with the gas-bearing sand. No definite structure was determined by the geophysical surveys or by wildcatting during this early period.

It was not until 1936 that the Reitbrook structure was outlined by refraction fan shooting. The detailed gravimetric and seismic reflection investigations which followed proved the existence of a deep-seated salt plug below a domal uplift of Cretaceous limestones. Subsequent drilling confirmed the structural picture predicted by reflection seismograph with remarkable accuracy. In July 1937 crude oil in commercial quantities was discovered, and Reitbrook was developed into one of the major fields of northwestern Germany.—*Author's abstract.*

10814. Bell, G. K. Explosives and petroleum: Explosives Eng., vol. 26, no. 2, pp. 39–43, no. 3, pp. 76–78, 90, Wilmington, Del., 1948.

The development of the petroleum industry is outlined, the advances achieved in petroleum exploration by seismic methods beginning with the early 1920's are indicated, and the nature of these methods is explained briefly. Attention is then centered on the use of explosives in seismic surveying, in well shooting, and in gun perforating. Deepwater seismic operations off the California coast are described as an example of open-sea exploration.

The ocean bottom slopes rapidly to depths of nearly a thousand feet within 5 miles of the California shore, and yet the complex structures of localities such as that west of the Ventura Basin require detailed work for conclusive interpretation. The techniques here employed have included the use of towed floating seismometer spreads and of floating charges of explosives, sometimes in areas of rock bottom and over kelp beds. The day's work begins with a check of the traverse line prepared on the preceding day and its further extension by the setting out of additional buoys from a 50-foot twin-screw survey boat. A record boat, usually a 104-foot Diesel-driven ex-subchaser, which follows the survey boat, lays out the cable line of floating seismometers along this traverse, and a cable boat stretches it out in the rear. The intercommunication system is then turned on, the instruments are checked, and blasting and recording operations begin. As many as 50 profiles can be shot in a day in clear, calm weather.—*V. S.*

10815. Berson, I. S.   On the determination of seismic velocities from the initial points of surficial hodographs of Mintrop waves [in Russian] : Akad. Nauk SSSR Izvestiia, Ser. Geog. i Geofiz., vol. 12, no. 6, pp. 561–566, Moscow, 1948.

The interpretation of hodographs of Mintrop waves requires a knowledge of average velocities in the strata overlying the refracting horizon. I. P. Kosminskaia has derived the average velocity in an overlying layer from the initial points of hodographs of Mintrop waves for two-dimensional cases in which the velocity in the lower layer is known (see Geophys. Abstracts 126, no. 8692). The author gives the three-dimensional determination of velocities in the overlying and the refracting layer from the same initial hodograph points for conditions when both velocities are constant and the refracting boundary has an arbitrary shape characterized by the existence of tangential surfaces at all points.

An equation is deduced for such a determination providing a single value of boundary velocity for each overlying velocity, and a graphic method is described for its simple solution. This method makes it possible to find the most probable approximate values of velocities from pairs of initial hodograph points, or from several points, when the refracting boundary is relatively steeply inclined. In the case of a horizontal boundary the velocity in the overlying layer can be found from a given boundary velocity. The determination of each velocity when the other velocity is known is considered.—*V. S.*

10816. Caloi, Petro, Lo Surdo, Antonido, and Peronaci, F.   La determinazione dell' accelerazione massima nei fenomeni macrosismici [Determination of the maximum acceleration caused by a macroseismic disturbance] : Annali Geofis., vol. 1, no. 3, pp. 315–323, Rome, 1948.

Knowledge of the maximum acceleration resulting from a seismic disturbance is of importance in geology and in engineering, because it determines the stresses to which a structure is exposed during an earthquake. The National Geophysical Institute of Italy has developed an instrument, first suggested by A. Lo Surdo, which makes possible such acceleration determinations. It consists of a rectangular weight pressed against a rigid stop by a spring. This weight and its stop remain in contact as long as the acceleration in the direction perpendicular to the plane of contact remains below a certain limit which is determined by the tension of the spring. Interruption of this contact is indicated by a special device. It is possible, by placing such instruments at different angles and with different degrees of spring tension, to determine the maximum acceleration in any direction developed during an earthquake. The indications of the instrument are independent of the shape of the seismic wave.—*S. T. V.*

10817. Caloi, Petro, Lo Surdo, Antonido, and Ponte, G.   Agitazioni microsismiche originate da attività vulcanica [Microseismic disturbances caused by volcanic action] : Annali Geofis., vol. 1, no. 1, pp. 5–9, Rome, 1948.

Attention is called to the appearance of microseismic waves on the seismograms of the Catania Seismological Observatory, in Italy, on June 30, 1942, and on subsequent days to July 5. The frequency of these

vibrations was about three cycles per second and their direction was east-west.

These microseisms cannot be explained as resulting from local or remote hurricanes but must be attributed to the volcanic action of Mount Etna, which during these days showed signs of activity.

The microseisms observed are, in the opinion of the authors, Love waves spreading from the crater of the volcano. The possibility of volcanic origin of microseisms has also been advanced by R. Takahasi, E. Nagata, and K. Hirano (see Geophys. Abstracts 98, no. 5067) in their study in 1938 of the volcanic activity of Mihara-yama, Japan.—*S. T. V.*

10818. Charpentier, Jacqueline. Centres dépressionnaires, agitation microséismique et houle [Depression centers, microseismic tremor, and sea swell] : Annales de Géophys., vol. 4, no. 1, pp. 1–14, Paris, 1948.

"Storms" observed in microseismic tremors registered in France are found to occur simultaneously with the arrivals of Atlantic centers of meteorological depression at the European continental plateau, extended to include the isobath of 1,000 meters. A parallelism is also noted between the records of the variation of sea swell on the coast of Morocco and the records of microseismic tremor in Strasbourg. This parallelism, it is concluded, should not be taken as evidence of a casual relationship between microseisms and swells, but as an indication that the two phenomena are independent effects of the same cause.—*Author's abstract, amplified by V. S.*

10819. Cialdelo, Renato. Registrazione delle onde longitudinali di breve periodo [Recording of longitudinal waves of short period] : Annali Geofis., vol. 1, no. 2, pp. 207–213, Rome, 1948.

The author analyzes the functioning of the instrument proposed by H. Benioff for the recording of longitudinal seismic waves and suggests certain modifications of its design, especially important for waves of short period. These changes are expected to make possible a more accurate recording by the instrument. In the proposed form the described instrument can be equipped with a mechanical, optical, or electrical system of recording and with an arrangement for remote reading.—*S. T. V.*

10820. Cram, I. H. Case history, Cumberland oil field, Bryan and Marshall Counties, Oklahoma, in Geophysical case histories, vol, 1, 1948, pp. 327–333, Menasha, Wis., Soc. Expl. Geophysicists, 1949.

The Cumberland-Madill-Tishomingo area in southern Oklahoma, considered promising for oil on the basis of drill-hole data and magnetic evidence, was surveyed in 1938 with reflection seismograph. For reconnaissance the line of detectors was split into two independent groups, the center of the first one being 1,750 feet from the shot point and the center of the second group 500 feet farther from the shot point. The reflections obtained with each group were calculated independently, providing a measure of dip between corresponding depth points. They indicated a closure of approximately 1,000 feet on the down side of the Ravia fault zone, in the upper part of which oil had been found in an outcrop of Bromide sand southwest of Tishomingo. These data led to locating the discovery well.

After a few wells were drilled, a more detailed reflection survey was made by the method of continuous profiling for developing the field. The combined results of this and the first survey permitted the identification of the largest fault in the southern end of the field. Some refraction work and core drilling was also carried out in the southeastern part of the area to clarify uncertain local data.—*V. S.*

10821. Deutscher Ausschuss für Baugrundforschung [German Committee on Study of Structural Properties of Soil]. Richtlinien für bautechnische *Bodenuntersuchungen* [Recommendations concerning soil investigations for engineering structures], 3d ed., 81 pp., Berlin, 1941.

The investigation of the soil in this case has as its aim the determination of the mechanical properties of the terrain; its adaptability to the construction in view; ground-water conditions and possible variations; and the geologic structure of the subsoil.

In addition to usual load tests and exploratory drilling, often employed by civil engineers, this committee suggests also a dynamic test of the ground with vibrators and seismographs. By these means the velocity of the wave spreading through the soil can be determined, as well as the thickness of the formations carrying the load.

An extensive bibliography on soil investigation for structural purposes is included.—*S. T. V.*

10822. Due Rojo, Antonio. Contribución al estudio sismotectónico del Océano Atlántico [A contribution to the seismotectonic study of the Atlantic Ocean]; Granada Observatorio Cartuja, Trabajos Geofísicos, vol. 1, no. 6, pp. 1–7, Tarragona, Spain, 1947.

Recent submarine investigations of the bottom of the Atlantic Ocean brought to light many important facts concerning its tectonics. Vast deposits of basaltic lava originating from submarine craters, huge mountains with sharp contours, rising from the bottom of the ocean, the absence of sediments, and structural details incompatible with the enormous pressure prevailing there can be explained only on the basis of the hypothesis of a sudden submersion of a great part of this area as a result of some seismic action.

The author constructed seismic maps, on which the foci of the known earthquakes of the Atlantic and the Pacific Oceans are plotted. In the Pacific these foci are found around the periphery, in the circumpacific seismic belt, with a quiet central area. In the Atlantic Ocean these foci cluster along a twisting line connecting the Arctic and the Antarctic Oceans, with a seismically quiet periphery. This line follows the Atlantic ridge, lying at a depth of less than 3,000 meters but separating areas of much greater depth.

The author concludes that the presence of this highly active seismic ridge confirms Wegener's hypothesis of the genesis of continents and increases the probability of the legendary disappearance of Atlantis, a large island which once existed in the latitude of the Strait of Gibraltar.—*S. T. V.*

10823. Due Rojo, Antonio. Sobre un método gráfico para determinar el azimut del rayo sísmico [A graphic method for determining the azimuth of a seismic ray]: Granada Observatorio Cartuja, Trabajos Geofísiscos, Ser. B, vol. 1, no. 6, pp. 1–7, Tarragona, Spain, 1947.

The determination of the epicentral coordinates of an earthquake is feasible if seismograms of at least two observatories situated not too close to each other are available. It is essential, however, to avoid discrepancies in time measurements on the records; especially important are the instants of the first arrivals. The author suggests using the existing seismological observatories of the Iberian Peninsula, with Toledo as a center, for the determination of the epicentral coordinates of earthquakes. This will be feasible for distances of at least 10,000 kilometers from Toledo. The paper contains several charts, which facilitate location of epicenters, as well as examples of the possible recording of the incoming seismic waves by different observatories of the proposed network.—*S. T. V.*

10824. Finkelstein, R. The normal reflection of a shock wave: U. S. Navy Dept., Bur. Ordinance, Explosives Res. Rept. 6, 41 pp., Washington, D. C., August 1944, (Library of Congress OTS PB Rept. 37077.)

The normal reflection of a shock wave from a rigid surface is studied in the light of the fact that when a structure is subjected to a shock the resulting damage depends upon the duration of the blow and the initial pressure due to it. An analytical method is used to find pressure-time curves at a reflecting surface in air and in water. The pressure-time curves obtained at a wall are described by their characteristics of peak pressure, curvature, and duration. It is found that in typical fluids the correct theoretical pressure-time curves for a wall are concave upward more strongly than their accoustic approximations. However, gases and water are found to behave differently. In gases the blow is prolonged, and the impulse delivered to a rigid wall exceeds the value predicted by acoustic theory. In water the blow is shorter, and the impulse is less than would be expected from acoustic approximation. The pressure-time curves obtained are given.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no 13, p. 989, Washington, D. C., 1946, condensed by V. S.*

10825. Gaby, P. P., and Solari, A. J. Geophysical history of the McDonald Island gas field, San Joaquin County, California, in Geophysical case histories, vol. 1, 1948, pp. 602–610, Menasha, Wis., Soc. Expl. Geophysicist, 1949.

This is the full text of the paper. For abstract published in advance, *see* Geophys. Abstracts 134, no. 10290.

10826. Gardner, L. W. Seismograph determination of salt dome boundary using well detector deep on dome flank: Geophysics, vol. 14, no. 1, pp. 29–38, Tulsa, Okla., 1949.

The method given for determining the boundary of a salt dome is based upon first-arrival time measurements of seismic waves from ordinary shot points distributed around the dome and received by a well detector within a deep hole flanking the dome and penetrating it at depth. This case is important, first because deep holes on the flank become available

as a byproduct of drilling programs, and second because a flank location permits the acquisition of good information on the velocity distribution in the sedimentary section surrounding the dome, which informaton is essential to the success of the method. The three-dimensional problem of locating the dome boundary, taking account of radial and vertical changes of velocity within the surrounding sedimentary section, is solved by the determination of vertical and horizontal cross sections of "aplanatic surfaces."—*Author's abstract.*

10827. Goldstone, F.   Geophysical history of the Gibson field, Terrebonne Parish, Louisiana, in Geophysical case histories, vol. 1, 1948, pp. 201–207, Menasha, Wis., Soc. Expl. Geophysicists, 1949.

An account is given of the gravity and seismic reflection surveys of 1928–41, which led to the discovery of the Gibson field in Louisiana. The difficulties in identifying faults, which had handicapped the seismic method in this area, were overcome in 1939–41 by refined techniques of continuous profiling, with detectors spaced 100 feet apart.   Shot points were offset by 2,500 feet from both ends of all spreads, and each spread was shot into from four shot points on the same side of the profile.   Thus, the subsurface along each profile was covered twice.   The purpose was to develop a criterion for discriminating between actual displacements caused by faults and small apparent displacements due to inadequate surface corrections or other factors associated with individual detector locations.

In all, exploration led to the finding of three separate productive areas where oil accumulation is occasioned by a considerable uplift but is controlled by small faults and low relief closures.   The resolving power of the seismic method in application to the problems involved is discussed.—*V. S.*

10828. Gutenberg, B., and Richter, C. F.   Deep-focus earthquakes in the Mediterranean region: Geofis. Pura e Appl., vol. 12, no. 3–4, pp. 1–4, Milan, 1948.

In a table the authors give a list of known deep-focus earthquakes in the eastern Mediterranean.   A sketch map shows that their epicenters generally lie in the zones of active volcanoes, as in the regions surrounding the Pacific Ocean; however, their concidence with positive gravity anomalies is less evident.—*Authors' abstract.*

10829. Hagiwara, Takahiro.   On the periods of the vibrations that are produced by superposing several simple harmonic vibrations of different period and amplitude [in Japanese]:   Tokyo Imp. Univ., Earthquakes Res. Inst. Bull., vol. 23, no. 1–4, pp. 1–22, Tokyo, 1945.

A mathematical analysis is made of the periods that result when two or three simple harmonic motions are superposed.   The calculations are carried out by a graphic method which gives the frequencies of occurrence of periods.—*Author's abstract.*

10830. Hodgson, J. H.   A seismic survey of the Canadian shield [abstract]:   Geophysics, vol. 13, no. 3, p. 501, Tulsa, Okla., 1948.

A series of large rock bursts, occurring at Lake Shore mines, Kirkland Lake, Ontario, offers a source of energy for the investigation of

the crustal structure underlying the Canadian shield. In .order to obtain a refraction profile, two field stations, each equipped with a three-component Sprengnether seismograph, will be operated at a succession of points along a line between Kirkland Lake and Ottawa. Each point will be occupied until a burst has been recorded. The paper outlines the peculiar advantages of rock bursts as a source of energy and describes the instrumental and mechanical details of the project, which was instituted on July 1, 1947.

10831. Inglada Ors, Vicente. La exploración de los ciclones por el movimiento microsísmico [The exploration of hurricanes by (observation) of microseisms]: R. Acad. Cien. Rev., vol. 45, no. 3, pp. 339–360, Madrid, 1946.

A change in barometric pressure corresponding to 1 millimeter of mercury caused a variation of the load spread over 1 square kilometer of the earth's surface equal to 13,600 tons and produces a deviation of the plumb line, of 0.3 second. Correlation between the variation of barometric pressure and the appearance of microseismic movements was suggested as early as 1900 by J. Algué, director of the Manila Observatory, who sent warnings of an approaching hurricane whenever a microseismic disturbance of a specific frequency was observable. Only after the invention of sensitive and accurate seismographs, however, was it possible to study the causal relation between microseisms and hurricanes.

The author reviews the investigations of J. B. Macelwane and J. E. Ramirez on measurements made at the tripartite seismological station at St. Louis in 1938 (Geophys. Abstracts 101, no. 5499 and 102, no. 5638); the investigations of M. H. Gilmore in Guantanamo, Cuba, in 1944 and Puerto Rico (Geophys. Abstracts 126, no. 8681); and the study by H. T. Orville and Beno Gutenberg (Geophys. Abstracts 130, no. 9381). The author concludes that these studies by American seismologists establish the correlation between microseisms and remote hurricanes and make the seismograph as necessary for the meteorologist as it is for the prospecting geophysicist.—*S. T. V.*

10832. Kelsey, M. C. Studies in fault detection with the reflection seismograph: Geophysics, vol. 14, no. 1, pp. 21–28, Tulsa, Okla., 1949.

Faulting has long been recognized as an important factor in the formation of traps for the accumulation of oil and gas. A discussion is presented of some of the problems of reflection seismograph exploration connected with fault interpretation, together with suggestions as to methods which may be employed to assist in their solution. Field data and the final fault interpretation of a peculiar problem serve as an illustration.—*Author's abstract.*

10833. Kishinouye, Fuyuhiko. Experiments with elastic waves in the ground, part 1 [in Japanese, with English summary]: Tokyo Imp. Univ., Earthquake Res. Inst. Bull., vol. 20, no. 2, pp. 284–290, Tokyo, 1942.

When a mass eccentrically attached to a shaft fixed in the ground is rotated by an electric motor elastic waves are generated in the ground. Amplitudes and phases of the spreading waves can be measured conveniently by placing geophones at chosen points on the ground. The

shape of the orbit of a point, registered on the oscillograph, changes in accordance with the phase difference of the waves picked up at any two points of the plane, varying from ellipse to straight line when the geophones are set at intervals equal to an integral number of half wave lengths. The frequency of the spreading vibrations is equal to the number of revolutions of the vibrating shaft.

The relationship between the wave length and the period of vibrations is shown by a series of graphs. The results of the experiments are not always consistent.—*S. T. V.*

10834. Kishinouye, Fuyuhiko, and Iwama, K. Propagation of shock waves in soil.—Experiments with elastic waves in the ground, part 2 [in Japanese] : Tokyo Imp. Univ., Earthquake Res. Inst. Bull., vol. 22, no. 2–4, pp. 170–179, Tokyo, 1944.

Three geophones and electromagnetic oscillographs were used to record the elastic waves generated in loam by the fall of a 16-pound iron ball. The results are presented in graphs that show the changes of wave form with distance at every 5 meters over a length of 30 meters. The curve of attenuation of the maximum amplitudes is plotted, together with the reciprocal curve of respective distances for comparison. It is found that the velocity of the first seismic movement, which may be regarded as that of the P wave, is on the average 290–310 m./sec. for the first 10 meters and 260–300 m./sec. for the total distance of 30 meters. The velocity of the principal movement, which may be that of the S wave, is 110–120 m./sec., and that of the maximum amplitude is 85–95 m./sec.— *Authors' abstract, revised by V. S.* (For part 1 *see* Geophys. abstract 10833.)

10835. Lahn, E. Note sur l'activité sismique dans la region de Denizli-Sarayköy-Buldan [Note on seismic activity in the region of Denizli-Sarayköy-Buldan] : Geol. Soc. Turkey Bull., vol. 1, no. 2, pp. 46–50, Istanbul, 1948.

The earthquake of December 21, 1945, in the Sarayköy-Buldan area of western Anatolia is studied on the basis of local geology and available information on previous shocks. It is concluded that seismic activity in the Denizli-Sarayköy-Buldan district in the upper part of the Büyük Menderes trough is centered about the faults of recent age, related to the Neogene cover of this trough, and about the points of intersection of tectonic lines. The tectonic lines formed by the borders of the trough are not related to seismic activity.—*V. S.*

10836. Lee, S. P. Tectonic relation of seismic activity near Kangting, East Sikang : Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp. 43–50, Nanking, 1948.

