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PLEASE NOTE

This report presents unevaluated information on Soviet Bloc International Geophysical Year Activities selected from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

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I. GENERAL

Contemporary Problems of Studying the Earth's Shape

The study of the shape and gravitational field of the earth is the fundamental problem of geodesy.

In determining the shape of the earth, three fields of geodetic investigations are available: "statistical" geodesy; "kinetic" geodesy; and "dynamic" geodesy.

Contemporary high-altitude aerial photography can and does give exact data and measurements of the earth's shape and gravitational fields. This field of investigation is called "statistical" geodesy.

Through improving the accuracy of the results of successive "instantaneous photography" changes in the earth's shape and gravitational fields can be studied and determined. This field of investigation is called "kinetic" geodesy.

The third problem in geodesy is the study of the reasons behind the changes in the earth's shape and gravitational field; the explanation of the observed field of gravitational anomalies and peculiarities in the structure and development of the earth's surface. This field of investigation is called "dynamic" geodesy. ("Contemporary Problems of Studying the Earth's Shape," by M. S. Molodenskiy, Corresponding Member of the Academy of Sciences USSR; Geodeziya i Kartografiya, No 7, Jul 58, pp 3-5)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Dobronravov Discusses Satellite Recovery, Lunar Probe, and Manned Space Flight

Prof V. Dobronravov, Doctor of Physicomathematical Sciences, states in an article appearing in Sovetskaya Aviatsiya that the direct development of events in the conquest of cosmic space can proceed along two lines: either the creation of controlled and recoverable satellites and consequently satellites with pilots aboard, or even the sending of a satellite must be controlled, that is, it must change its motion according to a particular, previously prepared program. Such a satellite must be stabilized in the sense of the orientation of its longitudinal axis in relation to the Earth and must have no transverse rotations in relation to its own center of gravity. It should be stated, says Dobronravov, that Soviet scientists almost arrived at a solution of the problem of stabilization when on 27 August a high-altitude rocket launched in the Soviet Union reached 450 kilometers and was precisely stabilized, having no rotation either around its longitudinal or transverse axes. In addition to its stabilization system, the satellite must have motors with fuel reserves. According to its predetermined program, the satellites engines would be switched on at determined intervals with respect to the locations of the satellite in its orbit. Thus the satellite can glide down through the entire atmosphere, landing at a previously selected point on the surface of the Earth. ("In Terrestrial Space," by Prof V. Dobronravov, Doctor of Physicomathematical Sciences; Moscow, Sovetskaya Aviatsiya, 4 Oct 58)

Sputnik I Anniversary Observed in Soviet Press

The anniversary of the launching of Sputnik I is observed in Pravda and Izvestiya with full page articles, some of which are written by leading Soviet scientists.

L. Sedov, Academician, Academy of Sciences USSR, reviews the historic launchings of the three Soviet satellites and goes on to say that the time is not far off when rocket craft with human crews will be launched into interplanetary space and onto other planets. "It is certain," says Sedov, "that up to this time, interplanetary flights of automatically operating research laboratories will be made. Equipped with the most modern radio and television apparatus, they will be able to transmit the results of experimental investigations of the Moon, Mars, and Venus, performed by complex instruments back to Earth. These instruments will be stowed in special containers launched with the aid of rockets. Modern developments of rocket engineering fully allows us to speak of all of this as realizable in the very near future. ...Man's culture is entering into a new phase of its development. At present, it is still difficult to predict what the prospects are and what discoveries lie ahead. One thing is clear, and that is that further great successes are possible only in a condition of peace between nations and that the rapid tempo of the development of astronautics and the realization of complex and great rocket of the future will require international cooperation." ("Cosmic Laboratory," by L. Sedov; Moscow, Pravda, 3 Oct 58)

Academician V. Fesenkov, Institute of Astrophysics, Academy of Sciences Kazakh SSR, regards the creation of Sputnik I as the notable start of a new era. For astronomy, he says, the event opened the possibility of gradually transferring investigations into cosmic space and with it the elimination of the serious disturbances of the terrestrial atmosphere which frequently render the most powerful and modern apparatus completely useless. It is certain that in the very near future, flights around the Moon, Mars, and other planets of the solar system will be possible. To do this, it is only necessary to increase the power of the flight of the elliptical orbit around the Earth by two times. To hasten the day of astronomy's greatest development, Soviet observatories must be able to use the flights of artificial Earth satellites in the interests of science.

"The systematic observation of satellites using the most precise methods is of great importance. At this point, it should be indicated that an extremely accurate method for determining the location and velocity of the movements of satellites by means of "tying-in" [to star positions] was developed, for instance, in the Mountain Astrophysical Observatory of the Academy of Sciences Kazakh SSR [redacted] and his coworkers." ("New Epoch," Academician V. Fesenkov; Moscow, Izvestiya, 4 Oct 58)

Academician A. Lebedev, regards the launching of the satellites as the opening of a door on a fantastic world. The time is not too distant when "laboratories" similar to and possibly even more perfected than Sputnik III will begin flying to the Moon and to the more distant planets. The expenditure of much labor and inventiveness is necessary to create instruments which would ensure obtaining necessary information, and to devise methods for their automatic operation in the laboratory (satellite) flying at enormous speed through space. It is also necessary to consider that in the cosmic laboratory, which continuously and rapidly rotates around its own axis, there is no gravity. For maintaining the necessary temperature and providing a long-lasting source of power for the electrical equipment it is possible to depend on solar energy alone. One of the problems which can be solved only by raising instruments to the upper boundary of the atmosphere is the study of the far ultraviolet and X-ray regions of the solar spectrum. The all-around study of the processes originating on the Sun is a problem of paramount value, as the role played by solar radiation in life on Earth is enormous. ("Door to A Fantastic World," by Academician A. Lebedev; Moscow, Izvestiya, 4 Oct 58)

The true conquest of space can come only with man's entrance into the cosmos. The problem is widely studied in the world of science. First must come a knowledge of the effect a number of unusual factors -- G-stress, dynamic weightlessness, cosmic radiation and solar radiation -- will have on the human organism. For the solution of these problems scientists are depending on a young, but rapidly developing, science -- space medicine.

