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CONTENTS

Chairman: Mr. Ismail FAHMY (United Arab Republic).

AGENDA ITEM 92

Examination of the question of the reservation exclusively for peaceful purposes of the sea-bed and the ocean floor, and the subsoil thereof, underlying the high seas beyond the limits of present national jurisdiction, and the use of their resources in the interests of mankind (A/6695; A/C.1/952)

GENERAL DEBATE

1. The CHAIRMAN: As the Committee agreed yesterday [1514th meeting, para. 140], we shall start today consideration of item 92 of the agenda, dealing with the sea-bed and the ocean floor. Members of the Committee may have noticed that a new document has been circulated by the Secretary-General under the symbol A/C.1/952.

2. The first speaker this morning is the representative of Malta.

3. Mr. PARDO (Malta): May I first of all, Mr. Chairman, express my deep appreciation to you for permitting me to introduce at such an early date the item submitted by my delegation entitled "Examination of the question of the reservation exclusively for peaceful purposes of the sea-bed and the ocean floor, and the subsoil thereof, underlying the high seas beyond the limits of present national jurisdiction, and the use of their resources in the interests of mankind".

4. I understand that the fact that Malta has raised the question of the sea-bed and of the ocean floor in the General Assembly has aroused some astonishment, if not suspicion, in the minds of some delegations, and even among legislators in some countries. A member of the House of Representatives of the United States recently expressed the feelings of many in the following words:

> "The United States as a member—and I might add paying member—of the United Nations is entitled to know:
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> "First, why did the Maltese Ambassador, Arvid Pardo, make this premature proposal?
>
> "Second, who put the Maltese Government up to the proposal? Are they, perhaps, the sounding board for the British?
>
> "Third, and, most of all, why the rush?
>
> "It is my conviction that there is no rush; it is my conviction that the presently agreed to international law is reasonable and substantive. There is little reason to set up additional unknowns and additional legal barriers, which will impair and deter investment and exploration in the depths of the sea even before capabilities and resources are developed." 1/

We feel that we owe a brief explanation to those in this room who may share the sentiments so frankly expressed by the Congressman.

5. The Maltese islands are situated in the centre of the Mediterranean. We are naturally vitally interested in the sea which surrounds us and through which we live and breathe. We have been following closely for some time developments in the field of oceanography and deep-sea capability and have been impressed by the potential benefits both to our country and to mankind if technological progress takes place in a peaceful atmosphere and within a just legal framework and, on the other hand, by the truly incalculable dangers for mankind as a whole were the sea-bed and ocean floor beyond present national jurisdiction to be progressively and competitively appropriated, exploited and used for military purposes by those who possess the required technology. Hence our request for United Nations consideration of the question. Our proposal was formulated entirely without the benefit of advice from other countries and I can categorically state that we are not a sounding-board for any State, and that nobody "put the Maltese Government up to it".

6. My Government decided to take action at this session of the General Assembly because rapidly developing technology makes possible the exploration, occupation and exploitation of the world's sea-beds and much of its ocean floor. We are convinced that in accordance with historical precedent this capability will lead, indeed is already leading, to appropriation for national use of these areas, with consequences for all our countries that may be incalculable. Appropriation for national use of the sea-bed and the ocean floor underlying the seas beyond the limits of present national jurisdiction may be inevitable, but we believe that Governments might appreciate an opportunity to

1/ United States Congressional Record, Washington, D.C., 1967, vol. 113, p. H 12681.

give careful consideration to the issues involved and to examine whether it might not be wise to establish some form of international jurisdiction and control over the sea-bed and the ocean floor underlying the seas beyond the limits of present national jurisdiction, before events take an irreversible course.

7. The dark oceans were the womb of life: from the protecting oceans life emerged. We still bear in our bodies—in our blood, in the salty bitterness of our tears—the marks of this remote past. Retracing the past, man, the present dominator of the emerged earth, is now returning to the ocean depths. His penetration of the deep could mark the beginning of the end for man, and indeed for life as we know it on this earth: it could also be a unique opportunity to lay solid foundations for a peaceful and increasingly prosperous future for all peoples.

8. The air is the atmosphere of our planet: the seas and the oceans are the atmosphere of the submerged land which constitutes more than five-sevenths of the area of this earth. The sea has been used as a means of communication in peace and war for thousands of years: its living resources, plants and fish have long been exploited; and around the use of the surface and upper layers of the seas a complex body of international law has developed; but the depths of the oceans and the ocean floor were of little interest until little more than a hundred years ago when the question of laying a transatlantic cable came to the fore. It was at that time that the first scientific deep-sea surveys were undertaken. Subsequently, the invention of the echo-sounder enabled scientists to obtain much more precise and detailed information on the shape of the bottom of the seas and oceans than had been possible by using the previous method of the weighted line. Ocean floor photography and deep submergence vessels with near-bottom capability now enable us to acquire an ever-increasing store of knowledge about the sea-bed and the abyss, although we must remember that vast areas still remain to be mapped.