To clarify the causes of earthquakes the author has studied the tectonics of a strongly seismic area near Kanting, East Sikang, in the mountainous western part of China. This area has been shaken recently by numerous earthquakes, one of them violent, and seven epicenters have been located within it. The local geology is characterized by fissures indicating the occurrence of earthquakes at various ages, by faults developed parallel to folding, by widespread early Devonian volcanic rocks,

and by pre-Cambrian massifs which apparently withstood tectonic shifts.

The study of this evidence appears to indicate that earthquakes are caused here by the resistance offered by the pre-Cambrian massifs to a northeastern orogenic movement, which is deflected by them to the southeast. The stress thus created is transmitted to the overlying sediments, and the accumulated energy is released in sudden discharges. Accordingly, the earthquakes must originate in the zone about the boundary between the solid granite and the underlying magma. The geologic mechanism producing shocks is outlined briefly. It is concluded that the seismicity of the region is closely related to tectonic activity.—*V. S.*

10837. Lyons, P. L. Geophysical case history of the London field, Illinois, in Geophysical case histories, vol. 1, 1948, pp. 461–470, Menasha, Wis., Soc. Expl. Geophysicists, 1949.

A seismic reflection survey was made by the Carter Oil Co. in 1936 over a large tract of land acquired in Fayette and Effingham Counties, Illinois, after a limited study of surface geology. As a result of the survey an extensive anticline of low relief was delineated, and through subsequent drilling four oil-bearing horizons comprising the major London field were located. The evidence from drilling is in substantial agreement with the original interpretation by the correlation of seismograms. The shallow closure is found to exceed the deep one. This is unusual in basin folds and points to the desirability of obtaining reflections and maps on as many horizons as possible. It has been reported that the London anomaly lies along the axis of a large regional gravity anomaly and that the smaller St. James pool to the south of London coincides with a gravity maximum closure.—*Author's abstract, amplified by V. S.*

10838. McCready, H. J. Relevant significant figures in seismic interpretation [abstract]: Geophysics, vol. 13, no. 3, p. 498, Tulsa, Okla., 1948.

The principle of relevant significant figures is introduced, and its role in seismic interpretation is discussed. The importance of the principle is stressed by examples of its efficacy. It is indicated that recourse should be made to this principle if fallacious inferences concerning velocity, depth, and dip data are to be avoided.

10839. Matuzawa, Takeo. Elastische Wellen in einem anisotropen Medium [Elastic waves in an anisotropic medium]: Tokyo Imp. Univ., Earthquake Res. Inst. Bull., vol. 21, no. 2, pp. 231–235, Tokyo, 1943.

The author expresses the opinion that the earth's crust, though isotropic in any horizontal plane, may be antisotropic in a vertical plane because of the effects of gravity. This makes imperative the investigation of the propagation of deep seismic waves under the assumption of vertical anisotrophy. In such an assumption, as in phenomena of hexagonal crystals, the stress components vary with direction, and the differential equation of wave motion in a specific direction has coefficients depending on this direction.

The following results were obtained by the author: One of the waves is the horizontal shear wave, and the other two are dilatational

waves with different velocities of propagation. They oscillate in mutually perpendicular planes. Each of these three waves can propagate independently of the others.

The formulas are applied to hexagonal crystal of beryllium and different velocities of wave propagation through it are computed. The ratio of the calculated velocities can be as high as $1 : 2.1$.—*S. T. V.*

10840. Milne, W. G. Bibliography of Canadian Seismology: Canadian Geophys. Bull., vol. 2, no. 2, pp. 1–12, Ottawa, Ontario, 1948.

This bibliography lists 144 papers on seismological work in Canada published by Canadian or foreign authors in Canada or other countries. The entries have been selected from the Bibliography of Seismology, of the Dominion Observatory, Ottawa. They include mainly general descriptions of earthquakes, studies of earthquake waves, investigations of the earth's structure and of the origin of earthquakes, papers on seismic prospecting and on the relation of mining to seismology, predictions of earthquakes, and seismological reports. A subject index is appended.—*V. S.*

10841. Omote, S. On the coda waves of earthquake motions, parts 1–3 [in Japanese, with English summaries]: Tokyo Imp. Univ., Earthquake Res. Inst. Bul., vol. 21, no. 3–4, pp. 458–500, 1943, vol. 22, no. 2–4, pp. 140–169, 1944, vol. 23, no. 1–4 pp. 47–78, 1945, Tokyo.

Coda periods were investigated for earthquakes with different epicentral distances. For distances of less than 1,000 kilometers it was found that the nearer the epicenters the shorter the predominant periods. In the case of epicentral distances greater than 1,000 kilometers but less than 10,000 kilometers, the same relationship persisted, but the rate of increase of predominant period with distance declined, suggesting that the increase of the period may have a limit. Finally, in the case of epicentral distances greater than 10,000 kilometers the rate declined still further, until the period became almost constant with distances greater than 13,000 kilometers. The curves obtained are presented.

Very strong earthquakes recorded at epicentral distances greater than 10,000 kilometers were also found to register coda oscillations even after the large surface waves propagated along the major arc of the earth's surface had passed away, which is not so for weaker earthquakes. The predominant periods of this second part of coda waves had a constant value of 16 seconds independently of epicentral distances.— *V. S.*

10842. Osterhoudt, W. J. The use of electric logging equipment in seismic exploration [abstract]: Geophysics, vol. 13, no. 3, p. 497, Tulsa, Okla., 1948.

In a Texas Panhandle area located north of Pampa, Texas, in Gray and Roberts Counties, seismograph experiments disclosed a low-velocity weathered zone, or zones, about 350 feet thick. Records from shots placed above the V_1–V_2 boundary were generally worthless. The quality of the reflection records approached an optimum if shots were detonated at critical positions below the V_1–V_2 boundary, but multiple shooting ruined the holes. A small Guyod electric logger was then employed to

map the V_1–V_2 boundary and to predict the more favorable shooting depths. The resistivity curves on the electric logs showed a strong discontinuity at the base of the V_1 zone, which correlated with seismograph measurements and with calculated data from up-hole times and plots of V_2 arrivals versus shot detector distances. The electric logs were used for determining the depths to set casing for guiding the seismograph operator .in the selection of favorable shot-hole depths, and for aiding geophysicists in checking weathered zone corrections. The use of a portable electric logging equipment is recommended as an aid to seismic exploration in certain areas.

10843. Pendse, C. G. On the theory of seismometers, II : Philos. Mag., vol. 39, no. 299, pp. 985-988, London, 1948.

In a previous paper (*see* Geophys. Abstracts 127, no. 8857) the author obtained the equation of motion of a seismometer, taking into account the fact that the motion recorded by a seismometer is relative to a frame determined by the instrument, whereas the system of forces in question refers to axes fixed in the earth relative to which the frame of the instrument also moves.

In this paper certain errors of the previous study are corrected, and the important particular case applicable to vertical seismometers is discussed. The differential equation of such motion is derived, and the equilibrium positions are determined. Its solution is not attempted in the present paper.—*S. T. V.*

10844. Peterson, R. A. Use of the seismograph in mineral exploration [abstract] : Geophysics, vol. 13, no. 3, p. 504, Tulsa, Okla., 1948.

The usefulness of conventional seismograph equipment in mineral exploration is limited mainly to surface refraction surveys, including determinations of depth to bedrock in placer deposits and similar applications. In a few cases reflection surveys may give "regional" structural data of value. In underground surveys in mines the relatively limited size of ore bodies requires increased "resolving power," which may be obtained by utilizing frequencies in the range of 200–1,000 cycles per second and higher. Interpretation of data is facilitated by wave-front mapping methods whereby the presence of bodies of high- or low-velocity rock may sometimes be detected from distortions in the shape of the initial wave front. Under favorable circumstances reflection data of value may be obtained from underground shot points. The success of seismograph surveys in mineral exploration will hinge largely on the ability of seismologists and geologists to translate seismic data into geological information.

10845. Petroeschevsky, W. A. Vulkanologische Berichten [Volcanological reports] : Bur. Mines and Geol. Survey of Indonesia Bull., vol. 1, no. 1, pp. 12-13, Bandoeng, 1947.

This paper contains brief remarks on observations made with the horizontal seismograph which was put into operation in Bandoeng, Indonesia, in May 1946. It mentions the Japanese earthquake of December 1946 and the tectonic earthquake of September 5, 1946, in Djokja.— *J. F. S., Dominion Observatory, Bibliog. Seismology, No. 8, January–June 1948, p. 64, Ottawa, Ontario, 1948.*

10846. Ramirez, J. E.   El terremoto de Pasto (Colombia) de 14 de Julio de 1947 [The earthquake of Pasto, Colombia, of July 14, 1947] : Rev. Geofís., vol. 7, no. 27, pp. 282-290, Madrid, 1948.

On July 14, 1947, a violent earthquake occurred in the Republic of Colombia, with its center near the city of Pasto.   Three horizontal shocks of E–W direction, reaching an intensity of 9 on the Mercalli scale, destroyed half the city's buildings.   The earthquake was of a strictly local character and was not felt at Quito or Lima.   The city of Pasto is located on the eastern slope of the volcano El Galeras, but no signs of volcanic activity connected with this earthquake were noticed.

The article gives a description of the geologic structure of the region and its previous seismic history.   It also contains a map with isoseismic lines of the last earthquake.—*S. T. V.*

10847. Reel, C. E.   Strategic correlation vs. multiple reflections [abstract] : Geophysics, vol. 13, no. 2, p. 300, Tulsa, Okla., 1948.

In the San Joaquin Valley, California, an example is shown where no deep structure is indicated by the correlation on deep beds.   However, in this area there is good reversal in the upper beds.   Multiple reflections from the reversing shallow beds could be misleading and cause a misinterpretation in the deep zone.

10848. Ricker, N. H.   Critical study of shallow seismic exploration in the limestone areas of the Ozark highlands : U. S. Waterways Experimental Sta., Tech. Mem. 199–1, 48 pp., Vicksburg, Miss., 1943.

The efficacy of the seismic refraction method in determining the depth to bedrock at dam sites was tested by a survey in areas of weathered limestone in the Ozark highlands.   The field technique is described, and the results checked by drill-hole data are discussed in the light of local geology.   It is found that the refraction method failed to reveal the position of solid rock in areas of deep weathering and of irregular bedrock surface but gave precise information in areas where the unweathered rock was covered with alluvium.   The findings are illustrated by profiles and sketch maps.—*V. S.*

10849. Robertson, R. G.   Earthquake-resistant structures—The seismic factor and the use of reinforced brickwork in Quetta civil construction, with discussion : Inst. Civil Eng. Jour., vol. 29, no. 3, pp. 171–184, and Suppl. to no. 8, 1947–48, pp. 402–410, London, 1948.

The damage caused in Quetta, India, by the earthquakes of 1935 and 1941 is described, the types of buildings most affected are indicated, and counter measures in the form of box-type structures, vertical and horizontal reinforcements of brickwork, and other designs are discussed.

The analysis of the seismic factor and seismic force involved shows that the anticipated acceleration of the earthquake motion must be augmented by an "acceleration multiplier" to allow for the increase in force due to the superposition of the induced free and forced vibrations in the structure.   Such calculations yield an equivalent uniform acceleration which, if applied uniformly throughout the structure, produces the same effect at the base as the actual earthquake motion.   The seis-

mic factor can then be calculated as the ratio of this corrected acceleration to gravity, and the seismic force as the maximum side-sway force acting on any portion of the structure. Data are presented on the seismic factor for buildings, roofs, and roof projections, and the methods for limiting the seismic force are given brief consideration. The paper is discussed by V. A. Murphy, D. L. Thornton, J. B. Wilson, and the author.—*V. S.*

10850. Rozova, E. A. The seismicity of central Asia [in Russian]: Akad. Nauk SSSR Izvestiia, Ser. Geog. i Geofiz., vol. 12, no. 5, pp. 453–462, Moscow, 1948.

In studying the seismicity of central Asia the author uses a method of graphic intersection for determining the locations of earthquake epicenters and the depths of their foci from data of regional stations. The results give the hypocentral depths of 72 percent of the recorded shocks and show that there are two focal surfaces in central Asia engendering 84 percent of surficial and normal earthquakes. The foci of the rest of the earthquakes are located at depths of 60 to 300 kilometers, so that 16 percent of the shocks must be classed as intermediate earthquakes. The latter type of earthquake occurs most frequently along mountain chains, whereas a greater number of earthquakes with a normal hypocentral depth take place in the much disturbed region over the intersection of Hercynian stratification with Tertiary formations.—*Author's abstract, translated by V. S.* (*See also* Geophys. Abstracts 133, no. 10059.)

10851. St. Amand, Pierre. The central Alaska earthquake swarm of October 1947: Am. Geophys. Union Trans., vol. 29, no. 5, pp. 613–623, Washington, D. C., 1948.

The earthquake swarm of October 1947 is discussed. Investigation of the activity is described. Intensities in the epicentral region are estimated, and an epicenter at lat. 64.2° N., long. 149.0° W. is assigned. The assigned epicenter of the 1937 swarm is investigated and found to be essentially correct. Photographs of earthquake activity are included, along with an isoseismal map and a plot of epicenters.—*Author's abstract.*

10852. Sezawa, Katsutada, and Kanai, Kiyoshi. Transmission of arbitrary elastic waves from a spherical source, solved with operational calculus, 1: Tokyo Imp. Univ., Earthquake Res. Inst. Bull., vol. 19, no. 3, pp. 417–442, Tokyo, 1941.

This is a continuation of a previous paper by the authors (*See* Geophys. Abstracts 112, no. 6804.) on the transmission of elastic waves generated by a spherical source oscillating spheroidally. In the first paper the case of spheroidal vibrations of the order $n=0$ was discussed; in this paper the problem is extended to the case of $n=2$. Two types of exciting disturbance are analyzed, that of a rectangular wave and of a sinusoidal wave, both starting from rest.

Dilatational as well as distortional waves generated in the space are discussed. Each of these waves was found to consist of free and forced vibrations. Their periods of vibrations and the corresponding damping coefficients are determined.—*S. T. V.*

10853. Silgado, E. Datos sismológicos del Perú, 1947 [Seismological records of Peru for the year 1947] : Inst. Geológ. Perú, Bol. 11, 42 pp, Lima, 1948.

An annual report of the Geological Institute of Peru contains a catalog of earthquakes that occurred in that country during the year 1947, as well as a description of the most violent one, which occurred on November 1 of that year. On 116 days during this year earthshocks were observed in different localities of Peru to reach second or higher intensity on the Mercalli scale. The earthquake of November 1 was of intensity IX and affected an area of 1,300,000 square kilometers. Its epicenter was near the town of Merced, geographic coordinates lat. 11° S., long. 75° W. The depth of the focus was determined as 75 kilometers.

The report contains statistical data on the damage caused by this earthquake to structures of various designs and materials.—*S. T. V.*

10854. Spencer, L. C., and Peters, J. W. Geophysical case history of the Magnolia field, Columbia County, Arkansas—Seismic history, gravity investigations, in Geophysical case histories, vol. 1, 1948, pp. 443–460, Menasha, Wis., Soc. Expl. Geophysicists, 1949.

A brief history is given of the seismic and gravity surveys that led to the discovery of the Magnolia field, Columbia County, Arkansas. The results are illustrated by seismic maps of shallow and deep horizons as interpreted from exploration data of the Atlantic Refining Co. These maps show the field to be located on a large anticlinal structure of salt origin. Absence of structural evidence below the Louann salt is pointed out, and the shift in the position of the structural axis from the shallower to the deeper horizons is discussed.

Gravity meter data, obtained in this area by the Magnolia Petroleum Co. subsequent to both the discovery of the field and the seismic survey of the Atlantic Refining Co., are included. The pronounced minimum gravity anomaly observed at the Magnolia field is attributed to the deep salt structure which was delineated by the seismic survey. The gravity interpretation is supported by an analysis of measured and predicted density conditions and by gravity calculations based on the seismic salt structure.—*Authors' abstract.*

10855. Swan, B. G. Index of wells shot for velocity, second supplement: Geophysics, vol. 14, no. 1, pp. 58–66, Tulsa, Okla., 1949.

This is the second supplement to the original index published in the October 1944 issue of Geophysics, the first supplement having appeared in the October 1946 issue. Information is listed on 239 velocity surveys, most of which were shot in the years 1946–48. A considerable number of foreign wells are included. Corrections and information missing on some of the surveys of the original index and of the 1946 supplement are tabulated.—*Author's abstract.* (For original index and first supplement *see* Geophys. Abstracts 119, no. 7696, and 128, no. 9031.)

10856. Thralls, H. M. Seismic interpretation problems and proposed solutions by joint research [abstract] : Geophysics, vol. 13, no. 3, p. 497–498, Tulsa, Okla., 1948.

Interpretation problems are occasionally encountered which defy solution by accepted procedures. Examples of such problems are given.

The opinion is advanced that the oil industry as a whole is lacking detailed information regarding average velocities from the surface, interval velocities between key horizons, and proven correlations between seismic events and formation tops and that such detailed information in one or more specific areas is a starting point for joint interpretational research which should be valuable to the industry as a whole. Other general problems to which solutions could be approached by joint research are mentioned. A procedure for such research is outlined, and the existing organizations which might sponsor the research are named.

10857. Tsvetaev, A. A., and Shapirovskii, N. I. Marine seismic exploration along the southern coast of the Apsheron Peninsula [in Russian]: Prikladnaia Geofizika, no. 1, pp. 77–82, Moscow, 1945.

An experimental survey was made in 1941 in the Caspian Sea near Baku to test the possibilities of marine seismic exploration. More than 50 miles of traverse were covered, for the most part with the reflection method of continuous profiling. Fishing boats served for shooting operations, a motor barge carried the observation station, and anchored buoys floated the seismometers at a predetermined distance from the bottom. The technique was found suitable for a strip of coastal water 10 miles wide and 50 to 70 feet deep. Seismograms differed little in appearance from land records, and reflections with well-developed amplitude and phase characteristic were recorded along many sections of the coast. Depending on the location, the period of the reflected waves varied between 0.015 and 0.03 second. Subsequent drilling confirmed the results.

The difficulties of marine seismic exploration are reported to include low-frequency disturbances from "bottom waves," high-frequency disturbances from the water medium, and secondary arrivals of reflections. Findings on the use of filters to overcome the first two types of interferences are discussed, and requirements of marine seismic equipment are listed.—*Review by A. J. Hermont, Geophysics, vol. 13, no. 3, pp. 483–485, Tulsa, Okla., 1948, abstracted by V. S.*

10858. Valle, P. E. Sulla costituzione del nucleo terrestre [On the constitution of the earth's core]: Ricerca Sci. Ricostruz., vol. 15, no. 1, pp. 67–69, Rome, 1945.

The question of the physicochemical composition and structure of the earth's core is one of the unsolved problems of science. The study of deep seismic waves generated by remote earthquakes seems only to complicate the matter, because different seismologists arrived at contradictory conclusions. H. Jeffreys concludes that the core lacks viscosity and is approaching the state of a fluid. On the other hand, seismological observations by J. B. Macelwane and L. Bastings seem to lead to the hypothesis of an important rigidity of the core. The author sums up his considerations by stating that the first hypothesis seems to be in better agreement with astronomical and seismological data. He also assumes that a discontinuity exists at the upper surface of the core. The author emphasizes the probability that the transverse seismic wave SKS, which presumably passes through the core, must have a different trajectory.—*S. T. V.*

10859. Valle, P. E. Contributo allo studio delle characteristiche sismiche del Mediterraneo centro-orientale [Contribution to the study of seismic characteristics of the central-eastern part of the Mediterranean]: Annali Geofis., vol. 1, no. 2, pp. 266–278, Rome, 1948.

The results of a study of longitudinal and transverse seismic waves produced by the principal shock of the earthquake which took place in Calabria, Italy, on March 11, 1947, are presented. The author has calculated the epicentral coordinates of the seismic shock and the velocities of different waves generated by it. These calculations show that the velocity of the Pn waves decreases progressively from the European continent towards the Mediterranean, whereas that of the Sn waves increases.