One of the problems faced by this science is connected with the necessity of safeguarding man from low barometric pressure and the lack of oxygen in the upper layers of the atmosphere. This can be done with hermetically sealed cabins and in the event of the cabin's rupture, with special space helmets and so-called high-altitude pressure suits. Manned rocket flights will use hermetically sealed cabins. On short flights, oxygen will be supplied by means of reserve tanks, and on long flights, it will be possible to use different chemical substances, capable of absorbing carbon dioxide and moisture. For the future, it is also considered possible to use plants and microorganisms for this purpose which will absorb excess carbon dioxide and produce the necessary quantity of oxygen. Thus, science at present can see no principal difficulties it is necessary to overcome to ensure man's sojourn into cosmic space. However, for an engineering solution to this problem, there is still much work to be done.

The solution of problems of cosmic flights is connected with a certain risk for human life and, therefore, the first stages of the investigations are conducted with animals. Tests with dogs showed that the vital activity of animals at very great altitudes could ensure with the use of hermetically sealed cabins of space suits.

Along with this is the problem of rescuing animals in case of danger during the flights. Animals fitted with space suits were ejected from rockets and lowered by parachutes from altitudes of 75-80 and 40-50 kilometers in these experiments. All animals were landed safely. The most notable deviation in the functional state of the animal's organisms occurred when the rockets gathered speed, that is, when G-stress acts on the organism.

The effects of G-stress on man during rocket flights deserve special attention. Certain conclusions can be made here in this connection. If a man is placed in a rocket so that his head is in the direction of the forward motion of the rocket, he experiences the forces of a longitudinal G-stress directed from head to foot. If this force exceeds gravity (on Earth) by 4-5 times, and lasts more than 20-25 seconds, then the passenger of the rocket experiences a whole series of changes in his organism.

In these cases a man's motions become somewhat uncoordinated, certain displacements and deformations of the internal organs occur as a result of which their normal activity is disrupted, the functional state of the nervous system is changed, changes in the circulation of the blood appear, etc. As a result of the disruption of the circulation of blood in the brain and the insufficient supply of blood to the eyes, his vision can be disturbed. The eyes may dim, the sensation of a gray or black film before the eyes and even the loss of sight may occur. With a longer lasting G-stress action, partial or complete loss of consciousness is possible.

There is, however, a means of preventing these unfavorable after-effects. First of all, before flying, a man must undergo preliminary ground training.

Special anti-G suits will play a large role in the struggle against the harmful action of G-stresses. These suits have rubber chambers filled with compressed air in the region of the stomach, hips and legs. Compressing the blood vessels in the lower part of the body, the suit prevents the accumulation there of blood and decreases disturbances of blood circulation. The amount of pressure in the suit's chambers is regulated by a special automatic device and always corresponds to the amount of G-stress. The possibilities of such suits are, however, limited.

There is another method of combating the effects of G-stress. Man can best withstand G-stress acting in a transverse direction, i.e., from chest to back. In this case, no substantial disturbance in the blood supply of the organs and the tissues arises since the displacement of blood will be insignificant. Therefore, during the rocket's acceleration its passenger must be placed in a special chair with a hinged back, in a semi-prone position. Such a posture will enable him to withstand a load of 10-12 Gs for several minutes.

The weight of a body decreases as its altitude above the Earth increases. At 100,000 kilometers from Earth, a body is almost weightless. This same condition will be encountered by man during the circular motion of a rocket ship around a planet.

The effects of weightlessness on a living organism are studied outside the Soviet Union and inside it by different methods. During the flights of rockets to altitudes of 100 and 200 kilometers it was possible to study the conduct of organisms in conditions of weightlessness which continued for several minutes. The flight of the dog Layka in Sputnik II made it possible to obtain preliminary data on the state of a living organism during a long period of weightlessness. Weightlessness did not cause any substantial and persistent changes in the state of the animal's physiological functions. It is possible to make this conclusion, that life during weightlessness is fully possible; that gravity is not a necessary condition.

In solving the problems of weightlessness only the first steps have been taken. However, on the basis of data already at hand it is safe to say that it does not present an insurmountable barrier to the life and activity of man during cosmic flights. ("Man Before the Start Into the Cosmos," Ye. Yugov and A. Serov, Candidates of Medical Sciences; Moscow, Izvestiya, 4 Oct 58)

Some results of the investigations conducted with the aid of Sputnik III are presented in a 5 October Pravda article. The majority of this material is a review of previously reported information. Several pictures are included in the article, showing an ionization manometer and direct current amplifier, a mass spectrometer and electron unit, and a magnetometer with an orientation node. ("Discoveries Widening the Knowledge of the Universe,"; Moscow, Pravda, 5 Oct 58)

Soviet Professor Believes "US is Behind"

"The power of the Soviet rocket which launched the third sputnik is 100 times greater than that of rockets used for the same purpose by the US," stated Professor Pokrovskiy, Soviet rocket (fusees a reaction) specialist, during a press conference in Moscow on 26 September.

