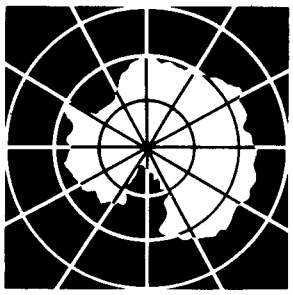
ANTARCTIC TREATY
TENTH CONSULTATIVE MEETING

ДОГОВОР ОБ АНТАРКТИКЕ
ДЕСЯТОЕ КОНСУЛЬТАТИВНОЕ СОВЕЩАНИЕ



TRAITÉ SUR L'ANTARCTIQUE
DIXIEME REUNION CONSULTATIVE

TRATADO ANTARTICO
DECIMA REUNION CONSULTIVA

SEPTEMBER 17 - OCTOBER 5, 1979

WASHINGTON, D.C.

AGENDA ITEMS 5 and 9

ANT/X/20
September 20, 1979

ORIGINAL: ENGLISH

THE REPORT OF THE GROUP OF ECOLOGICAL TECHNOLOGICAL AND OTHER RELATED EXPERTS ON MINERAL EXPLORATION AND EXPLOITATION IN ANTARCTICA

ANT(79)PM ET/7(Rev.2)
June 29, 1979

THE REPORT OF THE GROUP OF ECOLOGICAL TECHNOLOGICAL AND OTHER RELATED EXPERTS ON MINERAL EXPLORATION AND EXPLOITATION IN ANTARCTICA

The Group of Experts was established in accordance with Recommendation -1, operative paragraph 3. The Group met in Washington, D.C., between 25 and 29 ne 1979, "with a view to developing scientific programs aimed at:

"(i) improving predictions of the impact of possible technologies for mineral exploration and exploitation in the Antarctic, as outlined in Section IIB of the Report of the Group of Experts, and in Section 5 of the SCAR/EAMREA Group Report;

"(ii) developing measures for the prevention of damage to the environment or for its rehabilitation, in accordance with Section IIC of the Report of the Group of Experts."

The Group at its first session elected Dr. Robert Rutford (United States) as s Chairman.

The Group adopted the revised agenda (Annex A).

1. Outline of Scientific Programs on Environmental Impacts

It was the understanding of the Group that the unique Antarctic ecosystem is losely related to neighboring ecosystems and that gross perturbation in one area the Antarctic may have effects, however attenuated, both in the Antarctic and other areas. The Group recognized that a better understanding of the Antarctic cosystem as a whole was an important objective. The Group of Experts considered hat the purpose of the scientific programs with which it was concerned was to btain information critical to decisions concerning the possibility of the exploraion for and exploitation of mineral resources in Antarctica, should these activities ccur.

5. The Group agreed that scientific, technological, and economic factors indicate little likelihood of the commercial exploitation of Antarctic mineral resources other than offshore hydrocarbons in the foreseeable future. Accordingly, scientific programs to deal with the impacts of mineral activity should be concerned primarily with that resource.

6. The Group considered that the Report of the Group of Experts to the IXth Consultative Meeting and the SCAR/EAMREA report identified information needs and gaps in knowledge that are little changed since those reports were presented. The Group noted that the question of geologic hazards is referred to in the Report by the Group of Experts to the IXth in other sections but is not specifically cited in Section IIB. No major technologic advances were noted that would negate or alter the areas of concern identified in those reports.

7. The Group, noting the three stages of mineral resource activity identified in paragraph 32 of the Report of the Group of Experts of the IXth Consultative Meeting, considered the kinds of environmental risks and impacts directly associated with each of these stages:

a. Stage one, basic exploration was considered to involve negligible environmental risks except possibly those which might be associated with the operations of ships in Antarctic waters;

b. The second and third stages, exploratory drilling and full scale exploitation, involve greater environmental risks.

It was noted that the impacts from many of these activities might be more drastic in the Antarctic because of the severe environmental conditions, and strict regulation would be necessary were these activities to occur.

8. The Group suggested that basic and baseline information on the Antarctic environment is required in order to predict, mitigate, and monitor possible impacts resulting from mineral resource exploration and exploitation, should such activities occur.

9. It is possible that there is available, as a result of the research activities of the various nations during the past years, considerable information that through compilation and analysis, might satisfy part of this information requirement as well as more clearly identify those areas where further information is required. The Group acknowledged the admonition of the previous Group of Experts that it would be quite impossible to measure all of the environmental variables or describe all Antarctic ecosystems in detail. The selection of key factors is critical to these studies.

10. Ongoing and planned research activities (inter alia, BIOMASS, ISOS, POLEX) that will concentrate on the Antarctic marine and coastal ecosystems should take account of the requirements for information outlined in this report in order to avoid unnecessary duplication of effort.

11. In attempting to fulfill the mandate set forth in the first part of its terms of reference, the Group agreed that more time and expertise than was available at the meeting would be necessary for the preparation of detailed research proposals. In this connection, however, the Group concluded that in relation to the possible exploitation of hydrocarbons (see para. 5) it would be more cost effective to contribute towards an improved understanding of the Antarctic ecosystem by means of sharply focussed programs primarily devoted to the marine environment.

12. The Group also concluded that the following four specific areas were particularly deserving of attention:

a. Identification of the structure and dynamics of principal marine, acquatic, and terrestrial ecosystems that might be impacted by activities associated with mineral development.

b. Identification of key components of the ecosystem and components that might be the most sensitive indicators of the effects of mineral resource development and especially of the impact of either catastrophic or gradual pollution of the Antarctic environment.

c. Identification of those areas in Antarctica where mineral exploration and exploitation activities are more likely to occur.

d. Identification of areas of special ecological significance, and areas that might be particularly vulnerable to disturbance, taking account of the areas defined pursuant to the previous subparagraph.

13. In the light of these conclusions the Group felt that it could take a significant step towards the development of appropriate research programs by concentrating on the "subjects needing attention" set out in paragraph 69 of the Report of the Group of Experts in order to distinguish between the various sources from which relevant information might be derived, viz.:

a. information that may already exist but which needs to be retrieved and appropriately analyzed;

b. information that is or might be expected to be available without the initiation of new research programs;

c. information that requires the initiation of new research programs or additional work on lines already underway in national programs and programs coordinated by SCAR; and

d. information that requires the initiation of new or additional research when prospective regions have been identified with greater precision than has been done at present.

