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

GEOLOGICAL SURVEY
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JANUARY–DECEMBER 1942

COMPILED BY

W. AYVAZOGLOU

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CONTENTS

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By Departmental Order of October 5, 1942, the geophysical section was transferred back to the Bureau of Mines.

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

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W. C. Mendenhall, Director

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GEOPHYSICAL ABSTRACTS 108, JANUARY–MARCH 1942

Compiled by W. AYVAZOGLOU

1. GRAVITATIONAL METHODS

6377. Belousov, V. V., Gravitation and tectogenesis [in Russian]: Acad. sci. U. R. S. S. Bull., No. 2, pp. 147–166, Moscow, 1941.

Belousov discusses questions concerning the geotectonic interpretation of geophysical data, such as present distribution of gravitational anomalies, reasons for gravitational anomalies, geotectonic factors, contraction and expansion of the material underlying the earth's crust as a cause of gravitational anomalies, changes in the gravitational conditions during the geotectonic cycle, and considerations concerning the nature of the oceans.

He discusses also the relation between gravitational anomalies and movements of the earth's crust and gives hypotheses regarding the changes in the density of deep strata of the earth during the geotectonic periods of geologic time.—*W. A.*

6378. McCready, H. J., The gravity meter in Colombia: Mines Mag., vol. 31, No. 9, pp. 449–454, Denver, Colo., 1941.

The gravity meter has been used extensively in exploring for petroleum in Colombia, South America, because it is both economically and geologically feasible to use. The writer discusses some of the basic problems that are peculiar to the gravity-meter surveys in Colombia, such as special organization of a party, transportation, camp equipment, and health conditions, and he gives the solutions that were made by several parties working in Colombia. A topographic map of Colombia and 11 photographs illustrate the article.—*W. A.*

6379. Skeeters, W. W., Gravity work in Illinois: Mines Mag., vol. 31, No. 9, pp. 427–429, 472, 494, Denver, Colo., 1941.

The Illinois basin presents unique problems in field procedure and interpretation because the regional gravity is a resultant of the anomalies produced by regional dip, by extreme convergence in the sedimentary rocks, and by probable variations of density in the crystalline basement. Consequently, the regional gravity frequently shows no apparent relation to the known contours of the basin. The writer describes the gravity survey of the Beecher City-Loudon and St. James fields, and he shows, on a gravity map of the region, an example of both a successful and an unsuccessful survey. The survey illustrates the importance of closely spaced stations in an area where stratigraphic changes are rapid. He describes briefly the Mott-Smith model C gravimeter, which he considers to be satisfactory for operations in the area occupied by the Illinois basin.—*W. A.*

6380. Woollard, G. P., Geologic correlation of areal gravitational and magnetic studies in New Jersey and vicinity [abstract]: Geol. Soc. America Bull., vol. 52, No. 12, pt. 2, p. 1942, Washington, D. C., 1941.

One thousand nine hundred and thirty gravitational and magnetic stations were occupied to study the regional extent and distribution of large-scale anomaly variations and also the effect of local geologic structural and lithologic variations on the observed anomalies. About half the stations were distributed with an average station spacing of 4 miles on profiles across an area extending from the northern tip of New Jersey to Cape Cod, Mass., and southward to Cape Henlopen, Del., Washington, D. C., and Harrisburg, Pa. The rest of the stations were concentrated in a strip 4 miles wide extending from Barnegat Bay to Phillipsburg, N. J., with a station spacing of 0.3 mile on traverses about a mile apart. The survey shows the presence of several previously unknown anomaly areas, as well as the extent of those known from earlier investigations, and the trend of all these anomalous areas parallels the structural trends of the Appalachian Mountain system. On the more detailed survey, marked local anomalies are superimposed upon the large regional features. These local variations reach their greatest magnitude in the area of exposed pre-Cambrian and Lower Paleozoic rocks, and these same lithologic types appear to control the local anomalies in both Triassic and Coastal Plain areas except where there is intrusive diabase. Depth of sediments, structural displacement, and basement surface configuration apparently exert only a minor control on the anomalies in these areas as compared to the basement lithology. Similarly, the large regional anomalies appear to be related to intrabasement lithologic variations.

2. MAGNETIC METHODS

6381. Berkner, L. V., Contributions of ionospheric research to geomagnetism: Am. Philos. Soc. Proc., vol. 84, No. 2, pp. 309–322, Philadelphia, 1941.

The technique of radio echo-sounding of the ionosphere is described and the interpretation of the results given in terms of atmospheric ion densities. The separation of penetration frequencies and the polarization of the reflected waves by the geomagnetic field have up to the present provided proof of the "magneto-ionic" theory; now that this is confirmed on other grounds, variations in the geomagnetic field at great heights may in the future be measured by ionospheric observation. In particular, the level of flow of the atmospheric current-systems may be so determined. The connection between ionospheric ion densities and geomagnetic diurnal and secular variations is discussed, and the complicated relations between chromospheric eruptions, geomagnetic disturbances, and the ionospheric eruptions which cause short-wave radio fade-outs are described.—*A. Hu., Sci. Abstracts, vol. 44, No. 526, 1941.*

6382. Chapman, S., Charles Chree and his work on geomagnetism: Physical Soc. Proc., vol. 53, pt. 6, No. 300, pp. 629–634, London, 1941.

After having gained distinction as an authority on the mathematical theory of elasticity, Charles Chree's interests were turned to the study of geomagnetism by his appointment, at the age of 33, as superintendent of the Kew Observatory. There he gained an enduring place in the list of distinguished British contributors to geomagnetism. His work

is briefly reviewed, particularly in its relation to that of his contemporary fellow workers in the subject. He did outstanding service, in addition to maintaining the regular activities of his observatory at a high level, in discussing the data obtained there and on four Antarctic expeditions. Though critical of current physical theories of the geomagnetic variations, and though he himself refrained from speculation on the physical causes of geomagnetic disturbance, his examination of the discussion of the magnetic data led him to his finest achievements.—*Author's abstract.*

6383. Chapman, S., Geomagnetic time relationships: Physical Soc. Proc., vol. 53, pt. 6, No. 300, pp. 635–649, London, 1941.

On the average, on days of notable geomagnetic disturbance, the sunspottedness is declining from a maximum value attained 2 or 3 days earlier; this is proved most directly by the method of superposed epochs, devised by Charles Chree for the study of geomagnetic time relationships. The method lends itself well to graphic illustration. By the same method Chree gave the most convincing demonstration of the existence and interval of the 27-day recurrence tendency, which Maunder had previously demonstrated by means of a time pattern of magnetic storms and interpreted in terms of the solar rotation. The time-pattern method of studying geomagnetic disturbances and sunspottedness (either alone or comparatively) was developed further by Chree and Stagg and perfected by Bartels. Chree's method of superposed epochs has recently been successfully applied to cosmic-ray data.—*Author's abstract.*

6384. Chapman, S., Greenwich frequency-statistics of geomagnetic disturbance: Terres, Magn. and Atmos Electr., vol. 46, No. 4, pp. 385–400, Baltimore, Md., 1941.

The sum of the hour-to-hour changes (regardless of sign) of the horizontal magnetic intensity, H, at Greenwich from one Greenwich noon to the next is denoted by V_H; it has been determined for 21.323 days, covering a period of 62 years (1848–1913, less 1864–67). On quiet days V_H is governed by the quiet-day solar daily variation, S_q; on disturbed days the disturbance-field D makes the main contribution to V_H. Frequency tables are given showing the proportion of days on which V_H lies within assigned ranges, (1) for the mean of the years, (2) for the mean of each calendar month, (3) for each of three seasons for five groups of years of different mean sunspot number, and (4) for two groups of years of similar mean sunspot number but taken from the ascending and descending parts of the sunspot cycle. Similar frequency tables for the same years (plus 1914), and for the same subdivisions of the material, have previously been given for 20,762 Greenwich lunar days for R_{DD}, the daily range of the variation of the Greenwich magnetic declination D, after the monthly mean solar daily variation S has been removed; R_{DD} thus depends on the D-field except that when this field is weak R_{DD} will partly measure the day-to-day variation of the S_q-field.

The frequency distribution for V_H and R_{DD}, especially as regards their dependence on the season and the sunspot epoch (divisions 2, 3, and 4 of the data), are rather similar. A method of correcting the V_H statistics for the influence of S_q is devised and applied to the annual mean frequency curve; the R_{DD} statistics are more tentatively corrected for the influence of the S_q day-to-day variability on quiet days; the

corrected frequency-curves for H and D are in notably good agreement. The numerical measure V_H, which except on quiet days is largely determined by the D-field, is shown to be rather closely correlated with the international daily magnetic character figure C for nearly all the months of a simple year (1901).—*Author's abstract.*

6385. Chapman, S., The future of world magnetic surveying: Physical Soc. Proc., vol. 53, pt. 6, No. 300, pp. 650–657, London, 1941.

The secular geomagnetic variation necessitates continual repetition of world magnetic surveying. Since iron ships displaced wooden ones, ocean magnetic surveying requires special nonmagnetic ships; it practically ceased when the *Carnegie* was lost in 1929, and the subsequent secular geomagnetic changes are imperfectly known. Magnetic surveying is slow; one ship or one land party makes measurements at only one or two stations daily. These stations may not be representative of the area over which they chiefly determine the local course of the isomagnetic lines on the charts. In drawing the charts, some well-defined smoothing process is desirable; continuous magnetic measurements along a world network of lines would best serve this purpose. If such records could be made on aeroplanes, a world magnetic survey might require only 2 or 3 years; research into this possibility is desirable.—*Author's abstract.*

6386. Gartlein, C. W., Aurora and geomagnetism: Am. Philos. Soc. Proc., vol. 84, No. 2, pp. 299–308, Philadelphia, 1941.

Correlations are pointed out between the earth's magnetic lines of force and lines of equal auroral frequency, the positions of auroral arcs, and the angles of inclination of auroral rays to the horizon. Coronae appear always at the magnetic zenith for the time of observation. Relations between the auroral frequency curve, the sunspot cycle of 11 years, and the solar rotation period of 27 days are discussed. A correlation diagram between auroral and magnetic character figures for the same 3-hour periods gives a correlation coefficient of 0.63. Similar correlation with auroral intensity is shown by earth-current activity.—*A. Hu., Sci. Abstracts, vol. 44, No. 526, 1941.*

6387. Gish, O. H., Terrestrial electricity in relation to geomagnetism: Am. Philos. Soc. Proc., vol. 84, No. 2, pp. 187–204, Philadelphia, 1941.

The author discusses the magnetic storm of March 24, 1940, giving observations of the earth's magnetic field, earth currents, potential gradient in the lower atmosphere, ion density in the F_2 layers, and cosmic-ray intensity. The correlation between magnetic disturbances and earth currents is emphasized and contrasted with the lack of correspondence between the atmospheric potential-gradient records and the others. Solar and lunar effects are also discussed. Theoretical and observed values of the diurnal variation of earth currents are compared, and it is concluded that the diurnal variations observed in earth currents and in geomagnetism are both manifestations of electric-current systems in the upper atmosphere, the main features of which are sketched.—*A. Hu., Sci. Abstracts, vol. 44, No. 526, 1941.*

6388. Higasinaka, H., Investigation of the magnetic anomalies relating to the geological structures of the Chin-lin-chen iron-ore field, North China:

Shanghai Sci. Inst., J 2, sec. 1, separate print No. 2, pp. 7–38, November 1940.

