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UNCLASSIFIED - INFORMATION ON SOVIET BLOC INTERNATIONAL GEOPHYSICAL COOPERATION - 1960

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INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM -- SOVIET-BLOC ACTIVITIES

Table of Contents

I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

New Books on Soviet Space Achievements

A number of new books recounting Soviet successes in the field of space conquest appeared at the beginning of the year. Among them were the following. Besprimernyy Nauchnyy Podvig (Unprecedented Scientific Achievement), issued by the State Publishing House of Physicomathematical Literature, presents a detailed account of the three Soviet cosmic rockets. Issued by the same house is a revised and supplemented edition of Ari A. Shternfel'd's Ot Iskusstvennykh Sputnikov k Mezhplanetnym Poletam (From Artificial Satellites to Interplanetary Flights).

A third book, Sovetskaya Raketa Issledyet Kosmos (Soviet Rocket Explores the Cosmos), by V. I. Levantov, V. A. Leshkovtsev, and I. Ye. Rakhlin, tells the story of the first Soviet cosmic rocket. Problems of space flight and research are covered in it in some detail. ("unprecedented Scientific Achievement"; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 23 Dec 59, p 4)

II. UPPER ATMOSPHERE

New Magnetic Spectrometer Developed at Armenian Academy of Sciences

One of the principal methods of investigating cosmic rays in the USSR involves using the Alikhanyana-Alikhanova magnetic mass-spectrometer. Described as possessing a number of advantages over other methods (high resolving power in pulse measurements, the determination of the sign of the charge of the particle, etc.), the magnetic mass-spectrometer became the standard apparatus for the study of cosmic rays in a number of laboratories and, in particular, in the high-mountain Aragatskoy station of the Physics Institute of the Academy of Sciences Armenian SSR.

The Bol'shoy Elektromagnit Laboratory of the Aragatskiy station developed a new form of the instrument of removing the hodoscopic-collecting device under the magnetic field and replacing it with a large rectangular Wilson chamber. Later, a second Wilson chamber was added above the instrument. This made it possible to, not only identify a particle and investigate the character of its collision in the plates of the lower chamber and its subsequent behavior, but also to obtain information on whence the particle came -- whether it came from outside or whether it was formed as the result of some process in the matter in the upper chamber.

The principal parts of the instrument are a magnetic spectrometer of high resolving power for measuring the pulses of the charged cosmic particles; a large rectangular Wilson chamber (620 x 280 x 180 millimeters)

positioned close up under the poles of the magnet; an upper Wilson chamber the same size as the lower one but different in that in each expanding head the movable grids move separately, independent of each other, whereas in the lower chamber, these are linked together; and several electronic control units.

The instrument has been further improved by the development and building of a new five-layer proportional counter which permits measuring ionization with high accuracy in addition to measuring the pulse and travel of the particle. At present, the laboratory is developing an anticoincidence circuit for inclusion with the instrument which will increase the effectiveness of recording high energy nuclear fissions. A very essential improvement will be the transition to a two-layer coordinated series of counters and a change to higher intensities of the magnetic field. These measures will make it possible to introduce new tasks in physical research and to study nuclear introductions of particles with energies up to 10^{11} electron volts. ("The Alikhanyana-Alikhanova Magnetic Spectrometer With Two Large Wilson Chambers," by A. T. Dadayan and G. V. Badalyan; Yerevan, Izvestiya Akademii Nauk Armyanskoy SSR, Seriya Fiziko-Matematicheskikh Nauk Vol 12, No 4, 1959, pp 109-119)

III. METEOROLOGY

Weather Modification Studies Being Conducted by Armenian Institute

The study of the problem of artificial atmospheric precipitations occupies a prominent place among the investigations conducted by the Institute of Power Engineering and Hydraulics of the Academy of Sciences Armenian SSR. The work during the last 2 years was conducted jointly by the institute and the Main Geophysical Observatory (Leningrad) in the region of Lake Sevan.