14. The approach adopted was to consider each of the major "subjects needing attention" and to tabulate them in four columns (see Table on following page.) The Group did not attempt to differentiate between programs that would be undertaken by governments and programs that could be undertaken in the course of exploration and exploitation, should this occur.

TABLE. SUGGESTED FRAMEWORK FOR THE DEVELOPMENT OF RESEARCH PROGRAMS AIMED AT IMPROVING PREDICTIONS OF THE POSSIBLE IMPACT OF HYDROCARBON EXPLORATION AND EXPLOITATION IN THE ANTARTIC.

I	II	III	IV
Information retrievable from analysis of past observations and research programs	Information obtainable from existing or planned research programs	Basic information requiring new or additional research that is not obtainable from ongoing programs or analysis of past work	Information requiring new or additional research when prospective regions have been identified
		Marine geological, geophysical and geochemical research on a regional basis	Definition in relevant detail of the physical oceanographic environment: (i) Water movements (currents and tides) (ii) Sea surface state (waves and over-icing) (iii) Floating ice regime (pack ice and icebergs)
Physical Oceanography			Sea bottom studies: (i) Morphology/bathymetry (ii) Sediment dynamics (iii) Stability
		Methodology of dating iceberg scours	(iv) Evidence of iceberg scour (including age assessments)
Antarctic climatology			Regional meteorology
Definition of the structure of those types of marine ecosystems, within the Antarctic ecosystem as a whole, likely to be affected by hydrocarbon exploration and exploitation.	Further definition of the structure of those types of communities and ecosystems likely to be affected by hydrocarbon exploration and exploitation; improved general understanding of population, community and ecosystem dynamics in pelagic and local inshore areas.	Influence of pack ice on the structure and dynamics of marine biological communities.	Characterization of regional biota and definition of areas of special biological significance.
	Atmosphere and ice cap pollutant levels.	Determination of baseline levels of hydrocarbon contamination in representative components of the marine ecosystem (including birds and mammals).	Determination of baseline levels of hydrocarbons in the water column and bottom sediments.
		First and second order effects of various kinds and concentrations of hydrocarbons and other pollutants on key components of the marine ecosystems.	
		The fate of various hydrocarbons under Antarctic environmental conditions (biodegradation, biological uptake and physical dispersal).	
		Design of monitoring programs based on indicator species sensitive to environmental pollution.	

15. While the Group was conscious that a great deal of relevant information could have been listed in columns I and II, it was taken as being self-evident that new or additional research would take account of relevant earlier work and of information that might be expected to become available from national programs and programs coordinated under the auspices of SCAR. Absence of an entry into columns I and II was not to be interpreted to imply irrelevance. It was to be taken, rather, that an entry implies either that a special contribution towards an improved understanding in that field could be made by analysis of past observations and research programs or that a special effort should be made to bear in mind the relevance of results derived from existing programs.

16. In drawing up the table the Group had in mind additional purposes which might not be immediately apparent. These were:

a. to help in arriving at an appreciation of the sequential component in research that would need to be incorporated in any integrated research plan (e.g., broad-scale marine geological and geophysical research would be needed before prospective regions could be identified; knowledge of the biological significance of pack ice would be needed before characterization of regional biota could be of relevance in defining certain areas of special biological significance);

b. to begin to distinguish between those requirements that were oriented towards a better understanding of dynamic processes in the Antarctic and others that were oriented towards a better understanding of particular regions.

17. The Group recognized that this tabulation could be considerably refined by bringing to bear on it additional relevant scientific and technological expertise, including the discipline of systems analysis.

18. Bearing in mind that the tabulation represented only a framework within which appropriate research programs might be developed, the Group believed that the detailed development of research programs might best be remitted to SCAR which would profitably involve its Working Groups, Groups of Specialists and other expert opinion (see Section 5 of the SCAR/EAMREA Group Report). It was also noted that this consideration was in accord with the advice given in para. 68 of the Report of the Group of Experts to the Ninth Consultative Meeting.

19. The Group, noting the need for the development of research programs aimed at improving predictions of the possible impact of hydrocarbon exploration and exploitation in Antarctica, proposed that the Representatives at the Tenth Consultative Meeting should recommend to their governments that they encourage SCAR, through their National Antarctic Committees, to define programs, taking account of the report of this meeting, with the objectives of:

a. retrieving and analyzing relevant information from past observations and research programs;

b. ensuring in relation to the needs for information identified by the Group that effective use is made of existing programs;

c. identifying and developing new programs that should have priority, taking account of the length of time required for results to become available.

20. The Group was conscious that SCAR had already indicated that costs would be involved in responding to initiatives on this subject, and it was agreed to draw this to the attention of the Consultative Parties prior to the Tenth Consultative Meeting.

II. Outline of Scientific Programs on Prevention and Rehabilitation

21. The Group of Experts considered Section IIC of the London Report as an excellent summary of the possible ways that pollutants might be introduced into the Antarctic environment by mineral resource exploration and exploitation. They acknowledge that the prevention of damage to the environment is largely dependent on the establishment of safeguards to prevent the introduction of pollutants and to protect areas of special significance, both terrestrial and marine. The problem of prevention of such damage is not restricted to the Antarctic although the unique environmental conditions found there require the development of special safeguards. The application of results from ongoing scientific and technological research in other areas, combined with research specifically related to the impacts of the Antarctic environment on exploration and exploitation activities, will assist in the development of measures for the prevention of damage to the Antarctic environment.

22. The development of Science programs related to the restoration and/or rehabilitation of damage resulting from mineral resource activities will depend on the acquisition of an understanding of the Antarctic ecosystem and an assessment of the possible impacts on that ecosystem. It was deemed premature by the Group to attempt to outline scientific programs dealing with these matters at this time. Further consideration should be given to these subjects at a later time by the Consultative Parties.

III. Oil Contamination of the Antarctic Marine Environment

23. As suggested by Recommendation IX-6, reports were submitted by Japan (Annex B) (ANT(79)PM ET/2 dated June 22, 1979) and by the Union of Soviet Socialist Republics (Annex C)(ANT(79)PM ET/6 dated June 26, 1979) on oil contamination of the Antarctic marine environment. In addition, Argentina submitted a suggestion for the study of pollution in the Antarctic (Annex D)(ANT(79)PM ET/4, Rev.1 dated June 28, 1979). These documents are annexed to this report.