9. It may be useful at this stage to give a general idea of the geophysical features, known resources of the ocean floor and present technological capability to exploit them.

10. The land underlying the seas and the oceans constitutes nearly three-quarters of the land area of this earth. It is commonly divided into the continental shelf, the continental slope and the abyss.

11. The continental shelf can be defined as that area of the sea or ocean floor between the mean low-water line and that sharp change in the inclination of the floor that marks the inner edge of the continental slope. The sharp change in inclination from about one-eighth of one degree to more than three degrees, occurs at varying depths, usually around the 130 to 150 metre contour line. The width of the shelf ranges from less than one mile to up to 800 miles. Continental shelves, frequently scarred by deep canyons, can be generally characterized as the geological continuation of adjacent land areas of which they are the submerged extension.

12. The continental slope, usually from ten to twenty miles wide, extends from the outer edge of the continental shelf to the abyss or ocean floor. The inclination of the slope varies widely from as little as three degrees to over forty-five degrees: slopes of twenty-five degrees are common.

13. The abyss or ocean floor appears to be a rolling plain from 3,300 to about 5,500 meters below the surface of the sea: it is scarred by deep gorges called trenches and studded with sea mounts and guyots. The mean depth of the superjacent waters is 3,800 metres. More than 75 per cent of the ocean floor lies at a depth of less than 5,000 metres.

14. Ocean basins are frequently separated by great submarine mountain ranges, a few of the peaks of which sometimes rise above the water. The greatest mountain ranges on earth are not on any continent, but in the sea. The Mid-Atlantic ridge extends the entire length of the Atlantic, spanning one-third of the circumference of the globe and frequently rising 3,500 metres above the ocean floor. The Mid-Oceanic ridge, extensively mapped during the years 1959-1965 by the International Indian Ocean Expedition, organized by the Inter-governmental Oceanographic Commission, curves in a great arc, in places 1,500 miles broad, from the Arabian peninsula to the Crozet Islands, rising occasionally to 5,000 metres above the abyss, yet even its highest peaks miss the surface.

15. The floors of the seas and oceans are covered by sediments: terrigenous comparatively near the coast, pelagic farther from shore. Pelagic sediments are called clays when they contain less than 30 per cent of organic remains, and oozes when they contain more than 30 per cent of these remains. The oozes in turn are divided into two main groups: calcareous oozes and siliceous oozes. Oozes and clays are the dominant sediments of the ocean floor. However, other materials must also be mentioned; the most important of these are manganese nodules.

16. The beach and sea-water resources of continental shelves have been exploited for hundreds, indeed many thousands, of years for the extraction of salt, sand, gravel and other useful products. The chemical composition of water has long been known. I remember learning at school, almost forty years ago, that a cubic mile of sea-water contained so many million tons of salt, of compounds of calcium, magnesium and potassium, so much bromine and so many tons of other minerals, including sixty-five tons of silver and twenty-five tons of gold. I had visions of discovering a successful method of extracting a portion of all this wealth, visions which apparently were shared by the German Government after the First World War when it outfitted a vessel, the Meteor, to investigate whether it was possible to find a cheap method of obtaining gold from sea-water to pay war reparations. Unfortunately, it was found that the cost of extraction far exceeded the amount of gold recovered, and the Meteor returned with much scientific information but little gold.

17. An economic method of extracting gold and silver from sea-water has not yet been found, but in-solution mining—that is, the process of recovering resources by extracting them from sea-water—is acquiring ever increasing importance in unexpected fields. I do not refer so much to the mining of salt, bromine, compounds of potassium, calcium, magnesium or iodine

or to the possibilities of mining other minerals, as to the development of an advanced technology for the cheap extraction of fresh water from sea-water which gives us the promise of making deserts bloom and the possibility of supplying the water needs of multiplying urban populations.

18. In contrast to in-solution mining, on-bottom mining—that is, the process of recovering resources lying on the ocean floor—is quite recent and may be said to date substantially from the end of the Second World War. It involves three stages: exploration, the mining operations themselves and transportation to markets. Photography and dredging have up to the present been the principal methods of undertaking exploration, and have enabled us to obtain a good knowledge of the on-bottom mineral resources of large areas of the sea-beds of the continental shelves of many countries. The recent construction of specialized submersibles will enable us to expand our knowledge more rapidly and conveniently. Principal on-bottom minerals mined at the present time on continental shelves, usually by means of bucket ladder, hydraulic or grab bucket dredges, include tin off Thailand, Indonesia and Malaysia, diamonds off South Africa, phosphorite off California, and so on.