Stating that the USSR has made enormous progress in rocket techniques since the launching of its first satellite on 4 October 1957, Professor Pokrovskiy questioned the aptitude of the Americans for reaching the moon using their present rockets. "In this field," he said, "the US does not have sufficient scientific and technical preparation." ("Soviet Professor Believes US is Behind"; Paris, L'Humanite (Com), 27 Sep 58)

Satellite Photographic Observations With Maksutov Telescope

Tests for observations of artificial earth satellites using a 50 centimeter Maksutov telescope (F = 120 cm; D:F = 1:2.4) were conducted at the Institute of Astrophysics of the Academy of Sciences Kazakh SSR. Shifts of the satellite's track were made by oscillations of a plane-parallel glass plate located before the correcting lens of the telescope. The oscillations have a period of one second and an amplitude of 3-4°. The images of the stars and the satellite's track are shifted by $\Delta s \sim \frac{n-1}{n}$ h.a, where n is the index of refraction, h is the thickness, a is the oscillation amplitude. The oscillations of the plate are carried out by an electromagnet connected in series into the circuit of the contact chronometer and the chronograph. The tests gave star tracks of 6 m at a velocity of motion of 1° per second (Ilford HP-3 plates). The accuracy of timing was $\sim 0^s05$. For greater accuracy it is suggested that the chronograph be replaced by an oscillograph. ("Organization of Photographic Observations of Satellites and Rockets on the 50 cm Meniscus Maksutov Telescope," by D. A. Rozhkovskiy; Astron. tsirkulyar, No 187, Dec 1957, pp 3-4, from Referativnyy Zhurnal, Astronomiya i Geodeziya, No 8, Aug 58, Abstract No 5233)

Some Results of Satellite Observations

The mean value of the density of the atmosphere at the perigee altitude of an orbit (226-228 kilometers), which proved to be equal to 3/10,000th of a gram per cubic meter, was determined by analysis of the braking of Soviet artificial earth satellites. This value is approximately five to ten times greater than values used earlier in a number of models of the atmosphere.

Significant results were obtained according to the study of the propagation of radio waves through the ionosphere, that region of the upper atmosphere consisting of ionized atoms and molecules. In addition, the extralong-range propagation of radio waves for distances exceeding the limits of direct visibility were noted. The phenomenon of a circumterrestrial echo was even noted.

It was successfully established that the concentration of positive ions in the daytime at an altitude of 790 kilometers is approximately 160,000 ions per cubic centimeter, and at an altitude of 240 kilometers, 500,000 ions per cubic centimeter.

A wide program of investigations in the region of cosmic radiation was carried out by Sputnik I and II. A new radiation, apparently connected with the structure of the Earth's magnetic field, was discovered. The intensity of this radiation was very great. The number of particles in such flows exceeds the number of particles in the flows of cosmic rays by thousands of times. Thus it appears that the Earth is enveloped as if by an aureole of charged particles retained by the magnetic field. ("Reported by the Satellites," Moscow, Izvestiya, 4 Oct 58)

Sakhalin Satellite Observation Station

The most eastern Soviet station engaged in observations of artificial Earth satellites was created under the Chair of Physics of the Yuzhno-Sakhalinsk Pedagogical Institute. The station is headed by Konstantin Kan, Candidate of Technical Sciences.

The station's duties consist of recording satellite coordinates and the time of the satellite's passage through these same coordinates. This information aids in more precisely determining the motion of satellites according to given orbits, and to predict their course. They also give rich material for explaining the density of the atmosphere, the force of gravity, and other laws and phenomena.

The station is equipped with AT-1 telescopes, mine compasses, timers, tape recorders and other instruments. Despite the frequent fogs, rain, and almost continuous cloudiness on Sakhalin, 64 observations on satellites have been successfully made since the launching of Sputnik I.

At present, the scope of observations has been expanded and includes the recording of changes in the brightness of satellites and also tracking their motion on photographic film. The station developed a method of fixing the moment of change in the brightness of a satellite with an accuracy of up to one tenth of a second. Seventeen observations of Sputnik III carrier rocket have already been made by this method, during which 654 moments of the change in its brightness were recorded. ("The Most Eastern Artificial Earth Satellite Observation Station"; Moscow, Sovetskaya Aviatskiya, 4 Oct 58)

Purple Mountain Observatory Reports on Sputnik II Observations

The use of miniature cameras in photographing Sputnik II is revealed in a Chinese Communist periodical. Thirty-four photographic observations of Sputnik II were made during the period from 18 December 1957 to 18 March 1958 by the Purple Mountain Observatory, Nanking. Exposure times were recorded on a chronograph. Exposure time was usually about 5 seconds. It was found that star images up to almost the 8th magnitude could be obtained on Kodak Tri-X film.

Most of the observations were made in Nanking ($\lambda = 7^h\ 55^m\ 17^s.02$ E, $\phi = 32^\circ\ 03'\ 59''.9$), and some were made in Chenkiang ($\lambda = 7^h\ 57^m\ 45^s.5$ E, $\phi = 32^\circ\ 12'\ 20''$), a town about 50 kilometers northeast of Nanking.