A magnetic survey was made in the summer of 1937 in which some 400 stations, at an interval of 400 m., were made with both a vertical- and a horizontal-intensity Askania magnetometer. An area some 16 km. on a side was covered in Shantung Province, North China. As far as the writer knows, this is the first application of the magnetic method in China. It was made to obtain information on the geology of the above-named iron deposits and to investigate to what extent the induction theory of magnetization of geologic bodies may be applied. The deposit forms a horseshoe-like chain of hills rising to 200 m. above the surrounding alluvial plain. It involves Ordovician limestone on the outer side and Mesozoic diorite on the inner and steeper slope; and in one part of the area, Permo-Carboniferous sandstones and slates. Magnetite areas and hematite occupy the limestone diorite contact. The ore occurs in both types of rocks and outcrops in places.

The results of the survey are presented in contoured maps of vertical and horizontal intensity and in several profiles. Definite relation between the geologic structure and the magnetic anomalies was obtained, the latter following the limestone diorite contact zone. The maximum vertical intensity was 21,000 gammas and the horizontal intensity 32,000 gammas. It was calculated that the base of the diorite was 500 m. deep. Abnormal polarization found at one place was attributed to possible faulting. The ore body at Peri-chun-shao is deep in comparison with that at other localities, being at a depth of 140 m.; and it can be considered spherical, with its center 300 m. below the surface. Certain concealed ore bodies were indicated by the survey.

Magnetic susceptibility of the rock types involved was measured. The constants of the instrument and their determination are discussed. The paper describes a successful and well-executed piece of work. It was made under adverse circumstances, for it is noted that surveys carried on by Japanese in China are attended by "anxieties" and "personal difficulties," for at the time of the survey the relations between Japan and China had "deteriorated very much."—*D. W., Annot. Bibl. Econ. Geology, vol. 13, No. 2, 1941.*

6389. McNish, A. G., Significance of fossil magnetism: Am. Philos. Soc. Proc., vol. 84, No. 2, pp. 225–237, Philadelphia, 1941.

The varved Pleistocene clays left at the retreat of the last glaciation contain magnetic particles alined to the direction of the earth's field at the time of deposition, and the layering they exhibit enables a self-contained time scale to be established. Present-day measurements of the direction in which the particles are alined can thus be interpreted as observations of the direction of the earth's field in past geologic ages. Measurements of this fossil magnetism suggest that the field has remained relatively constant in direction, such changes as were then taking place being comparable in magnitude and rate to those now observed. A model in which the earth's field and its present secular variation are represented by a set of suitably disposed dipoles is interpreted in terms of a slow back-and-forth migration of extensive magnetized regions in the rock mantle of the earth.—*A. Hu., Sci. Abstracts, vol. 44, No. 526, 1941.*

6390. Randell, J. T., Some theoretical and practical magnetometric comparisons: Canadian Min. Met. Bull., No. 355, pp. 495–512, Montreal, 1941.

Randell gives information concerning the instruments available for magnetic surveys, the theory governing their operation, and the relative advantages of different instruments for various types of surveys. He discusses briefly magnetic fields, magnetic materials, magnetometers, dip needles, the Askania vertical variometer, and the Hotchkiss superdip, and he gives five typical examples of magnetic surveys with various instruments. The information given in this article is intended especially to help the small operator who, as a rule, has little or no personal knowledge of the possibilities and limitations of magnetic methods.—*W. A.*

6391. Rayner, J. M., Examination of the Henbury meteorite craters by the methods of applied geophysics: Australian and New Zealand Assoc. Advancement Sci. Rept., vol. 24, pp. 72–78, Sydney, 1939.

Rayner describes a search by the magnetic method for large meteorites beneath the craters at Henbury, in Central Australia. Magnetic observations were made at some 540 stations. He compares these observations with tests made on an actual meteorite under laboratory conditions and concludes that large meteorites are not likely to lie beneath the Henbury craters because magnetic anomalies of a type that would arise from large meteorites at likely depths are absent, and statistical considerations make it improbable that large meteorites would have penetrated to depths great enough to take them beyond the range of detection by the magnetic method.—*W. A.*

3. SEISMIC METHODS

6392. Bullard, E. C., Gaskell, T. F., Harland, W. B., and Kerr-Grant, C., Seismic investigations on the Paleozoic floor of east England: Royal Soc. London Philos. Trans., vol. 239, No. 800, pp. 29–94, 1940.

The depth of the Paleozoic floor under part of east England has been investigated by the refraction-seismic method. Records have been taken every 200 ft. along lines 4,000–8,000 ft. long. Such detailed shooting enables various sources of uncertainty in the results to be investigated. The interpretation of the seismic results required a more thorough knowledge of the contours of the Jurassic and Cretaceous than was available; the data from boreholes and outcrops have therefore been collected and are presented in the form of contoured maps showing the depths of various horizons and the thicknesses of rock between them.

A map of the form of the Paleozoic floor and a discussion of its constitution are also given. The discussion is based on a reexamination of the borehole cores and on the seismic velocities.—*Authors' abstract.*

6393. DeLisle, J. F., On dispersion of Rayleigh waves from the North Pacific earthquake of November 10, 1938: Seismol. Soc. America Bull., vol. 31, No. 4, pp. 303–308, Berkeley, Calif., 1941.

Rayleigh waves from the North Pacific earthquake of November 10, 1938, have been investigated in different azimuths for dispersion. Using depression curves of Jeffreys based on the hypothetical structure of a single crusted layer, the average thickness of this layer along great

circle paths from Bering Sea to each observatory has been calculated. The values found give a comparison between Pacific and continental crustal structure which affords confirmation of other evidence on this point.—*Author's abstract.*

6394. Dix, C. H., Notes on refraction prospecting: Geophysics, vol. 6, No. 4, pp. 378–396, Menasha, Wis., 1941.

This is a series of notes dealing with several aspects of the problem of the interpretation of refraction data. A method of dealing with unreversed refraction lines is outlined. The case of a high-velocity section with an overburden having a linear increase of velocity with depth is discussed. We show how the accuracy of the relative depth calculations depends upon the difference between the upper and lower velocities at the interface in question. A method of computing tables for the linear-velocity depth case is given, which is well adapted to machine calculation. Finally, reflections at the ground-air interface and the formation of shadows by such obstacles as high- or low-velocity layers are considered.—*Author's abstract.*

6395. Failing, G. F., Modern exploratory drilling equipment: Internat. Oil, vol. 1, No. 2, p. 83, July 1940.

Photographs and description of modern seismograph shot-hole drills and "slim hole" exploration drills. The development and application of such drills to seismograph work are discussed.—*D. W., Annot. Bibl. Econ. Geology, vol. 13, No. 2, 1941.*

6396. Gutenberg, Beno, Mechanism of faulting in southern California indicated by seismograms: Seismol. Soc. America Bull., vol. 31, No. 4, pp. 263–302, Berkeley, Calif., 1941.

Study of the direction of the first impulse (compression or dilatation) in about 4,100 seismograms recorded at California stations from about 1,700 local earthquakes leads to the following conclusions: (1) The results strongly support the rebound theory. (2) In almost all of the earthquakes the block on the northeast side of the fault moves toward the southeast relative to the other block. Vertical movements are relatively small. South of the Transverse Ranges the directions of the movements with few exceptions are very uniform from the margin of the continental shelf to beyond the San Andreas fault, where the shocks become scarce. There is no difference between the larger shocks on the major faults and the many small shocks scattered between them. Reversed movement has occurred in only a few instances, if at all. North of the Santa Monica Mountains the fault pattern complicates the picture, but there is no evidence that this area does not conform to the general results. In the Sierra Nevada some movements of another type are indicated. Most of the shocks in western Nevada begin at the two Owens Valley stations with the direction to be expected if this region is included in the general movement. (3) Southern and central California, including the shelf, are under a shearing stress such that its tendency is directed toward the southeast in the crustal layers of the continent relative to the crust beneath the Pacific.—*Author's abstract in Geol. Soc. America Bull., vol. 52, No. 12, pt. 2, 1941.*

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6397. Haskell, N. A., The relation between depth, lithology, and seismic-wave velocity in Tertiary sandstones and shales: Geophysics, vol. 6, No. 4, pp. 318–326, Menasha, Wis., 1941.

Velocity data in Tertiary sands and shales, obtained at 62 wells in the southern San Joaquin Valley, Calif., are considered statistically. A mean vertical velocity gradient of 0.464 ft. per second per foot is found, and evidence is presented which indicates that, on the average, 0.360 ft. per second per foot, or 78 percent of the total vertical gradient, is due to the effect of the pressure exerted by the present overburden. It is found that in shales the effect of overburden is smaller than this average (0.240 and 0.231 ft. per second per foot for two shale formations), and in sandier formations it is greater than the average (0.428 and 0.581 ft. per second per foot for two moderately sandy formations). However, the velocity versus depth curves for sands and for shales may intersect at any depth, and it does not appear to be possible, in general, to distinguish between the two solely on the basis of the velocity at a given depth.

Comparison with similar data of Weatherby and Faust for older beds and with the experimental results of Birch and Bancroft for hard sandstone and slate suggests that these gradients cannot persist very far beyond the present maximum depth of observation of about 14,000 feet.—*Author's abstract.*

6398. Heck, N. H., and Neumann, Frank, Earth motions in the vicinity of a fault slip: Geol. Soc. America Bull., vol. 53, No. 2, pp. 179–194, Washington, D. C., 1942.

Existing lack of knowledge regarding the mechanism of fault slipping and resultant earth motions is in part met by new and important displacement data now available for the Imperial Valley earthquake of 1940 and the Long Beach earthquake of 1933. The ground displacements were not recorded directly but obtained by mathematical treatment of seismograph acceleration records. The accuracy of the original and deduced records has been proved adequate. In the case of the El Centro record of the Imperial Valley earthquake, maximum accelerations of 0.3 g., velocity of 24 in. a second, and displacement of 15 in. are all large and indicate greater values in stronger earthquakes. The record was obtained 7 miles from the epicenter and 5 miles from the nearest point of the fault on which slipping occured. All major wave types appear to be present, and they appear to have their genesis at a point or in a small area. The wave motions are not dominated by the direction of fault slip but are related to the direction from epicenter to recording instrument. The results show how improved records would make it possible to measure permanent displacement when it occurs. Doubt is thrown on the presence of really dominant wave periods during an earthquake in California.—*Authors' abstract.*

6399. Ishkov, P. K., On the propagation of elastic waves within a stratum overlying a hard foundation [in Russian]: Acad. sci. U. R. S. S. Bull., No. 2, pp. 169–176, Moscow, 1941.

The writer determined mathematically the velocities of propagation of waves within an elastic stratum along its border closely everlying a hard (noncompressible) structure. He found that the smallest wave velocities are similar to the wave velocities of Rayleigh surface waves.

Various wave velocities and wave lengths are shown in two tables.—*W. A.*

6400. Leet, L. D., Trial traveltimes for northeastern America: Seismol. Soc. America Bull., vol. 31, No. 4, pp. 325–334, Berkeley, Calif., 1941.

The present report assembles for station seismologists a series of type records and traveltime data that will help them in problems of interpretation. Tables show the times of principal phases at short-distance surface focus and structures represented by trial traveltimes. Seismograms show typical records at various distances from local shocks, and diagrams give data that were used as the basis for the results summarized in the tables.—*W. A.*

6401. Marsch, B., Electrical measurements in physical soil research [in German]: Elektrizität i. Bergbau, vol. 15, pp. 17–21, March 1940.