19. Sunken treasures are among the more romantic things sought for in the shallow waters of continental shelves. Their economic value is sometimes considerable: within the last few months the treasure, worth an estimated $3 million, carried by Admiral Shovell's fleet, was discovered near the Scilly Islands, and the hulk of a Netherlands ship transporting some half million dollars' worth of bullion was also discovered.

20. It may also be convenient to refer briefly at this stage to the archaeological treasures lying on continental shelves and on the ocean floor. I have seen an apparently authoritative statement to the effect that there would appear to be more objects of archaeological interest lying on the bottom of the Mediterranean than exist in the museums of Greece, Italy, France and Spain combined. There must be some basis for the statement since the French Government has constructed a submersible, the Archéonaut, specially designed for underseas archaeological exploration. In addition, the Archéonaut will have the important scientific mission of systematically studying for the first time in history the submerged quaternary beaches and their prehistoric inhabitants.

21. Sub-bottom mining involves the recovery of minerals existing under the floor of the sea-bed, and may involve either the exploitation of vein deposits or of materials such as petroleum, gas and sulphur. Vein deposits, exploited by driving shafts and tunnels from adjoining land, are now mined, among other places, off Finland and Newfoundland for iron and near Japan, England and Canada for coal. In view of the limited extent of known undersea vein deposits of metallic ores and the inconvenience and comparatively high cost of their exploitation, they would not appear to possess much potential significance for world production. Quite the contrary is the case for petroleum, natural gas and, to a somewhat lesser extent, sulphur.

22. Although offshore mining of petroleum dates from 1899, production did not become of real economic significance until after the Second World War. The rapid progress made both in evaluation and in the exploitation of offshore petroleum resources is illustrated by the following tentative and incomplete data: in 1947 petroleum reserves under the United States continental shelf were estimated at around 33 billion barrels and annual offshore production was about 25 million barrels, in 1965 known reserves were estimated at some 100 billion barrels and annual offshore production had grown to 240 million barrels which, however, was still only about 7.5 per cent of total United States petroleum production. In other parts of the world similar rises in annual offshore production and in known reserves have been recorded over the past twenty years. To give but one example, the Komsomolskaya Pravda of 16 August 1967 reported that enormously rich deposits of oil had been found on the arctic continental shelf of the Soviet Union at depths of twenty to twenty-five metres. The article stated: "The Tyumen region alone promises by 1980 —that is, in a dozen years—to yield as much oil as was produced in the entire Soviet Union last year (1966)". Exploration of offshore petroleum resources is proceeding at an accelerated pace in nearly all parts of the world with drilling expenditure growing at a 14 per cent compound annual rate.

23. Even more spectacular progress has been made in the exploration and exploitation of offshore natural gas. In 1950 United States offshore natural gas reserves were estimated at 50 trillion cubic feet and in 1965 they were estimated at 150 trillion, in the six-year period 1960 to 1965 offshore gas production has more than doubled from 403 billion cubic feet to 977 billion cubic feet. Exploration activity is continuing feverishly. We have all heard, for instance, of the enormous discoveries of natural gas under the North Sea. According to the Oil and Gas Journal of 27 February 1967 the Groningen field alone is reputed to contain 40 trillion cubic feet of natural gas, the Shell/Esso 49/26 field another 6 trillion, and several other blocs have reserves in the trillions.

24. Up to now I have been speaking exclusively of resources known to exist under the shallow waters of the continental shelf. I have tried to make the point that these resources are known to be valuable and that, at least in the case of petroleum and natural gas, systematic exploitation of presently known offshore resources is likely to be sufficient to cover by itself expected growth in demand.

25. The continental shelf, as we have defined it, however, constitutes less than 10 per cent of the sea-bed and ocean floor of the world. We must now examine whether the vast, mysterious submarine areas plunged in perpetual darkness that lie beyond the continental shelf contain valuable known resources and whether such resources may be commercially exploited on a large scale in the near future, and by the near future I mean within the next decade. In this connexion we shall not refer to the possibility of in-solution mining which, although practicable, does not appear likely, but rather to the potential for on-bottom and sub-bottom mining.

26. Nearly a hundred years ago the Challenger expedition discovered the existence of phosphorite and manganese dioxide concretions on the ocean floor.