The results of the observations are listed in Table 1, giving the number of the observation, Greenwich time, local sidereal time, right ascension, declination, and place of observation. The purpose of conducting observations from two neighboring towns was to determine the parallax of the satellite directly. The result of this determination is given in Table 2.

Seven circular orbits were derived from the observations. These are tabulated in Table 3. The determination of elliptical orbits on the basis of these observations was impossible due to the shortness of the arc observed. The article states that it is hoped that the orbital elements e and ω would be obtained if the satellites parallax could be accurately determined from two widely separated groups of observation stations, one near the northern border of China and one near the southern border. ("Photographic Observations of the Second Soviet Artificial Satellite," by the Artificial Satellite Work Group, Purple Mountain Observatory, Nanking; Acta Astronomica Sinica, Vol 6, No 1, 1958, pp 146-151)

Fesenkov on Problem of Reduction of Observations of Zodiacal Light

V. G. Fesenkov, Academician, Institute of Astrophysics, Academy of Sciences Kazakh SSR, considers the problem of the "The Reduction of Observations of Zodiacal Light," in an article appearing in Astronomicheskiy Zhurnal.

D. E. Blackwell, says Fesenkov, recently pointed out that there is no definite relation between point source extinction according to Bouguer and the extinction corresponding to such an extensive object as zodiacal light.

Fesenkov shows that the optical thickness of the atmosphere remains the same regardless of the nature of the source of light, but it is necessary to take into account the additional illumination of the troposphere caused by zodiacal light. Calculations made for the ideal case of normal orientation to the horizon show that this effect causes considerable distortion of the visible form of zodiacal light. Assuming that the coefficient of transparency is 0.83, and that the indicatrix of scattering corresponds to that found by Ye. V. Pyaskovskaya-Fesenkova [Investigation of the Scattering of Light in the Earth's Atmosphere," Izd-vo AN SSSR, Moscow, 1957, p 148], the following relative increases in brightness were found for this same almucantar at a zenith distance of 75 degrees for different azimuths:

A	0	10	20	30	40°
	5.84%	7.83%	11.62%	15.95%	30.6%

("Reduction of Observations of Zodiacal Light," by V. G. Fesenkov, Academician, Institute of Astrophysics, Academy of Sciences Kazakh SSR; Astronomicheskiy Zhurnal, Vol 35, No 3, 1958, pp 323-326)

Fesenkov Considers Zodiacal Light as a Possible Product of Interplanetary Matter

The process of the disintegration of asteroids has been established at present experimentally, inasmuch as for a number of meteorites, it was possible to find the approximate date of their separation from their parent body and their transformation into an independent body revolving around the Sun and subjected to the action of primary cosmic rays.

The liberation of a meteorite from a parent body of much larger size is necessarily followed by the production of a large quantity of fine dust which gradually fills interplanetary space. The density of interplanetary matter derived from the observed brightness of zodiacal light is relatively insignificant: 10^{-23} or 10^{-24} grams per cubic centimeter. Such a density is encountered in some cases in interstellar space and even in the neighborhood of some stars.

It is more difficult to explain the polarization properties of the dust theory. However, says Fesenkov, it may be stated that the high value of polarization of the day sky observed in the dry deserts of Egypt can be accounted for by the presence of a polarizing dust component.

The strongest argument in favor of the meteoric nature of zodiacal light arising as a result of the disintegration of asteroids is the rather good agreement of its observed form with theoretical isophots calculated on the basis of the known distribution of the orbits of asteroids according to the angles of inclination of the orbits to the ecliptic. Two such theoretical isophots are presented in the article. One, the case of a very elongated indicatrix of scattering deduced by Ye. V. Pyaskovskaya-Fesenkova from her observations, and the other corresponding to the case of a simple spherical indicatrix. The first corresponds to a very good representation of the familiar shape of zodiacal light as viewed by Fesenkov. ("Zodiacal Light as a Product of the Disintegration of Asteroids," by V. G. Fesenkov, Academician, Institute of Astrophysics Academy of Sciences Kazakh SSR; Astronomicheskiy Zhurnal, Vol 35, No 3, pp 327-333)

IV. ARCTIC AND ANTARCTIC

Drift Stations in Arctic

September was the last summer month of operation for the drift stations in the Arctic. On 30 September, N. A. Belov, chief of station Severnyy Polyus-7, reported that the arctic night had set in. It is still daylight at the station Severnyy Polyus-6 (chief of station S. T. Serlapov), however, the sun is expected to disappear in the next few days.

Despite difficult drift conditions and low temperatures (not above minus 20 degrees Centigrade), the staffs of the drift stations have conducted a large number of meteorological, hydrographical, and biological observations under the IGY program. During mid-September Severnyy Polyus-7, located about 180 kilometers from the North Pole, was visited by some polar bears, who remained on the ice island for quite some time....

At the end of September, planes from the mainland brought mail, food supplies, books, and various equipment to the drift stations.

The ice islands on which the stations are located are continuing their drift. According to preliminary data, Severnyy Polyus-6 traveled 70 kilometers in a straight line, or a total course including detours of 180 kilometers, during September. Since the very beginning of its drift operations, Severnyy Polyus-6 has traveled distances of 1,690 (straight line) and 6,540 (total) kilometers, respectively, in the Arctic Ocean.