A survey of the different methods used in tracing water, oil, and ore layers underground by surface investigations. The principles of resistance measurements leading to sounding and mapping are briefly dealt with. The instrument for direct-current and alternating-current measurements using current electrodes and voltage sounds or induction frames with two-phase compensators and amplifiers are described. The principles of the seismic methods are given, in which refraction or reflection is investigated by oscillograms, and the nature of the strata is determined by the velocity of sound. A bibliography is given.—*R. N., Sci. Abstracts, vol. 44, No. 524, 1941.*

6402. Mead, T. C., and Carder, D. S., Seismic investigations in the Boulder Dam area in 1940: Seismol. Soc. America Bull., vol. 31, No. 4, pp. 321–324, Berkeley, Calif., 1941.

Seismological work in the Boulder Dam area was enlarged in 1940 to include newly constructed stations at Pierce Ferry, Ariz., and Overton, Nev. Pending completion of permanent instruments, the Coast and Geodetic Survey has installed temporary instruments consisting of two Neumann-Labarre vibration meters at Overton and two Coast and Geodetic Survey vibration meters at Pierce Ferry. At Boulder City the Wood-Anderson torsion-type seismograph was left undisturbed for the time being. All the instruments measure the horizontal components of the earth's motion. A map of the Lake Mead area shows epicenters located late in 1940 and some of the more important faults.—*W. A.*

6403. Morgan, C. G., A new seismograph drill: Internat. Oil, vol. 1, No. 2, p. 90, July 1940.

The drill described is the "Concore type 5" exploratory drill. It is especially designed for shot-hole work and for extremely inaccessible regions requiring portability. It uses an "E" rod and can drill to a depth of 150 ft. The total weight is 1,050 lbs., the pump being the heaviest unit and weighing 215 lbs. The drill can be taken down and reassembled in less than 1 hr. A gasoline engine is used for power.—*D. W., Annot. Bibl. Econ. Geology, vol. 13, No. 2, 1941.*

6404. Romberg, Frederick, The probable errors of delta-T velocities: Geophysics, vol. 6, No. 4, pp. 356–369, Menasha, Wis., 1941.

It is proposed to test the accuracy of delta-T velocities by finding the average deviations and probable errors of the delta-T readings.

Data are provided to demonstrate that errors smaller than 1 percent can reasonably be expected. The quantitative effect of numbers of observations, shooting set-ups, quality of data, and computing methods are discussed and examples shown. Examples of regional and local lateral gradient are added.—*Author's abstract.*

6405. Seth, I. D., Reflection and refraction of attenuated waves in semi-infinite elastic solid media: Indian Acad. Sci. Proc. A 13, pp. 151–160, Calcutta, March 1941.

In earthquakes it is known that waves of one type starting from the origin inside the earth produce waves of other types after impact at the free surface of the earth. The author discusses the reflection and refraction of waves which have their amplitudes increasing with depth like the initial-diverging earthquake waves which, after reflection, produce the apparent surface waves in which the displacement decreases with depth. In one case it is found that at a free surface a plane wave of *SV* type, traveling parallel to the surface, is capable of generating surface waves after internal reflection which, in a certain state of attenuation, are identical with the Rayleigh waves.—*Author's abstract.*

6406. Steele, W. E., Jr., Comparison of well-survey and reflection "time-delta time" velocities: Geophysics, vol. 6, No. 4, pp. 370–377, Menasha, Wis., 1941.

Empirical curves are given, comparing directly measured well-survey velocities and velocities indirectly determined by means of reflection data. The observed relationships are discussed.—*Author's abstract.*

6407. Stulken, E. J., Seismic velocities in the southeastern San Joaquin Valley of California: Geophysics, vol. 6, No. 4, pp. 327-355, Menasha, Wis., 1941.

For the first time, seismic-velocity measurements from well surveys have been made intensively enough to justify an analysis of the velocity field in an entire area instead of just along lines between wells. Maps are drawn showing velocity changes in the southeastern San Joaquin Valley of California. A portion of the valley floor in the neighborhood of Bakersfield about 25 miles wide and 35 miles long was chosen for study because of the number of wells in the area whose velocities were known. Differences in average velocity of 1,700 ft. per second for a constant depth are observed, and horizontal velocity gradients averaging over 100 ft. per second per mile are computed. Correction schemes for the adjustment of seismic data are suggested and correction maps shown. An attempt is made to establish a connection between stratigraphy and seismic velocity. Comparative study of the logs of wells and the velocities observed in them yields certain qualitative conclusions, but attempts to express the relation in a quantitative way fail.—*Author's abstract.*

6408. Sulkowski, E. L., The cut-off bias principle in automatic time recording: Seismol. Soc. America Bull., vol. 13, No. 4, pp. 345-348, Berkeley, Calif., 1941.

The problem of recording exact time confronts every seismologist whenever accurate interpretation of seismograms is desired. Although it has now become standard practice to register time signals manually, manual registration is disadvantageous because it involves a human

error that varies with the operator. The writer describes the cut-off bias recorder, which in conjunction with a receiver offers absolute control in automatic registration. A figure illustrates the features and the circuit of the recorder. The equipment used has fulfilled all expectations.—*W. A.*

6409. Ulrich, F. P., Progress report for 1940 of the United States Coast and Geodetic Survey in the western United States: Seismol. Soc. America Bull., vol. 31, No. 4, pp. 335–344, Berkeley, Calif., 1941.

The work of the seismological field survey during 1940 has been a combination of the previous program of operating strong-motion seismographs in the western United States (see Geophys. Abstracts 106, No. 6171); of carrying on a limited amount of vibration work on special problems; of assisting cooperating institutions in instrumental problems; of collecting information on earthquakes; and of investigating strong earthquakes. In particular, the following work was done on instruments: (1) The vibration-meter records were changed so as to use a roll of photographic paper, and all batteries were eliminated by using a transformer; (2) some work was done on the experimental displacement meters to give more stability; and (3) the seismic acoustic equipment was studied, and plans were completed for building equipment that, it is believed, will overcome past instrumental difficulties.—*W. A.*

4. ELECTRICAL METHODS

6410. Archie, G. E., The electrical-resistivity log as an aid in determining some reservoir characteristics: Am. Inst. Min. Met. Eng., Tech. Pub. 1422, 8 pp., New York, 1942.

The usefulness of the electrical-resistivity log in determining reservoir characteristics is governed largely by: (1) The accuracy with which the true resistivity of the formation can be determined; (2) the scope of detailed data concerning the relation of resistivity measurements to formation characteristics; (3) the available information concerning the conductivity of connate or formation waters; and (4) the extent of geologic knowledge regarding probable changes in facies within given horizons, both vertically and laterally, particularly in relation to the resultant effect on the electrical properties of the reservoir. Simple examples are given to illustrate the use of resistivity logs in the solution of some problems dealing with oil and gas reservoirs. From the available information, it is apparent that much care must be exercised in applying to more complicated cases the methods suggested. It should be remembered that the equations given are not precise and represent only approximate relationships. It is believed, however, that under favorable conditions their application falls within useful limits of accuracy.—*Author's abstract.*

6411. Eisler, J. D., A direct-reading phase-shift meter: Geophysics, vol. 6, No. 4, pp. 311–317, Menasha, Wis., 1941.

A direct-reading phase-shift meter is described which is entirely electronic. The meter is capable of continuously indicating phase shift to within 1° in the frequency range between 10 and 1,000 cps., has calibration independent of supply voltages, and is portable.—*Author's abstract.*

6412. Keller, Fred, Jr., and Landsberg, Hans, Geoelectric investigations over Penn's Cave: Pennsylvania Acad. Sci. Proc., vol. 15, pp. 65–68, Church Center Press, Myerstown, Pa., 1941.

Keller and Landsberg made geoelectric measurements over Penn's Cave, an accessible and a well-explored solution cavity near Centre Hall, Pa., with the object of obtaining indications of the cave by a direct-current resistivity survey on the surface of the ground. They ran profiles across the cave at four places, with one profile parallel and one perpendicular to the strike of the strata in each place. Two diagrams show the results. The investigations indicate that solution cavities in limestone in humid climates would be shown on ground resistivity curves by a decrease in slope of the curve as the depth of the current penetrates to the cave roof, and in repeated measurements by a minimum of variability in the sensitivity. In this respect the effect of Penn's Cave resembles a water table, the position of which has to be ascertained from control measurements in the same area of the suspected cave structure.—*W. A.*

Gish, O. H., Terrestrial electricity in relation to geomagnetism. *See* Geophys. Abstract 6387.

6413. Longacre, W. A., A study of the problem of depth determination by means of earth-resistivity measurements: Am. Inst. Min. Met. Eng., Tech. Pub. 1392, 7 pp., 1941.

This paper describes a method of interpretation of earth resistivity data which is a modification of Tagg's second method but which simplifies and expedites the procedure. Representative analyses and data for the master curves are included.—*Author's abstract.*

6414. Malkin, D. S., and Jung, D. A., Marine sedimentation and oil accumulation on the Gulf coast, Part 1, Progressive marine overlap: Am. Assoc. Petroleum Geologists Bull., vol. 25, No. 11, pp. 2010-2020, Tulsa, Okla., 1941.

A large part of the Gulf coast petroleum reserves is in transgressive sands. The history of a marine transgression is presented and is illustrated by a discussion and by electrical-log profiles of the Cockfield (Eocene) formation. Since a transgressive sand presents conditions favorable for the migration, accumulation, and recovery of petroleum, it is advised that both local and regional studies be made of producing horizons in the light of the theory of marine overlap.—*Authors' abstract.*

Marsch, B., Electrical measurements in physical soil research. *See* Geophys. Abstract 6401.

6415. Muskat, Morris, and Evinger, H. H., Current penetration in direct-current prospecting: Geophysics, vol. 6, No. 4, pp. 397–427, Menasha, Wis., 1941.

Using previously developed methods for calculating the potential about an electrode on the surface of a stratified earth, the fractions of total current, due to two current electrodes, flowing in a given layer and across the vertical plane midway between the electrodes, are calculated. The method employed is applicable in principle to any number of layers, and numerical values are given for two-layer and three-layer earths. Curves are given showing the variation of these current fractions with electrode spacing for the following types of conductivity

stratification: Two-layer earths which are homogeneous except for the middle layers, the latter having thicknesses equal to or twice that of the top stratum; and three-layer earths having either infinitely conducting or resisting bottom layers and with middle stratum thicknesses equal to, twice, or three times that of the uppermost stratum.—*Authors' abstract.*

6416. Spicer, H. C., Earth resistivity as applied to problems of exploration in the potash-bearing region near Carlsbad, N. Mex.: Am. Inst. Min. Met. Eng., Tech. Pub. 1354, 10 pp., 1941.

Results are described of resistivity observations made over the potash-bearing formation in southeastern New Mexico and obtained with the Gish-Rooney apparatus. The salt (Salado) and Rustler formations were contoured, and aquifers were studied in relation to possible flooding of mines. Potash beds made no alteration on the resistivity curves.—*Author's abstract.*

6417. White, G. E., Further advances in prospecting by electric transients: Am. Inst. Min. Met. Eng., Tech. Pub. 1389, 9 pp., 1941.

Advances in techniques of electrical prospecting by current surges is given, with field data and the theory by which computations are made. Direct current and surface resistivities are obtained, in addition to the transient data.—*Author's abstract.*

5. RADIOACTIVE METHODS

6418. Beers, L. C., Radioactivity logging through casing: Petroleum World, vol. 38, No. 11, pp. 95–100, Los Angeles, 1941.

The method employed in radioactivity logging is briefly explained, and the arrangement of the equipment is shown schematically. Field procedure, including the logging of a cased well with a radioactive field unit, is described.