An important increase in the velocities of the P^* and S^* waves was found also. To explain these findings the author suggests the absence of the upper sialic layer in this area. Consequently the magma should be found there directly below the basaltic layer.—*S. T. V.*

10860. Veitsman, P. S. On the maintenance of the principle of reciprocity in seismology [in Russian]: Akad. Nauk SSSR Izvestiia, Ser. Geog. i Geofiz., vol. 12, no. 3, pp. 231–238, Moscow, 1948.

In seismic exploration by the correlation method of reflected or refracted waves a basic criterion for judging whether waves and phases are identical is that corresponding waves must have the same arrival times and registration patterns at reciprocal points. This reciprocity principle is discussed by the author as a particular case of a general law found in several fields of physics in order to clarify its applicability in seismic exploration of geologically complex media.

The theoretical analysis is supported by evidence from a series of field experiments conducted in the Ukraine in an area of known geology. Electrodynamic vertical and horizontal seismographs were buried in different combinations and positions in two holes of different sizes and orientations dug 15 to 20 meters apart and used interchangeably as the generator station and the receiver station. The shocks were administered at each hole alternately by striking vertical or horizontal blows with a wooden rod at the base of the seismograph operated at the moment as the generator. The field procedures are described, and the results are illustrated by examples of the seismograms obtained.

It is found that the reciprocity principle holds in localities of heterogeneous geology on the condition that the receptivity and orientation characteristics of the receiver station remain unchanged with the reversion of the functions of the generator and the receiver. Since existing methods of seismic exploration do not satisfy this condition, the reciprocity principle is fully maintained in practice only in cases when the medium between the shot point and the receiver is homogeneous or horizontally layered.—*V. S.*

10861. Weibull, Waloddi. Waves in compressible media: Royal Inst. Technology Trans., no. 18, 38 pp., Stockholm, 1948.

Basic equations are deduced for acoustic waves in compressible media on certain simplifying assumptions. Consideration is limited to the

propagation of plane continuous waves, and tables of the values involved are given for air of moderate density and more particularly for shock waves in air. The analysis includes derivation of equations of motion and consideration of the boundary conditions and of the effects of pressure.—*V. S.*

10862. Wharton, M. Shooting for oil: Explosives Eng., vol. 26, no. 5, pp. 142–146, 155, Wilmington, Del., 1948.

Beginning in 1943 the Continental Shelf off the California coast between San Luis Obispo and the Mexican border has been explored by the seismic method as a joint project of 17 oil companies. The survey is outlined, the local geology is compared with that of the Gulf of Mexico, and some features of the seismic technique and equipment are reported. The Continental Shelf in California is much narrower than in the Gulf and often ends with a sharp break, so that depths greater than 600 feet occur within 5 miles from shore. Structurally the region consists chiefly of sharply folded anticlines associated with faults and pinch-outs, the dips varying from 30° to 60°. Rough seas and ocean currents complicate the work.

In surveying the boats have ranged from 18 to 25 feet in length, except for a 50-foot tug employed as the recording boat. Geophones were mounted on platforms, with their cables taped to a steel line, and the assembly was buoyed to float near the surface. Spreads of 1,000 feet were used, with two sets of cables laid out at right angles to each other in places of steep contours, so as to record the component dips in two directions from the shot. The charges of dynamite, at first placed on the ocean floor, later were detonated within a few feet of the water surface to allow time for the bubbles to rise and thus to eliminate several sets of first arrivals on the seismograms caused by the bubbles' successive collapse and expansion. The shooting procedures are described.— *V. S.*

10863. Wilson, E. B., Jr., and Cole, R. H. Measurement of underwater explosion pressures, progress report: U. S. Office Sci. Res. and Devel. Rept. 523, 44 pp., Washington, D. C., Apr. 1942. (Library of Congress, OTS PB Rept. 32190.)

This report from the Carnegie Institute of Technology discusses a number of problems related to the measurement of pressures of underwater shock waves. It describes small, exceedingly simple tourmaline gages which, together with auxiliary cathode-ray equipment, give very promising results on the pressure-time curves for underwater explosions. These gages consist of a thin crystal slice less than 20 x 52 millimeters, with two electricaly conducting faces, fastened to a shielded cable and coated with a thin insulating layer. Details and diagrams of the equipment appear in the appendix.—*U. S. Dept. Commerce, Office Tech. Serv., Bibliog. Sci. Indus. Repts., vol. 2, no. 11, p. 807, Washington, D. C., 1946.*

4. ELECTRICAL METHODS

10864. Abelès, Florin. Sur la propagation des ondes électromagnétiques dans les milieux stratifiés [On the propagation of electromagnetic waves in stratified media] : Annales de Physique, ser. 12, vol. 3, pp. 504–520, Paris, 1948.

The stratified media considered by the author are composed of several homogeneous and isotropic layers separated by plane, parallel surfaces. The waves that propagate therein are plane, sinusoidal waves oriented in an arbitrary direction. The case of conducting layers is reduced theoretically to that of nonconducting layers. Inasmuch as Maxwell's equations are integrated *a priori* for the waves considered, the problem is one of determining the constants of integration that satisfy conditions at the boundaries. It is thus necessary to solve a system of $2p$ linear equations with $2p$ unknowns.

The solution is achieved by using recurrence formulas which change the number of equations from $2p$ to $2(p+1)$. For a better understanding of the mechanism of propagation a study is made of waves not only at the two boundaries of the layers but also within the layers, with emphasis on the physical aspects of the solution. The analysis gives formulas derived by a summation of the rays reflected an odd number of times and also full expressions of the complex coefficients of reflection and transmission for the investigated media. It is considered possible to deduce from these quantities with ease all necessary data concerning the effect of such media upon an incident wave of the type studied. Three general theorems are formulated and discussed.—*Author's abstract, translated by V. S.*

10865. Airborne Instruments Laboratory. Polar recorder : Rev. Sci. Instruments, vol. 19, no. 1, p. 59. Lancaster, Pa., and New York, N. Y., 1948.

The polar recorder is used for the investigation of electrical fields. It charts voltage on either a linear or a logarithmic scale as a radial distance in the proper azimuthal direction. It was developed for studying patterns of aircraft antenna radiation but now is built in either rack-mounted form or as a portable instrument convenient for field use.—*S. T. V.*

10866. Al'pin, L. M. Dipole electrical sounding [in Russian] : Razvedka Nedr. no. 1, pp. 26–35, Moscow, 1941.

The author describes a new method of electrical gradient measurement which he calls dipole axial gradient sounding. Measurements made by the author, using this scheme, prove the practicability of the suggested modification. The observations confirm expectations based on theoretical calculations. The author proposes two wiring diagrams for ordinary use and a special configuration applicable over brachy anticlinal uplifts. The latter method is free of induction effects and is also convenient where the electrodes cannot be placed in a straight line. The article contains several diagrams and master charts.

The author expects to obtain valuable information from a comparison of the results of the usual four-electrode method, the two-electrode method, and the proposed dipole axial arrangement. One of the ad-

vantages will be the possibility of dispensing with measurements of current intensity.—*S. T. V.*

10867. Blazey, E. L., Rayner, J. M., and Nye, P. B. Geophysical report on the Norseman area, Norseman: Aerial, Geol. Geophys. Survey northern Australia, Western Australia Rept. 38, 8 pp., 3 pls., Canberra, 1941.(?)

In 1937–38 the gold-mining area near Norseman, Western Australia, was surveyed by geophysical methods to trace possible extensions of the Princess Royal, Maraoa, and Norseman quartz reefs. As these reefs are associated with shear zones, tests were made by the potential-drop ratio method for the delineation of the reefs themselves and by the electromagnetic method for the detection of the zones, as well as by the resistivity and the magnetic method. Only the electromagnetic data gave definite indications, and the survey was carried out by this method, using a frequency of 500 cycles per second, a traverse spacing of 100 to 200 feet, and observations at 30-foot intervals.

The results showed 25 indications of good electrical conductors, but insufficient geologic information rendered their correlation with shear zones and reefs inconclusive. It could only be surmised that shear zones probably existed at a comparatively shallow depth vertically beneath the indications, that reefs were not necessarily confined to shear zones of high conductivity, and that shear zones containing quartz reefs were not necessarily good electrical conductors.—*V. S.*

10868. Bleil, D. F. Induced polarization—a method of geophysical prospecting [abstract]: Geophysics, vol. 13, no. 3, p. 504, Tulsa, Okla., 1948.

Geophysical prospecting by the method of induced electrical polarization, as discussed in the literature, is subject to criticism. Laboratory experiments using metallic targets in a medium of quartz sand and also in salt water have been performed to study the fundamental relations involved and to settle some of the discrepancies existing in the literature.

It has been found that the induced polarization (*IP*) is a linear function of the potential gradient applied, requiring no threshold potential but showing a saturation potential which is slightly larger than a volt. There is also a saturation effect with time which is a function of the resistivity of the surrounding medium. The decay curves (*IP* vs. time) obtained are not exponential in character and endure for a time which is too long for the ordinary transient phenomenon. No polarization has been observed for clean sand or fresh or salt water, but a polarization potential is always measured in the earth in regions which are considered to be free, in a commercial sense, of electrically conducting minerals. Theoretical explanation of the earth's polarization is given in terms of the results of the laboratory experiments. The field apparatus is described, and the results of the field survey work are interpreted in terms of the laboratory results.

10869. Brekhovskikh, L. M. The field of refracted electromagnetic waves in the problem of the point source [in Russian]: Akad. Nauk SSSR Izvestiia, Ser. Fiz., vol. 12, no. 3, pp. 322–334, Moscow, 1948.

The problem of the electromagnetic field of a point source has not been fully solved for the case of refracted waves when the source is situated at a distance from a plane boundary between two media. To contribute

to the solution the author deduces the mathematical expressions of the components of the field of these waves for the lower medium. He also shows that certain simple formulas which connect this field with the field existing in the upper medium near the boundary remain valid for any type of source and any parameters of the two media when the waves are considerably absorbed in the lower medium. Mathematical derivation for the vertical dipole is presented, the formulas for the horizontal dipole being deducible in analogous fashion. In the derivation of the integral expression of the Hertzian vector for the dipoles an added precision is introduced into the usual methods of calculation.—*V. S.*

10870. Evjen, H. M.   Theory of low-frequency electromagnetic fields [abstract]: Geophysics, vol. 13, no. 3, p. 499, Tulsa, Okla., 1948.

Based directly on Maxwell's field equations, the extremely low end of the frequency spectrum may be reduced in the first approximation to simple potential theory. The approximation theory is borne out by some field experiments, the results of which are presented. Agreement with the theory, however, requires that the ground have a very large effective dielectric constant. This conclusion is supported by previous observations made by a number of independent observers. Thus, the relaxation time has been found to be extremely great in samples of mud as well as in observations directly on the ground, and the sign of an electric anomaly over a relative insulator, such as crystalline salt or gas and oil, invariably has been found to be negative. Both of these observations can be explained in terms of a very large dielectric constant. The value yielded by the present experimental work is of the order of 10^{10}.

10871. Fritsch, Volker.   Die Messung von Erdwiderständen [The measurement of earth's resistivities], 86 pp., Braunschweig, Vieweg & Sohn, 1942.

This book deals with the grounding of lightning and with other strong electrical currents in the ground, being intended primarily for electrical engineers. Of particular interest to geophysicists and the geologists who use geophysical methods are the sections on subsurface geological conductors and their resistivity in the case of strong currents.—*Zeitschr. Prakt. Geol., vol. 50, no. 10, p. 129, Halle, a. S., Germany, 1942, translated by V. S.*

10872. Ivanov, V. K.   On the question of existence of surficial electromagnetic waves in two different media in contact along a plane, with reply by V. G. Gogoladze [in Russian]: Akad. Nauk SSSR Izvestiia, Ser. Geog. i Geofiz., vol. 12, no. 2, pp. 183–186, 188–191, Moscow, 1948.

The problem of the existence of surficial electromagnetic waves in two different media in contact along a plane is reducible mathematically to the roots of the equation in the first leaf of the Riemann surface. Studying this problem A. Sommerfeld showed that there are such waves under certain conditions whereas V. G. Gogoladze sought to prove in a recent paper that such waves do not exist (*see* Geophys. Abstracts 129, no. 9226).

The author analyzes the underlying mathematical function, which enters into the expression of the Hertzian vector determining the

variable electromagntic field of a vertical electrical dipole in two media, and deduces the general conditions under which this function has the necessary roots in the first Riemann leaf. He finds an error in Gogoladze's demonstration and, pursuing the analysis, derives the equation which must be satisfied to make surficial waves possible. This equation shows that in the particular case of a conducting medium bordering on a nonconducting medium surficial waves exist.

Gogoladze recognizes in his reply the error indicated by Ivanov but shows by further demonstration the condition under which surficial waves do not exist. The equations expressing this condition indicate that the existence or nonexistence of waves can depend on wave length. They lead Gogoladze to the conclusion that in a certain range of values of the material constants involved and also within certain limits of amplitudes there are no surficial waves in the case of the media considered.—*V. S.*

10873. Lewis, Wm. B. Electric surveys of salt domes [abstract]: Geophysics, vol. 13, no. 3, p. 499, Tulsa, Okla., 1948.

Surveys were made of the Long Point and Brookshire (San Felipe) domes by means of the Elflex method. The anomalies mapped showed excellent agreement with known subsurface geology.

10874. Ramachandra Rao, M. B. Notes on the geophysical. prospecting for graphite: Mysore Geol. Dept. Records, vol. 44, pp. 59–72, Bangalore, India, 1948.

During the summer of 1945 an area of about 60 acres around the graphite workings in the Mysore district, India, was surveyed by spontaneous polarization and resistivity methods along 15 profiles totaling 15,400 feet, making 1,472 determination in all. Fairly strong electrical indications were obtained at locations either very close to the known lodes or far away from them. The more important of these indications were tested by trenching. It was established by these tests that the electrical indications were not due to graphite but to such factors as very moist clayey materials and decomposed rocks.

The article gives a geologic description of the area surveyed and a detailed report on the measurements made.—*S. T. V.*

10875. Skal'skaia, I. P. The field of an electrical point source placed over an inclined layer on the earth's surface [in Russian]: Zhur. Tekhn. Fiz., vol. 18, no. 10, pp. 1242–1254, Moscow, 1948.

The author presents a complete solution of the formulated problem, using the method of integral transformation of the derived differential equations controlling the pattern of the electric field. The final solution is greatly simplified when the angle a, formed by the inclined layer with the ground, is an aliquot fraction of π, such as $\pi/3$, $\pi/4$, or $3\pi/2$. Numerical computations in such cases do not present any difficulties. The possibility of calculating the isopotential lines on the earth's surface is of great practical importance. They are very useful in the interpretation of the results obtained from electrical surveys by the spontaneous polarization method.—*S. T. V.*

10876. Slichter, L. B., and Snowdon, S. C. Inductive method of prospecting for conducting ores [abstract] : Geophysics, vol. 13, no. 3, p. 504, Tulsa, Okla., 1948.

This paper consists of two parts : (1) An instrumental analysis, in which rational design of the basic electrical components of the inductive system is discussed, from the point of view of sensitivity and efficiency, and (2) a description of initial field tests which were performed at frequencies of 200, 800, 3,200, and 12,800 cycles per second for the purpose of studying the dependence of the response upon frequency and upon the geologic conditions. This part of the investigation is still in its preliminary stages.

10877. Spicer, H. C. Electrical resistivity investigations at Memphis and Bolivar, Tennessee : U. S. Geol. Survey, Geophysical Investigation, 60 pp., 10 figs., 3 maps, Washington, D. C., 1947.‡

This report describes a geophysical survey made with the Gish-Rooney earth resistivity apparatus. A concise description is given of the technique of measurement and of the methods employed in the interpretation of the apparent resistivity curves. The results of the interpretations are summarized by text and by figures which compare the resistivity interpretations with drilling logs. Maps showing the locations of the stations are included, and drilling logs and apparent resistivity curves are appended, the latter being shown on a logarithmic plot. The best locations for the drilling of water wells are given for both areas investigated, and in the Bolivar area a cross section is shown of the geophysically interpreted boundary of the Porters Creek clay. In conclusion the author emphasizes the worth of electrical resistivity measurements in the evaluation of locations for drilling water wells and in the tracing of geologic formations.—*Abstract prepared by the author for this report.*

10878. Wellman, H. W. Kawau copper mine—self-potential electrical prospecting : New Zealand Jour. Sci. Technology, vol. 29, no. 5, pp. 247–256, Wellington, 1948.

This survey has been undertaken to consider the possibilities of renewing mining operations which were interrupted some time ago. The area surveyed was about three-quarters of a square mile, mostly inclined toward the shore, with some slopes exceeding 30°. The potential differences were measured by a bridge-type millivoltmeter in which the difference in potential between the earth electrodes is balanced against an equal potential difference taken from a potentiometer. Thus no current flows from the earth electrodes and the ground is not disturbed during measurements. The work is done so rapidly in this method that it was possible to observe about 100 stations a day. This is important because numerous stations had to be covered in this survey owing to the fact that the copper ores here are in discontinuous lodes.

Sulfide-bearing bodies were detected by the survey. Positive anomalies of superficial origin were also found, caused probably by slips extending down only a few feet from the surface.

Some difficulty was encountered because the roots of big trees produced local variations of self potential.—*S. T. V.*

5. RADIOACTIVE METHODS

10879. Aliverti, Giuseppina. Nuovo metodo per la misura del contenuto radioat-tivo dell' aria tellurica [A new method of measuring the radioactivity of soil air]: Annali Geofis., vol. 3, pp. 372–375, Rome, 1948.

In view of the increased interest in prospecting for radioactive ores,. measurements of telluric emanation were made at different places in Italy in 1947–48, and certain improvements in existing methods were proposed by the author. These modifications of the known apparatus of Elster and Geitel make possible an exact determination of the volume of the air used in the experiment. The complete apparatus consists of a cylindrical vessel containing the electrometer installed in the ground in a hole, 2–3 meters deep. The electrometer can be lowered to the bottom of the hole, and always remains protected against the influx of atmospheric air by an inflated rubber belt which fits the walls of the hole tightly.

With this instrument the radon content of the soil air in the garden of the Geophysical Observatory Pavia, Italy, was measured and was found to be about 10^4 atoms of radon per cubic centimeter. An increase of radioactivity with a decrease of atmospheric pressure and with the drying out of the ground around the hole was also observed.—*S. T. V.*

10880. Curran, S. C., and Reid, J. M. The properties of some new types of counters: Rev. Sci. Instruments, vol. 19, no. 2, pp 67–75, Lancaster,. Pa. and New York, N. Y., 1948.

The authors have investigated various geometric forms of the cathode and different positions of the wire as anode, as well as counters with multiple wires. The results show that a large variety of shapes and many positions of the anode wire can operate satisfactorily. In certain arrangements improved performance can be attained, making possible operation with reduced voltage or shorter dead-time.

By using several wires a counter can be constructed with a larger solid angle to an external source. Such a counter would be of interest to. geophysicists for field work in investigating radioactivity of different ores.—*S. T. V.*

10881. Faul, H., and Sullivan, G. Density correction in beta-ray assaying of rock and mineral samples: Nucleonics, vol. 4, no. 1, pp. 5356, New York, N. Y., 1949.

Measurements have been made of the beta activity of a number of minerals mixed in constant proportion with uranium, thorium, and potassium. The results showed that the apparent density correction for samples of varying densities is of significant magnitude. With the use of the data presented a calibration curve can be obtained by measuring two or three samples of identical radioactive content but of widely different density and by interpolating between the points obtained.— *Authors' abstract, amplified by V. S.*

10882. Festa, C., and Santangelo, M. La radioattività della terra [Radioactivity of the earth]: Annali Geofis., vol. 1, no. 4, pp. 581–609, Rome, 1948.

The determination of the amount of radioactive substances contained in the terrestrial globe is a very important problem of geophysics, re-

lated to the past and future history of our planet. It is also of practical importance in well logging and in the various branches of mining engineering. The available knowledge is very limited, because most of the research done so far has been confined to the study of the upper surface of the crust. Direct measurements at a depth not exceeding 3,000 meters have been made in only a few oil wells. Lava and gases emanating from volcanoes give information of conditions at greater depth, but active volcanoes are rare. The greatest amount of radioactive substances is to be found on the earth's surface and the amount decreases rapidly with depth. But even on the surface of the earth this content is exceedingly low. Sea water contains less than 0.3×10^{-14} percent of radium, and the average radium content in solid substances is even lower.