The characteristics of cumulus congestus clouds at an altitude of 5-8 kilometers were studied, and a series of experiments on the action of carbon dioxide on the cloud were conducted. As a result of these experiments, rains of rather long duration were caused. ("Artificial Atmospheric Precipitations"; Moscow, Vestnik Akademii Nauk SSSR, No 7, Jul 59, p 70)

Sixth All-Union Conference on Clouds

The sixth conference on the problem of studying clouds, precipitations, and weather modification was held 15-20 June 1959 at the Institute of Applied Geophysics, Academy of Sciences USSR. The conference was called by the Coordinating Council on the Problem "Physics of Clouds and Precipitations," under the Department of Physicomathematical Sciences, Academy of Sciences USSR. Representatives of 44 USSR scientific research institutions

and representatives of the Academy of Sciences, Communist China, took part in the work of the conference. Sixty-eight reports on the results of investigations in the field of aerology and aerosynoptics, cloud physics and weather modification, the electricity of clouds, and special instruments were given.

A considerable expansion of scientific work in the field of cloud physics and precipitations and weather modification was noted in the period since the fifth conference (February 1956).

Some shortcomings in the conduct of the investigations were noted. The lack of efficient coordination of work in view of the ever-growing volume of investigations in the USSR was decried.

A member of resolutions were accepted. These emphasized more work on the problem of weather control; more work on cloud studies, in particular, cumulus congestus and the cloud belts above and below that of the noctilucent clouds; more work on the chemistry of water aerosols and their modification; further development of instruments making use of telemetry and electronics; the organization in 1962 of an "All-Union Cloud Year"; future improvement of the coordinated activities of the Academy of Sciences USSR on the problem of "Clouds and Precipitations"; and the need to call another conference on the problem in 1961.

The works of the current conference will be published by the Institute of Applied Geophysics, Academy of Sciences USSR. ("Sixth All-Union Conference on Clouds," by E. L. Aleksandrov; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 10, Oct 59, pp 1526-1527)

Study on Influence of Updrafts on Shower and Hail Formations and Hail Prevention

Radar studies of stratocumulus and cumulus congestus clouds were conducted in 1956-1958 in the Transcaucasus and Caucasus for determining the influence of vertical wind currents on the formation of intense showers and hail.

The studies showed that the velocity of the vertical currents increases with altitude, reaching a maximum in the upper part of the cloud, after which it quickly decreases; that the temperature in the cloud during its development is higher than the surrounding medium on the same level, while it is lower in the upper part of the cloud than the surrounding medium during the stabilization and dispersal of the cloud; that the water content in the front-top part of the cloud increases sharply, while the water content and spectra of the cloud droplets in the lower and middle parts of the cloud change very little; and that the detection on the radar screen of a pulsating and growing zone of reflection is explained by the increase in the water-bearing capacity in the upper part of the cloud. This zone of

reflection is located above the level of maximum vertical wind current velocity. The lowering of this zone coincides with the beginning of the fall of intense showers.

Drops are retarded in the upper part of the cloud where the velocities of the updrafts are low and the main growth of the drop or hail occurs in the front-top of the cloud. If the top part of a cumulus congestus cloud is at temperatures above freezing, the cloud remains liquid. When the temperature of the top of the cloud is lower than freezing, hail forms. The final size of the hail depends very little on the vertical mass of the cloud. The principal parameters determining the final dimensions of hail are the water content of the air masses entering the cloud, the height of the zero isotherm, the magnitude of the maximum wind velocity and its stability with time, and the gradient velocity of the vertical currents according to altitude.

The principal condition leading to quantitatively new results in comparison with proceeding investigations on the growth of hail particles consists of the calculation of changes in the vertical component of the velocity of air currents according to altitude, on which the following conclusions are based:

Accumulations of large reserves of water droplets and hail occur in the front-top zone of the cloud, which also explains the great intensity and short duration of intensive showers and hail.

The action in the upper part of the developed cumulus congestus cloud, with a maximum velocity of the vertical current (W_m) approaching the critical velocity (V_K) with surface-active and hygroscopic substances, does not give a positive effect. Such action can cause precipitation and scattering of cumulus clouds having a small mass and insignificant vertical currents.

The prevention or reduction of hail is possible by means of complete crystallization by injecting liquid droplets of a supercooled fraction into the cloud. This prevents the gravitational growth of the hail.

If the time and place of formation of the focus is known, then to prevent hail by means of continuous crystallization, 4-10 kilograms of silver iodide would be required. However, since these parameters are not known, the amount of matter required for the prevention of hail is 2-3 times greater.