Radioactivity logs are compared with electrical logs of a Gulf coast well and of several wells in California. Experience has shown that radioactivity logging is of strategic value in solving many cased-hole problems that confront the oil industry. The most effective method of employing radioactivity logs is first to evaluate the properties of the strata in a given area by running the radioactivity log in a key well where complete stratigraphic information is available, and then to make correlations across the area by locating the precise depths in old wells at which the horizons of interest occur.—*W. A.*

6419. Driscoll, R. L., Hodge, M. W., and Ruark, A., An interval meter and its application to studies of Geiger-Müller counter statistics: Rev. Sci. Instruments, vol. 11, No. 8, pp. 241–250, Lancaster, Pa., 1940.

As part of examining the ability of a Geiger-Müller counter to give quantitative results, an instrument is described for sorting time intervals, between counts, into size classes. It is thus possible to study the time distribution of impulses on these counters. General principles of the interval meter are discussed, and a description of it is given. It was found that two argon-filled counters excited with gamma rays and operated at certain rates gave results in good agreement with fluctuation theory. A hydrogen counter excited with light or gamma rays gave discrepant results.—*D. W., Annot. Bibl. Econ. Geology, vol. 13, No. 2, 1941.*

6420. Foyn, Ernst, Gleditsch, Ellen, and Rosenquist, I. T., The determination of radium in some igneous rocks: Am. Jour. Sci., vol. 239, No. 1, pp. 805–808, New Haven, Conn., 1941.

A new method for determining radium in rocks by making use of the acid flouride of ammonium is described. The method does not require specially constructed or high-temperature apparatus. A schematic design of the apparatus is given. The results of experiments on light gneissic granite and augen gneiss are summarized in two tables.—*W. A.*

6421. Hess, V. F., Radioactivity of rocks and ionization balance of the atmosphere: Terres. Magn. and Atmos. Electr., vol. 46, No. 4, pp. 409–416, Baltimore, Md., 1941.

It is shown that if one computes the ionization produced by gamma rays from radioactive substances in rocks and soil from figures given recently as average values for representative classes of rocks by Evans and Goodman, the expected ionization turns out considerably smaller than the one actually observed by placing ionization vessels over land and over water. Two methods are developed theoretically which make it possible to determine simultaneously the residual ionization, the effect of cosmic rays and of the gamma rays from radioactive substances in the earth, and to separate these components of the total ionization. Comparisons of ionizations determined by one of these methods with values computed from given figures of radioactive material in well-defined rocks are planned.—*Author's abstract.*

6422. Keevil, N. B., Radioactive aureoles around some ore deposits [abstract]: Econ. Geology, vol. 36, No. 8, p. 844, Lancaster, Pa., 1941.

Mineral deposits are sometimes less, sometimes more, radioactive than country rock. When the ore body is relatively high in activity, concentrations of radioactive material in the vicinity of the deposit have been observed in some instances. At Gilman, Colo., where a series of samples collected during a Lundberg geophysical survey was examined, the activity was observed to be higher near radioactive ore and to decrease in concentration away from the ore body. Some of the activity appeared to be due to diffused radon, but spectrochemical concentrations of silver, copper, lead, and zinc associated with the radioactivity suggested that much of the radioactive material was introduced during mineralization. The results suggest that sample analysis may be useful in indicating proximity to ore in some instances.

6423. Keevil, N. B., The distribution of helium and radioactivity in rocks—Mineral separates from the Cape Ann granite: Am. Jour. Sci., vol. 240, No. 1, pp. 13–21, New Haven, Conn., 1942.

The Essex County granite at Cape Ann, Mass., and its common mineral constituents have been thoroughly studied by the helium age method. The granite is more radioactive than usual, probably due to active accessories associated with the femic minerals. The relative radioactivities of the femics, quartz, and feldspar are about 23 : 2 : 1. In spite of the relatively high rate of helium production, the femics gave the highest helium index, 189. The quartz (94) and feldspar (59) showed evidence of losing helium during geologic time and after exposure at the surface. Further experiments on minerals are necessary before the helium indices can be used in geologic correlation.—*Author's abstract.*

6424. Kolhörster, Werner, and Weber, E., Das Zählrohr als Messinstrument [The tube counter as a measuring instrument]: Phys. Zeitschr., vol. 42, No. 1, pp. 13–19, Leipzig, 1941.

The investigation is concerned with methods of carrying out measurements, particularly of cosmic rays, with tube counters. A large number of arrangements of tube counters with amplifiers and registering apparatus, employed by various investigators extending over several years, are critically examined. The conclusion is reached that with the arrangements described continuous registration of cosmic rays can be carried out and reproduced with a high degree of accuracy and constancy in no wise inferior to the results obtained with a very good high-pressure ionization chamber, but these arrangements are essentially superior to ionization chambers, especially by virtue of the use of direction-sensitive tube counters and the coincidence method.—*H. G. S., Sci. Abstracts, vol. 44, No. 524, 1941.*

6425. Piggot, C. S., and Urry, W. D., Radioactivity of ocean sediments—The radium content of sediments of the Cayman Trough: Am. Jour. Sci., vol. 240, No. 1, pp. 1-12, New Haven, Conn., 1942.

The radio elements are not in equilibrium in the uppermost layers of the sediments at the bottom of the ocean. Of these elements, uranium, ionium, and radium have sufficiently long half life to be of importance. A history of these three elements is reflected in the variation of the radium content of ocean sediments with the depth below the ocean floor. Measurements of this variation demonstrate that the concentrations of uranium, ionium, and radium at any given time are established by the usual laws of radioactivity governing the growth and decay of radio elements in a system that is not in radioactive equilibrium. The experimental results must be adjusted to the conditions that pertained to the undisturbed sediments. This requires a knowledge of the history of the specimens from the time that the sediment was taken by the coresampler to the time at which the specimens were analyzed. The relation between radium content and depth in a given ocean sediment promises a method of determining the rate of accumulation of the deposit at that place.—*Authors' abstract.*

6426. Rose, R. B., Radioactive exploration: Mines Mag., vol. 31, No. 12, pp. 617-620, 635, Denver, Colo., 1941.

Advances have been made recently in the research of gamma-ray radioactive measurements, which are actively employed in both petroleum and mining exploration. These measurements have a high degree of penetration through solid material and can register an effect through more than a foot of iron. The writer reviews the fundamentals of radioactivity to help the reader to understand the manner in which field mapping of earth-structure changes and ore deposits can be accomplished. He discusses the methods of exploration and well logging and describes the "Ra-Tektor," a new type of highly sensitive and stable gamma-ray radioactivity detector for surface measurements, together with its operation.—*W. A.*

6427. Russell, W. L., Development of radioactivity well logging through casing: Mines Mag., vol. 31, No. 9, pp. 457–458, 464, Denver, Colo., 1941.

Russell emphasizes the possibility of using radioactivity surveys for

logging wells through the casing. He discusses briefly the action of radioactive elements, the instruments used, the preparation for logging, the characteristic patterns, and the results of gun perforating. He shows the accuracy of response of radioactive well logging through the casing by two logs, one log taken in an open hole and the other after a 7-inch casing had been set in the same hole.—*W. A.*

6428. Urry, W. D., and Piggot, C. S., Radioactivity of ocean sediments—Concentrations of the radio elements and their significance in red clay: Am. Jour. Sci., vol. 240, No. 2, pp. 93–103, New Haven, Conn., 1942.

The relationship between the radio elements uranium, ionium, and radium in those deep-sea deposits known as "red clay" is similar to that previously described for the calcareous sediments of the ocean. The red clay, represented here by a core 246 cm. long, is distinguished from the calcareous sediments by a very rapid decrease in the radium content just below the surface of the ocean bottom and by the attainment of the final equilibrium between the above three radio elements in the bottom quarter of the core, which signifies a very slow deposition compared with that of the calcareous deposits. The radium content at equilibrium with the uranium is only 7 percent of that near the surface of this red clay deposit. The high surface concentrations of radium and ionium, particularly in red clay, are therefore only transient phenomena, produced by some unknown mechanism which concentrates these elements, relative to the uranium content, during the deposition of the sediment.—*Authors' abstract.*

6. GEOTHERMAL METHODS

6429. Jeffreys, Harold, The thermal state of the earth: Am. Jour. Sci., vol. 239, No. 11, pp. 825–835, New Haven, Conn., 1941.

The available data related to the internal heat of the earth are reviewed. From these considerations it is concluded that (1) the average radioactivities of surface rocks show a steady decrease with increase of density, though there is much scatter within a given type; (2) heat generated at depths up to 300 km. or so has had sufficient time to approach a state where it is conducted out as rapidly as it is produced; (3) nothing in the new results encourages the hope that fusion temperatures are a normal feature at any depth within the crust; and (4) the thermal contraction available for mountain formation remains essentially unchanged except that a more uniform rate is suggested.—*Author's abstract.*

7. GEOCHEMICAL METHODS

6430. Geochemical laboratory goes to the field [editorial]: Internat. Oil, vol. 1, No. 3, p. 91, October 1940.

In the section on oil-field engineering equipment and methods, a description and pictures of a trailer laboratory equipped for geochemical well logging and surface prospecting are given. The use of such a portable field laboratory cuts down the time required for shipping samples from the field and permits the analyses of samples concurrently with motor drilling. Similar advantages occur in field prospecting in controlling the progress and layout of a soil-analysis survey.—*D. W., Annot. Bibl. Econ. Geology, vol. 13, No. 2, 1941.*

6431. Nisle, R. G., Considerations on the vertical migration of gases: Geophysics, vol. 6, No. 4, pp. 449–454, Menasha, Wis., 1941.

The vertical migration of a perfect gas saturated with aqueous vapor is studied with a view toward determining what effect it may have on the porous strata through which it passes. It is found that evaporation of water and the consequent concentration of minerals may occur at certain depths. Further, it is pointed out that the cooling due to the evaporation of water and the expanding gas may be a contributing factor in the appearance of geothermal anomalies.

Suggestions for further study are included.—*Author's abstract.*

6432. Pirson, S. J., Recent developments and successes in geodynamic prospecting: Oil Weekly, vol. 104, No. 6, pp. 20–30, Houston, Tex., 1942.

Pirson first announced geodynamic prospecting to the industry in two technical papers, "Geodynamic prospecting for oil or gas" and "Progress in geodynamic prospecting" (see Geophys. Abstracts 106, Nos. 6189 and 6190). In this paper he discusses the further development and recent successes of this method and illustrates it by diagrams.

He concludes that geodynamic prospecting for oil and gas fields has definitely passed the experimental stage and has been accepted as a prospecting tool of high resolving power. Results have established the theory that gas leakage from a subterranean accumulation takes place, not only vertically but laterally as well. Geodynamic prospecting can distinguish between a shallow and a deep accumulation, requires but a limited number of stations, is fast in operation, and needs no corrections whatsoever for different types of soils, their permeabilities, and other characteristics.—*W. A.*

6433. Rosaire, E. E., Discovery trends indicate new prospecting: Oil Weekly, vol. 104, No. 3, pp. 32–35, Houston, Tex., 1941.

Rosaire discusses the present prospecting situation and emphasizes the need for using new prospecting methods to increase the returns in the discovery of oil fields by the old methods. He believes that the most promising methods are those directed toward the recognition and measurement of the geochemical manifestation of the petroleum accumulation itself, a direct prospecting approach as contrasted with the indirect approach through structural prospecting, which is now generally practised.—*W. A.*

8. UNCLASSIFIED METHODS AND TOPICS RELATED TO GEOPHYSICS

6434. Advancements continue to be made in geophysical field [editorial]: Oil Weekly, vol. 99, No. 3, pp. 50–51, Houston, Tex., 1940.