24. The Group particularly noted the following pathways of man-made oil contamination identified in the Japanese report:

a. from scientific stations in the Antarctic;

b. from ships supporting scientific stations, conducting fishing operations or engaging in marine scientific research in Antarctic waters;

c. from water masses contaminated elsewhere and carried by natural forces into the Antarctic;

d. from possible future petroleum exploration and exploitation in Antarctica.

25. The Group particularly noted the following from the Soviet Report:

"From 1974 to 1978, as part of the Soviet Polar Experiment Southern Group Program, ships of the Soviet Arctic and Antarctic Scientific Research Institute (AANII) selected samples and examined them for petroleum product content at 161 points in the Southern Ocean, the Drake Straits, the Scotia Sea, along a line from Africa to Antarctica (20° east longtitude), and along a line from Antarctica to Australia (132° east longitude). At the end of each trip the samples were delivered to the AANII, where they were examined by infrared spectrophotometry.

"The results showed that the petroleum product level in the samples taken at the indicated points in the Southern Ocean was in most cases less than 0.03 mg/liter. Some of the concentrations fell within the 0.03-0.08 mg/liter range, which approaches the sensitivity limit of the method (0.03 mg/liter).

"Most of the values for petroleum product content which were in excess of 0.03 mg/liter were for the frontal zone of the Scotia Sea, where there is a high level of biological activity. It is possible that the increase in the level of substances identified as petroleum products is due in some degree to hydrocarbons of biogenic origin.

"No oil films or patches were observed visually from aboard ship.

"Thus, the results show that in the areas inspected, the Southern Ocean is virtually free of contamination by petroleum products."

26. The Group noted with interest the data presented in the Soviet Report concerning the low levels of hydrocarbons detected in the areas where observations were made. The Group urged the Consultative Parties and others operating ships or conducting activities that might introduce oil into the environment to continue their efforts to reduce possible oil contamination.

27. The determination of baseline levels of contamination of the Antarctic marine environment by oil has been included as a part of the suggested scientific programs aimed at improving the prediction of the impacts of possible mineral exploration and exploitation in the Antarctic.

28. The Group noted that up to now the most significant introduction of oil into the Antarctic marine environment appeared to be from the operation of ships. They further noted that both national and international groups were conducting research on oil contamination of marine areas by ships, and on means for its reduction, and that some of this research would be applicable to the Antarctic environment. They also noted that current research on the effects of oil in the Arctic marine environment resulting from offshore oil development would be useful in appraising effects of such activity in the Antarctic, should it occur. The results of these programs should be taken into account before similar programs are drawn up for the Antarctic.

29. There was inadequate time to consider the Argentine and Japanese suggestions for the study of pollution in the Antarctic. The Group suggests that the Tenth Consultative Meeting direct the attention of SCAR to these proposals and to the other documents submitted to the Group as listed below:

-- ANT(79)PM ET/3, June 25, 1979, by Poland (Annex E).

-- ANT(79)PM ET/5, June 25, 1979, by Poland (Annex F).

-- ANT(79)PM ET/8, June 27, 1979, by Poland (Annex G).

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ANNEX A

ANT(79)PM ET/1 ADOPTED
June 25, 1979

AGENDA

MEETING OF ECOLOGICAL, TECHNOLOGICAL AND
OTHER RELATED EXPERTS ON MINERAL
EXPLORATION AND EXPLOITATION IN ANTARCTICA
June 25-29, 1979
Washington, D.C.

A. Organization

B. Adoption of Meeting Agenda

C. Consideration of the Terms of Reference of the Group of Experts Meeting (reference Report of the Ninth Consultative Meeting)

D. Consideration of any documents or working papers that may be presented by members of the Group of Experts

E. Development of an outline of scientific programs aimed at improving predictions of the impact of possible technologies for mineral exploration and exploitation in the Antarctic (reference Section II.B. of the Report of the Group of Experts, Annex 5 of the Report of the Ninth Consultative Meeting, and Section 5 of the SCAR/EAMREA Group Report)

F. Development of an outline of scientific programs aimed at developing measures for the prevention of damage to the environment or for its rehabilitation (reference Section II.C. of the Report of the Group of Experts, Annex 5 of the Report of the Ninth Consultative Meeting)

G. Receive report and further consider the matter of oil contamination of the Antarctic marine environment (Ref: Recommendation IX-6)

H. Preparation of Statement to the Tenth Antarctic Treaty Consultative Meeting

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ANNEX B

ANT(79)PM ET/2
June 22, 1979

REPORT WITH REFERENCE TO RECOMMENDATION IX-6 (OIL CONTAMINATION OF THE ANTARCTIC MARINE ENVIRONMENT) OF THE NINTH ANTARCTIC TREATY CONSULTATIVE MEETING (SUBMITTED BY THE DELEGATION OF JAPAN)

The following are the results of study of the oil contamination of the antarctic marine environment by concerned agencies of the Japanese government.

1. Concerning the pathways by which oil may reach the Antartic Ocean (in relation to Recommendation IX-6, Paragraph 1):

(1) Possible causes of oil contamination in the Antartic marine environment

The main causes of oil contamination in the Antarctic marine environment are thought to be as stated below. It is remarked, however, that oils are also produced by living organisms which inhabit the Antarctic. These animal and vegetable oils would better be distinguised from mineral oils of subterranean origin, so that they have been omitted from this study in view of the need to focus attention primarily on the discharge of petroleum aromatic hydrocarbons, which form the oil content of petroleum origin, rather than on aliphatic hydrocarbons of biological origin.

a. Oil contamination from scientific stations in the Antarctic

Discharge of oil due to mishandling during operations and disposal of waste oil used at the scientific stations (light oil, kerosene, gasoline, etc.).

b. Oil contamination produced during transport operations for support of scientific stations, fishing operations, and ship movements for marine observations

Mainly due to discharge of oil contained in cooling water, etc., from ships' engines; negligence in operations; rupture of tanks, pipes, etc.; and shipwrecks.

c. Oil contamination resulting from movement of contaminated water masses, etc., from mid-latitude regions

Oil discharged or disposed of at a certain rate during its use in industrial and densely populated areas in mid-latitude regions, where human activities are concentrated, and also oil discharged from oiltankers in those regions are carried into the Antarctic marine environment by water circulation and atmospheric movements.

d. Oil contamination likely to result from future petroleum exploration and exploitation on the Antarctic continent and in the surrounding seas

Discharge of oil resulting from drilling operations in oil fields on the Antarctic continent and the surrounding seabed and from accidents, etc., occurring during these operations.