The abundance of such concretions—commonly called nodules—was confirmed over the years by a number of oceanographic expeditions, and their chemical composition was studied. Manganese nodules, in particular, have attracted attention and the extent of deposits and concentration of the nodules in various locations on the ocean floor have been ascertained with good approximation. Manganese nodules are irregularly spherical in shape, like potatoes, ranging from 0.5 to 25 cm. in diameter, and are commonly found on the surface of the ocean floor at a depth of between 1,500-6,000 metres. Concentration of the nodules on the ocean floor, their chemical composition and the extent of the deposits vary widely. It would appear that about 20 per cent of the surface of the Pacific Ocean floor is covered by nodules, sometimes in the almost incredible concentration of 50 kg. per square metre. Maximum known metal content of the main materials in the nodules has been determined as follows: 57.1 per cent manganese, 39.5 per cent iron, 2.1 per cent cobalt, 2.9 per cent copper, 2.4 per cent nickel and .5 per cent lead. I do not have world tonnage estimates of manganese nodules; tonnage estimates for manganese nodules lying on the surface of Pacific Ocean sediments are quoted by John L. Mero in his book The Mineral Resources of the Sea.2/ They range from estimates made by Zenkevitch and Skornyakova of 0.9×10^{11} tons to estimates of 17×10^{11} tons. On the basis of those estimates Mr. Mero has attempted conservatively to calculate the reserves of metals in the manganese nodules of the Pacific Ocean. The results are astounding. The nodules contain 43 billion tons of aluminium equivalent to reserves for 20,000 years at the 1960 world rate of consumption as compared to known land reserves for 100 years; 358 billion tons of manganese equivalent to reserves for 400,000 years as compared to known land reserves of only 100 years; 7.9 billion tons of copper equivalent to reserves for 6,000 years as compared to only 40 years for land; nearly one billion tons of zirconium equivalent to reserves for 100,000 years as compared to 100 years on land; 14.7 billion tons of nickel equivalent to reserves for 150,000 years as compared to 100 years on land; 5.2 billion tons of cobalt equivalent to reserves for 200,000 years as compared to land reserves for 40 years only; three-quarter of a billion tons of molybdenum equivalent to reserves for 30,000 years as compared to 500 years on land. In addition, the Pacific Ocean nodules contain 207 billion tons of iron, nearly 10 billion tons of titanium, 25 billion tons of magnesium, 1.3 billion tons of lead, 800 million tons of vanadium, and so on. Manganese nodules, however, are found also in the Atlantic and Indian Oceans and thus estimates made must be very substantially increased to obtain world estimates.

27. The vastness of this untapped wealth is made even more incredible by the fact that manganese nodules are forming at a rate faster than 1960 world consumption of magnesium, manganese, cobalt, zirconium and other metals.

28. In his book Mr. Mero states that manganese nodules could be mined, transported to port and processed at a cost of some $28.5 per ton, as compared to gross commercial value of recoverable metal content ranging from $40 to $100 per ton. Mr. Mero calculates that if the nodules are mined primarily to obtain nickel, which is at present the most significant metal, an operation designed to produce 100 per cent of United States consumption of nickel would also produce 300 per cent of its annual consumption of manganese, 200 per cent of that of cobalt, 100 per cent of that of titanium, etc., and the deposits would be accumulating faster than they could be mined.

29. It is, I think, clear that unrestricted national exploitation of the manganese nodules of the ocean floor would set a ceiling to prices and curtail the markets of a wide variety of mineral exports that are important for the economy of a number of countries, in the same way as the export markets for many materials of vegetal origin have been curtailed by the development of synthetic or substitute products.

30. But of course the valuable resources lying on the surface of the ocean floor are not limited to manganese nodules. There are the phosphorite nodules already being mined on the continental shelf. Very rich exploitable deposits of phosphorite nodules exist beyond the continental shelf which, Mr. Mero indicates, should give an annual return on investment of around 40 per cent after payment of all taxes.

31. The sediments of the ocean floor also contain an estimated 10^{16} tons of calcareous oozes accumulating at the rate of 1.5 billion tons per annum. If only 10 per cent of those deposits were mined for the manufacture of Portland cement, they would last for 10 million years, but they are accumulating eight times faster than the world limestone consumption in 1964. The siliceous oozes of the ocean floor are estimated to total 10^{13} tons and a product in excess of 99 per cent pure silica on a dry-weight basis is obtainable from them without much difficulty. Mero writes on page 117 of his book:

> "The uses to which this type of ooze may be put are many. It could serve in many of the ways in which diatomaceous earth is now used, such as in lightweight aggregates for concrete, as a filter, in the manufacture of insulation bricks for both heat and sound, as a mineral filler, as an absorbent and as a mild abrasive."