The conduct of future work in the following directions is considered necessary:

1. The study of cumulus congestus and hail clouds with the aim of rapidly determining the cloud parameters (temperature, the velocity of updrifts, and water content) and discovering the hail foci.

2. Development of a method for the continuous introduction of reagents into a specific zone of the cloud.

3. The search for newer, cheaper crystallizing substances and also for means of retarding the natural crystallization of cloud particles. ("Influence of Changes in the Vertical Component of Wind Velocity on the Formation of Intensive Showers and Hail," by N. Sh. Bibilashvili, A. M. Zaytseva, V. F. Lapcheva, A. A. Ordzhonikidze, and G. K. Sulakevelidze, El'brus Expedition of the Institute of Applied Geophysics of the Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 128, No 3, 1959, pp 521-524)

New Method for Determining Horizontal Atmospheric Transparency

A new method for determining the horizontal transparency of the atmosphere, developed by V. A. Gavrilov, is described in a current Soviet scientific periodical. This method is connected with certain pecularities of visibility meters and is marked by its simplicity and its sensitivity. Measurements made by this method, which is called the relative brightness method, showed that the determination of meteorological visibility range is possible with a value of z = 100-120 and even 150.

The system makes use of two absolutely black voids (polosti) [black boxes with the open ends facing the viewer] placed in the same line of sight at different distances. The size of the voids are such that one of them, the nearer is projected on the background of the other which is larger in size. With high atmospheric transparency, when no smog is noted against either void, the nearer void blends into the background of the farther one and cannot be seen. But the presence of the least trace of smog on the farther void causes it to seemingly grow lighter and makes it possible to distinctly see the nearer black void against the lighter background of the second.

The basic principle of the relative brightness method is that with any atmospheric turbidity or, in other words, with any value of brightness of the smog on the farther void, the nearer void must always be black. that is, its brightness must be taken as zero.

Use of the two black voids in conjunction with the IV-GGO [an instrument for determining the visibility range of actual objects], which uses a prism arrangement similar to a range finder for superimposing images, makes it possible to superimpose the images of the two black voids on the background of the sky near the horizon. The brightness of both voids in the instrument's field of view will change proportionally to the value of the superimposed brightness, i.e., the proportional brightness of the smog near the horizon.

Expressions for the contrast between the nearer and farther voids and the farther void and the sky near the horizon are given. A table of values compiled on the function of readings of the instrument by taking some threshold value for the contrast sensitivity and used with the instrument, is given.

The error of measurement is said to be much less than that for conventional instruments. ("New Method of Determining the Horizontal Transparency of the Atmosphere," by V. A. Gavrilov; Moscow, Meteorologiya i Gidrologiya, No 11, Nov 59, pp 53-57)

New Automatic Weather Station Developed in Rumania

A new automatic weather station for use in inaccessible areas has been developed by F. Patrichi, engineer, of the Meteorological Institute of the State Water Committee, Rumania.

The station will be used to report temperature, humidity, atmospheric pressure, and wind velocity by means of coded signals which are transmitted every 3 hours. Each message is repeated once and is preceded by a warning signal. Range is reported to be 300 kilometers. Electric power is provided by a large battery which is kept charged by a completely automatic wind generator. The station is said to be capable of operating for 6 months. ("Automatic Meteorological Station"; Bucharest, Romînia Libera, 7 Nov 59, p 2)

IV. SEISMOLOGY

Soviet Seismoscope Improved

As a result of changes in the design of the UZS-2 seismoscope and the addition of a high-frequency generator, the possibility of using the instrument for modeling seismic wave processes and determining the elastic properties of rock formations has been enlarged considerably. The pass-band of the amplifier has been enlarged from 14-70 kilocycles to 14-760 kilocycles. More complex experiments can now be conducted, particularly those involving low-intensity waves which require a more sensitive seismoscope. The sensitivity of the seismoscope in the average operating frequencies of 130-150 kilocycles has been increased 25 times. Recordings have been obtained which are of use in a frequency analysis with the apparatus described by Khudzinskiy and Melamud ("A Station for the Frequency Analysis of Seismic Waves," Izv. AN SSSR, ser. geofiz., No 9, 1957). ("Improvement of the UZS-2(31) Seismoscope," by V. A. Obukhov, Institute of the Physics of the Earth, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 10, Oct 59, pp 1513-1516)

Development of the Seismic Service in the USSR

Systematic observations conducted by continuously operating seismic stations are the principal scientific research tool in the study of earthquakes. There are 70 such stations in USSR territory. Thirty of these belong to regional seismological organizations and 40 to the Institute of the Physics of the Earth, Academy of Sciences USSR. In addition, seismic service is conducted by a number of geophysical observatories and temporary expeditionary stations located in seismically-active regions of the country.