(2) Pathways by which oil reaches the Antartic marine environment

a. Oil contamination from scientific stations

Most of the scientific stations have their headquarters on the coast of the continent or on adjoining islands. Therefore, except in the case of stations situated further inland, any release of oil can be expected to reach the marine environment in the vicinity of the station relatively quickly, via ice-free areas around the coast or the islands. Since the decomposition of oil in the Antarctic is slow due to the low temperature, dispersion of oil contamination is influenced by the snow conditions, topography and geology between the point of discharge at the station and the adjacent sea, and by movements of seawater and sea ice due to tidal currents and wind on reaching the sea. Under Recommendation VIII-11, certain measures have been implemented with regard to the disposal of wastes from the scientific stations, including the disposal of lubricating oil.

b. Oil contamination from ships

This poses the greatest threat as a source of oil pollution of the Antarctic marine environment. Since the number of vessels traveling in Antarctic waters is inevitably expected to rise with the increasing activity related to Antarctic observations and resources, there will be increasing risk of oil contamination due to discharge of bilge and ballast water and to shipwrecks and other accidents.

If the resulting oil contamination is assumed to occur along the shipping routes, it can be expected to move away from these areas carried by currents such as the Antarctic circumpolar current, or by the wind. Further, if oil contamination spreads in the vicinity of pack ice region, serious damage to living organisms can be expected when the wind and currents are weak, since the oil will remain stationary over a long period.

c. Oil contamination from mid-latitude regions

While there has been little oil contamination occurring in the Antarctic marine environment itself, it is possible that water contaminated by oil discharges from urban and industrial regions at mid-latitude regions and from oil tankers will reach the Antarctic seas through dispersion by wind and currents.

d. Oil contamination due to mineral resource exploration and exploitation

In the event of petroleum exploration and exploitation being carried out on land or on the offshore seabed of the continental coast, oil contamination can be expected to reach the marine environment from the exploration and exploitation sites by the same pathway as discussed in (2) a. above. In the case of drilling in seabed oil fields, there is a risk of greater damage due to direct flows of oil into the sea.

2. Concerning an effective program for the determination of baseline levels of contamination of the Antarctic marine environment by oil (in relation to Recommendation IX-6, Paragraph 3):

(1) Studies considered relatively practicable

a. Use of the supply ships supporting scientific stations to conduct

(i) Sampling of seawater for analysis of oil content

(ii) Visual observation of oil slicks

b. Comparison with data from other sea areas

(2) Studies meriting future consideration

a. Sea areas to be covered by monitoring

(i) Sea areas adjacent to scientific stations in the Antarctic

(ii) In the event of future exploitation of seabed oil fields, etc., the sea areas surrounding the exploitation site

(iii) The Antarctic Ocean

(iv) Areas of the Indian, Atlantic and Pacific Oceans, etc., contiguous with the Antarctic Ocean (sea areas of the Southern Hemisphere).

b. Items to be monitored

To be selected as appropriate for each sea area from the following

(i) Tar balls

(ii) Visual observation of oil slicks

(iii) Dissolved and dispersed oil in seawater.

c. Monitoring methods

(i) Coastal surveys from land

Surveys of the coastal areas in the vicinity of stations would be conducted using snow cars, light aircraft, etc. They would consist mainly of visual observation of tar balls and oil slicks.

(ii) Aerial and satellite surveys

For surveys of extensive sea areas, aerial remote sensing technology would be employed in the study of oil slicks.

(iii) Surveys from vessels

In addition to sampling by the supply ships supporting the scientific stations and by oceangraphic observation vessels, vessels engaged in future exploration and exploitation of Antarctic resources, fishing vessels, etc., would be requested to cooperate in collecting data by visual observation of oil slicks.

d. Principles of implementation of monitoring

Monitoring would be conducted on the basis of the principles of implementation of the Marine Pollution Monitoring Pilot Project (MAPMOPP) of the Integrated Global Ocean Station System (IGOSS).

e. Use of monitoring results

The Scientific Committee on Antarctic Research (SCAR) and the Intergovernmental Oceanographic Commission (IOC) would be requested to study methods of collecting and using the data obtained in the Antarctic Ocean.

f. Organization for implementation of monitoring

As for the monitoring items, methods, principles of implementation, etc., the MAPMOPP instituted under the IGOSS program which is being jointly promoted by IOC and the World Meteorological Organization (WMO) would probably serve as a model. It is desirable that the Consultative Parties cooperate with appropriate organization to promote these activities.

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ANNEX C

ANT(79)PM ET/6
June 26, 1979

ON THE STATE OF POLLUTION IN THE ANTARCTIC REGION SUBMITTED BY THE DELEGATION OF THE UNION OF SOVIET SOCIALIST REPUBLICS

The rapid development of industrial production in recent years has confronted mankind with the threat of exhaustion of the earth's resources and contamination of the biosphere with the products resulting from the activities of human society. The adverse consequences of contaminating man's natural environment are now becoming apparent not only on a regional but also a global scale.

Consequently, the development of programs for monitoring and reducing the harmful effects of pollution on the environment is at present a most urgent problem.

In this regard a special role is played by the Antarctic, a vast region of the earth with unique and exceptionally vulnerable natural systems (ecosystems) that are probably the only ones on earth to remain relatively untouched and to have suffered relatively little (as yet) from contamination of the atmosphere, land, and ocean.

The Antarctic is a suitable region of the earth in which to study, first, the background state of the biosphere as a whole, and second, the local contamination resulting from the ever-increasing activities of man in the Antarctic itself.

The Antarctic, or its separate ecosystems, can serve as a model for a general theory of the development of life under extreme conditions and for various problems in the field of ecology as well. Antarctic ecosystems can serve as natural scientific laboratories for the study of the habitat. And, finally, the Antarctic can become a huge laboratory for monitoring the state of the environment and studying its contamination.

Your attention is invited to several preliminary results of the research on the state of individual components of the natural environment performed over the past few years by Soviet Antarctic expeditions.

During the last few years the contamination of the atmosphere and the evaluation of its possible effects on fluctuations in the earth's climate have become the subject of greatly increased interest. Many distinguishing features of the composition and circulation of the atmosphere over the polar regions and the remoteness of these regions from centers of human activity give them a special role in a system for global monitoring of the environment. As we know, the southern hemisphere, and especially the Antarctic region, are less affected at present by anthropogenic factors than the northern hemisphere, where most industrial production is concentrated.