32. Ocean-floor sediments also contain 10^{16} tons of pelagic clays which contain manganese grains in concentrations of up to 5 per cent and, in addition, philippsite, palagonite, copper, nickel, cobalt, vanadium, etc., and rare earths in varying concentrations.

33. Nor is the economic potential of the deep seas and ocean floor limited to the mining of minerals; possibilities of truly inestimable value can clearly be foreseen when these areas can be exploited as a present and future source of food. I do not refer only to the possibilities for further expansion of world fisheries or to a more intensive exploitation of the plant life of the oceans, but primarily to the vast potential for farming and fish husbandry. An author, Arthur Clarke, in his book The Challenge of the Seas,3/ believes that "the time may come when only a few luxury products—fruits for example—will be grown on land and all else will come from the ocean." A

2/ Amsterdam, Elseirer Publishing Co., 1965.

3/ New York, Holt Rinehart and Winston, 1960.

United States business magazine, Forbes, believes that farming of the oceans and on the ocean floor may become commercially profitable in the 1980's. Fish husbandry, utilizing techniques such as the use of dolphins as sheep-dogs, and air-bubble curtains to delimit and protect fish ranges are no longer science fiction; these, together with other techniques, are clearly foreseen possibilities that may transform the entire world food picture in fifteen years' time. In the meantime, the first steps in the transformation of the ways in which the living resources of the sea are utilized have already been taken with the development by scientists of the United States Bureau of Commercial Fisheries of fish-protein concentrate (FPC) from less popular fish. A factory to produce fish-protein concentrate is being built. It is expected that ten grammes of this concentrate will provide adequate animal protein to meet the daily requirements of one child at an estimated daily cost of less than one cent in United States money.

34. Commercial ocean farming and fish husbandry, which I have mentioned in passing, lie in the future. National appropriation and the commercial exploitation of the mineral resources of the ocean floor, on the other hand, are imminent. Leases have already been granted for the mining of phosphorite deposits lying well beyond the continental shelf, at depths exceeding 1,000 metres and at a distance of up to 50 miles from the nearest coast. A prototype submersible for commercial mining of the rich manganese-nodule deposits of the ocean floor at depths up to 4,000 metres is under construction now, and others are planned. The nodules will be raked from the ocean floor and pumped into the vessel; from the submersible the nodules will be transferred easily to an accompanying cargo-ship by means of a floating conduit.

35. If the mineral resources lying on the ocean floor are incredibly vast, equally vast are the resources lying below the floor's surface.

36. We know little about the presence of vein deposits, yet they must in all likelihood exist, as their presence appears to be confirmed by a report which appeared on 7 August this year in The New York Times, to the effect that a rich concentration of gold, silver, zinc and copper ores had been found under the Red Sea at a depth of 7,000 feet. "A very conservative estimate puts the value of ores in this deposit alone at about $1.5 billion" in United States money.

37. More is known about petroleum, gas and sulphur deposits. The resources appear to be phenomenal, and estimates of reserves are constantly increasing as exploration proceeds. In 1947, Pratt estimated world petroleum reserves under the seas at 1,000 billion barrels; in 1966 these were estimated at 2.5 trillion barrels by Rear-Admiral O. D. Waters, Jr.

38. Present offshore commercial petroleum production is confined to the continental shelf at present in waters not exceeding 100 metres in depth, and it still uses land technology. This situation cannot be expected long to continue. Semi-submersible drilling rigs in operation today are capable of drilling in water in depths up to 350 metres. The Mohole project, discontinued in 1966, also potently stimulated progress in the techniques of deep-ocean drilling, and a vessel was constructed capable of drilling to depths of 7,000 metres. Self-propelled, ocean-going oil-drilling rigs currently being advertised in technical journals can anchor in water 180 metres deep and drill 6,500 metres into the ocean floor. Remote-controlled robots for underwater use have been developed to maintain underwater well-heads. Methods of transportation to the coast of offshore oil are also being improved. Oil is now carried by barge, but undersea pipelines already exist; it is probable that we shall see their extension beyond the continental shelf in the near future.

39. The forces that led to the national appropriation and intensifying exploitation of the continental shelf continue to gather strength. Exploitation of the continental shelf over the past twenty years was a gradual process; we must look to its intensification and to the rapid extension of national appropriation and exploitation far beyond the shelf in the next few years. There are various considerations that make such a development virtually certain.

40. Public and private expenditure on oceanographic research and technology is increasing very rapidly. In the United States governmental expenditures in these fields were only $29 million ten years ago; they are now nearly $500 million and are projected to exceed $5 billion in ten years' time. Similar increases in governmental expenditures may be observed in the Soviet Union and France, and no doubt also in other technologically advanced countries. Increases in public expenditure are paralleled by increases in private expenditure, particularly by the oil companies. Massive expenditure is likely to make possible far earlier break-throughs than are now foreseen in the technology still required to make intensive commercial exploitation of the ocean floor possible. As it is, remarkable advances in technology have been obtained with limited budgets in the last few years.