Severnyy Polyus-7 has traveled considerably more during the past month, i.e., 170 kilometers in a straight line, or an actual distance, including detours, of 330 kilometers. The total distance covered by Severnyy Polyus-7 is about 1,000 kilometers in a straight line, or over 3,000 kilometers including detours. (Ice Drift; Moscow, Literatura i Zhizn', 1 Oct 58)

Physicogeographical Characteristics of Antarctic Region Explored by Soviet Expedition (1955-1957)

The Soviet Antarctic Expedition has conducted research in East Antarctica covering a vast area of about one million square kilometers between 74 and 111 degrees East longitude, i.e. more than 2,000 kilometers along the coast and over 1,500 kilometers into the interior of the continent. The author of this article, Ye. S. Korotkevich, conducted general physicogeographical and biogeographical research in this region, mainly along the coast. Ground operations were carried out in the region of Mirnyy, in the three "oases" (Bunger, Greerson, and Vestfold), and on a number of individual mountains and nunataks (Gaussberg, Mt. Brown, Mt. Amundsen, Mt. Sandow, Mt. Strathcona, and others). Aerial surveys were made of these regions, as well as of the interior of the continent and of the ice-covered Davis Sea. The preliminary results of the general physicogeographical research are described below.

The area of operations of the expedition represents a portion of the antarctic ice cap, a level surface which descends gradually toward the sea from an elevation of 3,500-4,000 meters (between 75 and 80 degrees South latitude). As it approaches the sea, the slope becomes steeper. The seaward edge of the ice cover breaks off in a steep 10-15-meter-high ice cliff. The glacial surface, which is almost completely even and smooth in the interior, becomes more undulating as it approaches the sea and the subglacial relief begins to show. In some places, the elevations of the glacier bed cause the formation of crevasses even in interior regions. In the coastal zone, individual ice streams isolate themselves in the subglacial valleys, i.e., outlet glaciers, in which the ice moves considerably faster than the surrounding parts of the ice sheet and is broken up by numerous crevasses into separate blocks. However, even beyond the limits of the outlet glaciers, the movement of the ice cover in the coastal zone is noticeable and causes numerous crevasses in the ice. The zone of crevasses extends along the coast in a solid strip, which is from several kilometers to several tens of kilometers wide. As a rule, snow-covered and exposed crevasses alternate, blocking the way from the coast into the interior of the continent. Only in occasional, very narrow strips, such as in the region of Mirnyy, is it possible to penetrate into the interior of Antarctica along lower sections of the glacial cover, where the crevasses are less developed and are covered with massive snow bridges.

In the coastal zone, the bottom of the ice sheet moving down from the central parts of the continent lies below sea level in a fairly large area. Frequently, the depth of the sea near the ice cliff is so great that the edge of the ice breaks off the bottom and floats to the surface. In the places where outlet glaciers reach the coast, long floating ice tongues project far out into the sea (Helen Glacier, and others).

In the area explored by the expedition, there are numerous ice shelves bordering the coast over considerable distances. The largest of these are the Shackleton Shelf Ice and the West Shelf Ice. These ice shelves rest partly on the bottom of the sea, but many of them are afloat. Above the generally even surface of the shelf ice, gradually sloping, dome-shaped elevations stand out, which are a reflection of elevations of the subglacial relief. Sometimes such domes are located outside the limits of the shelf ice, representing ice islands resting on submarine elevations and surrounded by the sea. The largest of these islands is Drygalski Island, located 90 kilometers north of Mirnyy. A similar island is at the northwest extremity of the West Shelf Ice.

The structure of ice shelves is complex. The lower parts consist of ice flowing from the interior of Antarctica, and the upper parts represent ice formed by local accumulation of snow.

In areas, where the ice from the interior regions of the continent moves rapidly (i.e., in outlet glaciers such as Denman Glacier and Scott Glacier), a horizontal layer of firn and ice of local origin does not have time to form, and the glaciers consist entirely of continental ice. However, in other places, the glacier moves very slowly and here the locally accumulated ice covers the continental ice with a thick layer, which means that the snow line in such areas is below the sea level. This has been observed in most of shelf ice areas, including the Shackleton Shelf Ice, where the seaward sides of the 20-40 meter-high cliffs are covered with a horizontal layer of ice of local origin.

The eastern portions of the shelf ice have a slightly different structure. Their foundation consists of an accumulation of icebergs, driven there by the prevailing southeast and east winds and by the currents produced by these winds. These icebergs, accumulating near the east edge of the shelf ice, form extensive fields. The sea ice forming between the icebergs does not break up, and the whole area is covered from above with a layer of slowly accumulating snow, which subsequently changes into firn and ice. In certain favorable spots, where no ice arrives from the interior of the continent and where the ice foot does not break up, fairly large sections of shelf ice may be formed on the sea ice; however, such cases are rare. The formation of shelf ice through accumulation of icebergs can be seen especially clearly in the eastern part of the West Shelf Ice in the area of Gaussberg.

Under the pressure of the ice flowing from the interior of the continent, the newly formed sections of shelf ice gradually move toward the edge of the shelf, break off in the form of icebergs, and float out into the sea. If the formation of new sections of ice predominates over the outflow of ice, the east edge of the shelf ice will gradually move eastward. With the predominance of the process of iceberg formation over the process of ice inflow, the west edge of the shelf ice will also move eastward. Thus, the whole shelf ice would be moving to the east. However, at present it is difficult to say which process predominates.