One effective way to study the composition of the atmosphere is to use spectral methods, which make it possible to determine the total amount of impurities in a column of atmosphere based on the weakening of the sun's rays. In 1958, at the Mirny Station in Antarctica, regular measurements of total ozone content were begun and have continued with brief interruptions to the present time. During the past few years regular measurements of total ozone content have also been made at the Vostok Station.

During the 23d SAE (Soviet Antarctic Expedition) personnel of the IFA (Institute of Atmospheric Physics) of the USSR Academy of Sciences and the AANII (Arctic and Antarctic Scientific Research Institute) in Molodezhnaya carried out experiments to investigate gases present in small amounts in the Antarctic atmosphere and also the transparency of an entire layer of the atmosphere in the infrared part of the spectrum. For the first time the spectral method was used to measure the content, throughout an entire layer of Antarctic atmosphere, of such impurities as carbon monoxide (CO), methane (CH_4), and nitrous oxide (N_2O). During the 24th SAE a group was formed at the Mirny Station to monitor the state of the environment and to measure total ozone content, atmospheric opacity, and the amount of carbonic acid gas in the surface layer of the atmosphere. During the 24th SAE measurements were made in Antarctic coastal waters of the total carbon dioxide (CO_2) gas content in a column of atmosphere.

The main results of these studies are as follows:

1. Many years of measurements of the ozone content at Mirny have made it possible to establish the distinctive characteristics of a periodic increase in total ozone content in the spring. This kind of change is most pronounced in early spring and is evident until completion of the spring warming of the stratosphere over this region. The absolute maximum of total ozone content in spring here is 585×10^{-3}cm and the absolute minimum is 180×10^{-3}cm. The variations in total ozone content over Antarctica are closely related to atmospheric circulation. A combined analysis of data on total ozone content and from separate

releases of ozone probes, which make it possible to determine the ozone concentration at different levels, showed that in the Antarctic troposphere the amount of ozone present constitutes 2-5% of the total amount in the atmosphere. As in other regions of the globe, most of the ozone is concentrated in the layer of the stratosphere between the 100 and 50 mb levels.

2. The carbon monoxide content in a vertical column of Antarctic atmosphere during the period of observation has a tendency to be lower in January (up to 0.03×10^{-3}cm) than in March and April (up to 0.05×10^{-3}cm). It is interesting to note that in the middle latitudes of the northern hemisphere the summer minimum of CO (0.07×10^{-3}cm) is greater than the maximum levels in Antarctica.

3. No regular variations were found in either total methane (CH_4) content and its surface concentration or total nitrous oxide (N_2O) content in the Antarctic atmosphere during the period of observation. The amounts of these gases were found to be 1.28×10^{-3}cm for total methane content and 1.32 ppm for surface methane concentration. The data on N_2O for the Antarctic proved to be close to those obtained in the northern hemisphere by various authors. Total CH_4 content and surface concentration are lower in Antarctica than in the northern hemisphere.

4. Study of the weakening of radiation at different wavelengths reveals a very low aerosol content in the Antarctic atmosphere.

5. The Schupp B_{500} power factor, one of the criteria recommended by the WMO for measuring atmospheric opacity, averaged 0.025 in regular observations in Antarctica. This figure agrees with that obtained during intermittent observations made earlier at the Mirny and Plato stations, an indication of the stability over time of Antarctic aerosol opacity during the past ten years.

6. The apparatus and methodology used for making measurements in Antarctica are completely suitable for making measurements under difficult conditions.

7. Similar research will be continued in Antarctica in order to evaluate the trend in the level of possible changes in basic indicators of pollution and also to make a more detailed analysis of space-time variations.

Prior to 1974 practically no study was made of pollution in the Southern Ocean in areas away from heavily traveled shipping lanes because of the inadequacy of the methods used to select and process samples. After reliable methods were developed, systematic study and monitoring began of pollution of the Southern Ocean by petroleum and petroleum products, which are among the most common contaminants found at sea.

From 1974 to 1978, as part of the POLEX-Southern Group program, ships of the AANII selected samples and examined them for petroleum product content at 161 points in the Southern Ocean, the Drake Straits, the Scotia Sea, along a

line from Africa to Antarctica (20° east longitude), and along a line from Antarctica to Australia (132° east longitude). At the end of each trip the samples were delivered to the AANII, where they were examined by infrared spectrophotometry.

The results showed that the petroleum product level in the samples taken at the indicated points in the Southern Ocean was in most cases less than 0.03 mg/liter. Some of the concentrations fell within the 0.03-0.08 mg/liter range, which approaches the sensitivity limit of the method (0.03 mg/liter).

Most of the values for petroleum product content which were in excess of 0.03 mg/liter were for the frontal zone of the Scotia Sea, where there is a high level of biological activity. It is possible that the increase in the level of substances identified as petroleum products is due in some degree to hydrocarbons of biogenic origin.

No oil films or patches were observed visually from aboard ship.

Thus, the results show that in the areas inspected, the Southern Ocean is virtually free of contamination by petroleum products.

Despite the low level of contamination of natural systems on the Antarctic continent, in areas around scientific stations, bases, and outlying camps local anthropogenic contamination may have adverse effects on some local ecosystems, especially if these effects are of long duration.

All activities of Soviet Antarctic expeditions are carried out in keeping with the decisions and recommendations of the Antarctic Treaty consultative conferences.

Inspections performed by medical and biological personnel at Soviet Antarctic stations have shown that lately a great deal of work has been done to improve living conditions and sanitation in residential and working quarters at the stations.

Problems of solid and liquid waste disposal are being satisfactorily handled at most stations. For example, all stations now burn solid wastes and garbage that do not contain harmful substances and dispose of housecleaning waste water and sewage in special tanks containing disinfectants.

Certain as yet unresolved problems involving subsequent purification, utilization, and removal of wastes at a number of stations (Novolazarevskaya and Bellingshausen) will be solved in the next few years.

Naturally this is only the start of a great deal of work that needs to be done to make a comprehensive study of the state of the Antarctic environment within the framework of a "Global System for Monitoring the Environment".

Now, during the 24th SAE, a baseline background station has already started work in the vicinity of the Mirny observatory. In addition to studying long-term trends in the change in concentrations of contaminants and the transparency and aerosol opacity of the Antarctic atmosphere, it has undertaken to "monitor the past" by measuring the background levels of contaminants in different layers of the Antarctic ice cover.