The reorganization of the control of the people's economy carried out in recent years, which broadened the rights and possibilities of local administrative-economic organs, created favorable grounds for further intensification of the republican (border) seismological scientific research institutions and the expansion of the station networks belonging to them.

At the session of the Council on Seismology of the Academy of Sciences USSR held in Moscow on 19-21 March, a plan for a new Regulation on a Single Seismic Service for the USSR (YeSS) was discussed and accepted.

According to this regulation, seismic stations are subject to the scientific institutions of the Academy of Sciences USSR, the academies of science of the union republics, and the ministries of administrations of the territories in which they are located.

The regulation specifies that the institutions heading the republican network of stations bring about a Single Seismic Service of the USSR on cooperative bases. Unity of the service is ensured by the application, without fail, of standard apparatus and uniform conditions of operation, by the fulfillment of a single program and method of making observations and processing of their results, and by maintaining a single form of seismic bulletin. General supervision of the service will be headed by the Council on Seismology.

The principal attention of the session was focused on the problem of standard apparatus for the stations (report by D. P. Kirnos, and the report by I. P. Pasechnik and N. Ye. Fedoseyenko). The future development of both theoretical and applied seismology requires the development and mass introduction of new types of seismic apparatus, primarily of highly-sensitive seismographs operating in different ranges of the spectrum of seismic oscillations, seismographs for recording and analyzing strong soil movements, new clock systems, etc.

A number of other problems were also discussed at the session which are connected with a specific accomplishment of the new regulation (for example, on the creation of archives for seismograms and the working out of rules for their preservation, duplication, distribution, and dissemination to scientific workers.)

It is proposed not to include all seismic stations operating on the country's territory in the YeSS, but only those which are necessary for recording earthquakes in a given region beginning with a certain specified intensity level. Weaker earthquakes will be studied with the aid of temporary or permanent high-sensitivity stations built in accordance with these or any scientific problems. Similar investigations are already being conducted in many regions of the country at present, for example, in Central Asia, where important scientific results were obtained by the Tadzhik Complex Seismological Expedition of the Institute of the Physics of the Earth and the Institute of Earthquakeproof Construction and Seismology of the Tadzhik SSR.

The selection of this standard will also determine the number of YeSS stations necessary for this or any region. At present, the provision of seismic stations for the various seismically-active regions is not equal. If the Caucasus and Central Asia, obviously, are close to saturation, then, in Altay, local stations do not exist at all. The improvement of the list of stations for each region is the next task of the Council on Seismology and the republican institutions.

One of such lists (presented by the Siberian Branch of the Academy of Sciences USSR) has already been considered and confirmed at the session. In the next 7 years, 37 new stations must be opened in Siberia. Of these, 13 will be in the Baykal region, 8 in Altay, and 7 in Yakutiya.

It is possible to expect that the new Resolution on the Single Seismic Service of the USSR will stimulate an expansion of the volume and increase the quality of scientific research work conducted directly in seismically-active regions, which is the principal condition for the future development of seismology in the USSR. ("Development of Sesimic Service of the USSR," by S. L. Solov'yev; Moscow, Vestnik Akademii Nauk SSSR, No 6, Jun 59, pp 121-122).

V. OCEANOGRAPHY

Fifth Voyage of the Mikhail Lomonosov in the Atlantic Ocean

The expedition of the Marine Hydrophysics Institute of the Academy of Sciences USSR aboard the expeditionary ship Mikhail Lomonosov conducted operations according to the IGC program from 17 April to 10 July 1959 in the Atlantic Ocean.