Despite the fact that in the coastal zone, the snow line lies below sea level, a little higher up, along the coast, there is an almost uninterrupted strip where ablation exceeds the accumulation of solid precipitation; this is caused by the constant, strong winds blowing from the continent. This zone is distinguishable by the light-blue color of the snow-free ice against the general white background of the snow-covered surface.

Near the edges of the antarctic ice sheet, where the ice thickness diminishes, the highest parts of the basic relief emerge above the ice surface in the form of mountains - nunataks, and in the coastal zone also in the form of small islands and larger ice-free areas of land, so-called "oases," covering several hundred square kilometers. However, the ice-free areas of land are extremely rare even on the coast, and almost the entire coast represents an ice cliff.

The sea surrounding the shores of Antarctica is covered with ice during most of the year; this includes a large number of icebergs breaking off almost along the whole stretch of the ice cliff, but in especially large quantities in those places where the outlet glaciers approach the sea. Especially large icebergs, reaching several tens of kilometers in diameter, break off the shelf ice.

During the winter, a shore ice belt, which is up to 30-40 kilometers wide, surrounds the shores of the continent, mainly in the bays and inlets. It is separated from the drifting ice in the north by a strip of open water, the shore polynya, which is formed under the influence of strong, continental, south-east winds. In some places, this water opening directly adjoins the coast. For example, the sea near the "oases" cf Greerson and Vestfold, and at the north and west edge of the Shackleton Shelf Ice and West Shelf Ice, respectively, is ice-free during the greater part of the year. During the summer, the shore ice, as a rule, is broken up almost entirely. The belt of drifting ice also diminishes. At the peak of ice formation, the ice in the area of Davis Sea reaches 59 degrees southern latitude, i.e. it extends over 800 kilometers from the coast. However, in the summer, only a narrow strip of scattered ice remains north of Drygalski Island.

The fast ice forms early in April, and by mid-April it is already possible to walk on the young ice, as it reaches a thickness of 15 centimeters. By June, the ice is 50-60 centimeters thick. In the spring, the ice thickness is 150-160 centimeters, reaching a maximum of 180-190 centimeters. The snow, which is blown off the continent, plays an important part in the formation of fast ice. At the end of November, the fast ice at the edge of the polynya begins to break off. The ice also begins to melt on the surface, puddles appear, and after that thawing holes, i.e., wide cracks, are formed in the ice. By the end of January, the whole shore ice breaks up and is carried away. For 2 months, February and March, the sea near the coast is almost completely free of ice. Only a considerable part of the icebergs remain, most of which are stranded on a shoal. The portions of shore ice caught between the icebergs do not have time to melt during the short cold summer and, in the form of large ice floes and ice fields, they become a part of next year's fast ice.

However, in the region of the "oases" the ice forming in the bays and inlets, which reaches a thickness of 180 centimeters, melts completely as early as the beginning of February. This is caused by the slightly higher temperature in these regions and mainly by the fact that the ice is mixed with mineral debris blown off the snow-free rocks; this greatly decreases the albedo and at the same time increases the amount of solar heat absorbed by the ice surface.

The geological structure of the ice-free areas of land is uniform. Almost all the outcrops of basic rocks for about 2,000 kilometers along the explored coast consist of ancient, pre-Cambrian, greatly metamorphosed and faulted crystalline schists and gneisses, of a dark-grey, brown, sometimes light-grey color, which are broken up by granite intrusions and dikes of dolerites, as well as by quartz, pegmatitic, and aplitic veins. These rocks are found from the coast of the mountain summits in the 'interior,' i.e., nunataks such as Mt Garan, Mt Strathcona, and others, and elevations over 2,000 meters, such as Mt Brown (about 2,100 meters). Only 100 kilometers south of Bunger "Oasis" two smaller elevations, Mt Amundsen and Mt Sandow, are composed of younger (Proterozoic) red-colored sandstone, schist, and conglomerates, which are considerably less metamorphosed and disturbed than the Pre-Cambrian rocks. These elevations, as well as the fact that boulders of the Proterozoic era are found in the moraine, indicate that further south, in the interior of the continent, Proterozoic deposits occupy large areas. Gaussberg has a completely different structure, representing the remains of an extinct Tertiary volcano composed of basaltic lava.

No other rocks were encountered in the region explored by the expedition, with the exception of Quaternary deposits, mainly in the form of various moraines, beginning with individual boulders which reach 5 and more meters in diameter up to strata of argillaceous rock mixed with boulders of various sizes. The presence of moraines at the highest points, as well as the glacial hachure (shtrikhovka), indicate that during the peak period of glaciation, a heavy layer of ice covered all the land areas which are now ice-free.

As the general ice sheet of Antarctica diminished, following climatic changes on a planetary scale, the highest parts of the land appeared above the ice surface in the fringe zone, first in the form of individual cliffs, i.e., nunataks, and later, where conditions were more favorable, in the form of larger areas, now representing "oases."

The natural conditions in all three "oases" (Greerson, Bunger, and Vestfold) are very similar, although each one of them has its specific features. They are all located on the edge of the glacial cover of Antarctica and face the sea on one side, while the other edge adjoins the slope of the ice sheet rising above the oasis; the base of the ice sheet is apparently below sea level, so that the "oases" are actually islands. (This opinion has been confirmed by data of a gravimetric survey made by A. K. Dorokhin.) Bunger Oasis is bordered on the seaward side by the ice of the Shackleton Shelf Ice, and the connection between the inlets of the "oasis" and the open sea exists under the ice.