41. Seven years ago the deepest part of the ocean, the bottom of the Mariana Trench, was reached for the first time by a self-propelled vehicle, the bathyscaph Trieste, designed by Auguste Piccard; but vehicles like the Trieste and its French counterpart, Archimède, have serious limitations for commercial use: they require surface support; the use of aviation petrol for buoyancy is a hazard that limits the sea conditions in which they can successfully operate, and they are unwieldy for engineering operations. Thus increasingly advanced vessels derived either from the conventional ring-stiffened submarine hull or from the precision-controlled, welded pressure hull have been or are being built not only for ocean engineering but also for scientific, tourist, rescue and military purposes. Some of these vessels, which do not require surface tenders, like bathyscaphs, already have near-bottom capability exceeding 2,000 metres for extended periods of time. While further progress in the construction of the types of vessel described is possible, it is believed that if present materials—high-strength steels and aluminium—continue to be used, rapidly increasing costs would inhibit extensive commercial and military intrusion into the deep sea. It appears, however, that we are close to a vital breakthrough in technology.

42. In a paper presented at the Conference on Law, Organization and Security in the Use of the Oceans held at Ohio State University in March this year, Dr. Craven stated:

"It has also been suggested by many that the problem of ocean-mining is remote and that exploiters will be relatively few. The presumption is the projected high cost of vehicles and equipment operating on the ocean bottom. It is the thesis of the author that low-cost vehicles capable of exploitation are technologically feasible and will be realized within the next decade. This projection is based on three fundamental premises: one, that deep submersibles ... will operate independently of the free surface; two, that materials for deep submergence will ultimately be less expensive than materials now in use for relatively shallow submersibles; and, three, that free-flooded deep machinery will have been developed. It is surprising to the uninitiated and even to some professionals ... to realize that at present the major investment cost of deep submersibles is in the surface ships and surface support. ... This is so, because, except for static pressure, the greatest forces and most dangerous dynamics are at or near the surface and its attendant wave system. ... The resulting elimination of surface support will provide the greatest cost reduction in the system operation.

"The second greatest potential is in materials for deep submergence. Much has been said in the past about the promise of glass and ceramics for use as a low-cost hull material. ... Perceptible progress has been made.

"The third aspect is the development of free-flooding machinery capable of operating in the deep sea. Such equipment has indeed been built and employed. ... A costly development programme should see a commercially available capability for tethered, unmanned vehicles or even tethered, manned vehicles capable of exploiting the deep sea in the near future."

43. In a further paper published in the Proceedings of the U.S. Naval Institute in April 1966 Dr. Craven described at some length the advantages of using massive glass pressure hulls. I shall not go into technical details. All I say in this respect is that deep submergence vehicles, utilizing these new techniques, are now under construction; they will be capable of operating at depths exceeding 7,000 metres for prolonged periods. They will come into operation within the next two years.

44. A second major technological development which is making the sea-bed accessible and exploitable resides in the adaptation of the physiology of man to permit him to operate freely in the ocean at depths at least as great as those of the geophysical continental shelf. The major innovation here is the application of the technique of saturation diving. In this technique, the diver is compressed in an artificial atmosphere (usually oxygen, nitrogen and helium) appropriate to the depth at which he is to operate until the gasses dissolved in his body fluids and body tissues are at an equilibrium. Once appropriately saturated the diver may make limited excursion to deeper depths but may not safely enter shallower water without long and careful decompression. It has been observed that from the surface an excursion to 70 metres is near the maximum; from 70 metres an excursion to 150 metres is more easily tolerated; from 150 metres excursions up to 300 metres—well beyond the geophysical continental shelf isobath—appear to be permitted. The ability to do protracted work on the sea-bed requires the technological capability to heat the diver while he is in the water and a dry chamber which can be occupied during non-working hours. The Conshelf and Sea Lab I and II experiments have demonstrated that this capability exists and that man can live without excessive difficulty and operate with considerable freedom for periods up to one month at depths up to nearly 100 metres. Sea Lab III, which will take place next year, should prove man's ability to live efficiently for long periods at a depth of 150 metres with limited excursions to well over 220 metres. It is difficult to forecast the potential of the saturated diving technique; despite the complex problems involved in the acclimatization—but I would say, reacclimatization—of man to the ocean depths, Admiral Waters confidently predicts that by 1975 "we will have colonies of aquanauts living and working ... at depths in the neighbourhood of 1,500 feet—that is nearly 500 metres". In any case some of the summits of the great submarine mountain ranges are already within range of permanent occupation by man and the technology exists now, or is about to be developed, which will make vast areas beyond the continental shelves both accessible and exploitable.