In the future it will apparently be advisable to undertake a comprehensive study of local and global anthropogenic contaminants in this region in stations especially set aside for this purpose (land and marine ecosystems).

Next year, during the 25th SAE, plans have been made to use AANII research vessels and one of the Antarctic stations to study total CO_2 content in the atmosphere (Mirny) and technogenic pollution of the environment by toxic substances, including carcinogens (Mirny, Molodezhnaya).

It goes without saying that the problem of carrying out a comprehensive study of the state of the environment and of "protecting" the natural environment of such an enormous region can only be solved through the close cooperation of many countries of the world.

In our opinion, every effort must be made to encourage the creation (within the framework of national programs) of comprehensive stations for monitoring the state of the environment and the establishment of a system for simulating the effect of contaminants and other harmful substances on various ecosystems (biogeocenoses), and to encourage as well the comprehensive study of various cenoses.

Naturally, all of this should be done using uniform and similar methods. Apparently it is necessary to recommend criteria for selecting the most important pollutants and related environmental factors to be monitored in the Antarctic and to recommend a list of the most important pollutants and related environmental factors in this region of the globe.

It is necessary to continue the comprehensive study of the structure and dynamics of Antarctic ecosystems, biogeocenoses, groups, species, and so forth. It is also necessary to conduct studies to determine the sensitivity of various Antarctic ecosystems, as well as the "key species" to various forms of infractions such as irrational use of resources, pollution, and so forth. It is necessary to obtain more accurate information on marine ecosystems, as well as the species that need special protection, and to create the conditions for effectively protecting them.

It is extremely necessary to develop uniform criteria, mandatory for all parties to the Treaty, limiting the impact on the natural environment of the Antarctic. These problems should form the basis for international scientific cooperation on the Antarctic.

Only such an approach can, in our opinion, solve the complex problems involved in studying and "optimizing" the natural environment of the south polar region.

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ANNEX D

ANT (79) PM ET/4/Rev. 1
June 28, 1979

GROUP OF TECHNOLOGICAL, ENVIRONMENTAL AND RELATED EXPERTS
ON ANTARCTIC MINERAL RESOURCES
SUBMITTED BY THE DELEGATION OF ARGENTINA

Suggestion for the Study of Pollution in the Antarctic

Introduction: Recognizing the need to evaluate the current state of the pollution of the Antarctic, and its nature and scale in the future, it is clear that there is an urgent need to establish a program of the appropriate basic studies for detecting discharges and human acts that may endanger the delicate Antarctic ecosystem;

Recognizing as well the need for SCAR to coordinate the studies and all matters relating to sampling techniques, methods of analysis and interpretation and evaluation of data:

In the formulation of a study of pollution in the Antarctic the following points should be considered:

1) Parameters to be evaluated:

   a) Petroleum hydrocarbons in sea water, in marine sediments and at different trophic levels.

   b) Trace metals, both in water and in sediments and at different trophic levels.

   c) Halogenated hydrocarbons (DDT, PCB's, etc.) from the same sample units.

   These parameters will be evaluated to ascertain the horizontal distribution and, if possible, in the whole water column to the bottom.

2) For evaluation of the data in point 1), it is also necessary to know:

   a) Position, date and time of the sample.

   b) Oceanographic data such as temperature, salinity, dissolved oxygen, penetration of radiant energy, nutrients, phytoplanktonic pigments, primary production, etc.

   c) Supplementary meteorological information.

3) Areas of study:

The Study covers those Antarctic regions whose features make them most susceptible to being affected by the discharge or transport of pollutants, e.g.:

a) Areas of high primary production.

b) Areas of heaviest maritime traffic.

c) Areas where ice may automatically act as an agent of concentration.

d) Areas close to sites of intensive scientific exploration.

e) Areas in the vicinity of fixed, permanent or temporary stations.

4) Means of sample procurement:

Given present known concentrations and the enormous difficulties that must be overcome in order to make an adequate sampling, some of the platforms mentioned below should be available:

a) Oceanographic research ships.

b) Fishing boats, auxiliary vessels or vessels in transit through the area.

c) Aircraft.

5) Analysis of samples:

To facilitate comparison of the data obtained, given the specific features of the techniques to be used, the recommendations are:

a) For evaluation of petroleum hydrocarbons:

Fluorescence spectrophotometry.

Gas-phase chromatography.

b) For evaluation of trace metals:

Neutronic activation analysis.

Nuclear absorption spectrophotometry.

c) For evaluation of chlorinated hydrocarbons:

Gas-phase chromatography.

The following reference materials are mentioned as a guide for the preparation and evaluation of samples:

Manuals and Guides No. 7, UNESCO, 1976
Intergovernmental Oceanographic Commission
World Meteorological Organization
"Guide to Operational Procedures for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring"

"Baseline Studies of Pollutants in the Marine Environment and Research Recommendations"
Deliberations of the International Decade of Ocean Exploration (IDOE) Baseline Conference, May 24-26, 1972.

"Marine Pollution Monitoring: Strategies for a National Program"
Deliberations of a workshop held at Santa Catalina Marine Biological Laboratory of the University of Southern California, October 25-28, 1972.

"The Health of the Oceans" by Edward D. Goldberg, Scripps Institution of Oceanography, La Jolla, California. Paris: UNESCO Press, 1976.

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ANNEX E

ANT(79)PM ET/3
June 25, 1979

THE ROLE OF NEAR-SHORE RESEARCH IN ANTARCTIC

SUBMITTED BY S. RAKUSA-SUSZCZEWSKI
DELEGATE OF POLAND

In modern oceanology increasingly greater attention is being paid to the coastal regions. Most of the processes decisive for oceanic production take place in the immediate vicinity of land.

Shelf waters of both Americas and Africa give more than 50% of world fisheries. It is difficult to express this by numbers, at the present stage of our knowledge about Antarctic ecosystems. A similar situation may be expected in the Southern Ocean. Spatial distribution, patchiness, more or less periodical concentration of all organisms with a very high biomass of the food web is characteristic for this ecosystem. This occurs mainly in the inshore areas. Particularly abundant growth of phytoplankton may be observed at the lee side of islands, above the elevations of the bottom. In the same places great concentrations of krill in swarms may be observed. Coastal regions are places of spawning, and feeding of fish most of which are nonmigratory and demersal species. We have observed that the biomass of larval and juvenile stages of fish is about 5% of total krill biomass in swarms. The biomass of krill in swarms may approach 30 kg/m^3 and on the average it is about 2 kg/m^3 . On the other hand, the mean biomass of zooplankton in the open waters of the Southern Ocean is estimated to be 50-60 mg/m^3. Appreciable quantities of birds, seals and whales concentrate in the near shore areas to feed on krill. It is known that the presence of a large number of birds and whales is a good indicator of the presence of krill swarm. For the ecologists the aggregation of the representatives of all trophic levels in a relatively small space creates a number of consequences which we do not appreciate fully yet.