Two main profiles were completed during the voyage. The first from 60 N, from the Faroe Islands to 30 W, and the second along the meridian 30 W from the Greenland continental shelf to 22 02 S. The meridional profile crossed a number of natural regions to which the region of north polar waters, the region of drift currents, two calm regions, two trade current regions located on both sides of the equator, and the equatorial current regions belong. In addition, a number of stations were made at the approaches to Rio de Janeiro (Brazil) and in the region of Dakar (Africa). Sixty-three deepwater stations were made, among them, four 24-hour anchor stations in depths up to 5,000 meters, with measurements of the elements of currents being made with an anchored buoy.

There were 198 bathythermograph observations made while the ship was under way and at the stations. A record of the radiation balance and its components, continuous depthfinder readings, aerometeorological observations, launchings of 120 radiosondes, and weather forecasts servicing the expedition were made during the voyage.

The results of the observations made on this voyage are the first systematic complex oceanographic data permitting detailed investigation of the basic features entering into the distribution of hydrophysical, aerometeorological, geological, and biological conditions along the longitudinal axis of the Atlantic Ocean from the north polar waters down to the central part of the Brazilian Basin and revealing changes in these conditions in the various physico-geographic zones.

New and interesting scientific and practical materials were obtained by the expedition. For example, the data of current meter observations permit consideration in greater detail than heretofore possible of the nature

and velocity of currents in the mass of waters for certain points in the northern hemisphere. A comparison of hydrological data obtained by the expedition with the materials of past years' observations shows good stability of the boundaries and properties of the water masses in the ocean and little changes in the characteristics of the mass of waters below 2,000 meters. The materials of hydrological observations also make it possible to study peculiarities in the vertical structure of the waters of the ocean for different physico-geographic zones, to consider the character, properties, and boundaries of the water masses, and to explain differences and similarities in hydrological conditions in various latitudinal zones.

Original material on the chemistry of the sea was collected, which makes it possible to consider the distribution of biogenic elements in the entire profile along the 30 W meridian. Material was collected on soils, and submarine photography of the sea bottom was conducted. Pictures of a lava flow at a depth of 2430 meters were obtained.

Biological investigations permitted the division of three different regions on the meridional profile according to the qualitative and quantitative composition of plankton and benthos. In the distribution of bottom fauna, a gradual lessening of biomass from north to south was observed. Between these three regions, there are areas characterized by very high indexes of benthos biomasses (especially in the north trades and in the region of the Brazilian Basin from 10 to 20 S).

A group of geophysicists from East Germany worked on the ship. This group's program of work included observations on the heat balance, temperature and salinity of the waters, currents, and electrical phenomena in the atmosphere.

During stops in foreign ports, the members of the expedition visited some scientific and scientific-engineering institutions. A number of foreign scientists in Rio de Janeiro, Dakar, and Liverpool were familiarized with the work of the expedition and inspected the laboratories of the Makhail Lomonosov.

Scientific associates of the institutes of the Academy of Sciences USSR, the Hydrometeorological Service, and the All-Union Scientific Research Institute of the Fishing Industry and Oceanography (VNIRO) took part in the expedition. The expedition was headed by A. A. Ivanov, Doctor of Physico-mathematical Sciences. ("Fifth Voyage of the Expeditionary Ship Mikhail Lomonosov in the Atlantic Ocean," by V. A. Lednev; Moscow, Meteorologiya i Gidrologiya, No 11, Nov 59, pp 69-70)

VI. GEOMAGNETISM

Three Main Trends in Soviet Electromagnetic Sounding

In the period 8-13 June 1959, the Institute of the Physics of the Earth and the Council on Methods of Geophysical Prospecting, under the Department of Physicomathematical Sciences, Academy of Sciences USSR, held a special conference aimed at a broad discussion of the present status and future promise of the application of electromagnetic sounding methods to geophysical prospecting. Associates of interested Soviet scientific and industrial organizations and representatives of the People's Democracies took part. Twenty-nine reports were read, illuminating all three trends in the utilization of alternating electromagnetic fields for sounding. This article summarizes briefly these three trends.

1. Emergence of the steady state of an electromagnetic field (transient process): It has long been known that, in electrical sounding by direct current, the excited field emerges only after a certain interval of time (from a fraction of a second to several seconds), depending on the spacing of the electrodes and on the geoelectrical cross section of the media. This causes considerable difficulty in electroprospecting in the field and has often led to errors in earlier (potentiometer) methods of measurement.