Recent progress in geophysical exploration methods is discussed. The application of the reflection method to seismology to meet more exacting geological requirements is pointed out. Increased interest in gravitational methods has been shown following the introduction of several new makes of gravity meters. Large areas are being extensively worked from a reconnaissance standpoint with gravity meters. The growing use of soil analysis and the principles involved are taken up. Other geophysical methods in use are briefly mentioned.—*J. E. H., Annot. Bibl. Econ. Geology, vol. 13, No. 2, 1941.*

6435. Baker, W. L., Modern prospecting, a broad and complex science: Oil Weekly, vol. 103, No. 9, pp. 97–102, Houston, Tex., 1941.

Baker reviews the history of oil accumulations and of methods for detecting their existence. He describes briefly surface mapping, the development of subsurface geology, and geophysics, including geochemical prospecting and geochemical well logging.—*W. A.*

6436. Bell, A. H., Role of fundamental geological principles in the opening of the Illinois basin: Econ. Geology, vol. 36, No. 8, pp. 774–785, Lancaster, Pa., 1941.

The opening of the Illinois basin to oil production in 1937 was the beginning of a large-scale development that restored Illinois to the position of a major oil-producing State after the lapse of a quarter century. The delay in the opening of the Illinois basin was the result of several factors, the most important of which was perhaps the theory that oil had migrated outward from the central parts of large structural basins and that consequently the central parts were barren of oil and not worthy of prospecting.

This paper discusses first the sequence of events leading up to the discovery of oil in the Illinois basin, with special emphasis on the influence of geologic theory, and second the application in the area of the new techniques of exploration and development, including geophysical methods, rotary drilling, and electric logging. The use of the reflection-seismograph method proved highly successful.—*Author's abstract.*

6437. Ducloux, A. H., The importance of statigraphic traps in petroleum geology: Mines Mag., vol. 31, No. 9, pp. 459–464, Denver, Colo., 1941.

According to Levorsen, a stratigraphic trap "may be defined as one in which a variation in the stratigraphy is the chief confining element in the reservoir which traps the oil" (see Levorson, A. I., Stratigraphic versus structural accumulation: Am. Assoc. Petroleum Geologists Bull., vol. 20, No. 5, pp. 521–530, May 1936). In this paper the writer considers the classification of stratigraphic traps, the different types of oil accumulations in them, and the methods for prospecting them, including the geophysical methods that may be applicable.—*W. A.*

6438. Heiland, C. A., Geophysical methods for the exploration and production division: Internat. Oil, vol. 1, No. 2, pp. 43–49, July 1940.

Geophysics in petroleum explorations is an internationally practiced technique, and its cost from 1923 to date is estimated at about a quarter billion dollars. The uses of geophysics in the exploration and production and processing phases of the petroleum industry and present trends in geophysical methods along the lines of direct oil finding are discussed. The article is illustrated by photographs, which include the daylight developer for a portable 6-channel reflection-seismic equipment recently developed. The status of the seismic-reflection method, gravimetric exploration, and the use of magnetic surveys are treated. Geophysical well-testing methods as electrical logging, geochemical analysis of well cuttings, gas-leak detection for pipe lines, as well as fluid-level determinations in wells, are covered in their petroleum production applications.—*D. W., Annot. Bibl. Econ. Geology, vol. 13, No. 2, 1941.*

6439. Kelly, S. F., Summary of reports by committee on geophysics education, Mineral Industry Education Division: Am. Inst. Min. Met. Eng. Trans., vol. 138, pp. 82–101, New York, 1940.

The geophysics education committee of the A. I. M. E. in this paper presents the results of a questionnaire which had been sent out to 147 universities in the United States, Canada, and abroad. The summary deals with the prerequisites, the viewpoints on geophysics, and the scope of the courses. Impressions and comments of a number of correspondents are added. The results of another set of questionnaires which had been sent out to graduate practicing geophysicists and their employers as to their valuation of the available academic preparation for a career in geophysics are discussed. The field of "pure" geophysics or earth physics was also treated by questionnaire and a comparison made with exploration geophysics. Papers presented in connection with the committee's report were: Krasnow, Shelly, "Some strong sentiments on geophysics education;" Thom, W. T., Jr., "Certain trends in geophysical research and their bearing on geophysical education;" Keevil, Norman, "Geophysics as the fundamental basis for modern geological instruction and research." Comments of others who took part in the discussion are included in the summary.—*J. E. H., Annot. Bibl. Econ. Geology, vol. 13, No. 2, 1941.*

6440. Krumbein, W. C., Criteria for subsurface recognition of unconformities: Am. Assoc. Petroleum Geologists Bull., vol. 26, No. 1, pp. 36–62, Tulsa, Okla., 1942.

Criteria which have been advanced as evidences of unconformities are summarized and discussed in terms of their application to subsurface studies. These criteria are classified as sedimentary, paleontologic, and structural; approximately 40 are considered. It is emphasized that certain limitations must be imposed on the criteria but that the convergence of several lines of evidence may strongly suggest the presence of stratigraphic breaks. Extensions of this reasoning to the possible development of new criteria are pointed out.—*Author's abstract.*

6441. Krumbein, W. C., Principles of sedimentation and the search for stratigraphic traps: Econ. Geology, vol. 36, No. 8, pp. 786–810, Lancaster, Pa., 1941.

Krumbein discusses the principles involved in the study of sedimentary environments and attempts to show that a study of fundamental properties of sediments may prove basic to future exploratory work. The role of basic research is to explore new paths of knowledge through the evaluation of fundamental sedimentary parameters such as size, shape, roundness, composition, surface texture, and fabric. The relation of these parameters to mass properties such as porosity and permeability needs study, and a knowledge must be gained of conditions that control the lateral and vertical variations of these mass properties in sedimentary environments. Sedimentary research is only one of several ways of exploring for petroleum by geologic methods. The closer coordination of paleontologic, stratigraphic, and sedimentary work should insure a continuously expanding frontier in the geological search for oil.—*Author's abstract, condensed by W. A.*

6442. Levorsen, A. I., Trends in petroleum geology: Econ. Geology, vol. 36, No. 8, pp. 763–773, Lancaster, Pa., 1941.

One of the peculiarities of the oil industry, in which it differs from many of the other industries using the minerals of the earth, is that its supplies of crude oil must be replenished continually by new discoveries. It is in the field of oil discovery that the petroleum geologist finds his chief work. The use of the microscope, with the consequent increase in detailed and accurate stratigraphic data, has proved to be one of the most important tools of petroleum geology. Not only does it give a better understanding of underground stratigraphy, but it also has stimulated an awareness of the importance of geologic history in the discovery process. The present trend is strongly in the direction of the application of this sort of data to the problems of stratigraphy and sedimentation. There is a growing trend of petroleum geologists into executive and managerial positions within the industry and into the oil business as independent operators. Probably as a result of this broadening viewpoint there is developing a greater interest in the college curricula of geological colleges. In many ways, the petroleum geologist is becoming an "oil man," which, after all, is proof of his place in the industry.—*Author's abstract.*

6443. Origin of oil: Am. Assoc. Petroleum Geologists, Research Comm., 81 pp., Tulsa, Okla., 1941.

This is a report of the conference on the origin of oil conducted by the research committee of the American Association of Petroleum Geologists, on April 5, 1941, in Houston, Tex.

About 40 geologists and chemists attended an all-day discussion on the origin of oil. A. I. Levorsen, chairman of the research committee, concludes the introduction to this report as follows: "The reader should bear in mind that this is a progress report—informal and not in any sense final. The style is generally free, as is natural in extemporaneous discussion. On the other hand, a group with an extremely wide background of experience and scientific ability took part in the discussion, and the result is believed to be something which should command the serious attention of students everywhere who are interested in this fundamental problem of the origin of oil."

A selective bibliography on theories of the origin of oil, compiled by Alan C. Skelton and Martha B. Skelton, is added.—*W. A.*

6444. Phelan, S. R., Geophysical prospecting: Internat. Oil, vol. 1, No. 3, pp. 60–66, October 1940.

The article treats of effective trends in geophysical prospecting, past, present, and future. The possibility of direct location of oil is considered, and the improvement of electrical-prospecting instruments such as meters and vacuum tubes and its effect on geophysical equipment is taken up. Low-frequency electrical methods, the soil-analysis method, development of gravimeters, improvements in field technique, and logging methods are some of the topics discussed. The article is illustrated by numerous field pictures. In conclusion, the discovery by Rabi of Columbia University is noted, namely that atoms of matter emit weak radio waves. This revives, perhaps, an old doodlebug fancy that vibrations are sent out by various substances.—*D. W., Annot. Bibl. Econ. Geology, vol. 13, No. 2, 1941.*

6445. Rosaire, E. E., Prospecting effectiveness: Geophysics, vol. 6, No. 4, pp. 428–448, Menasha, Wis., 1941.

The over-all prospecting effectiveness or power of any given method is made up of four component parts. Three of these tend to increase with successful use and the passage of time. These are: First, the operating effectiveness, which, referring to getting the data, is based on the cost of field operations in time and money; second, the technical effectiveness, which, referring to the quality of the data, is measured by the magnitude of the observational errors; and third, the resolving effectiveness, which, referring to the interpretation of the data, is measured by the ability to translate the data into terms of economic significance. The fourth component tends to decrease with successful use and passage of time and is the finding effectiveness, which is determined by the ratio of the magnitudes of findable anomalies to the magnitudes of the current observational errors. At any given time, the over-all prospecting effectiveness of a given method is determined by that particular component which displays the minimum effectiveness.

In the major petroleum-producing provinces of the United States of America, negligible or decreasing structure-finding effectiveness is displayed by all of the successfully used structural-finding effectiveness methods with one exception, the drill, the over-all structural-prospecting power of which is limited by a low operating effectiveness. However, these methods with existing low structural-finding powers, surface geology, gravity methods, and seismic methods display a more than appreciable finding effectiveness for anomalies which cannot be readily interpreted in terms of structure. This situation indicates that the existing low over-all efficacy of these various methods is determined not so much by a low absolute finding effectiveness as by a resolving power which is low because of structural inhibitions upon interpretation.

The sedimentary hydrocarbon prospecting method was introduced upon a theoretical basis which involved the depth of the source and the postulate of local lateral homogeneity but did not attain any measure of over-all prospecting potency until its interpretation technique was relieved of such purely theoretical inhibitions. Subsequent development has shown that similar limitations upon refraction interpretation were responsible for the collapse of that method in 1930 after the method had displayed marked prospecting effectiveness for shallow high-relief structure. Attention is called to the possibility that the removal of similar inhibitions also may result in a similar increase in resolving power for other methods which today display a low structure-finding effectiveness, and thus lead to their renaissance because of their thereby increased over-all prospecting effectiveness.—*Author's abstract.*

6446. Shaw, S. H., Nomograms for determining apparent dips: Inst. Min. Metallurgy Bull., No. 443, pp. 1–3, London, 1941.

The nomograms given in this article were constructed by Gluck and have proved to be useful where a large number of apparent dips must be determined, as in the construction of geologic sections. They may also prove to be useful to geologists and others engaged in geometrical problems concerned with dipping beds or veins.

The diagrams are based on the formula,

$$\tan X = \tan Y \sin A,$$

where X is the angle of apparent dip in a vertical plane that makes a horizontal angle, A, with the strike of the bedding plane, and Y is the angle of true dip of the bedding plane.—*W. A.*

6447. Taylor, M. D., Critical review of methods for the determination of the porosity, permeability, and saturation of core samples: Oil and Gas Jour., vol. 40, No. 28, pp. 40–41, 57, Tulsa, Okla., 1941.