A different situation exists in waters of the open ocean. Many species of fishes, birds and seals connected by their breeding places with the inshore areas are absent from the web of trophic relations. There has to be an equilibrium between the numbers of consumers and the amount of available food, as well as between the distance of the breeding sites and feeding areas. Since birds and seals get their food from the ocean, there is an intensive accumulation of organic matter of sea origin on land and fertilization in the areas of rookeries and breeding sites.

My aim is to call attention to the significance of investigations in the near-shore area and the necessity of long-term biological observations important especially for the understanding of the changes and trends occurring in this part of the Antarctic ecosystem. The area of the Antarctic Ocean South from the Antarctic Convergence may be divided zoogeographically and phytogeographically into provinces, regions and subregions. In the Antarctic ecosystem there is a natural division both longitudinal and latitudinal. This area differs, not only in the environmental conditions but also in the composition of species entering into food chains. This provides another evidence for the conception of patchy distribution of biomass and trophic relations in the Antarctic. As we know, shelves of the Antarctic continent and of some islands are potential regions for mineral exploitation, gas and oil especially. For example EAMREA-report 1977 gave some calculations showing that a spill of oil covering say 300 km^2 at the average density of about 50 tons of krill per km^2 may put at risk about 15,000 tons of krill. It is 0,00015% of the assumed standing stock. I agree that, it is not dangerous for the total krill stock in Antarctica, but at the same time we are worrying about the "Area of Special Protection" with the surface area of 1 : 500,000 of all Antarctic ecosystem. Is it consequential? Let me give you another example.

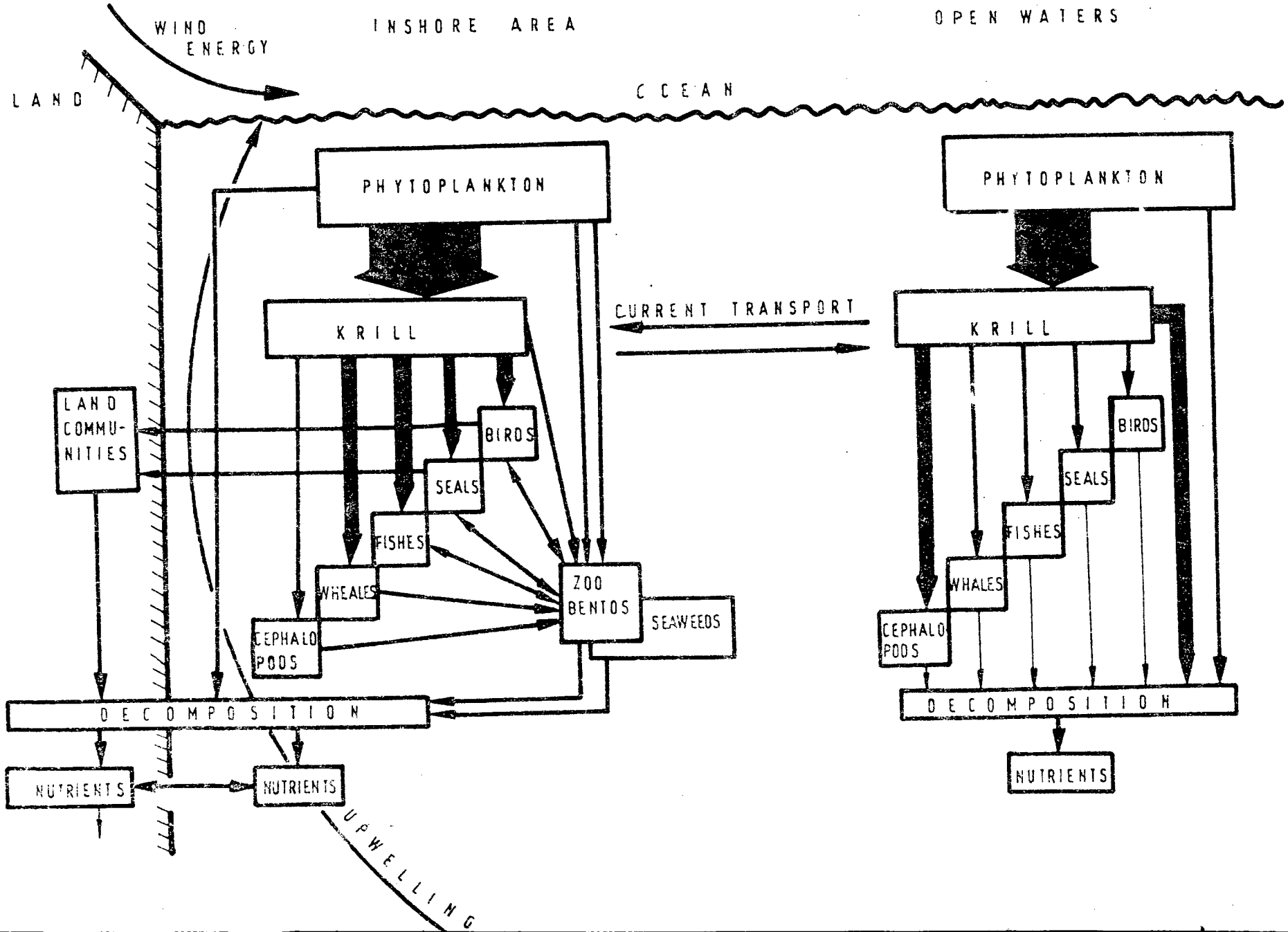
Region of Admiralty Bay, King George S. Shetland is a place of our complex investigations. Accordingly our proposition for the Xth Treaty Meeting is also a place recommended as a Site of Special Scientific Interest. I don't believe that in the near future we can start exploitation of oil or gas in Admiralty Bay, but it is more likely that another unlucky disaster like the sinking of a ship may happen.