The article gives a detailed description of the methods of detection and measurement of radioactivity. Five types of instruments are described: the scintillation apparatus, the ionization chamber, the Geiger-Müller and Geiger-Klemperer counters (proportional counter), and the Wilson cloud chamber. The article also contains a table of units used in measurements. Certain theoretical questions are discussed in four appendixes to the article.—*S. T. V.*

10883. Hirschi, H. Radioactive Messungen in Bezug auf Uranlagerstätten [Radioactivity measurements for finding uranium deposits]: Schweizer Min. Pet. Mitt., vol. 26, no. 1, pp. 28–33, Zurich, 1946.

A brief account is given of methods and instruments for uranium exploration, suitable both for preliminary tests of radioactivity in rock cores and powders and for fuller measurements of their radioactive emanation. The preliminary tests, designed for a rough identification of rocks containing uranium, can be made with various types of simple electrometers, including the one designed by the author for field use. Optimal procedures are suggested, the advantages of pulverized samples over piece samples are indicated, and the estimation of uranium content in ores is discussed.

Further measurements of radioactive emanation in the samples selected by means of preliminary tests require a special chemical treatment with hot concentrated hydrochloric acid and can be made with the same instruments and methods as the first tests. The chemical treatment is discussed briefly, and sulfuric acid is considered unsuitable. The dual method of preliminary tests and subsequent measurements under chemical reagents is especially desirable for weakly radioactive uranium ores.—*V. S.*

10884. Hoogteijling, P., and Sizoo, G. Radioactivity and mineral composition of soil: Physica, vol. 14, pp. 357–366, The Hague, 1948.

In sedimentary sands, as in the rocks from which they originate by physical pulverization, radioactivity is found to be concentrated in the heavy (zircon) mineral layer. In clays, which presumably are the result of chemical change, the radioactivity is not correlated with this zircon mineral. Correlation is found between the radioactivity and the potassium content of clays. It is concluded that in clays the radioactive elements are at least partly unbound by chemical change and spread

over the whole material by adsorption at the surface of small particles.—
Nucleonics, vol. 4, no. 1, p. 82, New York, N. Y., 1949.

10885. Joliot-Curie, Irène. Les radioéléments naturels [the natural radio
elements], 191 pp., Paris, Hermann, 1946.

The properties and methods of extraction and purification of the
naturally occurring radioelements, as well as methods of their determi-
nation, are described. Two chapters are devoted to methods of radio-
chemistry and its applications. An outline of existing knowledge of
artificial radioelements is included.—*Nuclear Sci. Abstracts, vol. 1, no.
6, p. 1031, Oak Ridge, Tenn., 1948.*

10886. Marble, J. P. Report of the Committee on the Measurement of Geologic
Time, 1946–47, 69 pp., Washington, D. C., National Research Council,
June 1948.

A report is given for 1946–47 on investigations within the province of
the Committee on the Measurement of Geologic Time. The work covered
includes research by Marble on uraninite and allanite; by W. Urry and
G. Davis on pallasite meteorites; by H. Yagoda on the use of the auto-
radiograph for measurement of the radioactive content of minerals; by
E. S. Larsen, Jr., on the radioactivity of mineral separates; and other
studies. Appendices give an annotated bibliography of articles relating
to the measurement of geologic time, by Marble; a report on investiga-
tions at the University of Edinburgh, by Arthur Holmes; a summary of
the use of the Rb/Sr method for the determination of geologic time, by
L. H. Ahrens; a paper "Surface effects on geotherms," by A. C. Lane; and
a progress report on a project for the determination of the age of black
shales, by R. F. Beers.—*V. S.*

10887. Marshall, F. H., Coltman, J. W., and Bennett, A. I. The photo-multiplier
radiation detector: Rev. Sci. Instruments, vol. 19, no. 11, pp. 744–770,
Lancaster, Pa., and New York, N. Y., 1948.

The photo-multiplier radiation detector consists of a commercial mul-
tiplier photo-tube arranged to register the scintillations produced in a
flourescent screen by radiation quanta. The signal pulses thus obtained
are large for alpha particles and other high velocity ions, but much
weaker for x-rays, gamma-rays, and high-velocity electrons. The
method's efficacy is limited by the presence of noise pulses caused by elec-
trons thermally emitted at the photo-cathode, as signal pulses can be
discriminated from noise pulses only to the extent that their amplitudes
exceed those of noise pulses.

Satisfactory detection of the weaker signal pulses has been ac-
complished by careful attention to the selection of photo-tubes, choice of
fluorescent screen, efficient collection of light, and proper circuit design.

Full construction details, performance characteristics (particularly
with weak signal pulses), and numerous suggestions for further im-
provement are given.—*Authors' abstract, condensed by V. S.*

10888. Monsuf, A. K., and Collett, L. S.   Bibliography of radioactivity of rocks in Canada: Canadian Geophys. Bull., vol. 2 no. 2, pp. 13–27, Ottawa, Ontario, 1948.

This bibliography lists 172 papers on measurements of radioactivity in the rocks of Canada. It dates back essentially to 1932, as previous papers were reviewed by H. V. Ellsworth in his book "Rare-element minerals of Canada." The radioactivity investigations covered included those for exploring uranium and thorium deposits, for explaining the source of the earth's internal heat and volcanism, and for establishing a geologic time-scale by the helium and the lead methods. Possible sources of error in the determinations are pointed out in a preface, and a few standard books on radioactivity of rocks are listed. Some of the entries are supplied with notations by J. T. Wilson, who also critically checked the bibliography.—*V. S.*

10889. Robinson, C. V., and Peterson, R. E.   A study of small ether-argon Geiger-Müller counters: Rev. Sci. Instruments, vol. 19, no. 12, pp. 911–914, Lancaster, Pa., and New York, N. Y., 1948.

Procedures applicable to the building of large counters have generally produced unsatisfactory small counters, with short plateau and poor stability. The authors have tested several combinations of structural elements and succeeded in constructing an ether-argon counter of a quarter-inch cathode diameter. This dimension can be further decreased to about $\frac{1}{16}$ inch.

The authors give a set of recommendations to be followed in the construction of such small counters and present a detailed description of the different parts. Good operating characteristics were obtained with such design and life tests of instruments resulted in breakdown only after 56 million counts.—*S. T. V.*

10890. Salvini, Giorgio.   Some Geiger-Müller and proportional counters of spherical shape: Rev. Sci. Instruments, vol. 19, no. 8, pp. 494–496, Lancaster, Pa., and New York, N. Y., 1948.

A Geiger-Müller counter with a spherically shaped cathode is described. The pulse shape from this counter is similar to that of cylindrical counters. It may be used satisfactorily in ordinary coincidence work. Some of the counters, slightly modified to avoid spurious discharge, were filled with boron trifluoride and used as proportional counters for detection of neutrons.—*Author's abstract.*

10891. Szalag, A.   Thorium and uranium content of the Velence Mountains, Hungary: Nature, vol. 162, No. 4116, pp. 454–455, London, 1948.

During the summer of 1947 the mountains near the lake, Velencei Tó in Hungary were explored for the occurrence of thorium and uranium minerals, using portable battery-operated Geiger-Müller counters. The instruments were of self-quenching type, filled with argon and alcohol vapors. Some 30 square kilometers were surveyed. The basic eruptive rocks, mostly andesite and quartzite, were found to be practically inactive, whereas the silicic eruptive rocks, such as granite, aplite, and granite-porphyry, show a radioactivity value of approximately 0.12×10^{-3} grams of thorium per gram of rock.

Samples of the silicic rocks were tested for radon and thorium and have been found to contain about 9 grams of uranium and 40–60 grams of thorium per ton of rock.—*S. T. V.*

10892. Trener, G. B., and Scaramucci, M. A. La radioattività tellurica dei dintorni di Merano e di Lurisia [Telluric radioactivity in the Merano and Lurisia regions] : Ricerca Sci., vol. 18, no. 7, pp. 756–760, Rome, 1948.

Extensive measurements of the radioactivity of soil gas were made during 1947 at the health resorts of Merano in Tyrol, and Lurisia in Piedmont. Almost 10,000 stations were occupied in 100 kilometers of traverse. An instrument of the Ambronn type, which permits rapid measurement, was used.

The geology of Merano is complex. Several zones of dislocation cross within the city limits, resulting in outcrops of eruptive masses, quartz porphyry, tonalite, and crystalline aggregates. Over the crystalline schists the radioactivity was found to be 3–4 eman. (0.5UM). Over the granites it was 7 to 8 times higher. Over one area several kilometers long and over 100 meters wide the radioactivity was found to be exceedingly high, reaching the value of 100 emanations. The values found are higher than at any other known locality in the world.

At Lurisia, where the geology is simpler, the measurements gave much lower values. At only few stations were they as high as 10–20 emanations. Chemical analyses of samples of rocks from Merano and Lurisia are being made.—*S. T. V.*

10893. Wu, C. S., and Rainwater, L. J. Batteryoperated inverse feedback electrometer circuits and gamma radiation meter: U. S. Atomic Energy Comm. Doc. 2050, 30 pp., Oak Ridge, Tenn., 1945(?).

For the detection of low intensities of alpha, beta, or gamma radiation a portable unit consisting of an ionization chamber and an electrometer circuit is designed to achieve the required sensivity and stability. Because the gain of the multistage amplifier employed to read the output on a microammeter depends directly on the characteristics of the vacuum tubes and varies with the potentials on the electrodes, the principle of inverse feedback is applied to eliminate the need of repeated calibration and to reduce other difficulties of multistage direct-current amplifiers. The battery-operated inverse feedback circuits developed for this purpose have proved to be sensitive, stable, and compact. The portable gamma-radiation meter employing them and incorporating a Freon (CCl_2F_2) pressure chamber gives very satisfactory service. Circuit diagrams and photographs are shown.—*Nuclear Sci. Abstracts, vol. 1, no. 2, p. 34, Oak Ridge, Tenn., 1948, condensed by V. S.*

GEOTHERMAN METHODS

10894. Bringhenti, Plinio, and de Leva, Marcello. Produción de energia electrica con fuerzas endogenas del Tatio, Antofagasta [Production of electrical energy from endogenetic thermal sources of Tatio, Antofagasta province] : Bol. Minero, no. 581, pp. 502–509, Santiago, Chile, 1948.

Important sources of thermal energy exist at Tatio, Antofagasta, at an altitude of 4,300 meters, coming from eruptive rocks of recent origin. The author discusses the possibility of their utilization for industrial purposes, and concludes that this is feasible. The size of the possible

installation can be determined only after a geophysical exploration of the site, with some deep sounding which must determine the amount of hot gases emanating from the ground. Geological structure of the region under study is in many respects similar to that of Lardellero, Italy, where a thermo-electric station of 100,000 kilowatts was installed in 1940. Analysis of hot gases emanating from the ground in Tatio established the presence of ammonia and boric acid, besides a great amount of superheated water vapor.—*S. T. V.*

10895. Cucuzza Silvestri, S., and Ponte, G.   Andamento termico delle fumarole laviche dell' Etna [Temperature variation of the fumaroles of Etna's lava] : Annali Geofis., vol. 1, no. 4, pp. 513–519, Rome, 1948.

Following the last eruption of Etna, in March 1947, the authors began a systematic observation of the variation of temperature of the lava and of the fumaroles which have been formed on the slope of lowest gradient of the volcano, some 1,800 meters from the main crater, at an altitude of about 1,500 meters. Readings were taken for a period of one year on seven selected fumaroles, starting one month after the eruption. Four of the fumaroles showed a regular decrease of temperature from an initial value of about 300° C. to 40° C. in September of that year. Three other fumaroles first showed the same decrease, but after falling to about 125° C., the temperature rose again to 270° C. This phenomenon reoccurred at a lower temperature.

The authors explain the observed rise of temperature by the chemical reaction taking place between the component parts of the lava, the water contained in the ground, and the nitrogen of the air. The chemical reaction is: $H_2S+2H_2O+2HCl+N_2=2NH_4Cl+SO_2$. The presence of these two substances has been established by chemical analysis of the gases emanating from the lava.—*S. T. V.*

10896. Grim, R. E.   Differential thermal curves of prepared mixtures of clay minerals : Illinois Geol. Survey Rept. Investig. 134, pp. 5–11, Urbana, Ill., 1948.

This paper presents differential thermal curves of clay minerals, of prepared mixtures of such minerals, and of some clay minerals diluted with inert materials. Variations in the size and perfection of crystals of particles of kaolinite appear to be reflected in variations in the intensity of the thermal reactions characteristic of the mineral. Thermal curves of many prepared mixtures show that the thermal reactions characteristic of the individual component minerals are not always discernible, particularly if the mixing is very intimate and if the components are poorly crystallized. Caution must be used in the identification of the clay minerals in mixtures and quantitative evaluations are very difficult.—*Author's abstract.*

10897. Ippolito, Felice.   Intorno di criteri di ricerca per energia geotermica [On the criteria of exploration for geothermal energy] :   Accad. Naz. Lincei Rend., ser. 8, vol. 2, no. 6, pp. 821-827, Rome, 1947.

The success of the 100,000 kilowatt thermo-electric installation of Larderello, Italy, has prompted interest in exploration for similar sources of geothermal energy. The author discusses the probability of

success in this endeavor and makes a sharp distinction between geo-thermal sources of plutonic and of volcanic nature. He stresses the following points: plutonic reservoirs of superheated vapor and hot gases are to be found in the orogenic zone, surrounded by silicic masses with a high content of volatile substances. On the other hand volcanic res-ervoirs are usually found in basic rocks. For industrial utilization plu-tonic reservoirs are more favorable, having higher temperature and pressure; also the geologic conditions make more probable the forma-tio nof plutonic geothermal reservoirs.—*S. T. V.* (*See also* Geophys. Abstracts 133, no. 10102.)

10898. Otuka, Yanosuke. Geologic consideration of the abnormal temperature distribution in the hot spring at Atami, Shizuoka-ken, Japan [in Jap-anese, with English summary]: Tokyo Imp. Univ., Earthquakes Res. Inst. Bull., vol. 21, no. 3-4, pp. 414–434, Tokyo, 1943.

A study of the relation between the geologic structure and the tem-perature of the hot spring of Atami, Shizuoka-ken, Japan, has shown that the heated mineral waters originate mostly from Neogene andesitic tuffites crossed by numerous faults. The area of highest temperature is situated on the northern side of the Hata-gawa and is bounded by a large fault that extends along that river and dips steeply north-eastward. The tuffites and lavas to the north of this fault have de-composed and been metamorphosed into solfataric clay and other soluble materials by heated gases and hydrothermal solutions during the later stages of the activity of the Pleistocene volcano of Taga. Some of the mineral water having high temperature appears to be ordinary under-ground water heated by the gases and the effects of hydrothermal solu-tion, whereas other water may be derived from these gases and the solutions particularly those ascending through the faults and the sol-fataric clay zone. The hot underground mineral-water surface seem-ingly has the characteristics of an ordinary underground water surface.—*Author's summary, condensed by V. S.*

7. GEOCHEMICAL METHODS

10899. Huff, L. C. A sensitive field test for heavy metals in water; Econ. Geology, vol. 43, no. 8, pp. 675-684, Lancaster, Pa., 1948.

A semiquantitative colorimetric analytical method using dithizone to detect traces of heavy metals in natural water is described. Although reagents of exceptional purity are required, only simple equipment is needed and the test can be made in a few minutes in the field. A combined mixed-color and mono-color technique makes the test suit-able for a wide range of concentrations. The test is very sensitive; as little as 0.01 part per million of either copper, lead, zinc or any combi-nation of the three metals can be detected readily.

The dithizone test permits rapid field identification of drainage ele-ments which contain significant concentrations of heavy metals. An example is given showing how the test can be used to trace the heavy metal content of a drainage system back to its source. It is possible that, under favorable conditions, the field test may facilitate prospect-ing by dejecting metals discharged by the weathering of hidden ore

bodies. However, until the method receives further investigation, it would be premature to predict its value.—*Author's summary*.

10900. Landergren, Sture. On the geochemistry of Swedish iron ores and associated rocks, a study on iron-ore formation: Sveriges Geol. Undersök-ning, Ser. C, no. 496, 182 pp., Stockholm, 1948.

This volume deals with the geochemistry of iron ores. Some significant minor constituents have been found by spectrochemical analysis in samples mainly from the pre-Cambrian iron-ore regions of Sweden. Samples of iron ore of different age from other countries have been analyzed for comparison. On the basis of the available data important statistical quantities were computed for the iron ores and for the main igneous rock series.

Special consideration is given to the relationship between the distribution of some major constituents of iron ores, and the distribution of igneous rocks. A method is proposed for using statistical data in geochemical investigations of igneous rocks. The endogene relationship between iron ores and the associated igneous rocks is discussed on geochemical premises, and a theory of iron-ore formation is formulated and applied to explain the origin of the pre-Cambrian iron ores of Sweden.—*Author's abstract, condensed by V. S.*

10901. Reichen, L. E., and Lakin, H. W. Field method for the determination of zinc in plants. U. S. Geol. Survey Circ. 41, 4 pp., 2 pls., Washington, D. C., February 1949. ‡

This circular describes a field method for estimating zinc in fresh plant leaves. The method was developed as part of the geochemical prospecting program of the U. S. Geological Survey and makes possible on-the-spot tests for zinc in plant tissues. Samples are collected with a leaf punch and are ashed directly over a flame, the zinc in the ash then being determined colorimetrically with dithizone. Results obtained by the field method compare favorably with those obtained by the more precise laboratory method. Forty or more samples can be tested for zinc in a day.—*Authors' abstract*.

10902. Sokoloff, V. P. Chemical prospecting for ore [abstract]: Geophysics, vol. 13, no. 3, p. 505, Tulsa, Okla., 1948.

The study of unusual concentrations of metals in soils, plants, and waters is a relatively new development in ore prospecting. Such concentrations often form an interrelated series of anomalies, termed a "dispersion halo," which may be correlated with geologic and geophysical data. Types of dispersion halos include mechanical dispersion and a buried, saline complex. Elements of present interest are lead, zinc, and copper which disperse differently in different climates and environments. For instance, zinc to a far greater extent than copper can be found in waters, forming a "dispersion train" miles away from its source.

10903. Vogt, Thorolf, Braadlie, O., and Bergh, H. Geokjemisk og geobotanisk malmleting—9, Bestemmelse Cu, Zn, Pb, Mn, og Fe i planter fra Rørosfeltet [Geochemical and geobotanical ore prospecting—9, Deter-

mination of Cu, Zn, Pb, Mn, and Fe in plants from the Røros district]: Kon. Norske Vidensk. Selsk. Forh. 1943, vol. 16, no. 15, pp. 55–58, Trondheim, Norway, 1944.

The results of analyses made for the determination of certain heavy metals in different plant species from soil at a sulfide copper deposit (Nyberget) and from normal soil (Kovedalen), are tabulated. Judging from these data, tests for copper and zinc in plants do not seem to be very useful as an ore prospecting method in the Røros area. The zinc content in the plants is remarkably high, the average ratio Cu : Zu being about 1 : 8.5.—*Authors' abstract.*

10904. Vogt, Thorolf, and Bergh, H. Geokjemisk og geobotanisk malmleting—10, Bestemmelse av kobber i jordprøver [Geochemical and geobotanical ore prospecting — 10, Determination of copper in soil]: Kon. Norske Vidensk. Selsk. Forh. 1946, vol. 19, no. 21, pp. 76–79, Trondheim, Norway, 1947.

The geochemical method of ore prospecting here described is based on the observation that soil containing humus can tie up comparatively large quantities of copper and other heavy metals. (*See* Geophys. Abstracts 134, no. 10368.) This effect depends on adsorption of cations of heavy metals to humic acids and the forming of "copper humates" and other compounds. Altogether, 134 analyses of copper, and as many of zinc, lead, iron, and manganese, were made in 1942 and 1943, constituting a geochemical investigation of the little-known ore deposit of southern Lossius near Røros.

The results are given in a table and are indicated on a map. The outcrop of the ore deposit is near the southeastern boundary of a large field where samples register more than 100 milligrams of copper per kilogram of water-free fine soil. Whereas normal soil generally contains about 20 milligrams of copper per kilogram, the most indicative group of samples is found to contain 100 to 500 miligrams of copper, the factor thus being between 5 and 25. The highest figure obtained in analyses is 7,000 miligrams of copper per kilogram.