In view of the published methods of core analysis used for the determination of the porosity, permeability, and saturation of oil-field core samples it has become increasingly evident that the particular method to be adopted depends on the type of samples to be analyzed, the speed with which an individual result is required, the number of samples to be handled, and the degree of accuracy needed. The methods of analysis which have been found most useful are briefly described, and the conditions for which they are most adaptable are stated.—*Author's abstract.*

6448. Wantland, D., The doodlebug versus applied geophysics: Mines Mag., vol. 30, No. 7, pp. 343–345, Denver, Colo., 1940.

The article deals with doodlebugs and kindred devices in their relation to geophysical prospecting and the instruments used in it. The thin line that often exists between what is legitimate in a prospecting instrument and a doodlebug is illustrated by the "puzzascope," which is in a sense a predecessor of the seismic-reflection method. "Shorty Hamilton's" treasure finder that could not detect "yellow bank bills" is described and contrasted with legitimate treasure finders or pipe locators. The views of Louis Agricola Bauer in 1556 on the forked twig, which he said should not be used by miners, are presented, as is the ancestral background of the divining rod.—*Author's abstract.*

6449. Weaver, P., The aid of geophysics to geology in finding oil fields: Internat. Oil, vol. 1, No. 2, pp. 50–52, July 1940.

The ideal instrument for locating oil is described as one that can determine directly the presence of oil in commercial quantities, outline the extent of the field, thickness of and depth to the oil-bearing formation, percentage of oil it contains, and its refining qualities. The author adds that when such an instrument is developed no more dry holes will be drilled. He takes up the different types of structures in which oil occurs and the importance of geology in finding them and traces the development along this line. The entrance of geophysics as a means to this end and the necessity of the coordination of the work of the geologist and geophysicist are treated. The early application by L. Mintrop, in 1923, of the refraction-seismograph method in the "Golden Lane" area of Mexico in mapping an extension of this line of structures is described as illustrating such coordination.—*D. W., Annot. Bibl. Econ. Geology, vol. 13, No. 2, 1941.*

9. NEW PUBLICATIONS

6450. Bodle, R. R., United States earthquakes, 1939: U. S. Coast and Geodetic Survey serial No. 629, 69 pp., illus., Washington, D. C., 1941. Price, 20 cents.

This publication is a summary of earthquake activity in the United States and the regions under its jurisdiction for the calendar year 1939 (for the previous publication see Geophys. Abstracts 105, No. 6083). It contains information on the instrumental results, noninstru-

mental results, miscellaneous activities, seismological-observatory results, strong-motion seismograph results, and tilt observations.—*W. A.*

6451. Heiland, C. A., Geophysics in war: Colorado School of Mines Quart., vol. 37, No. 1, 85 pp., Golden, Colo., 1942. Price, $1.

The book is divided into two main parts, Military operations and Mineral resources. In the first part the author discusses the application of geophysics to locating hostile guns, detecting airplanes, detecting hostile sappers, detecting submarines, adjusting friendly artillery, locating hostile weapons, marine communication and signaling, radio-acoustic position finding, marine echo-sounding, aerial terrain sounding, constructing fortifications, and locating shipwrecks. The second part deals with water supply, geophysical prospecting for oil, coal, and strategic and critical minerals.

All the important uses of geophysical methods, both in military operations and in the location of minerals, are discussed. Thirty-seven photographs, diagrams, and charts are included.—*W. A.*

6452. Levorsen, A. I., The origin of oil, 83 pp., Am. Assoc. Petroleum Geologists, Tulsa, Okla., 1941. Price, $1.

This is a photolithographed booklet published by the executive committee of the Association after the conference conducted on April 5, 1941, for the purpose of evaluating the present state of knowledge of the origin of oil.—*Condensed from Am. Assoc. Petroleum Geologists Bull., vol. 25, No. 11, p. 2086, 1941.*

6453. Longwell, C. R., Knopf, Adolf, and Flint, R. F., Outlines of physical geology, 2d edition, 381 pp., illus., New York, John Wiley & Sons, Inc., London, Chapman & Hall, Ltd., 1941.

New factual material and improved illustrations are included in this second edition of the book. A chapter on minerals and rocks brings together material that in the earlier edition was divided among several chapters and an appendix. One chapter treats volcanoes and intrusive igneous bodies as allied subjects, another deals with nonmetallic and metallic mineral deposits, and another explains the value of geology in large engineering projects such as the construction of dams, aqueducts, and tunnels. A special chapter deals with the nature and origin of earthquakes, their geographic distribution, seismology, precautions against earthquakes, and the interior of the earth.—*W. A.*

6454. Miller, W. J., Introduction to physical geology, with special reference to North America, 4th edition, 465 pp., 397 figs., New York, D. Van Nostrand Co., Inc., 1941. Price, $3.25.

This book, consisting of 15 chapters, deals with the earth as a planet, geologic time, the branches of geological science; diastrophism and earthquakes; materials of the earth; weathering; structure of the earth's crust; the work of streams, glaciers, wind, and sea; volcanoes; subsurface water; mountains; plateaus; plains; lakes and economic phases of coal, petroleum, natural gas, and some metals and rocks. A detailed index completes the volume.—*Review by H. L. Driver in Am. Assoc. Petroleum Geologists Bull., vol. 25, No. 12, condensed by W. A.*

6455. Mining engineers' handbook, edited by Robert Peele and J. A. Church, 3d edition, 2 vols., 3,515 pp., New York, John Wiley & Sons, Inc., 1941. Price, $15.

The new edition has been entirely reset and largely rewritten by 62 experts, and all sections contain changes. There are new sections on geophysical prospecting and petroleum production, and the backbone of the book "Prospecting, development, and exploitation of mineral deposits" has been largely rewritten and is abreast of the rapid changes in mining. The voluminous illustrations include a host of new ones.—*Alan Bateman's abstract in Econ. Geology, vol. 36, No. 8, 1941, condensed by W. A.*

6456. Poldini, E., La prospection électrique du sous-sol [Electrical exploration of the subsoil], 94 pp., 39 figs., Lausanne, Librairie F. Rouge et Cie., 1941.

Poldini gives an account of electrical prospecting by the use of continuous current methods. He first discusses the physical theories of the methods and then gives sections illustrating the application of the methods to problems in civil engineering, tectonics, ground-water supply, and the search for metalliferous or petroliferous deposits. This is a valuable reference book for all those interested in subsurface methods. —*W. A.*

6457. Possible future oil provinces of the United States and Canada; edited by A. I. Levorsen, 154 pp., 83 figs., Tulsa, Okla., Am. Assoc. Petroleum Geologists, 1941. Price $1.50.

Much information, skilfully welded together by the editor, is compressed into a few pages to make this book, which represents a symposium conducted at Houston, Tex., last April [1941] by the research committee of the American Association of Petroleum Geologists. Behind it lies the authority of regional geological societies and many geologists, both government and private, who met to investigate the undiscovered petroleum possibilities of the area north of Mexico, including Alaska, western Canada, Pacific Coast States, and Rocky Mountain, northern Mid-Continent, West Texas, eastern Canada, eastern United States, and southeastern United States regions.

The book not only gives a picture of the places of future oil discoveries in this vast area but is also a geologic handbook of each area, dealing with geologic sections, stratigraphy, and structures, illustrated by maps and sections, accompanied by selected references. Considerable credit is due the editor for his excellent task, and the Association for its sponsorship.—*Alan M. Bateman, Am. Jour. Sci., vol. 240, No. 1, 1942.*

6458. Tables of natural logarithms, vols. 1 and 2, prepared by the Federal Works Agency, Work Projects Administration for the city of New York, 501 pp. each, New York, 1941.

The first volume contains the 16 decimal-place values of the natural logarithms of the integers from 1 to 50,000; the second volume, those from 50,000 to 100,000—*W. A.*

6459. Wood, H. O., and Heck, N. H., Earthquake history of the United States, Part 2, Stronger earthquakes of California and western Nevada: U. S. Coast and Geodetic Survey serial No. 609, 30 pp., Washington, D. C., 1941. Price, 10 cents.

For Part 1, Continental United States (exclusive of California and western Nevada), see Geophys. Abstracts 97, No. 4980. The present volume is a revision of the previous publication on the "Destructive and near-destructive earthquakes in California and western Nevada, 1769–1933" (see Geophys. Abstracts 72, No. 2434). It includes also shocks through 1940.—*W. A.*

10. PATENTS

6460. Method and apparatus for recording waves; Esme E. Rosaire and Fabian M. Kannenstine, Houston, Tex., assignors by mesne assignments to said Rosaire: U. S. patent 2,257,859, issued October 7, 1941.

This invention relates to a device for locating sources of elastic waves, comprising, in combination, means for creating elastic waves; a plurality of means for translating the vibrations resulting from said disturbances into recordable impulses, said means being spaced from each other and from the point of origin of said disturbance; means for delaying said impulses in a plurality of primary delay circuits; means for compounding the delayed impulses in a plurality of secondary channels; means for recording the impulses from said secondary channels; and means for additional delay adjustment in each of said primary circuits whereby compensation for local or surface irregularities is provided. Claims allowed, 9.

6461. Measuring instrument; Fabian M. Kannenstine and Francis M. Floyd, Houston, Tex., said Floyd assignor to Kannenstine: U. S. patent 2,258,613, issued October 14, 1941.

This invention relates to a force-measuring instrument of the class described, comprising a base member; a mass; a substantially U-shaped beam extending horizontally and having its ends attached to said member and mass, respectively, so that the mass is supported in closely spaced relation with the base member, said beam lying in a vertical plane, the lower and upper limbs of the beam being of such different cross sections that they are relatively stiff and flexible, respectively, whereby the upper limb serves as a cantilever beam to support the mass; and means for measuring the distance between the mass and members as a measure of the forces acting upon the mass. Claims allowed, 3.

6462. Geophysical exploration system; Charles Gill Morgan, Pasadena, Calif., assignor by mesne assignments to Consolidated Engineering Corporation, Pasadena, Calif., a corporation of California: U. S. patent 2,259,478, issued October 21, 1941.

This invention relates to the method of profiling a subsurface formation, comprising generating sets of seismic waves successively at a plurality of spaced generating points; receiving and recording said waves after oblique reflection from corresponding series of incidence points on successive extents of said common formation; and receiving waves generated at the respective generating points, each series being located a distance from its corresponding generating point, which is large compared to the interval between successive detecting points in said series, whereby continuous exploration of said formation is obtained without interference from slow-traveling surface waves. Claims allowed, 12.

6463. Method and apparatus for logging boreholes; Bernard F. McNamee and Frank Rieber, Los Angeles, Calif.: U. S. patent 2,259,904, issued October 21, 1941.

This invention relates to the method of borehole logging, which includes the steps of magnetically developing latent magnetic characteristics of strata traversed by the borehole and thereafter obtaining indications of magnetic characteristics of the strata, which remain temporarily after the development thereof. Claims allowed, 18.

6464. Method and apparatus for seismograph prospecting; Engelhardt A. Eckhardt, Pittsburgh, and Gary Muffly, Penn Township, Allegheny County, Pa., assignors to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,260,217, issued October 21, 1941.

In seismograph prospecting methods wherein the output of a plurality of seismic detectors is applied to a single recording element, the improvement which comprises locating a plural group of electric signal producing seismic-wave detectors at spaced points in the earth; generating a seismic-wave impulse at a point spaced from the group of detectors so as to cause propagation of seismic waves undergoing reflection and refraction in the earth; maintaining electrical connection between only one of said detectors and the recording element during the arrival of the first refracted wave at said detector; and, before reflected waves arrive at the detectors, establishing electrical connection between a plurality of the detectors and the recording element, whereby the first refracted wave is detected individually by a detector and the reflected waves are detected by a plurality of detectors. Claims allowed, 10.