Inasmuch as the emergence of the steady state of the field depends substantially on geological-geophysical conditions and lasts for a considerable time, the idea arose of utilizing this emergence process as an auxiliary in vertical electrical soundings. In other words, the idea arose of utilizing the interference. As recent investigations have shown, this idea has been very fruitful.

Whereas electrical sounding by direct current (after the field has emerged) at a given point of observation gives only one value (of the apparent specific resistance), a recording of the transient process gives a curve -- the time function. This has been the basis of the hope that the utilization of the process of the emergence of the steady state of the field will considerably widen the information on the structure of media which is obtained by the ordinary method of vertical electrical sounding.

Calculations of the process of the emergence of the steady state of the field for a number of types of geoelectrical cross sections and experimental field work under various geological-geophysical conditions have confirmed this assumption. It has been shown that the transient process (emergence of the field) may be utilized in an independent prospecting method to provide a solution of structural problems in petroleum geology. In particular, the utilization of the process of emergence of the field affords the possibility of narrowing considerably the principle of equivalence. Furthermore, whereas, in the interpretation of data obtained in a direct-

current sounding, it is necessary to draw upon supplementary information, the utilization of the mechanism of emergence of the steady-state of the field affords the possibility of interpreting without drawing upon external parameters. In principle, such a "parameterless" interpretation has great importance; it is extremely economical, since, in a number of cases, it dispenses with the necessity of conducting supplementary research involving great expense.

This year, the method of utilizing the emergence of the field has had practical application in the field work of several geological prospecting teams. The data obtained by these teams have contributed to the evaluation of the possibilities of this method and of the areas of application of its various modifications.

2. Electromagnetic sounding with alternating current: Although the promise of using alternating current has been known for more than 30 years, this method has not been perfected, primarily because of the absence of the required processed data, which now have become easier to obtain with the advent of new computing techniques.

At the present time, the methods of electromagnetic sounding using alternating current are being developed intensely according to an approved plan (within the framework of the Council on Methods of Geophysical Prospecting) of three principal organizations: The Institute of the Physics of the Earth imeni O. Yu. Shmidt, Academy of Sciences USSR; the All-Union scientific Research Institute of Geophysics (VNIIG), Ministry of Geology and the Preservation of Mineral Resources USSR; and Leningrad University. Recently, several other organizations have joined in this area of work.

To date, as a result of research, a general method has been devised for calculating the electromagnetic fields induced by an electrical (or magnetic) dipole in stratified media; a universal program has been established for calculating any geoelectric cross section with electronic computers; calculations have been made of the fields of a number of two-, three- and four-layer cross sections for the purpose of determining the resolution and characteristic peculiarities of the elements of the field under one condition or another; studies have been made of the electromagnetic field in the remote zone; a model has been designed and built of a field electromagnetic prospecting station capable of recording the electrical and magnetic components of the field with respect to amplitude and phase; experimental methods of field work have been established; an apparatus has been devised for simulated study of electromagnetic sounding under laboratory conditions; a study has been initiated of the fields in heterogeneous and anisotropic media; and methods have been devised for interpreting the results of the research. The work already done reveals the great promise and effectiveness of electromagnetic sounding with alternating current.

The utilization of both the electrical and the magnetic components of the field, both with respect to amplitude and phase, and also the possibility of using a wide range of frequencies guarantee that abundant data will be obtained. The varied electromagnetic field affords the possibility of sounding structures which are located below extensive, practically nonconducting strata. It has also been shown that it is possible to discern structures in a manner similar to that of the direct-current method. Finally, as theoretical observations have indicated, the varied electromagnetic field affords the possibility of discerning anisotropy, even in the case of horizontal stratifications.

In comparison with vertical electrical sounding by direct current, the method of electromagnetic sounding has not only the preference in principle, but also a considerable technical and economic advantage. In particular, the above-mentioned utilization of wide-frequency ranges affords the possibility of employing the so-called "frequency sounding" method at one point of observation only. In sounding by direct current, on the other hand, the observation site has to be moved, which requires considerable time.

The data accumulated so far are not sufficient for an exhaustive analysis of all the possibilities of electromagnetic sounding, but are certainly worthy of great interest.

In a number of regions of the Soviet Union, experimental work has been done on electromagnetic sounding with alternating current and on the study of the utilization of the process of the emergence of the field for the purpose of determing the prospecting possibilities of these methods (particularly, for determining the depth of the crystalline basement when interstitial nonconducting strata are present).