This method of geochemical prospecting for copper deposits can be considered the best tested in the present series of investigations.—*Author's abstract, condensed by V. S.*

8. DRILL-HOLE METHODS

10905. Dakhnov, V. N. Exploration of geological formations on the basis of the findings of well logging [in Russian]: Trudy Vses. Tekhnich. Soveshchaniia, vol. 1, pp. 104–114, Narkomneft, Moscow, 1946.

Electrical well logging has been so improved during the last decade that further progress can be attained only by the incorporation of new procedures. Several suggestions for the use of thermal, radioactive, and other methods to supplement the existing procedure of electrical logging are made by the author. These would increase the value of well logging by making possible the differentiation of formations by new criteria. Many geologic formations, as for instance, hydrolytic precipitates, limestones and others, have very similar electric properties so that neither the resistivity curve, nor the self-potential curve permits their

differentiation. But the precipitates have higher thermal conductivity and this property can be used for differentiation of the formations. Similarly, sands and sandstones have almost identical electric properties, but can be easily distinguished by their different mechanical resistance to drilling. Other deep hydrolytic precipitates can be identified by their high radioactivity. This property of the formation can be detected even through the casing.

Permeability of the formation, a very important property in prospecting for oil, can be evaluated by measuring the apparent electric resistivity with expanding electrodes, by lateral sounding, by thermal logging in wells without casing, by gamma radiation, or by a close scrutinizing of self-potential diagrams.

Oil-bearing formations are usually very friable, porous, have less mechanical resistance to drilling, and show significant differences in thermal logs. These properties are often useful in the interpretation of the measurements.—*S. T. V.*

10906. Horvitz, Leo. Geochemical well logging: Texas Agr. Mech. Coll. Bull. 93, pp. 29–31, College Station, Tex. 1946.

Geochemical well logging consists in analyzing sample-cuttings for hydrocarbons and other constituents, such as chlorides, sulfates, and carbonates. Generally, the samples are collected for every 30 feet of drilling and are delivered to a laboratory, where hydrocarbons are removed from them in a partial vacuum at temperatures below −100° C., to prevent decomposition of organic matter that may be present. The analysis of the extracted gases involves a combination of low-temperature fractionation and combustion methods and consists in separating the gas sample into three fractions. The first fraction includes the portion of the gas mixture that is noncondensable at −196° C. and that contains the methane. The second fraction consists of gas not retained in the mixture at −145° C. but condensable at −196° C. and that contains ethane-propane and butane. The last fraction is retained in the mixture at −145° C. and contains pentane and heavier hydrocarbons. A few details of the technique of analysis are given, and practical applications of geochemical logging are listed.—*V. S.*

10907. Kean, C. H., and Tullos, F. N. Acoustic impedance well logging [abstract]: Geophysics, vol. 13, no. 3, p. 496, Tulsa, Okla., 1948.

Several years ago the senior author conceived the idea of placing a cylindrical sound source in a bore hole and obtaining an acoustic impedance log. There were mathematical reasons to believe that a certain type of tube driven in its longitudinal mode would be suitable. Such a device was constructed from magnetostrictive material (nickel) and built in a way that made the system self-driven. An "automatic volume control" indicated the amplitude of the tube when a fixed driving current was applied. Highly reproducible logs were obtained on a large number of core holes, and very good correlation was obtained from hole to hole. Slides are given indicating the construction, the operation, and the results.

10908. Keystone Development Corporation. Acoustic well sounder: Rev. Sci. Instruments, vol. 19, no. 2, p. 126, Lancaster, Pa., and New York, N. Y., 1948.

An acoustic well sounder (Sonolog) has been developed for determining the fluid level in the annular space between the casing and the tubing of an oil well. A small pressure-tight chamber attached to a casing outlet at the surface of the ground contains a microphone and a mechanism for firing a blank cartridge. The sound of the explosion travels down the annulus between the tubing and the casing, being partly reflected at different obstructions, such as tubing collars, and is finally almost totally reflected at the top of the oil column. The sound waves are transformed into an electric current, which is amplified and recorded on a moving strip of paper. A knowledge of sound velocity is not always required. The sonolog is designed as a portable instrument and is adapted for field use.—S. T. V.

10909. Lyle, H. N. Use of electric logs in locating porous zones [in English and Spanish]: Petroleo Interamericano, vol. 6, no. 1, pp. 49–53, Tulsa, Okla., 1948.

Porous zones in oil wells can be located by self-potential logs and electrical-restivity logs. These are discussed together with a method for determining water saturation in formations. It is found that self-potential curves generally require supporting data for reliable interpretation, such as results on coring, drill-stem tests, and drilling-time rates. In the light of experience with such checks certain tentative generalizations are advanced as guides for interpreting self-potential logs.

The electrical resistivity of formations, recorded on the four curves of resistivity logs, generally depends on a number of factors, but more particularly varies directly with cementation and inversely with the porosity, the percentage of interstitial water, and the salinity and temperature of the water. The percentage of water saturation, and hence the percentage of oil or gas saturation, may be determined by a simplified formula: $W = \sqrt{R_o}/R$, where R_o is the observed resistivity of the 100-percent water-saturated sand, and R is the observed resistivity of the oil or gas sand. Charts have been published which give the value of W for various values of R_o and R.—V. S.

10910. Petroleo Interamericano. Dipmeter surveys: Vol. 6, no. 3, pp. 85–91, Tulsa, Okla., 1948.

An abridged version is presented of the paper by E. F. Stratton and R. G. Hamilton on dipmeter surveys in oil wells. The dipmeter is a logging instrument for determining the direction and magnitude of formation dip. It records simultaneously 3 spontaneous-potential or restivity curves along the walls of a single well by means of 3 electrodes placed 120° apart in the well's cross section. Each curve thus marks one point on any boundary plane crossed by the well, and the position of such a plane can be determined from the displacement of corresponding points on the 3 curves. Spontaneous polarization dipmeter surveys are made with the same surface recording equipment and cable that are used for electrical logging. They have been found to succeed best

in regions where the geological section is sand or shale, as in California or the Gulf Coast. The field procedure is described, and the use of data for correlation and other purposes is discussed.—*V. S.*

10911. Pixler, B. O.   Mud analysis logging: Texas Agr. Mech. Coll. Bull. 93, pp. 14–28, College Station, Tex., 1946.

Mud analysis logging is made for a direct detection of oil- and gas-bearing formations during drilling operations and for a determination of their depth and thickness. It is simple, relatively reliable, and does not interfere with drilling. Several papers are listed which have been published in petroleum journals and describe in detail the equipment and the application of this form of logging. The present paper outlines briefly the principles of the method and reviews its applications and some late developments. The advantages of reduced coring time and expense, the factors affecting interpretation, and the techniques of estimating methane content are discussed and illustrated by sections of mud-analysis logs from wells in Louisiana, Texas, California, and the Gulf Coast, in part combined with electric resistivity logs.—*Author's preface, amplified by V. S.*

10912. Powers, R. E. and Craft, B. C.   Temperature gradients in gas lift wells: Petroleum Engineer, vol. 19, no. 6, pp. 118–120, Dallas, Tex., 1948.

Several temperature surveys were made with a Humble-type subsurface thermometer in two gas-lift wells at the University field, Louisiana. The purpose was to test the usefulness of gradient measurements for locating flow valves open to gas entry, for explaining increased paraffin deposition in the flow string, and for other applications. One surveyed well was operating with 3 pressure-opening flow valves, and the gas was injected into the annular space every 14 minutes, the duration of each intermittent period being 1.5 minutes.
The first temperature survey of this well showed three distinct temperature gradients, one above the 2d valve, one between the 2d and the 3d valve, and one below the 3d valve, the first two gradients being due to gas injected at valves 2 and 3, and the third being the normal flowing geothermal gradient. When the distribution of these gradients was plotted against well depth, it indicated positions of the valves different from those determined by depth measurements in the well. A second temperature survey revealed that there was an error of about one joint of tubing in the depth measurement to the position of the 2d valve. It is concluded that temperature surveys can be used to find points of gas injections. Other observations are given.—*V. S.*

10913. Standing, M. B.   A pressure-volume-temperature correlations for mixtures of California oil and gases, Am. Petroleum Inst., Drilling and production practice 1947, pp. 275–287, New York, 1948.

An equation of state is derived for a mixture of oil and gas. The knowledge of such relations is necessary for the solution of many problems concerning reservoir performance on the basis of geophysical measurements. The relationship obtained includes three parameters: gas gravity, oil gravity, and gas-oil ratio. The relationship was established from laboratory experiments in which different physical characteristics, such as bubble point, pressure, formation volumes, and other

properties were measured under varying conditions. The range of variation was: for pressure 400–5,000 p. s. i.; gas–oil ratio 75–37,000 cu. ft. per bbl.; temperature 100°–258°F., gas gravity 0.59–95 (air=1.00); oil gravity 16.5°–63.8° API. From the observed data the analytical equation of state was deduced and charts were constructed for convenient use.—*S. T. V.*

9. UNCLASSIFIED GEOPHYSICAL SUBJECTS

10914. Buwalda, J. P.   Unusual opportunities for training in geophysics at the California Institute [of Technology]: Eng. and Sci. Monthly, vol. 11, no. 2, p. 10, Pasadena, Calif., 1948.

The nature and scope of geophysics are described, and brief information is given on geophysical instruction offered at the California Institute of Technology. The curriculum is almost entirely at the graduate level and requires two academic years for its completion. About half the time in each of 6 terms is devoted to geophysical courses, the remainder being used largely for work in related branches of physics, mathematics, and geology. The M. A. degree is awarded usually after 1 to 2 years of study, the degree of Geophysical Engineer after 2 to 3 years, and the Ph. D. degree after 4 years. The opportunities for advanced instruction are considered to be outstanding.—*V. S.*

10915. Kröger, F. A.   Some aspects of the luminescence of solids, 310 pp., 74 figs., New York, Elsevier Pub. Co., 1948.

This monograph gives hitherto unpublished experimental results on the luminescence of solids, obtained at the N. V. Philips Gloeilampen-fabrieken, Eindhoven, Netherlands, and presents certain related theoretical considerations. The data concern the luminescent systems of tungstates, molybdates, and luminophors activated by manganese, titanium, and uranium. In the case of manganese special attention is devoted to the problem of its activating valency and to the newly discovered activating properties of tetravalent manganese. The influence of temperature on the efficiency of luminescence is considered, and an attempt is made to develop, on the basis of energy levels of pure and perturbed crystals, a general system covering all possible luminescence effects.—*Preface, condensed by V. S.*

10916. Kulikov, V. I.   Application of different geophysical methods in exploration for oil in Azerbaydzhan [in Russian], 53 pp., Moscow, Biuro Tekn.= Ekonom. Informatsii, 1948.

This book presents the history of geophysical exploration in the oil-bearing area of the Azerbaydzhan S. S. R. from 1926 to the present. The total area explored is about 23,000 square kilometers, of which 5,000 square kilometers are under water. During this period, 120 field surveys were carried out; of these 35 were gravimetric, 43 seismic and 42 magnetic and electric. The geological structure of this important oil-producing province, with its vast synclinal areas, is now well explored. This facilitates the selection of the most effective method for future detailed exploration of different localities. The results of the surveys are summarized in the book, which contains a geologic description of the area and presents several maps.—*S. T. V.*

10917. Lahee, F. H. Exploratory drilling in 1947: Am. Assoc. Petroleum Geologists Bull., vol. 32, no. 6, pp. 851–868, Tulsa, Okla., 1948; National Oil Scouts and Landmen's Assoc., Yearbook 1948, vol. 18, pp. 8–21, Austin, Tex., 1948.

In 1947 a total of 6,775 exploratory holes were drilled for oil and gas in the United States. Statistics on the relative success of different methods used to select drilling sites show that 1,301 exploratory holes located on technical advice (geology and/or geophysics) were successful, and 4,558 were dry; 31 holes located without technical advice were producers, and 533 were dry; and 46 holes located for reasons not stated were producers, and 306 were dry. Thus, 22.2 percent of the holes drilled on technical advice were producers, as contrasted with 5.5 percent successful in case of holes located without technical advice, so that in 1947 the locations based on technical recommendations were 4 times as successful as those drilled without them.

In the particular case of new-field wildcats, 200 producers and 1,691 dry holes were located mainly on geologic bases; 101 producers and 516 dry holes were located on geophysical information; 63 producers and 293 dry holes were located on geology plus geophysics; 15 producers and 380 dry holes were located on various nontechnical bases; and 15 producers and 197 dry holes were located for reasons unknown. Thus, among new-field wildcats 12 percent of the holes drilled on technical advice were successful. All figures refer to totals for the 32 states that contain over 98 percent of the proved oil reserves of the United States.— *V. S.* (For previous report *see* Geophys. Abstracts 130, no. 9448.)

10918. Mackay, D. K., and Danforth, L. F. Oil and gas development in Arkansas in 1947: Am. Inst. Min. Met. Eng., Statistics of Oil and Gas Development and Production, 1947, pp. 3–25, New York, 1948.

Geophysical exploration in Arkansas increased from 467 crew weeks in 1946 to 715 crew weeks in 1947, divided as follows: seismic 387, gravity 247, magnetic 81. Approximately 95 percent of all exploratory and drilling operations during 1947 were concentrated in south Arkansas, which contains oil and gas-condensate fields, and less than 5 percent in the northwest part of the State where only dry gas is produced. The distribution of geophysical activity by counties is indicated on a sketch map which shows a concentration of surveys particularly in Lafayette, Columbia, and Union Counties.—*V. S.*

10919. National Oil Scouts and Landmen's Association. Oil and gas field development in the United States, 1947: Yearbook 1948, vol. 18, 897 pp., Austin, Tex., 1948.

Reviews, statistical data, and maps are assembled to show the development of oil and gas fields during 1947 in 35 states and in the United States as a whole with respect to geological and geophysical prospecting, land and leasing activities, wildcat exploration, proved field work, oil and gas production, pipe lines, and refineries. The information is arranged by states and is prefaced by a foreword by E. DeGolyer and a review of exploratory drilling in the United States in 1947 by F. Lahee.

The data for most of the states include information on the scope of geophysical prospecting, differentiated by methods and counties. The

general review of exploratory drilling gives figures on the relative sucsess of geophysical and other exploratory methods in locating productive holes.—*V. S.* (*See also* Geophys. abstract 10917.)

10920. Nettleton, L. L., editor. Geophysical case histories, vol. 1, 1948, 671 pp., Soc. Expl. Geophysicists, Menasha, Wis., 1949.

Sixty papers on geophysical surveys, 57 of them case histories and 3 on general subjects, are collected in this volume to aid exploration. One third of these papers are new and the rest are reprinted from the journals Geophysics, the Bulletin of the American Association of Petroleum Geologists, and the Transactions of the American Institute of Mining and Metallurgical Engineers. Some papers concern relatively old surveys, and none deal as yet with measurements from the air. The material is divided into sections which cover introductory statements, case histories relating to salt domes, and case histories reported from the mid-continent region, the Rocky Mountain region, California, and foreign countries. The case histories generally discuss geophysical results in relation to subsequent drilling data and omit descriptions of the field techniques and instruments used in the surveys. An author-and-subject index and a map-and-figure index are provided.—*V. S.*

10921. Ny, T. Z., and Ku, K. G. Gravity, geomagnetic, and geophysical-prospecting work of the Institute of Physics, National Academy of Peking: Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp. 92–95, Nanking, 1948.

A brief account is given of investigations in theoretical and applied geophysics carried out at the Institute of Physics, National Academy of Peking, since its establishment in 1929. The work has included gravimetric and magnetic surveys throughout the accessible parts of China, the results of which have been summarized by P. Lejay in "Exploration gravimétrique de l'Extrême-Orient, 1936" and by M. Burgaud in "Carte magnétique de Chine, 1937." The measurements of gravity were made with a Holweck-Lejay pendulum and those of geomagnetism with a Helmholtz-coil magnetometer of the Smith type and an Askania earth inductor. Beginning in 1937 these surveys were discontinued because of the Sino-Japanese war, and magnetic, self-potential, and resistivity prospecting methods were applied in southwestern China in quest of metalliferous ores. Exploration centered in 11 mining districts containing iron, tin, lead, zinc, pyrite, lignite, and copper deposits located mostly in Yünnan. The results obtained have been published in 12 mimeographed reports in the Chinese language by the Institute of Physics.—*V. S.*

10922. Patrick, H. G. Case history of the Friendswood (Webster) oil field, Harris County, Texas, in Geophysical case histories, vol. 1, 1948, pp. 74–84, Menasha, Wis., Soc. Expl. Geophysicists, 1949.

The Friendswood (Webster) oil field, located in Harris County, Texas, is on a deep-seated salt-dome type of structure. Since there is no surface expression of this structure, oil operators were not attracted to the area prior to the advent of modern geophysical exploration. Early geophysical work consisted of short refraction fan-shots and torsion balance surveys. The Humble Co. drilled two wells on a lease block

acquired on torsion balance data in 1929. These and additional wells drilled in 1933 revealed the presence of structure but were not commercially productive.

In April 1934 the Humble Co. was attracted again to the area by subsurface information obtained from a well on the south flank of the structure and discovered the Friendswood dome by a reflection seismograph survey. The productive area is 4,025 acres and yields oil from 206 wells.—*Author's abstract, condensed by V. S.*

10923. Richards, T. C. Scientific oil prospecting—an account of geophysical methods used in the Bahamas survey: Discovery, vol. 9, no. 9, pp. 274–280, London, 1948.

The adaptation of gravitational, magnetic, and seismic methods of prospecting to marine surveying is illustrated by oil exploration in the shallow waters of the Bahama Islands. Gravity surveys were made from platforms on rigid tripods set on the sea floor, or conical diving chambers equipped with an airline and lowered to the bottom from the parent ship, or specially housed gravimeters set in position and operated at depths of as much as 200 feet by remote control from a ship; position fixing was effected by means of radar. In deeper waters such investigations can be conducted with a gravimeter installed on gimbals in a submarine which submerges to a constant depth.

Magnetic surveys in the Bahamas were made with an airborne magnetometer recording changes in the earth's total magnetic field and housed in a streamlined case which was towed by an aircraft by means of a cable. For ground control two boats equipped with shoran transmitters were stationed 30 miles apart and were gradually moved to new positions as a unit, while the aircraft flew circular paths around one of them, picking shoran signals from both. Seismic surveys in water-covered areas can be made easier by mounting the geophones on gimbals, floating them by combined buoys and sinkers for towing in mid-water, and tying the geophones cables together along their common lengths. Other adaptations of geophysical methods to marine surveying are outlined.—*V. S.*

10924. Rozanov, L. N. Geophysical exploration in the region of the middle Volga [in Russian]: Neftianoe Khoziaistvo, vol. 26, no. 6, pp. 33–37, Moscow, 1948.

The efficacy of magnetic, gravitational, seismic, and electrical methods of petroleum exploration in the middle Volga is appraised on the basis of their application in this region, and recommendations are made for further work. Though the local magnetic anomalies are not characteristic of sediments but of the crystalline basement, magnetic surveys can be useful because the basement bears a relation to the structure of sedimentary formations. Gravitational anomalies likewise reflect mainly the deeper density contrasts, obliterating those in sedimentary layers, but furnish conclusive indications of general regional geology and of zones of strong dislocations. Seismic methods have been in little use so far because of rugged local relief and unfavorable surficial layers but could be advantageous in certain areas. Of all geophysical approaches the electrical methods has yielded the greatest number of oil-bearing and gas-bearing structures, being responsible for

the discovery or delineation of about 100 dome structures in the Kuybyshev area alone. This success is attributed in part to the development of a technique of close correlation of electrical and geological data.—*V. S.*

10925. Shih, Y. H.   Geophysical work in Taiwan: Chinese Geophys. Soc. Jour., vol. 1, no. 1, pp. 96–98, Nanking, 1948.

Past and present geophysical investigation on Taiwan is outlined. The work has been carried on for more than 49 years and has included meteoreological, geomagnetic, seismic, oceanographic, and atmospheric-electrical observations. The activities and main results in each department are indicated briefly.—*V. S.*

10926. Sloat, John.   Geophysical history of Rio Bravo field, California, in Geophysical case histories, vol. 1, 1948, pp. 569–585, Menasha, Wis., Soc. Expl. Geophyicists, 1949.