The location of all three "oases" is characteristic. They face the sea with their northwest side, and their southeast edge borders on the continental ice sheet. This situation, apparently, is the result of the prevailing winds. Continuous, strong south-east and east winds break off and carry away by sea pieces of the edge of the ice sheet on the northwest side of the "oasis." However, on the southeast and east, even if the ice sheet originally did not exist, it would form through accumulation of icebergs and the further addition of ice, since the snow line at this point lies below sea level. In addition, the wind carries mineral particles from the "oasis" to the northwest, thereby increasing the melting of the ice sheet in the areas lying in this direction. Huge snow masses carried from the interior of the continent are deposited at the southeast edge of the "oasis," producing additional accumulations of ice.

The area of "oases," including sea straits and inlets which penetrate deeply into the land, covers several hundred square kilometers (greerson, about 300 square kilometers; Bunger, about 1,000 square kilometers; and Vestfold, about 500 square kilometers). However, not including the inlets, the area of Greerson "oasis" would cover about 100 square kilometers, and those of Bunger and Vestfold "oases," about 400 square kilometers each.

The coastline is extremely irregular and represents an alternation of peninsulas and deep inlets, often of a fiord type. Groups of rocky isles are situated near the coast.

The surface of the "oases" is heavily intersected. This is a hilly region, with hills composed of basic rocks reaching heights of 100-150 meters. The slopes of the hills, as a rule, are steep, rocky, and, in places, especially on Greerson "Oasis," terraced. The origin of the terraces varies. The sea terraces, which indicate a lowering of the sea level during the Quaternary period, are the most interesting. The lowest 2-meter sea terrace is fairly extensively developed. It is least developed in the Vestfold "oasis," where numerous remains of marine organisms have been found, including calcareous tubes of Serpula vermicularis worms, shells of Periploma sp., and other molluscs, Tetilla leptoderma glass sponges, Iophon radiatus, skeletons and mummified remains of seals Leptonychotes Weddelli, Lobodon carcinophagus, Mirounga leonina, and sea birds Aptenodytes forsteri, Macronectes giganteus, and others.

The higher terraces are fairly well developed in the Greerson "oasis," where up to seven terraces were distinguished, ranging in height from 15 to 85 meters. Higher up, terraces are rarely encountered. However, the flat summits of elevations, and the occurrence in some places of well-shaped pebbles (on Gaussberg), as well as the analysis of remains of glass sponges, indicate that during the Quaternary period the sea covered all coastal elevations up to a height of at least 370 meters, as compared with the present level.

As a result of desquamation, and weathering by temperature and frost, rock debris is spread over a large part of the elevations. This debris is mixed to a large extent with boulders carried by glaciers. The depressions between hills are filled with debris largely of morainic origin. The valleys separating the hills have been dug out by glaciers and are often trough-shaped.

The wind carrying grains of sand plays an important part in the process of rock disintegration. There are numerous, characteristic forms of weathering, typical for arid regions, on the cliffs and boulders, such as pores, niches, mushroom-shaped ledges, and crests. In some places the surface of cliffs resembles lace. Sometimes the weathering of boulders goes so far as to completely destroy their interior parts. Only the surface layer in the form of a crust remains. On the surface of granite cliffs the process of desquamation causes peeling of rocks in the form of enormous scales or crusts. The effect of the wind on the cliffs continues throughout the year, because even in winter there is almost no snow cover in the "oases." The arid type of weathering is further stressed by the formation of desert varnish on the cliffs and of efflorescence of salt.

The present glaciation of the "oases" consists of small, residual glaciers and snow patches, more developed in the "oasis" of Greerson and almost completely absent in the Vestfold "oasis." The antarctic ice sheet descends toward the "oases" in a steep slope, fringed by rows of lateral moraines, which are especially pronounced in the Greerson "oasis." Small ice tongues reach from the ice sheet into the "oases" through valleys; however, as a rule they do not penetrate very far.

Permafrost extends over the whole area of the "oases." The active layer is relatively large: from 20 centimeters on clay soil to 100 centimeters and even more on detrital soil. There certainly must be patches of thawed ground underneath the bottom of some fresh-water lakes, which are several tens of meters deep (the greatest measured depth of Lake Figurnoye is 137 meters), and where the water temperature near the bottom is around 2.5 degrees Centigrade in the winter. There is apparently no permafrost under the lateral parts of the glacial cover, as indicated by the year-round inflow of water into Lake Figurnoye. In October, when there is practically no thawing, the small stream flowing out of this lake caused a current of water in the polynya. Even though this stream freezes down to the bottom in the winter, a current of water apparently continues in the debris constituting the river bottom. This water, apparently, comes from underneath the glaciers descending into Lake Figurnoye.

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In view of the small amount and coarse-grained nature of the loose deposits, almost no ground ice is formed. Polygonal (poligonal'nyye) types of ground are also poorly developed, although in some places, systems of polygons exist which are from 20-30 centimeters to 2-3 meters and more in diameter. As a rule, they are badly formed.

The climatic conditions in the "oases" differ from the climatic conditions of the icy shores of Antarctica, especially in the summer. The summer in this area is warmer and drier. The radiation balance is three to four times greater than on the surrounding ice (350-400 calories per day); this is explained by the great absorption of solar energy by the dark surface of the rocks, which are heated up to 30 degrees Centigrade, or sometimes even more.