6465. Process and apparatus for core-sample orientation; Lyle Dillon, San Gabriel, Calif., assignor to Union Oil Co. of California; U. S. patent 2,260,562, issued October 28, 1941.

This invention relates to a method for determining the resultant polar orientation of a magnetized body, comprising imparting relative rotation between said body and an inductor coil whereby one plane of maximum magnetization of said body is established; imparting relative rotation between said body and said coil about an axis which is perpendicular to said first-mentioned established plane; likewise establishing a second plane of magnetization which intersects said first-established plane; and measuring the angle of the line of said intersection with respect to a given axis of said body. Claims allowed, 15.

6466. Micromagnetic prospecting device; William P. Jenny, Houston, Tex.: U. S. patent 2,261,030, issued October 28, 1941.

In a device of the class described, the combination of a housing; a suspension fiber having one end attached to said housing; a balance beam attached to the other end of the fiber and suspended thereby; a mass fixed to said beam in spaced relation with the point of attachment to said strand; a second fiber attached to the beam opposite said mass; a bar magnet supported by said second fiber to balance said beams; and means for observing the position of rest of the beam, whereby the magnetic gradient of the terrestrial magnetic field at the location of the instrument may be determined. Claims allowed, 12.

6467. Seismic exploration method; Philip S. Williams, Tulsa, Okla., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,261,321, issued November 4, 1941.

In the geophysical exploration of earth substrata, the steps of creating a seismic disturbance at a selected point in the earth, whereby seismic waves are caused to travel through the substrata; receiving said waves at a plurality of points spaced from each other and from the point of creation; and recording, as a single trace, the average amplitude without regard to sign of the received waves. Claims allowed, 9.

6468. Apparatus for analysing gases; John C. Karcher, Dallas, Tex.; U. S. patent 2,261,498, issued November 4, 1941.

This invention relates to an apparatus for detecting gas in a gaseous mixture, comprising a stationary base; a collimating tube and an objective tube mounted on said base in spaced-apart relation, each of said tubes being provided with gas inlet and outlet parts; means for furnishing light rays for passage through said objective tube and connected therewith; means connected with said collimating tube to measure the intensities of light rays emanating from said light furnishing means; a turntable rotatably mounted on said base; a pair of similar prisms fixedly mounted on said turntable, each in the path of light rays passing through said tubes; and a concave mirror mounted on said turntable, said mirror being farther removed from said tubes than said prisms and being in the path of the light rays passing therethrough. Claims allowed, 2.

6469. System for measuring earth conductivity; Frank Rieber, Los Angeles, Calif.: U. S. patent 2,261,563, issued November 4, 1941.

This invention relates to the process of ascertaining electrical earth conductivities along a well bore, which comprises passing a current through the earth between a spaced point and the bore; influencing a magnetic member with a component of the magnetic field produced by said current; reducing the effect of said component on said member to zero by moving a magnet, the strength of which is proportional to said component; and recording the position of said magnet relative to said member when said zero point is reached. Claims allowed, 6.

6470. Geochemical prospecting; Leo Horvitz, Houston, Tex., assignor to Esme E. Rosaire, Houston, Tex.: U. S. patent 2,261,764, issued November 4, 1941.

This invention relates to the method of exploration for carboniferous deposits, which comprises the steps of taking samples of soil in a region to be explored; treating said sample to evolve in gaseous form constituents contained therein which are due to leakage from said deposits; and subjecting the evolved gases to analysis for the quantitative determination therein of carbon monoxide as an indication of proximity of the samples to the sought deposits. Claims allowed, 5.

6471. Gravity meter; Dayton H. Clewell, Dallas, Tex., assignor by mesne assignments to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York; U. S. patent 2,262,165, issued November 11, 1941.

In a gravity meter having a mass pivoted for rotation in a vertical plane, a pretensioned spring for elastically balancing the weight of the mass; an indicator carried by the mass; fixed means adapted to cooper-

ate with the indicator for measuring the displacement of the mass; a helical spring secured to the pretensioned spring at a point intermediate the ends thereof; a support; and means for adjustably securing the free end of the helical spring to the support, whereby a change of tension in the helical spring will laterally displace the body of the pretensioned spring to effect a change in the lever arm through which the pretensioned spring acts upon the mass to displace the mass an amount sufficient to null the instrument. Claims allowed, 5.

6472. Method of electromagnetic logging; Lawrence F. Athy and Harold R. Prescott, Ponca City, Okla., assignors to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2,262,419, issued November 11, 1941.

This invention relates to a method of electromagnetically logging boreholes in the earth, including the steps of passing an alternating current of predetermined frequency between two points disposed on opposite sides of the borehole, whereby said current will flow through various subsurface strata at different densities in accordance with respective conductivities of the strata; thereby inducing alternating magnetic fields in the borehole adjacent various strata, said magnetic fields varying in intensity as a function of the respective conductivities of the strata; and measuring the intensity and instantaneous direction of the induced magnetic field adjacent successive strata. Claims allowed, 9.

6473. Gravity-measuring instrument; Joseph A. Marchand, Houston, Tex., assignor of 55 percent to Bailey Balken, Houston, Tex.: U. S. patent 2,263,096, issued November 18, 1941.

In a gravity-measuring instrument, a beam pivoted substantially midway of its length; a pendulum secured to and rigidly depending from said beam in vertical alinement with its pivot; a gravity responsive mass carried adjacent to one end and above said beam; counterbalance means connected adjacent to the other end and above said beam; and means for individually adjusting the vertical position of said mass and the point of connection of said counterbalance means with respect to said beam and its pivot, to thereby vary the period of oscillation of said pendulum. Claims allowed, 5.

6474. Geophysical prospecting; Joseph A. Marchand, Houston, Tex., assignor of 55 percent to Bailey Balken, Houston, Tex.: U. S. patent 2,263,097, issued November 18, 1941.

This invention relates to the method of geophysical prospecting, comprising the steps of measuring the potential produced by telluric currents between a point and a plurality of points spaced equidistant thereabout; and measuring the current which flows through a fixed resistance connected successively between said point and measurements about each of a plurality of additional points within a prospect area, so that such measurements of potential and current constitute information of the location and extent of sought subsurface structures. Claims allowed, 1.

6475. Logging wells during drilling; Robert W. Stuart, Tulsa, Okla.; assignor to Stanolind Oil & Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,263,108, issued November 18, 1941.

This invention relates to apparatus for detecting crude oil in a flowing fluid stream, comprising a conduit for said stream having an upwardly facing opening therein; a light-proof case mounted on said conduit and completely covering said opening, said case comprising an airtight chamber above the surface of said stream; means within said case for direct ultraviolet light against the surface of said stream through said opening; means within said case responsive to the intensity of fluorescent light produced by the action of said ultraviolet light on crude oil in said stream; and means for introducing a stream of air into said chamber. Claims allowed, 7.

6476. Seismograph prospecting apparatus; Otto F. Ritzmann, Pittsburgh, Pa., assignor to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,263,519, issued November 18, 1941.

In a seismograph prospecting apparatus including a seismophone adapted to produce electrical signals on being subjected to artificially produced terrestrial vibrations of relatively low frequency, said vibrations including some desired frequencies within a limited range, also including at least one frequency which it is desired to suppress and which lies within the range of desired signal frequencies, and said vibrations further including other frequencies beyond the desired range, which other frequencies it is also desired to suppress; recording means and a circuit connecting the seismophone to the recording means; the improvement comprising band-pass filter means in the circuit adapted to pass frequencies within the desired range and to suppress frequencies substantially higher and lower than the desired range; and separate adjustable filter means in the circuit tuned to cause attenuation of at least one disturbing frequency which is passed by the first-named filter means and which lies within the desired frequency range, said second-named filter means having such transmission characteristics as not to cause any substantial attenuation of frequencies other than said disturbing frequency; whereby all said undesired frequencies are suppressed by the filter while frequencies in the desired range are transmitted thereby. Claims allowed, 7.

6477. Geophysical surveying; Frederic W. Lee, Owings Mills, Md.: U. S. patent 2,264,318, issued December 2, 1941.

This invention relates to a system for differentiating geologic structure, comprising at least one exciting coil and one pick-up coil, said coils being axially spaced one above the other and movable axially relative to a geologic structure; means for exciting fluctuating current fields in the geologic structure, which in turn will induce potentials in the pick-up coil influenced by the electrical constants of the structure; and means for measuring the picked-up potentials to obtain an indication of the electrical constants of the structure, said exciting means comprising a calibrating impedance providing a potential drop; and said system further including means for applying said potential drop to said measuring means and for calibrating said measuring means to indicate directly, for a given exciting current and coil configuration, electrical constants of the structure. Claims allowed, 8.

6478. Geophysical-instrument mounting; Daniel Silverman and John L. Bible, Tulsa, Okla., assignors to Stanolind Oil & Gas Co., Tulsa, Okla., a

corporation of Delaware: U. S. patent 2,264,342, issued December 2, 1941.

This invention relates to a geophysical-instrument mounting, comprising a tripod having a fixed head and an adjustable head; a support for a geophysical instrument; means for adjusting said support to position said geophysical instrument above said tripod; and means for elevating said adjustable head to support said geophysical instrument. Claims allowed, 10.

6479. Method and apparatus for coring; Whitman D. Mounce, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,264,449, issued December 2, 1941.

This invention relates to a method for securing a core at the bottom of a borehole containing a drilling fluid, which comprises introducing into the hole a liquid immiscible with the drilling fluid and of greater specific gravity than the drilling fluid, whereby a layer of said liquid is formed at the bottom of the borehole; introducing a coring device into the borehole; conducting the coring operation beneath the layer of introduced liquid; and withdrawing the core produced. Claims allowed, 9.

6480. Gun perforator; Whitman D. Mounce, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,264,450, issued December 2, 1941.

In a gun for a borehole including a body, bullets arranged for projection from the sides of said body and explosive charges arranged behind the bullets for the projection thereof; a firing circuit comprising a plurality of electrical devices arranged in said explosive charges for firing the same, said devices being arranged in parallel in said circuit; a source of alternating current for actuating said devices; and an inductive coupling between said source and said devices. Claims allowed, 14.

6481. Geophysical instrument; Earley M. Shook and Robert W. Olson, Dallas, Tex., assignors by mesne assignments to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,264,596, issued December 2, 1941.

This invention relates to an apparatus adapted for use in seismic prospecting that comprises in combination means for detonating a charge of explosives to create seismic waves in the earth's surface; a radio transmitter adapted to send out a carrier wave of predetermined frequency; means for modulating the carrier wave with a signal of relatively low frequency; and means for interrupting the modulating signal coincidentally with the detonation of the explosive charge that creates the seismic waves. Claims allowed, 9.

6482. Prospecting method and apparatus; Kenneth E. Burg, New Orleans, La., assignor to Geophysical Service, Inc., Dallas, Tex., a corporation of Delaware: U. S. patent 2,265,513, issued December 9, 1941.

This invention relates to apparatus for determining subterranean earth formations, comprising means for creating elastic waves in the earth; means for detecting said waves at spaced points remote from the first mentioned means, said detecting means including a radio transmitting device operable to transmit the detected waves; and

receiving and recording means for producing a single common record of the waves transmitted from all of said points. Claims allowed, 3.

6483. Method of logging boreholes; Lawrence F. Athy, Harold R. Prescott, and Roland F. Hughes, Ponca City, Okla., assignors to Continental Oil Co., Ponca City, Okla., a corporation of Delaware: U. S. patent 2,265,768, issued December 9, 1941.