Electromagnetic sounding by alternating current has been used, for example, in one of the regions of the Moscow area where, at a certain drilling site, the crystalline basement lay at a depth of about 1,800 meters, while at a depth of 300 meters, there was a layer of high electrical resistance offered by hydrochemical deposits. This layer, practically nonconducting to electrical current, prevented a vertical electrical sounding by direct current. Electromagnetic sounding at frequencies of 0.07-150 cycles per second, however, made it possible to determine the depth of the crystalline basement. The primary importance in this case was that, in the interpretation of the results of observations, there was no need to draw upon any supplementary information; the interpreting was done solely on the basis of the electromagnetic sounding data.

In one of the areas of the Central Volga petroleum region, where electroprospecting by alternating current had not produced results, seismoprospecting operations (costing about 2 million rubles) were required in order to determine the profile of the crystalline basement. Electromagnetic sounding

utilizing the process of the emergence of the steady state of the field was successfully introduced in 1958 and produced (with an expenditure of only 80,000 rubles) practically the same profile of the crystalline basement as that obtained with the seismoprospecting method.

Despite the success of electromagnetic methods of sounding by means of alternating fields, there is still very much to be done in the theoretical area, in calculations and the substantiation of methods of interpretation, in complex apparatus requirements, and in the improvement of working methods in the field.

3. Electromagnetic sounding utilizing the intrinsic field of the earth: Electromagnetic soundings with artificial excitation require a powerful generating device in order to obtain a clear separation of the available signals on the available background of interference caused by the intrinsic electromagnetic field of the earth (earth currents and magnetic fluctuations).

Theoretical investigations have indicated, however, that the quantitative relationships between various components of the intrinsic electromagnetic field (magnetic and electric components) observed at the surface of the earth depend on the geoelectrical cross section of the media and, therefore, can be used for the solution of the problems of structural geology. Magneto-telluric profiling has been one interesting development in the field of magneto-telluric sounding.

Available data of field investigations show the great promise for the utilization of the intrinsic electromagnetic field of the earth in prospecting. ("Electromagnetic Sounding of the Earth's Crust," by A. N. Tikhonov and D. N. Shakhsuvarov; Moscow, Vestnik Akademii Nauk SSSR, No 10, Oct 59, pp 42-46)

VII. ARCTIC AND ANTARCTIC

Antarctic Traverse Continues

On 29 November 1959, the Soviet sled-tractor train arrived at the interior station Vostok. The train consisted of 3 "Khar'kovchanka" snow vehicles, 2 caterpillar tractors, and 8 trailer sleds. On the day of arrival at Vostok, the air temperature was minus 48 degrees centigrade.

The traverse had begun at the station Komsomol'skaya. The 540 kilometers from Komsomol'skaya to Vostok were traveled in 23 days. The 16 scientists, headed by Prof B. Savel'yev, conducted scientific observations along the way.

After a short stopover and a precautionary check of the vehicles, the members of the group will continue to travel south. Soviet scientists will begin complex scientific research in the central regions of Antarctica, which have not been explored before. ("Train Arrives at Station Vostok"; Moscow, Vodnyy Transport, 3 Dec 59)

Tractor-Train Moving Toward South Pole

On 8 December, the tractor-train continued from Vostok into the interior of the continent. The train, consisting of two "Khar'kovchanka" vehicles, one caterpillar tractor, and four sleds, headed toward the south geographic pole, along the eastern border of the Sovetskaya plateau.

At this time [12 December], the train has stopped at a point with coordinates 80 14 S and 106 50 E, 200 kilometers south of Vostok and over 1,600 kilometers from the Indian Ocean coast. The scientists are conducting seismic soundings at this point to determine the thickness of the ice sheet.

As a result of the scientific observations made by this expedition and by previous ones, a meridional cross section of Antarctica from the Pravda Coast into the interior will be constructed.

During the past few days, an IL-12 plane made a ski landing on the icy airfield of station Vostok. This was the first time a plane of this type landed in the interior of Antarctica, at an altitude of 3,420 meters above sea level. ("On the Way to the South"; Moscow, Vodnyy Transport, 12 Dec 59)

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