The air temperature is 2-3, and sometimes even 5 degrees Centigrade higher than in the ice-covered regions; it reaches 10 degrees Centigrade (maximum observed temperature, 11 degrees) in the daytime and seldom drops below freezing point at night. In Mirnyy, the maximum temperature was only 5 degrees Centigrade.

The relative humidity is exceptionally low, amounting to 50 percent at night and going down to 10-15 percent during the daytime. All this causes an enormous amount of evaporation from the surface of the ground and the ice of the snow patches and glaciers surrounding the "oasis." In addition, updrafts of air are formed which lead to the formation of cumulus clouds above the oases, hardly ever observed in any of the other regions.

The strong winds, mainly in an easterly direction, which sometimes exceed 50 meters per second, blow away even the small amount of snow which falls in the winter; in the summer, there is almost no precipitation whatsoever, and the annual balance of moisture is negative, as a result of which the snow cannot accumulate and form glaciers. Only in a few favorable spots protected from the wind, i.e. in the lee of cliffs, small glacierets and snow patches are formed. In this respect, the Greerson "oasis" is a little different. In this area most of the deep valleys and depressions between individual mountains are filled with ice, partly connected with the ice sheet but mostly separated from it, which has formed residual glaciers, often without noticeable traces of movement.

The negative balance of humidity (moisture?) in the "oases" results in a poorly developed hydrographic system. The numerous lakes often do not have any permanent, or even temporary (springtime) drainage.

There are practically no rivers. Actually, the whole "river system" consists of some hardly noticeable little rivulets, flowing out from underneath the infrequent snow patches. Especially the Vestfold "oasis" is poor in running water; a large area of ground has neither snow, nor rivulets. However, here and there are small brooks draining the melt water of the ice sheet. One such small brook flows out of Lake Figurnoye in Bunger "oasis;" the upper end of the valley in this "oasis" adjoins the edge of the ice sheet. Another brook flows from the ice sheet and crosses Vestfold "oasis," flowing through Lake Posadochnoye. The discharge of the first brook (the largest one in Bunger "oasis") in mid-summer is only about 2 cubic meters per second.

A large number of the lakes have a varying degree of salinity. Salinity is especially high in the driest "oasis" of Vestfold, where some fairly large lakes have bitter-salt water.

The salt-water lakes are mostly of relict origin. The bitter-salt lakes of Vestfold "oasis" are remnants of sea inlets, which were separated from the sea by a rising of the coast. The negative moisture balance and the absence of water inflow from outside caused the lakes to dry out and resulted in a concentration of salts. At present, the water level of some lakes is 30-40 meters below sea level, and the salinity in the lakes reaches almost 230 per mil, i.e. six times more than in the sea. The composition of salts is slightly different from that of the sea, especially the percentage of chlorine salts is greater than in sea water. A portion of the salts (mainly mirabilite) has already been separated as a sediment and has been deposited in the form of layers along the lake shores. Such lakes can freeze only at temperatures below minus 18 to 20 degrees Centigrade; as a result, they apparently do not freeze even in the winter. Only occasionally a thin ice crust appears for a short time. The temperature at the bottom of one of these lakes, which is 25 meters deep, was about minus 5 degrees Centigrade during the daytime on 13 December; at the same time, it was plus 8 degrees Centigrade at the surface, and even plus 11 degrees Centigrade in a few shallow places near the shore.

The temperature regime of fresh-water lakes differs greatly from that of the bitter-salt lakes. The temperature is more uniform at different depths. In the summer, i.e., end of January, the temperature varied between 3.7 degrees Centigrade at the surface and 3.3 degrees Centigrade at the bottom, a depth of 26 meters. In winter, the lakes are covered with a 160-170 centimeter layer of ice. The ice is transparent, speckled with numerous closed thermal cracks, and has large numbers of air bubles. The ice cover on the large lakes begins to form at the end of February and beginning of March, and it disintegrates in mid-November, when intense evaporation of ice from the surface begins, up to the beginning of January, when the ice, which is greatly weakened by melting, finally breaks up. The water temperature in the winter is also uniform, i.e. from 2.3 degrees Centigrade at a depth of 3 meters (from the lower surface of the ice) to 2.7 degrees Centigrade at a depth of 135 meters. These temperature readings were taken in Lake Figurnoye at Bunger "oasis."

Because of the fac+ that there is a slight water discharge even in the winter, polynyas are formed in the narrow and shallow straits and at the mouths of the small rivers in the spring, when the air temperature rises. Their appearance follows an inflow of relatively warm depth water to the lower surface of the ice as a result of turbulent mixing caused by a local current.

The slopes of the basins of drying-out salt lakes are terraced, the upper terrace being of marine origin, i.e., having been formed when these basins were connected with the sea. The lower terraces indicate the breaks between the lowering of the level of each lake. There are numerous remains of marine animals, including bodies of seals and marine birds, on the terraces and slopes of the basins; in view of the high salinity and low temperature of the water, the animal remains are preserved by salt and decompose very slowly, and then only after they have been thrown out on the shore.

The extreme dryness of the air and of the ground further aggravates the severe climatic conditions caused by low temperatures and strong winds, so that the possibility of existence of organic life is reduced to a minimum. [Conclusion in next week's report.] (Physicogeographical Characteristics of the Area of Operation of Soviet Antarctic Expedition 1955-1957, by Ye. S. Korotkevich, Leningrad, Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva, Vol 90, No 3, May-Jun 58, pp 220-231)

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