Do you remember what happened to "Lindblad Explorer" some years ago? Besides tourists and Polish population at Arctowski station what else would be at risk in this case? This area of Admiralty Bay is 131 km^2. Last summer we have noted in this region 23,661 pairs of Adeli penguins, 10,550 pairs of P. antarctica, 3117 pairs of P. papua, so all together 74,656 specimens of penguins will be at risk. All these penguins ate 50,181 tons of krill per day in December and transported on to the land about 6,348 tons of dry weight of faeces per day. We have in Admiralty Bay 600-960 elephant seals, about 110 Weddell seals, and 220 fur seal, 25 species of fish were recorded in water of Admiralty Bay, one more than in the Scotia Sea because one new species of Raja was described by our ichtiologist as the Raja rakusai.

Hitherto we have no exact data on krill stock in this region, but it is clear that standing stock in this place is too low for the maintainance of all penguins, seals and fishes. They must get food off Admiralty Bay. Admiralty Bay as a part of inshore ecosystem is not self-supporting in its geographical boundaries in summer season. I think, that some of the presented data, together with the earlier comments are sufficiently convincing for the appreciation of the significance of neritic zone investigations for the understanding of the whole Antarctic ecosystem.

The IXth Treaty Consultative Meeting suggestion about gas and oil drilling moratorium is fully in accordance with our conviction about the negative influence of this on the inshore part of the Antarctic ecosystem.

Fig. 1 shows conceptual model of major trophic relations conditioning the circulation of matter and energy flow in the inshore and off-shore parts of the Antarctic ecosystem.


WIND ENERGY
INSHORE AREA
OPEN WATERS
LAND
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KRILL
CURRENT TRANSPORT
LAND COMMU-NITIES
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FISHES
WHEALES
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ZOO BENTOS
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NUTRIENTS
UPWELLING
PHYTOPLANKTON
KRILL
BIRDS
SEALS
FISHES
WHALES
CEPHALO PODS
DECOMPOSITION
NUTRIENTS

ANNEX F

ANT(79)PM ET/5
June 25, 1979

POLISH PROPOSAL FOR AN ANTARCTIC GEOPHYSICAL GEOTRAVERSE DRAKE PASSAGE - ANTARCTIC PENINSULA GEOTRAVERSE

SUBMITTED BY PROFESSOR K. BIRKENMAJER
DELEGATION OF POLAND

Outline of the program for geophysical marine expedition to South Shetland Islands, West Antarctica, in 1979/80.

Organizers: Polish Academy of Sciences, Institute of Geophysics (Warsaw)

Vessel: O.R.P. "Kopernik", 1600 BRT.

Area: Between Antarctic Peninsula and Drake Passage, including Bransfield Strait and the shelf area surrounding South Shetland Islands. Based on H. Arctowski Station, Admiralty Bay, King George Island (South Shetland Islands). Area of investigations about 150 x 500 km.

Scientific Tasks:

(1) Geophysical measurements (seismic, magnetic) on geotraverses across shelf, continental slope and rise and oceanic bottom, with particular stress upon tectonically active areas such as Bransfield Rift and Bridgeman Island - Penguin Island - Deception Island volcanic zone;

(2) An attempt at constructing geodynamic models for this part of West Antarctica.

Methods: Reflection seismology (air-gun system) down to 3-5 thousand meters on shelf geotraverses, altogether 1500-2000 km of profiling:

(1) Shallow refraction seismology (air-gun system) along short profiles 50-60 km long each, altogether ca 500 km;

(2) Magnetic profiling along seismic profiles.

The above methods are harmless to Antarctic marine environment and are generally approved techniques for investigation of shallow parts of the Earth's crust.

(3) It is also considered a program of deep refraction-seismic sounding for recognition of structure of Earth's crust and the Upper Mantle, and the depth of Moho. This would be done on point geotraverses 150-300 km long. This method needs some shooting in open ocean outside shelf area to obtain good results. It is necessary to use small explosives of 25-50 kg of dynamite. A special technical project is being elaborated and will be consulted with SCAR.

It should be noted that such technique using small explosives has been used with good results by the same scientific team of ORP "Kopernik" and Institute of Geophysics of the Polish Academy of Sciences in a joint Polish-American-Norwegian project (Polish Academy of Sciences - St. Louis University - University of Bergen) for deep seismic sounding of the shelf and shelf-margin area of Svalbard (Spitsbergen) in the Arctic, and proved to be of minimum negative impact on polar biota.

Further Proposals: The Drake Passage-Antarctic Peninsula Geotraverse could be a starting point for similar geotraverses of other shelf and shelf-margin areas of Antarctica done on international cooperation basis. An informal working group could be established to delineate and supervise such programs.

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ANNEX G

ANT(79)PM ET/8
June 27, 1979

SOME PROBLEMS IN ANTARCTIC ECOSYSTEM PROTECTION

SUBMITTED BY K. BIRKENMAJER
AND S. RAKUSA-SUSZCZEWSKI
DELEGATES OF POLAND

International programs coordnated by SCAR should be elaborated and carried out to determine zones and areas of necessary protection of major ecologic elements of Antarctic ecosystem (in relation to Recommendation IX-1, IX Consultative Meeting, London 1977, Report of the Group of Experts on Mineral Exploration and Exploitation).

As an example, we would like to stress the need for closer investigation of the following elements of Antarctic ecosystem:

(1) Location and problem of stability of larger krill accumulations with respect to oceanographic, climatic and other parameters, as a basic element of Antarctic ecosystem;

(2) Location and problem of stability of principal breeding grounds of penguins and other birds, and determination of feeding grounds of larger bird colonies at the time of breeding;

(3) Location and problem of stability of main breeding grounds of pinnipeds, such as Sea Elephant (Mirounga leonina) and Kerguelen Fur Seal (Arctocephalus gazella), and determination of feeding grounds of larger colonies at the time of breeding.

The research should be directed towards determination of minimum, maximum and optimum zones and areas of necessary protection of such breeding-and-feeding grounds.

It is suggested that such breeding-and-feeding grounds determined as the result of special investigations should be registered by SCAR as Antarctic Breeding and Feeding Grounds (ABFG) which would include breeding grounds on land and/or ice and related feeding grounds at sea.

Recommendations should be elaborated as to the types of activity allowed in the ABFG's. It is believed that no exploratory drilling (phase 2) and no

full-scale exploitation (phase 3) of minerals either at sea or on land should be allowed in the areas designated and registered as ABFG, and that the basic exploration (phase 1) within the ABFG's should be kept at minimum.

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