The Rio Bravo field, first Vedder zone discovery in the San Joaquin Valley, California, was originally surveyed by seismograph in 1935. Details of this and a later pre-drilling survey in 1937 are discussed. The spread used in the 1937 survey was 800 feet long, noncontinuous, with the shot hole offset 200 feet opposite the center. Several strikes were computed and plotted, indicating a closed structure in the Miocene.

The seismograph maps made from these surveys and the present production maps of the field are found to agree in general outline but show discrepancies in the amount and location of closure which can be attributed to the astounding velocity gradient recorded across the field. The effect of this gradient on seismograph results is discussed. Magnetometer and gravimeter surveys made after the drilling of the discovery well have revealed closed maxima near the crest indicated by the seismic data ; the gravity maximum is shifted somewhat to the southwest.—*Author's abstract, amplified by V. S.*

10927. Starmont, D. H.   Y.P.F. intensifies exploration in northern Argentina [in English and Spanish]: Petroleo Interamericano, vol. 6, no. 1, pp. 56–61, 80, Tulsa, Okla., 1948.

A review is given of geophysical and geological exploration by Yacimientos Petroliferos Fiscales (Argentine Government Oil Field Administration) in the province of Salta in northern Argentina. At the end of 1946 a total of almost 49,000 square kilometers had been explored by means of various geophysical methods in the northern districts of Orán, Rivadavia, and Anta, including 4,200 square kilometers covered by seismic-reflection surveys. The work, combined with geological investigations, resulted in the discovery of several promising structures, such as the lower Sierra de Orán, Sierra de Macuta, Sierra Aguarague, and others. Areas of reconnaissance and of detailed surveys are shown on maps.

During 1947 exploration was made in the northern extremity of Salta by seismic reflection and refraction parties and a gravimetric party. Plans for 1948–51 call for seismic, gravimetric, and magnetic surveys, particularly in the llanos devoid of outcrops. The work has already started on the Río de los Salteños in the Chaco and in the Orán and Riva-

davia districts.   Geological studies point to the northern part of Salta as
the most promising.—*V. S.*

10928. Straley, H. W.   The coastal plain of North Carolina: Elisha Mitchell
Sci. Soc. Jour., vol. 64, no. 2, pp. 250–252, Chapel Hill, N. C., 1948.

About the middle of the last decade interest developed in finding pe-
troleum in the eastern seaboard states.   The article reports on progress
in search for oil in North Carolina.   It describes the geology of the
region under consideration and gives an account of the geophysical work
done.   North of the Dismal Swamp gravitational, magnetic, and seismic
surveys have been conducted by Lehigh and Princeton Universities.
The University of North Carolina conducted extensive geophysical ex-
ploratory work in both North and South Carolina.   Oil companies have
explored parts of the plain in considerable detail.   A sharp change of
gradient near the coast is reflected in all profiles.   A magnetic anomaly
was found along the Cape Fear River.   It may be interpreted as rep-
resenting the nearness of crystalline rocks to the surface.   In the
opinion of the author the Pamlico basin deserves more thorough in-
vestigation.—*S. T. V.*

10929. Tuve, M. A., editor.   Journal of Geophysical Research, the continuation of
Terrestrial Magnetism and Atmospheric Electricity (1896–1948), an
international quarterly, Baltimore, Md., The Johns Hopkins Press,
March 1949.

Beginning with March 1949 the journal "Terrestrial Magnetism and
Atmospheric Electricity" will be known as the "Journal of Geophysical
Research" and will expand its coverage of theoretical and experimental
geophysics.   In addition to the subjects previously dealt with, the pub-
lication will present papers on physics in geology and oceanography;
studies of special features of the earth's crust, including gravity anom-
alies, experimental seismic waves, and tilt; and investigations of the
upper atmosphere, solar and terrestrial relationships, auroras, and
other topics.   It is proposed to give an international journal directed
toward purely scientific goals and providing a medium for exchange of
borderline information between workers in different branches of geo-
physics.—*V. S.*

10. RELATED GEOLOGICAL SUBJECTS

10930. Ashirov, K. B.   The problem of the sub-salt oil of southern Emba oil
field [in Russian]: Neftianoe Khoziaistvo, vol. 26, no. 11, pp. 38–44,
Moscow, 1948.

The Emba oil region of the U. S. S. R. has been exploited only with
respect to the oil accumulated about the top of its salt structures.   Dur-
ing 1930–35 some boring was done to reach the sub-salt oil but it did
not proceed beyond a depth of 2,165 meters, a depth insufficient for
reaching the sub-salt oil.   The author examines the possibilities of oil
accumulation at the base of the local salt domes in the light of the
available geologic, gravitational, and seismic evidence and finds them
favorable in several respects.

The Artinsk strata underlying the Emba domes apparently consist of
limestones which, together with dolomites, are the only rocks known to

form oil reservoirs under salt structures. In the adjacent provinces of Bashkirskaya ASSR, Aktyubinskaya Oblast', and Chkalovskaya Oblast' these strata contain considerable oil and gas. The depressions at the base of domes theoretically are likely to form traps conducive to oil accumulation, and the presence of such traps in Emba has been confirmed by boring and seismic reflection. Other favorable considerations are given, and the depth of drilling necessary to reach sub-salt horizons is estimated to be about 3,000 meters.—*V. S.*

10931. Bilibin, Iu. A. Problems of the metallogenic evolution of geosynclinal zones [in Russian] : Akad. Nauk SSR Izvestia, Ser. Geol., no. 4, pp. 51–66, Moscow, 1948.

The author advances the hypothesis that the development of metallogenic zones coinciding with extensive structural elements of the earth's crust occurs according to a unified plan and consists of two stages which correspond to the formation of external and internal zones. The metallogenesis of external zones is characterized by the type of mineralization found in the Ural Mountains (Ural'skiy Khrebet), U. S. S. R. The metallogenesis of internal zones is divided into that characterized by the Far-Eastern type of mineralization and that characterized by the western European type. Each type of mineralization is described briefly. The hypothesis is supported by numerous examples.—*Author's abstract, translated by V. S.*

10932. Conolly, H. J. C. Geology in exploration : Australian Inst. Min. Metallurgy Proc., new ser., no. 143–144, pp. 156–187, Melbourne, 1946.

The origin of ore deposits is discussed to aid exploration for gold, copper, tin, lead, and zinc, known to exist in Australia. A study of structural geology shows that the distribution of ore bodies is associated with rock solidity, the elongation of weak rocks, and the shear of strong rocks, as the result of the repetitive or intermittent character of fracturing. Among these factors particular attention is given to the elongation of rocks which is illustrated by the example of the Cobar copper and gold field in New South Wales, thought to be characterized by intersecting stretch thrusts. Reference is also made to the part played by intrusives in fracturing. Geologic considerations are applied to the planning of drilling sites.—*V. S.*

10933. Hess, H. H. Major structural features of the western north Pacific, as interpretation of H. O. 5485, bathymetric chart, Korea to New Guinea : Geol. Soc. America Bull., vol. 59, no. 5, pp. 417–445, Baltimore, Md., 1948.

This is an explanatory text to the bathymetric chart, constructed by the U. S. Navy, Hydrographic Office, and published as H. O. 5485. It contains data on the sources of information and on the process of construction of the chart, as well as on the main geologic features of the area covered. Special sections contain a description of its volcanic and seismic activity and a discussion of gravity anomalies observed. An additional map shows the location of numerous active and inactive volcanoes and of several submarine volcanoes. Also, a special map is presented of the foci of shallow-focus and deep-focus earthquakes observed in the area. The seismic and volcanic activities are related to the buckling of the earth's crust, that is, to the tectogene. The gravita-

tional field is described on the basis of numerous gravity measurements of Japanese observers in the northern part of the area and of French and Dutch investigators in the south. Several positive and negative anomalies were found and their geologic meaning is discussed.—*S. T. V.*

10934. Kosygin, Iu. A., Shvemberger, N. A., and Nikitina, Iu. P.   On certain regularities in the location of salt domes in the southern Emba region [in Russian] : Moskov Obshch. Ispyt. Prirody Biull., Otd. Geol., vol. 23, no. 2, pp. 63–66, Moscow, 1948.

The salt domes disposed on the periphery of the limestone depression of Baychunas in the southern Emba region, U. S. S. R., are discussed as evidence that the location and orientation of domes in western Kazakhstan is related to localized depressions within the pre-Caspian geosyncline. Maps drawn of the isopach contours of the lower limestone layers reveal a close correlation between these layers and the positions of domes. Furthermore, the development of domes within the depression has been more intensive than elsewhere, the domes here have been subject to greater erosion than domes outside the depression, and the beginning of meridional orientation in the domes coincided in time with the formation of the depression. Other relationships are noted between the domes and the depression in support of the hypothesis of a geologic connection between them. The text is illustrated by sketch maps.— *V. S.*

10935. Krynine, P. D.   Mineralogical research on oil reservoirs : Mineral Industries, vol. 18, no. 4, pp. 1–3, State College, Pa., 1949.

The art of finding oil is based essentially upon the anticlinal theory, which is almost a century old. The possibilities of applying this theory in the United States, particularly in the Appalachian region, are largely exhausted.

During the last few years several investigators have developed a new theory concerning the controlling factors in the occurrence of oil, namely the presence of an adequate reservoir, capable of storing oil in preference to other fluids. The porosity of the formation must be considered as the decisive factor. Because finer pores contain water, and only the larger ones contain oil, the pore pattern is an important consideration. The author emphasizes the importance of studying porosity to find a means for the measurement and characterization of this property as the new method of oil finding.—*S. T. V.*

10936. Lawson, A. C.   Some further implications of the doctrine of isostasy : Geol. Soc. America Bull., vol. 59, no. 3, pp. 197–210, Baltimore, Md., 1948.

J. Barrell's hypothesis of the asthenosphere is shown to have resolved the initial difficulties in the development of the theory of isostasy by explaining the operation of isostatic processes. Some geologic implications are then drawn from these processes, principally that the zone of least resistance in the asthenosphere is located at a shallower depth than Barrell has supposed, and that it comprises the basalt, which must first be displaced by the descending roots of growing mountains before the dunite is reached. Evidence for these deductions is found in several broad geologic readjustments. Among them particular atten-

tion is given to the processes of depression and uplift during deltaic and orogenic cycles, to the renewal of topographic relief by orogenic movements caused essentially by horizontally compressive stress in excess of the local strength of the earth's crust, and to the shifting of loads under the control of isostatic balance, occasioned in part by the melting of three-quarters of the volume of the continental ice sheets since the time of maximum glaciation and by the consequent changes in sea level.—*V. S.*

10937. Li, Hsiao-Fang. Bibliography of geology and geography of Sinkiang: Nat. Geol. Survey of China, Bibliography of Chinese Geology, 213 pp., Nanking, July 1947.

The literature on the geology, geography, geophysics, ethnography, and other physical features of Sinkiang, China, is listed by author and subject. The entries include books, articles, and maps, in Chinese, English, German, French, Russian, and other languages published during the 19th and 20th centuries. The geologic subjects are general geology, mineralogy, petrography, paleontology, glaciology, ore deposits, and soils. Geophysics is represented by entries on meteorology, climatology, geodesy, gravitation, geomagnetism, and seismology. Several general bibliographies on Sinkiang are included.—*V. S.*

10938. McKinstry, H. E. Mining geology, 680 pp., New York, Prentice Hall, Inc., 1948.

This book deals with various phases of the application of geology to mining. The contents cover the procedures of assembling and correlating data on ore deposits, including geologic mapping, sampling, geophysical surveying, and laboratory techniques; geologic guides aiding in ore search and ore appraisal, such as physiographic, mineralogical, and structural clues; use of geology in the field exploration of deposits, in the examination and evaluation of mines and prospects, and in the operation of mines; and amenability of ores to metallurgical treatment. The text is supplied with numerous citations from geologic literature, with illustrations, and tables.—*V. S.* (A review appeared in Min. Eng., vol. 1, no. 1, sec. 1, pp. 39–40, New York, 1949.)

10939. Ruby, G. M. Petroleum possibilities along eastern front of the southern Andes: World Oil, vol. 127, no. 12, pp. 215–220, Houston, Tex., 1948.

Several geologically distinct basins show oil possibilities in the vast region extending over 1,600 miles along the eastern front of the southern Andes, from the Tupungato oil field in Argentina to the Spring Hill oil field in the Chilean part of Tierra del Fuego. The Mendoza basin, the northernmost of the Patagonian embayments, contains two fields producing from sands of Rhaetic age and from overlying tuff probably Jurassic in age, and has two other areas of promising structures. In the basin south of Río Diamante and north of Río Colorado reservoir rocks are lacking, but surface indications suggest upper Jurassic and lower Cretaceous oil-bearing shales. An extensive sedimentary basin of unknown depth, covered by beds of late upper Cretaceous age, extends southward to Río Neuquén and Río Negro, reaching the general vicinity of the large embayment that contains the oil district of Plaza Huincul between Río Neuquén and Río Limay. The basin of Comodoro Riva-

davia comprises near its western limit two large anticlinal uplifts, where
the lower tuff series appears to grade upward into oil-bearing strata, and
has in its central part various oil sands underlain at a depth of several
thousand feet by harder tuffs containing Jurassic fossils. The geologic
features of these and other promising area are described, and a sketch
map of the region is given.—*V. S.*

10940. Schwartz, G. M.   Some aspects of ore deposits important in geophysical
work [abstract] : Geophysics, vol. 13, no. 3, p. 506, Tulsa, Okla., 1948.

The application of geophysics to mining problems is much more diffi-
cult than to petroleum problems. The fundamental contrasts between
the occurrence of petroleum and ores are outlined. Difficulties arise
because of the great complexity and variation in occurrence of commer-
cial metallic and nonmetallic minerals. These complexities are dis-
cussed, and illustrations are cited in terms of mineralogic, petrographic,
structural, and genetic variations in ores.

One of the important problems in the application of geophysics to ore
finding is determining the definite relations of ore to specific geologic
features, so that the results of geophysical work can be interpreted in
terms of the probable location of more ore. This is essentially a
geologic problem and one not easily solved in many districts. For the
successful application of geophysics and interpretation of the results, a
very detailed knowledge and understanding of the geology is funda-
mental. Also additional geophysical methods are required, particularly
those which might locate ore directly rather than indirectly, through
geology, as is largely the case in petroleum.

Because of the complexities involved, no one method should be con-
sidered a true test of an area, but several methods should be utilized.
Much more extensive and intensive application of geophysics to prob-
lems of ore-finding is demanded by the rapid depletion of present ore
reserves.

10941. Strakhov, N. M.   Distribution of iron in the sediments of lake and sea
basins, and the factors controlling it [in Russian] : Akad. Nauk SSSR
Izvestiia, Ser. Geol., no. 4, pp. 3–50, Moscow, 1948.

Geologic processes governing the distribution of iron in the sediments
of lake and sea basins are studied in the light of the migration of iron
particles in waterways, relative iron concentration in various basins, and
geochemistry of ore sedimentation. A method of comparative lithology
is used, consisting in investigating mechanics of iron distribution and
sedimentation in the present water basins and utilizing the data for a
reconstruction of the same processes in earlier epochs.

The evidence shows that usually the primary factors determining iron
distribution in a basin are the influx of river waters laden with iron
particles and the erosion of shores. Other, infrequent factors can be
ground waters, hydrothermal processes, depth currents, and intensive
diagenetic migrations of iron. Notwithstanding their diversity, all
these secondary factors produce the same anomalous type of iron dis-
tribution characterized by a shift of deposition toward the shore from
pelite facies to silt-and-sand facies.—*V. S.*

10942. Wilson, J. T.   Some aspects of geophysics in Canada with special reference to structural research in the Canadian Shield, Part 2: Am. Geophys. Union Trans., vol. 29, no. 5, pp. 691–726, Washington, D. C., 1948.

The use of air photographs in interpreting some geologic features of the Canadian Shield is illustrated, and the method is applied to several large areas.   It is shown that many large faults can be distinguished. With the aid of existing field data and physical theory, an attempt is made to classify these structures and to show the direction of the major orogenic forces which produced them.   The faults have been divided into groups which, it is suggested, are connected with the folded roots of several former mountain ranges. The arrangement of these and later ranges outside the Shield suggests that the North American continent has grown by the accretion of successive systems of mountains arranged tangentially along the former margins of the continent.—*Author's abstract.*

11. TECHNICAL AIDS TO EXPLORATION

10943. Baver, L. D.   Soil physics, 2d ed., 398 pp., New York, John Wiley & Sons, 1948.

The physical properties of soils which determine their mechanical behavior are discussed for college students and professional men.   The subjects covered include the mechanical composition, consistency, and structure of soils; the physical characteristics of soil colloids; the water and air content and the temperature of soils; and physical properties of soils in relation to runoff, erosion, and tillage.   Information concerning recent work with the electron microscope on the shape of soil particles, on the relationship between soil and moisture, and on developments in the field of soil structure and aeration is included in the 2d edition.   Selected references supplement chapters.—*V. S.*

10944. Beringer, C. C.   Geologisches Wörterbuch [Geologic dictionary], 2d ed., 154 pp., 66 figs., 5 tables, Stuttgart, Germany, F. Enke, 1943.

This German dictionary gives definitions and explanations of terms employed in geology, paleontology, mineralogy, soil science, and related fields.   The text contains German equivalents of foreign terms in general use, systematized geologic tabulations and schematic drawings, and a sixfold classification and index of 92 principal types of geologic formations.   The 2d edition is expanded by the addition of 200 new entries—*V. S.*

10945. Breed, C. B., and Hosmer, G. L.   The principles and practice of surveying, vol. 2, Higher surveying, 6th ed., 674 pp., New York, John Wiley & Sons, 1947.

In the sixth edition of this book (*see* Geophysical Abstracts 95, no. 4720) extensive revisions have been made.   The chapter on triangulation has been rewritten to conform with current practice, and recent developments have been included.   The symbols have been revised to conform with those now used by government agencies.   Part 3, on photogrammetric surveying, has been entirely rewritten to include recent developments in this field.   Definitions and symbols have been revised to

agree with the recommendations of the American Society of Photogrammetry. Chapter 8 on aerial photogrammetry has been expanded to include a fuller treatment of methods and instruments used for compiling maps from aerial photographs. The chapter on stereo-photogrammetry has been considerably enlarged.—*S. T. V.*

10946. Gringorten, I. I.   Long-range flight by single magnetic heading: Am. Geophys. Union Trans., vol. 29, no. 5, pp. 640–646, Washington, D. C., 1948.

The purpose of this paper is to describe a system which will enable a navigator to plan a long-range flight that will require only one heading of the aircraft by his magnetic compass. Such a system will make possible automatic flying or the flight of pilotless aircraft. The paper shows how to find the track that the aircraft should follow, giving one example of a cross-country flight near the 10,000-foot level.—*Author's abstract.*

10947. Hanahen, P. M.   Explosives accidents on geophysical crews: Geophysics, vol. 13, no. 3, pp. 421–427, Tulsa, Okla., 1948.

This paper discusses accidents caused by the improper handling of explosives by geophysical crews. Geophysical companies are reported to have experimented since the war with aluminum loading poles, the use of which has resulted in premature ignitions of detonators by the electric current generated by the galvanic cell formed by these poles, the alkaline mud, and the steel casing of the shot hole. A brief summary is presented of the tests made by the U. S. Bureau of Mines on the amount of this electric current (U. S. Bur. Mines Rept. Inv. 3852), and consideration is given to the probability that ignition of detonators was caused by static electricity while the primer was being prepared. From the data reviewed the author concludes that there is a need for establishing a set of standard safety regulations in the geophysical industry, and that before any new equipment is introduced it should be examined to insure that a new hazard is not incurred. Only a safe geophysical crew operates economically and efficiently.—*Author's abstract, condensed by V. S.*

10948. Horn, J. W.   Use of the light airplane in geophysics [abstract]:   Geophysics, vol. 13, no. 3, p. 494, Tulsa, Okla., 1948.