45. A series of considerations will strongly encourage early employment by nations of the techniques which they have developed. From a commercial point of view, exploitation of on-bottom or sub-bottom resources of the ocean floor has many advantages over exploitation of any but the richest and most favourably located land resources: prolonged negotiations with sometimes unsympathetic foreign governments are avoided, labour costs are minimized, transport costs reduced, and so on. From the point of view of governments of technologically advanced countries, assurance of adequate and independent sources of supply of petroleum, natural gas and many minerals vital to industry eliminates a dangerous import dependency in peace and war and a major factor in foreign exchange difficulties. Finally there are grave considerations of a security and defence nature that impel the major Powers to appropriate areas of the ocean floor for their own exclusive use.

46. The latter is a somewhat sensitive subject which I would have preferred to avoid, but my silence would not prevent security considerations from weighing heavily, and perhaps decisively, on the attitude that will be taken by different countries on the proposals which we shall make. My delegation must therefore show some awareness of the difficult problems that some countries face. I shall not attempt a strategic analysis, but I will limit myself to describing briefly some of the developments we anticipate if the United Nations does not take urgent action.

47. We are all aware of the importance of the sea for defence purposes: from the sea the vastest land masses can be dominated, and the sea in turn is dominated, and can be dominated, from the sea floor. The importance of the sea increases rather than decreases in the age of the nuclear submarine. The development of a technology that permits the physical occupation and military use of large areas of the sea-bed beyond the continental shelf drastically alters traditional constraints on the use of the sea with con-

sequences which even experts may find difficulty fully to assess at the present time; in any case a new dimension is added to strategy.

48. We all know that extremely powerful and sophisticated land-based nuclear missile systems have been developed and are being constantly refined, but the very technology that has made the development of these systems possible has also provided the means for their destruction. What could be more attractive in the era of multiple war-head ballistic missiles, capable of overwhelming defences and destroying land-based hardened missile sites, than to transfer offensive and defensive capability to the seas, an environment highly resistant to the over-pressures of nuclear attack. This indeed has already occurred to some extent with the development of nuclear-powered submarines equipped with nuclear missiles: the present inestimable advantage of these vessels is that they can maintain the balance of terror by guaranteeing a measure of second strike capability since they are almost immune to detection. This immunity and hence this second strike capability could, however, be seriously impaired were tracking devices (which incidentally are already available) installed in suitable areas of the deep seas and of the ocean floor. Such devices can be used, of course, for scientific and commercial purposes, for instance as aids to navigation and for the charting of fish migrations; but they can also be used to detect and to trail possible hostile submersibles.

49. Deployment of an anti-ballistic missile system on suitable areas of the ocean floor, such as on the oceanic mountain ranges, could prove an effective counter to multiple war-head missiles aimed at land targets. The advantages of such a system are obvious: more than one strike at incoming missiles would be possible; secondly, incoming multiple war-head missiles could be attacked before the several war-heads separate.

50. Mobile near-bottom nuclear missile systems can be conceived which, while immune from any presently conceivable form of detection, would provide immense offensive capability.

51. Establishment of fixed military installations on the ocean floor might also be found useful for many purposes.

52. A high degree of self-sufficiency could be obtained for the various military installations hypothetically envisaged by the construction of nuclear power plants providing oxygen by the electrolysis of sea-water while sufficient nutrients exist in the sea to provide ample supplies of food.

53. Thus the advantages of proceeding to utilize the deep seas and the ocean floor for military purposes might at first sight appear compelling to the country or countries possessing the requisite technology. Yet there are disadvantages to such a course of action.

54. Since more than one country is able to utilize the deep seas and the ocean floor for military purposes, we could expect an immediate and rapid escalation of the arms race in the seas, if any of the hypothetical developments that I have mentioned were known to have taken place beyond the limits of the geophysical continental shelf. There would certainly be a race to occupy accessible strategic areas on the ocean floor without much regard to the claims that other nations, not having the capability to occupy these areas, might put forward. Military installations on or near the ocean floor require protection against spying or harassment. This would almost inevitably lead to unilaterally proclaimed jurisdiction over large areas of the surrounding and superjacent sea; and the consequent curtailment of lawful traditional activities on the high seas would be bitterly resented by many countries. We can only speculate also on what counter-measures would be taken against any specific action to militarize any area of the deep seas or of the ocean floor beyond the continental shelf. It is certain that effective counter-measures are possible: thus the effectiveness of acoustic detection and surveillance devices installed in the oceans could be destroyed by insonifying parts of the oceans themselves. This would be effective militarily, but it would also render near-bottom navigation for all purposes, including scientific purposes, extremely hazardous and would render fishing sonar virtually unusable.