This invention relates to a method of logging boreholes, including the steps of generating a harmonic potential; impressing said potential upon a vibratory means adapted to respond thereto to create standing waves in the strata traversed; lowering said vibratory means into a borehole the log of which is being made; measuring changes of impedance in said vibratory means caused by the counter effects of motions created as said vibratory means is lowered into the borehole; and plotting impedance changes to determine the character of the standing waves created. Claims allowed, 19.

6484. Alternating-current electrologging of well bores; Dean E. Batchelder, Los Angeles, Calif., assignor to Lane-Wells Co., Los Angeles, Calif., a corporation of Delaware: U. S. patent 2,265,978, issued December 16, 1941.

In an apparatus for electrical surveying of earth formations, means for creating an electrical field in said formation comprising a pair of input electrodes; a source of alternating current and input-circuit means connecting said source to said input electrodes, at least one of said input electrodes being movable with respect to said formation; probe circuit means including a probe electrode movable with but in spaced relation to said movable input electrodes, said probe circuit including, in series relation with said probe electrode, dynamometer means for indicating variations in the phase of potential in said probe circuit as said electrodes are moved; and variocoupler means for in part neutralizing potential induced in said probe circuit by the electric field in said formation. Claims allowed, 6.

6485. Geophysical-prospecting receptor circuits; Herbert Hoover, Jr., Sierra Madre, Calif., assignor to Consolidated Engineering Corporation, Los Angeles, Calif., a corporation of California: U. S. patent 2,266,040, issued December 16, 1941.

In a geophysical-prospecting system, a receptor; a receptor line; an amplifier and recorder electrically connected in the named sequence; a coupling device between said line and said amplifier; and an isolation transformer between said line and said coupling device, the primary of said isolation transformer being grounded between the line connection thereof at a point which will balance the two sides of said line to ground. Claims allowed, 17.

6486. Geophysical-prospecting receptor circuits; Herbert Hoover, Jr., Sierra Madre, Calif., assignor to Consolidated Engineering Corporation, Los Angeles, Calif., a corporation of California: U. S. patent 2,266,041, issued December 16, 1941.

In a geophysical-prospecting system, a combination which comprises at least three receptor circuits, a corresponding plurality of recorders; intermediate current-carrying circuits coupling each said receptor circuit with the said corresponding recorder; and means including electrical-impedance elements coupling each of said intermediate circuits to at

least one other of said intermediate circuits, said impedances and intermediate circuits being so connected and arranged as to introduce a controlled amount of cross feed from one intermediate circuit to another intermediate circuit through one of said impedance elements and also connected and arranged to introduce no cross feed between two of said intermediate circuits that are nonadjacent, whereby some of said recorders receive signals from more than one receptor circuit and none of said recorders receive signals from all of said circuits. Claims allowed, 19.

6487. Well-surveying device; Raymond G. Piety, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Delaware: U. S. patent 2,266,071, issued December 16, 1941.

This invention relates to a method of electrically logging a borehole, comprising suspending an elongated electrode in the borehole to be logged; grounding a second electrode; setting up an electrical potential between the two electrodes to establish a current; intercepting current at points along the length of the elongated electrode; and comparing the characteristics of the intercepted current with those of the first claimed current. Claims allowed, 5.

6488. Method of locating oil deposits; Walter A. Kelly, Paterson, N. J.: U. S. patent 2,266,556, issued December 16, 1941.

This invention relates to a method of locating oil deposits, which consists in sinking a plurality of false wells; dropping containers of gas-absorbing material within said wells in such a manner as to expose the absorbent material to the gases in said wells; the removing of said containers from said wells after a predetermined time; and making a comparative analysis of the gas absorbed in each well. Claims allowed, 5.

6489. Method of surveying boreholes and locating tools therein; Steven W. Gurasich, Bakersfield, Calif., assignor to Sperry-Sun Well Surveying Co., Philadelphia, Pa., a corporation of Delaware: U. S. patent 2,266,623, issued December 16, 1941.

This invention relates to the method comprising lowering a directional well-surveying instrument by means of a sectional hollow drill stem, the sections of which are lined up relatively to each other and said instrument so that the orientation of said instrument is at least approximately determinable during the lowering operation; causing said instrument to make a series of records of inclination at various depths during such lowering; removing said instrument from the hole through the drill stem while the drill stem remains in the hole; and causing said instrument to make a series of records of both inclination and direction at various depths during such removal. Claims allowed, 10.

6490. Method and apparatus for translating seismic waves; Harold F. Wiley, Pasadena, Calif., assignor by mesne assignments to Consolidated Engineering Corporation, Pasadena, Calif., a corporation of California: U. S. patent 2,266,837, issued December 23, 1941.

In an apparatus for seismic prospecting, means for generating seismic waves and means spaced therefrom for receiving said waves after reflection from subsurface strata, comprising a seismometer weighing less than substantially 3 pounds, whose frequency of maximum

response lies above the frequency range of seismic waves employed in seismic prospecting. Claims allowed, 6.

6491. Apparatus for and method of seismograph recording; Otto F. Ritzmann, Aspinwall, Pa., assignor to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,267,856, issued December 23, 1941.

In a seismograph-recording apparatus, a traveling photosensitized recording band, at least two electro-optical oscillation-recording means, comprising light-source means and each adapted to modify light proportionally to applied signal strength; a plurality of separate seismic detector-signal channels; circuit means for connecting said channels separately to said oscillation-recording means; and means for impinging light beams from at least two of said oscillation-recording means upon a single spot on the recording band to produce a single composite record of the channels. Claims allowed, 13.

6492. Method of seismic surveying; Charles Hewitt Dix, Pasadena, Calif., assignor to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,267,858, issued December 30, 1941.

In a refraction method of seismic geophysical surveying, which includes the creation of seismic pulses at a series of points and the detection of said pulses at seismometer stations spaced along the line of survey, the improvement which comprises: After the creation and recording of each seismic pulse, measuring from the "last useful seismometer station" back along the line of survey toward the point of creation of said pulse a distance not substantially less than the distance from the point of creation of said pulse to the "nearest useful seismometer station" as indicated by the records of said pulse; creating a subsequent seismic pulse at the location so determined; recording said subsequent pulse at seismometer stations placed along the line of survey in the direction away from first said point of creation of a seismic pulse; and repeating the recited operations until the line of survey is covered. Claims allowed, 2.

6493. Radio-wave prospecting; Ludwig W. Blau, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,268,106, issued December 30, 1941.

This invention relates to a method for determining the subsurface structure of the earth over a given area, which comprises moving over said area an antenna whereby radio waves passing over the area are picked up; selecting from the picked-up waves a plurality of waves different and definite in frequencies and produced by separate transmitting stations; separately amplifying and recording the variations in field strength of the waves so selected; and comparing the records so obtained. Claims allowed, 4.

6494. Method of geophysical investigation; Morris M. Slotnick, Houston, Tex., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,268,130, issued December 30, 1941.

This invention relates to a method of outlining a subsurface structure, comprising the steps of penetrating said structure with a borehole; arranging a detector of seismic waves in said borehole at a known point within said structure; initiating seismic waves at points on the surface of the earth with a plurality of seismic waves at points on

the surface of the earth, with a plurality of said points arranged on each of two concentrically closed curves and points on one curve paired with points on the other so that lines passing through said pairs of points will, when extended, intersect the axis of said borehole; receiving with said detector waves initiated at each of said surface points; and determining the traveltime thereof between the points of initiation and the detector, whereby the paths of the waves between each of said surface points and the detector may be determined and the subsurface structure outlined. Claims allowed, 1.

6495. Electrical well-logging system; Haakon Muus Evjen, Houston, Tex., assignor to Shell Development Co., San Francisco, Calif., a corporation of Delaware: U. S. patent 2,268,137, issued December 30, 1941.

In an electrical circuit for logging formations traversed by a borehole, at least one electrode in contact with the ground at the surface thereof and a plurality of cable-supported electrodes within the borehole, means for passing an interrupted reversing direct current between two of said electrodes; means for passing an alternating current between two other electrodes; first direct-current indicating means for observing the potential generated between the second two electrodes by the flow of the reversing direct current between said first two electrodes; alternating-current indicating means for observing the impedance to the flow of the alternating current between said second two electrodes; second direct-current indicating means for observing the spontaneous potential existing between said second two electrodes during the interruptions in the flow of the reversing direct current between the first two electrodes; and filter means in the circuit between said second two electrodes to separate the flow of the direct current from that of the alternating current. Claims allowed, 3.

6496. Electrical well-logging system; Haakon Muus Evjen, Houston, Tex., assignor to Shell Development Co., San Francisco, Calif., a corporation of Delaware: U. S. patent 2,268,138, issued December 30, 1941.

In a method for electrically logging formations traversed by a borehole containing a fluid, the steps of maintaining a plurality of electrodes in contact with the borehole fluid and the ground in a region comprising said borehole and a zone surrounding said borehole; passing an alternating current between a first pair of electrodes; detecting the spontaneous potential existing between said first electrodes; separating the direct current due to said spontaneous potential from said alternating current and separately indicating said spontaneous potential and the potential and intensity of said alternating current; rectifying a portion of said alternating current; detecting between a second pair of electrodes the alternating potential generated therebetween by the flow of the alternating current between the first electrodes; rectifying said detected alternating potential; and indicating said rectified alternating potential by balancing it against a potential derived from the rectified portion of the alternating current flowing between the first electrodes. Claims allowed, 3.

6497. Geochemical well-logging method; Standard Oil Development Co., Linden, N. J., assignee of Leo Horvitz, Houston, Tex., both in the United States of America: Canadian patent 399,868, issued October 7, 1941.

This invention relates to the method of logging a well, which comprises collecting samples of soil at spaced intervals along a borehole;

analyzing the samples for their content of at least one selected inorganic ion; and correlating the concentrations of said ion so determined with the depths of the samples, the samples collected being sufficient in number to yield data showing the variation in concentration of the selected ion with depth. Claims allowed, 19.

6498. Ground-wave velocity-determining method; Bolidens Gruvaktiebolag, assignee of Johan David Malmquist, both of Stockholm, Sweden: Canadian patent 400,592, issued November 11, 1941.

This invention relates to that method of measuring the velocity of propagation of seismic impulses through the ground which consists in producing a cathode ray; causing said ray to oscillate under the influence of a sine-curved alternating current of definite frequency; causing the production of a seismic shock in the ground and thereby imposing for an instant a second electric current on the sine-curved current to vary the oscillation and distort the path of the cathode ray; causing said shock to again impose for an instant the second current on the sine-curved current from a point in the ground spaced at a known distance from the point of origin of the shock whereby to again vary the oscillation and distort the path of the ray oscillations rendering the ray oscillations visible; determining the distance between the two distortions; and therefrom determining the velocity of propagation. Claims allowed, 2.

6499. Well-survey apparatus; Well Surveys, Inc., assignee of Serge Alexander Scherbatskoy, both of Tulsa, Okla., United States of America; Canadian patent 401,688, issued December 23, 1941.

In a method of geophysical exploration that comprises lowering an ionization chamber into a drill hole or the like and measuring the rate of current flow therethrough at various levels as an indication of the intensity of the radioactive radiations encountered at those levels, the method of measuring the rate of flow of the current through the ionization chamber, which comprises electrically matching said current flow with an external current flow; transmitting an indication of any difference between said current to a recording point; adjusting said external current flow at said recording point so that it will exactly balance the current flow through the ionization chamber by reference to the transmitted indication of difference; and recording the magnitude of the external current flow as a measure of the intensity of the radiations impinging upon the ionization chamber. Claims allowed, 11.

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