A light airplane has several uses in geophysical work. It has been found to be both effective and economical for the scouting of prospective areas and of areas under survey; in some localities supervision can be greatly expedited. It is also very useful for transportation of personnel, equipment, and supplies when time is an important factor. The plane can be used to maintain close contact between the field office and the central office with an appreciable saving of time. It has been used in special emergencies and in one case probably saved a man's life. The most useful plane is one with a top cruising speed of approximately 100 miles per hour, a minimum safe cru'sing speed of about 65 miles per hour, and a landing speed of about 45 miles per hour. Total cost of operation of such a plane, with moderate flying time, approximates the cost of the same transportation by automobile.

10949. Hurault, Jean. Manuel de Photogrammetrie [Handbook of photogram-metry], 405 pp., Paris, Institut Geographique National, 1947.

This is a textbook of photogrammetry, containing the following chapters: History and evolution of photogrammetric methods; the human eye, binocular vision, stereoscope; photographic cameras, simple lens and multiple lens, aerial photography; process of rectification, graphic and instrumental; photographic triangulation; stereophotogrammetry, formation of relief; and stereotopography. The book contains a detailed theoretical discussion of the problems presented on the basis of axonometric relations and a description of different instruments used in practical work for automatic or semiautomatic solution of the problems.—*S. T. V.*

10950. Lauritsen, C. C., and Lauritsen, T. A null-reading fluxmeter: Rev. Sci. Instruments, vol. 19, no. 12, p. 916, Lancaster, Pa., and New York, N. Y., 1948.

The authors give a description of a simple, but sufficiently precise, null-reading fluxmeter for relative magnetic field measurements. Its sensitivity is about 0.03 percent of the full-scale deflection of the pointer. The measurement of the magnetic field consists of a determination of the intensity of the current required to hold a coil in a special orientation against a constant torque. The magnet is water-cooled, making the instrument almost insensible to temperature variation. The article gives a description of different parts of the instrument with important details illustrated by drawings. A fluxmeter of this type has been used for over a year with less than 0.2 percent change in calibration.—*S. T. V.*

10951. Makarov, P. O. A clock for measuring and registering very short intervals of time [in Russian]: Akad. Nauk SSSR Doklady, vol. 61, no. 5, pp. 833–836, Moscow, 1948.

This is a description of a modified clock mechanism of K. Lucas, used for measuring very small intervals of time. The author claims the following advantages for this instrument: the range of the scale can vary from 0.03 to 15 milliseconds, with an attainable accuracy of 3.3 microseconds; the mechanism makes possible the simultaneous observing and timing of as many as twelve phenomena; the inertia of the electric registration has been substantially decreased and thus the accuracy of the instrument enhanced; this instrument is provided with an attachment for photographic recording and kinematographic observation.

The article contains several pictures of the instrument and a diagram of electrical connections.—*S. T. V.*

10952. Mertie, J. B., Jr. Application of Brianchon's theorem to construction of geologic profiles: Geol. Soc. America Bull., vol. 59, no. 8, pp. 767–786, 13 figs., Baltimore, Md., 1948.

A method for constructing a profile normal to the strike of the rocks and for measuring stratigraphic thickness is described, which consists in utilizing five observations of dip along a suitable linear traverse. Graphical methods are also given for constructing a parabolic evolute from four observations and a circular evolute from three observations. All these methods are adaptations of the general method of evolutes and

involutes and are offered as quicker though somewhat less accurate means of obtaining similar results where structural conditions justify their use. The underlying mathematical analysis, based on Brianchon's theorem, is presented. Additional points on the conic evolutes are obtained by the application of Pascal's theorem.—*Author's abstract, condensed by V. S.*

10953. Mott, P. C.   Maps from the air: South African Min. and Eng. Jour., vol. 58, pt. 2, no. 2866, pp. 529-532, Johannesburg, 1948.

Photogrammetry is defined as the science of measurements from photographs, and its history, current progress, and applications are outlined. Among the recent advances are listed thermostatically controlled cameras, camera-stabilizing controls, automatic pilots, and position fixing by radar and radio. Illustrations show the Williamson O. S. C. camera, which can be heated at great altitudes, and the Wilde "Autograph A.5," by means of which topographic photos are observed stereoscopically and can be mapped on scales of 1:1,000, with contours at 5-foot intervals.—*V. S.*

10954. Pires de Matos, Manuel.   Manual de Astronomia Geodesical [Handbook of geodetic astronomy], 161 pp., Lisbon, Portugal, Publicações do Sindicato Nacional dos Engenheiros Geografos, 1941.

This is a manual of geodetic astronomy covering topics of interest to geophysicists in connection with gravitational or magnetic surveys. It deals with the simplest methods of determinating the geographic coordinates of a point, chronometer correction, and the azimuths of stars, as well as with the calculation of various reductions. The author derives the necessary formulas of spherical astronomy and gives many practical examples and problems. The necessary instruments are described and instructions for their use are given.—*S. T. V.*

10955. Taylor, D., and Westcott, C.   Principles of radar, 137 pp., Cambridge, England, University Press, 1948.

This book is designed as a brief introduction to the basic principles underlying the design of complete radar systems. The contents cover the generation and detection of the radio signals by which targets are located, the physical conditions governing the strength of the echo returned, the measurement of range and bearing, and the design of typical radar systems for particular purposes. An elementary acquaintance with normal radio practice is presupposed.—*Review by J. M. M. Pinkerton, Endeavour, vol. 7, no. 28, p. 174, London, 1948, condensed by V. S.*

10956. Tham, Persy.   Photogrammetric orientation data and determination of their accuracy: Royal Inst. Technology Trans., no. 14, 38 pp., Stockholm, 1947.

Pothenot's problem, encountered in photogrammetric resection procedures for determining the position of an air photograph relative to the ground, has been given a practical solution after O. von Gruber abandoned the previously used analytical methods in favor of principles of perspective. However, Gruber did not develop a complete solution. Adopting the same approach the author seeks to clarify further the

problem and its treatment, and particularly to elucidate the methods of determining the accuracy of.photogrammetric-orientation data in cases where supernumerary measurements are used. Attention is given to the determination of the accuracy of coefficients of mathematical perspective derived by means of supernumerary measurements in calculating the most probable shape of generating rays.—*V. S.*

12. PATENTS

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

10957. (1) Hängend angeordnete Drehwaage [Suspended torsion balance]. August K. Birnbaum, Triangel b. Gifhorn, Germany: German patent 738,610, issued Aug. 23, 1943.

A gravity-measuring apparatus of the type of a torsion balance is suspended inside a water-tight casing equipped with a device for lowering it into water. Claims allowed, 1.

10958. (2) Magnetometer. J. D. Seaver, Marblehead, Mass., assignor to General Electric Co., a corporation of New York: U. S. patent 2,447,880, issued Aug. 24, 1948.

A magnetometer comprising a pivoted shaft, a pointer on said shaft, a scale with which said pointer cooperates, a spring for rotatively biasing the shaft toward a zero pointer scale indicating position, and a permanent magnet armature on the shaft less than $\frac{1}{16}$ inch in diameter and polarized in a direction at right angles to the shaft and made of an alloy of silver, manganese, and aluminum having a coercive force of the order of 6,700 oersteds and a maximum permeability of the order of 1.11. Claims allowed, 5.

10959. (2) Magnetic field gauge. M. L. Mages, and G. W. Coon, Chicago, Ill., assignors to Magnaflux Corp., Chicago, Ill., a corporation of Delaware: U. S. patent 2,447,911, issued Aug. 24, 1948.

A magnetic field gauge pick-up head comprising a laminated U-shaped paramagnetic core, at least one inductance coil mounted on said core, and paramagnetic boots mounted on the lower ends of the legs of said core, said boots having portions thereof extending between laminations whereby better magnetic contact is maintained between said boots and said legs. Claims allowed, 1.

10960. (2) Magnetic detector. F. G. Merrill, Chatham, N. J., assignor to Bell Telephone Laboratories, Inc., New York, N. Y., a corporation of New York: U. S. patent 2,448,613, issued Sept. 7, 1948.

In a magnetic detecting system, the circuits comprising a source of alternating current of fundamental frequency, a magnetometer having at least one winding thereon, a filter connecting said source to a winding on the magnetometer, said filter passing most readily only currents of fundamental frequency, utilization means responsive to a selected even order harmonic voltage generated in said magnetometer, a second filter connecting the utilization means directly across a winding on the magnetometer, said second filter passing most readily only currents of

the selected even order harmonic frequency, and a frequency selective shunt path connected directly across a winding of the magnetometer, said path passing most readily only currents of third harmonic frequency generated by the magnetometer, whereby the selected even order harmonic output voltage of the magnetometer is rendered less sensitive to changes in the excitation voltage of said source of fundamental frequency. Claims allowed, 7.

10961. (2) Apparatus for orientation. Eugen Merten, Houston, Tex., assignor to Shell Development Co., San Francisco, Calif., a corporation of Delaware: U. S. patent 2,451,443, issued Oct. 12, 19⁻8.

In a system for orientation with regard to the earth magnetic field, two coils each mounted for independent oscillation about a vertical axis in said field, means for adjusting the angular position of said coils about said axis, means for initiating an oscillation of said coils, and means for simultaneously and separately recording the voltages produced by the oscillation of said coils in the earth magnetic field. Claims allowed, 12.

10962. (2) Induction magnetometer. Alex Frosch, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,451,819, issued Oct. 19, 1948.

A magnetometer comprising, in combination, a coil arranged in a circuit including a potential indicating device, a relatively flat nonmagnetic high conductivity element, a mounting means securing the coil in fixed position, nonmagnetic means of stable elastic properties securing the high conductivity element to the mounting means for angular movement about a fixed axis and a driving means arranged to vibrate the element and move its plane through a small angle with respect to the axis of the coil at a relatively rapid rate, said high conductivity element being mounted in the electromagnetic field of said coil and with its plane, when at rest, substantially perpendicular to the axis thereof and adapted to vary the current induced in the coil when the element is in motion. Claims allowed, 4.

10963. (2) Instrument for geophysical exploration. Theodore Zuschlag, West Englewood, N. J., assignor to Hans T. F. Lundberg, Toronto, Ontario, Canada: U. S. patent 2,461,864, issued Feb. 15, 1949.

An instrument for geophysical prospecting comprising, a pair of magnetic compass needles of substantially the same pole strength, mountings for supporting the needles to operate in spaced planes with their axes of rotation in substantial alignment, means for simultaneous rotary adjustment of the mountings in opposite directions, and means for simultaneous rotary adjustment of the needles in the same direction in a plane at right angles to the planes of the first named adjustment. Claims allowed, 12.

10964. (3) Vibrating apparatus. E. W. Larsen. Elmhurst, Ill., assignor to Western Electric Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,438,756, issued March 30, 1948.

In a vibrating apparatus, a vibratory means to be vibrated, variable means for vibrating said vibratory means, a variable speed motor for

driving said vibrating means, an operative connection between said vibrating means and said vibratory means, and means for varying the action of said vibrating means to compensate for inherent elasticity between said vibrating means and said vibratory means including a driven cam, a cam lever driven by said cam, an adjusting lever for varying the vibratory action of said vibrating means, means for operatively connecting said adjusting lever to said vibrating means comprising reciprocatory elements movable in spaced parallel paths, a universal joint connecting said elements, and means for operatively connecting said adjusting lever to said cam lever at a selected position on the cam lever to vary the action of said adjusting lever on said vibrating means in accordance with the speed of the motor. Claims allowed, 15.
(*See* also Geophys. Abstract 135, no. 10704.)

10965. (3) Seismic method of locating faults. Alexander Wolf, Houston, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,449,921, issued Sept. 21, 1948.

A method of locating the position of a fault in an area in which the presence of a fault is suspected, which comprises selecting a series of shot points along a line substantially at right angles to the expected strike of the fault, placing groups of seismic detectors along said line of shot points, each group of detectors being disposed substantially symmetrically with regard to its respective shot point, firing an explosive at each of said shot points, recording seismic reflections received by said detectors from substantially horizontal beds to indicate the dip and position of said beds, recording other reflections obtained while simultaneously eliminating reflections from said substantially horizontal beds, and determining, from the reflections obtained from said substantially horizontal beds and from said other reflections, the position of the fault. Claims allowed, 1.

10966. (3) Apparatus and method for seismographic exploration shooting. Jerry D. Williams, Ninnekah, Okla.: U. S. patent 2,450,336, issued Sept. 28, 1948.

In apparatus for seismographic shooting, an anchor for an explosive charge adapted to be lowered into a bore hole and comprising, a support of an approximately triangular shape, in elevation, with an apex pointed downwardly and whose upper end is formed with an approximately horizontal supporting surface, an explosive charge on said surface whose transverse diameter is not substantially greater than the width of said surface, a post secured to one side of, and upstanding from, the support, means for securing the charge to the post, wall engaging members secured to the downwardly converging margins of the support and diverging upwardly from the support and whose free ends are adapted to yieldably engage the wall of the bore to prevent substantial upward movement of the anchor in the bore, said support post and said wall engaging members forming shields for the charge to shield the charge against the force of an explosion in the bore beneath. Claims allowed, 1.

10967. (3) Device for transmitting and receiving compressional energy. Hugo Benioff, Pasadena, Calif., assignor, by mesne assignments, to Submarine Signal Co., Boston, Mass., a corporation of Delaware: U. S. patent 2,450,412, issued Oct. 5, 1948.

A device for transmitting and receiving compressional energy comprising a casing having a radiating member at one side thereof with the external surface in acoustic relationship with the sound-propagating medium and the interior surface shielded therefrom, said radiating member comprising a heavy plate with elements aligned and projecting at right angles to the surface of the plate and forming longitudinal resonant vibratable elements in which the plate contains the nodal plane, and a second resonant vibrator for translating acoustic energy into electrical energy, or vice versa, attached at one end of said first resonant vibratable element, said second resonant vibrating element comprising a longitudinal resonant magnetostrictive shell attached at the end of said first vibrating element, a plate member supported from said radiating member, a permanent magnet positioned within said magnetostrictive shell and an energizing coil surrounding said shell and means suspended by said plate supporting both said permanent magnet and said coil. Claims allowed, 8.

10968. (3) Spark transmitter. Hugo Benioff, Pasadena, Calif., assignor, by mesne assignments, to Submarine Signal Co., Boston, Mass., a corporation of Delaware: U. S. patent 2,450,413, issued Oct. 5, 1948.

An ultra high frequency spark transmitter comprising an oscillatory circuit having a pair of opposed plates with discharge electrodes opposed to one another and an antenna system having an input loop one arm of which has a portion adjacent the discharge electrodes. Claims allowed, 7.

10969. (3) Means for the interchange of electrical and acoustical energy. Edwin E. Turner, Jr., West Roxbury, Mass., assignor, by mesne assignments, to Submarine Signal Co., Boston, Mass., a corporation of Delaware: U. S. patent 2,452,085, issued Oct. 26, 1948.

Means for the interchange of electrical and acoustical energy comprising a hollow cylindrical element the outer surface of which serves to radiate and receive compressional wave energy, a stack of laminations positioned in said cylindrical element with the plane of each said lamination being substantially at right angles to the axis of the cylinder, said laminations being of a magnetostrictive material and initially having a dished form and means provided at one end of said cylinder for compressing said laminations therein to make a good acoustic coupling between the edges of the laminations and the inner walls of the cylinder. Claims allowed, 6.

10970. (3) Sound producer and receiver. Edwin E. Turner, Jr., West Roxbury, Mass., assignor, by mesne assignments, to Submarine Signal Co., Boston, Mass., a corporation of Delaware: U. S. patent 2,452,086, issued Oct. 26, 1948.

Means for producing a beam of compressional waves comprising a radiating member having a substantially plane surface on one side and

the other side formed with concentric annular areas having radial sections in the form of cycloidal arches, and vibratory means comprising concentric cylindrical members firmly attached at the vertices formed by the cycloidal arches, an energizing coil positioned between the ends of the cylindrical members, said cylindrical members comprising magnetostrictive elements forming with the radiating member tuned vibratory systems with vibrational nodes in said cylindrical member away from the base of the cycloidal arches in the vicinity of said energizing coils. Claims allowed, 5.

10971. (3) Amplitude control. Darwin S. Renner, Dallas Tex., assignor to Geophysical Service Inc., a corporation of Delaware: U. S. patent 2,462,551, issued Feb. 22, 1949.

In an automatic gain control system for a vibratory event in a seismic amplifier the combination of, an attentuation network having input and output terminals, a plurality of resistors interconnecting said terminals, at least some of said resistors being filamentary and adapted to adjust attenuation by heating thereof, and means including a source of alternating current of a frequency widely displaced from the frequencies of the vibratory event, said source being connected to said resistors for conductively varying the heating of the resistors in a predetermined manner to control the output of the network. Claims allowed, 1.

10972. (4) Locator. Samuel Berman, Richmond Hill, N. Y., assignor to Waugh Equipment Co., New York, N. Y., a corporation of Maine: U. S. patent 2,437,455, issued March 9, 1948.

Apparatus for detecting the presence of metallic bodies, which comprises a detecting transformer including a primary and a secondary winding in inductive relation, a balancing transformer including a primary and a secondary winding in inductive relation, the primaries of the transformers being connected in series and the secondaries being connected in series but opposed, and a control device including a primary winding connected to a source of energy, a pair of secondary windings in inductive relation to the control primary, said control secondaries being connected in series with the transformer secondaries and with one another but in opposed relation to one another, and means movable within the field of the control primary for varying the effect of said field on the respective control secondaries. Claims allowed, 7.

10973. (4) Self-balancing potentiometer. Bernard J. Baecher, New York, N. Y.: U. S. patent 2,452,539, issued Nov. 2, 1948.

Electrical apparatus comprising a transformer having a pair of primary windings and a secondary winding, first and second sources of electric energy, means coupling said first source to develop a first voltage across one of said primary windings, means coupling said second source to develop a second voltage across the other of said windings in phase opposition with said first voltage, whereby a net voltage difference between said first and second voltages is derived at the terminals of said secondary winding, means responsive to said net voltage difference for adjusting said second voltage to a value minimizing said net voltage

difference, and means connected to said secondary winding for indicating the magnitude of the net-voltage-difference minimizing voltage. Claims allowed, 10.

10974. (5) Differential twin chanber neutron meter.   H. M. Parker, Oak Ridge, Tenn., assignor to the United States of America, as represented by the Atomic Energy Commission : U. S. patent 2,437,476, issued March 9, 1948.

In combination, two spaced ionization chambers equally responsive to gamma radiation and unequally responsive to neutron radiation, and means supporting said chambers for rotation about an axis midway between said chambers so that upon being rotated 180° the two chambers mutually interchange positions, whereby differences in gamma ray ionization due to directional effects undergo a change in sign for each 180° of rotation.   Claims allowed, 4.

10975. (5) Ionization chambers, Geiger-Müller tubes, and the like.   Arnold Graves, Surbiton, and T. J. Dawes, Bridgefield, Farnham, England, assignors to Alltools, Ltd., Brentford, Middlesex, England, a company of Great Britain : U. S. patent 2,449,697, issued Sept. 21, 1948.

An ionisation counter tube, for use in estimating and detecting alpha and beta particles and gamma radiation, comprising a single ionisation chamber having an outer envelope and containing a filling of intert gas, a press sealed into the envelope, and two electrodes only mounted on the press, said electrodes being a cathode in the form of a segment of a cylinder disposed with its concave surface facing a wall of the envelope and an anode coaxial with said cathode and said cathode being substantially insensitive to photons of wavelength adjacent the visible portion of the spectrum.   Claims allowed, 1.

10976. (5) Ionization chamber.   H. D. Roop, Los Angeles, Calif.: U. S. patent 2,458,099, issued Jan. 4, 1949.

An ionization chamber for the measurement of intensity of an ionizing radiation, said ionization chamber including : a housing providing an axis and including means for confining a gaseous substance therein, said housing including a thin window traversing said axis for transmitting the ionizing radiation to the interior of said housing and to the gaseous substance therein ; two electrode sets in said housing, each set comprising a plurality of tubular electrodes, concentric with said axis, the tubular electrodes of one set bisecting the spaces between the tubular electrodes of the other set to provide a plurality of small-width interelectrode spaces ; means for insulating the electrode sets from each other whereby a high potential difference can be maintained therebetween to establish electric fields in said interelectrode spaces ; and a coating of phosphor on at least some of said tubular electrodes to receive incident radiation transmitted through said window, said phosphor being excitable by such radiation to produce ultra violet radiation and thus produce a supplementary ionizing radiation for ionizing said gaseous substance.   Claims allowed, 10.

10977. (5) Method of detecting and measuring radiant energy for locating subterranean petroleum deposits. Walter Armstrong, Washington, D. C.: U. S. patent 2,461,799, issued Feb. 15, 1949.

A method of detecting radiant energy for the presence of subterranean petroleum deposits that comprises surrounding an ionization chamber with a shield against earthly ionizing radiation, charging negatively electrostatically the inner surface of said chamber, subjecting said shielded ionization chamber to the radiant energy emanating from subterranean petroleum deposits, determining the rate of change of charge on the inner surface of the ionization chamber and comparing that rate of change of charge with the rate of change of a negative electrostatic charge on the inner surface of the chamber when not subjected to the radiant energy emanating from subterranean petroleum deposits. Claims allowed, 6.

10978. (5) Apparatus for detecting and measuring radiant energy for locating subterranean petroleum deposits. Walter Armstrong, Washington, D. C.: U. S. patent 2,461,800, issued Feb. 15, 1949.

Apparatus for detecting radiant energy emanating from subterranean petroleum deposits encountered in a geophysical exploration, comprising an ionization chamber, shielding substantially impervious to earthly ionizing radiation incident upon said shielding surrounding the ionization chamber, and means for measuring the change in the ionization chamber charge during the operation of the apparatus. Claims allowed, 4.

10979. (5) Apparatus and method for detecting and measuring radiant energy for locating subterranean petroleum deposits. Walter Armstrong, Washington, D. C.; U. S. patent 2,461,801, issued Feb. 15, 1949.

Apparatus for detecting radiant energy emanating from subterranean petroleum deposits encountered in geophysical explorations for locating subterranean petroleum deposits, comprising an ionization chamber; an inclosing shield substantially impervious to earthly ionizing radiation incident upon said inclosing shield surrounding said chamber; two types of additional shields in alternation around the sides and bottom of said chamber, one of said types of shields being a gaseous shield for the disintegration of a portion of the radiant energy emanating from subterranean deposits of petroleum incident upon said shield and the other of said types of shields being a metallic shield for shielding the ionization chamber against earthly ionizing radiation and the radiant energy emanating from subterranean petroleum deposits except for a portion of said metallic shield between the ionization chamber and the earth's surface; and means for measuring the change in the ionization chamber charge during the operation of the apparatus. Claims allowed, 9.

10980. (5) Apparatus and method for detecting and measuring radiant energy for locating subterranean petroleum deposits. Walter Armstrong, Washington, D. C.: U. S. patent 2,461,802, issued Feb. 15, 1949.

Apparatus for detecting radiant energy emanating from subterranean petroleum deposits encountered in geophysical explorations for locating

subterranean petroleum deposits, comprising an ionization chamber, shielding surrounding the ionization chamber for shielding said chamber against earthly radiant energy except for a portion of said shielding between the ionization chamber and the earth's surface with the excepted portion of the surrounding shielding substantially impervious to earthly ionizing radiation incident upon said portion, and electronic means for measuring the change in the ionization chamber charge during the operation of the apparatus.   Claims allowed, 6.

10981. (5) Apparatus and method for detecting and measuring radiant energy for locating subterranean petroleum deposits.   Walter Armstrong, Washington, D. C.: U. S. patent 2,461,803, issued Feb. 15, 1949.

A method for detecting radiant energy emanating from subterranean petroleum deposits that comprises surrounding an ionization chamber with shielding against earthly radiant energy except for a portion of said shielding between the chamber and the earth's surface which excepted portion of the surrounding shielding shields the ionization chamber from earthly ionizing radiation, moving said ionization chamber and surrounding shielding to direct said excepted portion of the shielding at any desired angle in relation to the earth's surface, charging negatively electrostatically the inner surface of said chamber, subjecting said shielded chamber to the radiant energy emanating from subterranean petroleum deposits, determining electronically the rate of dissipation of the charge on the inner surface of said chamber, comparing that rate of dissipation with the rate of dissipation of a similar negative electrostatic charge on the inner surface of said chamber when shielded against radiant energy emanating from subterranean petroleum deposits, the presence of petroleum deposit emanations encountered from a limited area of the earth's substrata being detected thereby.   Claims allowed, 6.

10982. (5) Portable battery-powered gamma-ray counting rate meter of high sensitivity.   Herbert Cecil Spicer, Takoma Park, Md.:   U. S. patent 2,462,140, issued Feb. 22, 1949.

A portable highly sensitive device for detecting radio activity and indicating the relative intensity thereof, comprising a Geiger-Mueller counter tube, means for generating and applying a high voltage to the electrodes of said tube, means for amplifying the output pulses from said tube resulting from repeated ionization occurring therein responsive to the receipt of radiation, means connected to said amplifying means for indicating the rate of receipt of said pulses, in which said means for generating a high voltage comprises a relaxation oscillator, an interrupter tube, a rectifier tube, a regulator tube, with batteries for energizing the same, in which the relaxation oscillator is connected to be energized by one of said batteries, means for applying voltage pulses derived from said relaxation oscillator to a control grid of said interrupter tube, means for connecting said inductance in the anode circuit of said interrupter tube, whereby current flow therein is interrupted under control of said relaxation oscillator, means for connecting the inductance to the rectifier tube whereby the high-voltage pulses incident to the interruption of the current in said inductance are rectified, means for connecting the output of said rectifier tube through said filter to energize the Geiger-Mueller tube, and means for deriving a voltage from

said rectifier tube proportional to its output voltage and for applying said derived voltage to the control grid of said regulator tube, the anode of said regulator tube being connected by suitable resistance to the end of said inductance opposite to that end connected to the anode of the interrupter tube.   Claims allowed, 6.

10983. (7) Werkwijze voor het kwantitatief bepalen van brandbare gassen in gasmengsels, in het bizonder in de bodemlucht, voor het opsooren van koolwaterstofhoudende ruimten [Process for determining combustible gases in gas mixtures, especially in entrapped air, for detecting hydrocarbon-bearing areas].   Standard Oil Development Co., Linden, N. J.: Dutch patent 54,429, issued May 15, 1943.

   The change in the resistance of an electrically heated catalytic wire is measured at first in the atmosphere of the investigated gas mixture in its natural state and then in the atmosphere of this mixture set burning and freed thereby of all combustible components.   The difference in the two values is used as an index of the quantity of combustible components present in the mixture.   The procedure consists in passing the gas mixture through separate chambers for the two phases of the test.   (Free translation from Dutch.)   Claims allowed, 4.

10984. (7) Geophysical prospecting.   R. M. Squires, Alice, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,451,883, issued Oct. 19, 1948.

   A method of prospecting for subterranean petroliferous deposits which comprises collecting a number of soil samples at strategic locations in a prospect area, similarly and separately treating said samples by contacting with an organic solvent to extract significant organic constituents related to the sought deposits therefrom, subsequently removing said solvent from contact with said samples by evaporating said solvent from a relatively small fixed area of sample surface exposed to the atmosphere whereby the significant organic soil substances extracted from said sample are deposited on the exposed surface thereof, determining the fluorescence of the exposed sample surfaces, and correlating the fluorescence values obtained for the different samples in relation to the respective sampling locations in order to derive information as to the presence and location of a sought deposit.   Claims allowed, 10.

10985. (8) Method of determining the permeability of substrata.   Gerhard Herzog and Alexander Wolf, Houston, Tex., assignors to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,446,588, issued Aug. 10, 1948.

   A method of determining the permeability and porosity of an underground formation penetrated by a bore hole which comprises placing an artificially radioactive fluid in that portion of the hole which is in the vicinity of said formation, applying a constant pressure to force some of the liquid into the pore spaces of the formation, measuring the rate of increase in the radioactivity of the formation, continuing the application of said constant pressure until no further increase in radioactivity is noted and measuring the total increase in the radioactivity of the formation, the rate of increase being indicative of the

permeability of the formation and the total amount of increase being indicative of the porosity of the formation. Claims allowed, 7.

10986. (8) Well surveying instrument. Roland Ring, Houston, Tex., assignor to Sperry-Sun Well Surveying Co., Philadelphia, Pa., a corporation of Delaware: U. S. patent 2,450,060, issued Sept. 28, 1948.

A well surveying instrument comprising means for supporting a record member, means for recording position of the instrument on said record member, and temperature responsive means for controlling the recording action, the last mentioned means comprising a rotary spindle, and a thermally responsive element arranged to rotate said spindle upon occurrence of temperature changes and having a spline connection with the spindle for independent axial movement. Claims allowed, 10.

10987. (8) Method of logging boreholes. Alexander Wolf, Houston, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,450,365, issued Sept. 28, 1948.

A method of determining the nature of substrata traversed by a borehole containing connate liquid which comprises placing a liquid lighter than and immiscible in said connate liquid and containing a radioactive substance, in said hole, gradually increasing the pressure in the hole so as to force a portion of the radioactive liquid into the surrounding substrata to increase the radioactivity of said substrata, the interface between the connate liquid and the radioactive liquid being forced to descend with the increasing pressure, measuring the increased radioactivity of the substrata at any point a predetermined time interval after that point has been passed by the descending interface, continuously measuring the size of the hole at a point just above the descending interface, and subsequently measuring the total increase in said radioactivity after further increase has ceased. Claims allowed, 15.

10988. (8) Method of making geophysical explorations. Lawrence F. Athy, Ponca City, Okla., assignor to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2,452,515, issued Oct. 26, 1948.

The method of determining the nature of subterranean strata which comprises drilling through such strata and thereby creating significantly different physical waves while traversing significantly different strata respectively, translating such physical waves into correspondingly significantly different electrical impulses, and recording such electrical impulses. Claims allowed, 5.

10989. (8) Radioactivity logging device. Ralph E. Hartline, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,453,318, issued Nov. 9, 1948.

In well-logging apparatus sealed against the entrance of external moisture, including means in an elongated chamber for measuring minute electrical currents, said means including at least one high resistance insulator and at least one internal source of moisture, the combination of a conduit extending through a substantial length of said chamber, a drying chemical wholly enclosed within said chamber and confined by dust-filtering materials, and means for forcing the at-

mosphere in said chamber through said chemical and said conduit in series, said atmosphere being withdrawn from near said moisture source and being released near said high resistance insulator. Claims allowed, 5.

10990. (8) Method of geophysical exploration by microwaves. Morris Muskat, Oakmont, and N. D. Coggeshall, O'Hara Township, Allegheny County, Pa., assignors to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,455,940, issued Dec. 14, 1948.

A method of earth testing for use in logging a bore-hole comprising replacing the borehole fluid by an insulating medium, scraping the walls of the borehole substantially free of extraneous conducting material, generating microwave energy, transmitting microwave energy via the wall of a selected portion of the borehole, receiving said microwave energy and measuring a characteristic value of the received energy. Claims allowed, 1.

10991. (8) Geophysical prospecting in boreholes by microwaves. Morris Muskat, Oakmont, and Norman D. Coggeshall, O'Hara Township, Allegheny County, Pa., assignors to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,445,941, issued Dec. 14, 1948.

A method of earth testing for use in logging a borehole which comprises exciting a tubular open-ended wave guide with microwave energy, terminating said wave guide by peripheral contact with the side wall of the borehole so that the axis of the wave guide makes an acute angle with the plane tangent to the borehole wall, exciting from substantially the same microwave-terminating portion of the borehole wall a second tubular open-ended wave guide directed to receive microwaves reflected from said termination and measuring the microwave excitation of the second wave guide. Claims allowed, 2.

10992. (8) Method of and apparatus for measuring the electrical properties and surface characteristics of materials: Morris Muskat, Oakmont, and Norman D. Coggeshall, O'Hara Township, Allegheny County, Pa., assignors to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,456,012, issued Dec. 14, 1948.

A method of inspecting the outside surface of a cylindrical body comprising surrounding it with a larger substantially concentric hollow cylinder, generating microwave energy and launching it in the space between the cylindrical surfaces, transmitting microwave energy via a selected portion of said cylindrical surfaces, receiving microwave energy from the space between the cylindrical surfaces, measuring a characteristic value of the received energy and varying the portion of the cylindrical surfaces selected for transmission. Claims allowed, 2.

10993. (8) Well casing perforating gun and cartridge. Ira J. McCullough, Los Angeles, Calif., assignor to McCullough Tool Co., Los Angeles, Calif., a corporation of Nevada: U. S. patent 2,456,977, issued Dec. 21, 1948.

In a well casing perforating gun of the character described: a gun body having a chamber for a primary firing charge, means to ignite the

firing charge, a duct leading away from said firing charge chamber, and a cartridge chamber connected to said duct so as to receive fluid pressure resulting from the burning of said firing charge; a removable wall closing the front end of said cartridge chamber and having a bore therein for passage of a projectile to the exterior; and a cartridge in said cartridge chamber, said cartridge comprising a shell having a wall movable relatively to the remaining walls of the cartridge by externally applied fluid pressure, an opening with a projectile therein aligned with said bore, a powder chamber with a propelling powder charge therein and means acting in response to movement of said movable wall by said fluid pressure to ignite said powder charge. Claims allowed, 4.

10994. (8) Micropermeameter for measuring the permeability of oil field cuttings. Henry J. Welge, Tulsa, Okla., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,462,014, issued Feb. 15, 1949.

A device for measuring the permeability of a fragment of solid material, comprising a hollow cylindrical body member open at each end, a resilient fragment support mounted on one end of said member, there being a passageway through said support, having an open outer end, and an inner end communicating with the interior of said body member, a plunger, normally filling the interior of said body member, reciprocally movable therein through the other end of the member, a bracket secured to the body member, a clamp carried by said bracket in threaded engagement therewith, movable therein towards said fragment support over the outer end of said passageway, while exposing a portion of the fragment to the atmosphere, and a plunger stop member carried by said bracket limiting outward movement of the plunger from the body member. Claims allowed, 3.

10995. (8) Well perforating gun. Arthur L. Smith, Torrance, Calif., assignor to Lane-Wells Co., Los Angeles, Calif., a corporation of Delaware: U. S. patent 2,462,784, issued Feb. 22, 1949.

In a perforating gun of the character described, the combination of: a gun body having a plurality of gun bores to receive projectiles therein, and means for applying a gas pressure against the inner ends of said projectiles; projectiles in said gun bores; and restraining means at the inner ends of said projectiles operative when the gas pressure against the inner ends of said projectiles has built up to simultaneously release said projectiles so that said gas pressure may then discharge the same at high velocity from said gun bores; destructable liners extending from said projectiles along the walls of said gun bores to the extremities thereof, said projectiles being formed to engage and destroy said liners when the guns are fired; and means sealing the extremities of said liners to the extremities of said bores to exclude fluids in which the gun body may be immersed. Claims allowed, 16.

10996. (9) Geochemical prospecting. N. P. Stevens, Dallas, and R. M. Squires, Alice, Tex., assignors, by mesne assignments, to Socony-Vacuum Oil

Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,451,885, issued Oct. 19, 1948.

The method of determining the fluorescence of a soil sample which comprises the steps of placing said sample in a vessel adapted to expose a relatively small portion of the potential surface of said sample to the atmosphere, covering said exposed surface with a layer of granulated material which is substantially free of organic matter and which is substantially nonfluorescent in character, adding a predetermined amount of an organic solvent to the sample vessel to contact the sample and said granular material to extract organic constituents of said sample, removing the solvent from contact with said sample and said granular material by evaporating it from the surface of said material under conditions such that the desired, indicative portion of the extracted soil constituents are not vaporized along with the solvent but are deposited on the surface of said covering layer as the solvent is evaporated and measuring the fluorescence of the surface of said layer after the solvent has been practically completely removed from said sample and said layer. Claims allowed, 11.

10997. (11) Three-dimension radio direction finder. K. G. Jansky, Little Silver, N. J., assignor to Bell Telephone Laboratories, Inc., New York, N. Y., a corporation of New York: U. S. patent 2,437,695, issued March 16, 1948.

A method of determining the absolute direction in space of a radio wave which comprises simultaneously receiving three electric components of said wave, simultaneously obtaining a voltage representing the phase relation of one pair of components and another voltage representing the phase relation of another pair of components, and obtaining from said voltages two simultaneous indications representing the wave arrival angles in two perpendicularly related planes. Claims allowed, 8.

10998. (11) Altimetric-Stereo-Corrector. B. A. de Albuquerque Cavalcanti, Rio de Janeiro, Brazil: U. S. patent 2,448,484, issued Aug. 31, 1948.

In combination with a stereoscopic altitude plotting instrument for pairs of aerial photographs, said instrument including a carriage provided with a marker and displaceable along the stereoscopic parallax and at right angles thereto to determine on one photograph of a selected stereoscopic pair the point to be plotted, an element displaceable relative to said determined point along the stereoscopic parallax for altitude plotting purposes, and a measuring device for measuring the displacement of said element to permit plotting of the altitude at the selected point, an altimetric-stereo-corrector comprising a cam element having a cam surface curved and inclined in function of the curvatures and inclinations of the tilt surface datum for the stereoscopic pair of photographs to be plotted, a lever mounted on said carriage for pivotal movement relative thereto and including a follower in contact with said cam surface for displacement over the latter in function of the displacement of said carriage along the stereoscopic parallax, and means to displace said element and measuring device in unison relative to said determined point along the stereoscopic parallax in function of the pivotal movements of said lever. Claims allowed, 16.

10999. (11) Apparatus and method for rectifying and projecting aerial photographs. Max Zwillinger and S. G. Hall, Washington, D. C.: U. S. patent 2,448,568, issued Sept. 7, 1948.

An apparatus for projecting a tilted aerial photograph, comprising a cylindrical body member, a diaphragm containing a pinhole aperture mounted transversely thereof, a source of illumination, means for mounting said source on one side of said diaphragm, means for converging the rays of light emanating from the said source to obtain an intense illumination at the pinhole aperture for projection therethrough, and means for mounting said photograph on the opposite side of said diaphragm and at an adjustable distance from the pinhole aperture therein, the plane of the photograph being perpendicular to the optical axis of said projector. Claims allowed, 12.

11000. (11) Radio direction finder. William Joseph O'Brien, London, England, assignor to The Decca Record Co., Ltd., London S. W. 9, England, a corporation of Great Britain: U. S. patent 2,449,175, issued Sept. 14, 1948.

A radio direction-finder comprising two fixed receiving antennae arranged with their directional properties in a required angular relationship, two electronic devices, means for applying high-frequency signal potentials built up in the two antennae, respectively, to the control electrodes of said electronic devices, means for generating two low-frequency A. C. signals of identical frequency but out-of-phase to a degree corresponding to said angular relationship of the two antennae, means for applying the two out-of-phase A. C. signals, respectively, to said electronic devices so as to modulate the high-frequency signals, each of which electronic devices is arranged to provide a reversal of phase of the modulated signal due to reversal of polarity of the applied A. C. signal, means for combining the resulting out-of-phase modulated outputs of the electronic devices, a gas-discharge tube having ionisation control elements connnected by a suitable circuit with the combined output of the two electronic devices so as to produce ionisation voltage surges as varying phase-time points in said combined signal according to the relative amplitude of the two high-frequency signals, and means driven in synchronism with the A. C. supply and illuminated by the gas-discharge tube so as to indicate in a stroboscopic manner the positions of the surges in each cycle. Claims allowed, 5.

11001. (11) Radar control system. Royden C. Saunders, Jr., Hightstown, N. J., assignor to Radio Corp. of America, a corporation of Delaware: U. S. patent 2,450,991, issued Oct. 12, 1948.

A control system for a dirigible air-borne device comprising gyrostabilizer means for controlling the altitude of said device, distance measuring means for measuring altitude, distance measuring means for obtaining an indication of the slant distance to a point on the earth's surface, means actuated by one of said distance measuring means for controlling said gyrostabilizer means to make said device go to an altitude selected by an adjustment of said one distance measuring means, and means for changing said adjustment of said one distance measuring means in response to a change in the ratio of said altitude and slant distance measurements for causing a decrease in said altitude as said distance decreases. Claims allowed, 16.

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