55. In conclusion I would submit that the utilization for military purposes of the deep seas and of the accessible ocean floor, while perhaps attractive at first sight, might provoke political, military and economic complications of such magnitude as to compel very careful assessment of the probable consequences by the Powers concerned. I would respectfully urge upon the major Powers the utter futility of attempting to obtain a temporary military advantage by using the ocean floor, beyond the geophysical continental shelf, for military purposes. Legitimate defence needs and the balance of terror, as well as the interests of all countries, can far better be safeguarded by developing within an international framework credible assurances that the sea-bed and the ocean floor will be used exclusively for peaceful purposes. This has already been done with respect to outer space. We trust it will also be possible to do so with respect to the ocean floor.

56. Unfortunately the present juridical framework clearly encourages, subject to certain limitations, the appropriation for national purposes of the sea-bed beyond the geophysical continental shelf.

57. As I have already had occasion to mention, the sea-bed and the ocean floor are land. There are five generally recognized modes of acquiring land in international law: cession, subjugation, accretion, prescription and occupation. In the interests of brevity, I shall deal only with the latter.

58. Occupation is a mode of acquisition recognized by international law involving the intentional appropriation by a State of territory not already under the sovereignty of another State. Generally recognized principles of international law with regard to occupation may be summarized as follows. Effective occupation is required: possession and administration are two prerequisites to effective occupation. The extent of occupation required to establish title depends in practice upon the nature of the territory involved: the more remote or inaccessible the territory the less is the degree of control required by traditional international law to acquire title. Thus in the nineteenth century occupation of strips of coast in Africa

was deemed to confer rights, the exact nature and extent of which was disputed among the Great Powers, on the hinterland, also vaguely defined, over which in effect little control was exercised by the Power occupying the coast. In the 1933 Case of Eastern Greenland the Permanent Court of International Justice gave support to the doctrine of continuity as applied to remote areas, by holding that colonization of a part of Greenland served as effective occupation of the whole. 4/ These traditional concepts still constitute a valid background to present international law regarding the ocean floor, which has developed in the past twenty years on the basis of unilateral action taken by States in response to needs; action subsequently endorsed by the international community. The first and most significant event in the development of the present legal structure was the Truman Proclamation of 1945 5/ issued at a time when the United States, having acquired an advanced technical capability, was faced with the problem of acquiring jurisdiction and control over the continental shelf. The Proclamation declared that since modern technology was capable of exploiting the resources of the continental shelf, since recognized jurisdiction over such resources was necessary and since the exercise of such jurisdiction by the contiguous State was just and reasonable, the United States therefore regarded the resources of the shelf contiguous to the United States as "appertaining to the United States and subject to its jurisdiction and control" without this in any way affecting the character of the high seas above the shelf. The continental shelf was not defined in the Proclamation, but a subsequent State Department press release stated that it was delimited by the 100 fathom (200 metre) isobath. The Proclamation totally rejected the concept of the continental shelf as res omnium communis—a point on which there had been considerable dispute previously among legal experts—and avoided explicitly founding assertion of jurisdiction on the terra nullius occupation theory of acquisition of territory, preferring instead to justify the action taken on the assumption that the continental shelf is the geological extension of the littoral State and that the coastal State has a reasonable right to regulate activities off its shores.

59. The Proclamation was followed by pronouncements from a number of States asserting various rights, including sovereignty, over vast areas of the ocean floor extending at great distances beyond their territorial waters. Although protests were filed against such extensive declarations, virtually no opposition was registered against the Truman Proclamation and other similarly limited claims. The general acquiescence of the international community to the assertion of jurisdiction and control over the resources of the shelf by the littoral State may be construed as evidence—controverted, however, as late as 1951 by Lord Asquith in the Abu Dhabi case 6/—that a new rule of international law had been established. There existed, however, an evident necessity for uniformity with regard to the claims of States to the continental shelf and, at the request of the General Assembly [General Assembly resolution 899 (IX)], the International Law Commission studied the problem. The work of the International Law Commission was eventually considered by the United Nations Conference on the Law of the Sea held in Geneva in 1958, and this in turn resulted in the drafting of the Convention on the Continental Shelf 7/ of 29 April 1958, which came into force in 1964 and which embodies the current state of present international law.

60. The Convention, in article 1, recognizes the right of the coastal State to exercise sovereign rights over the continental shelf defined as:

> "(a) ... the sea-bed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 metres or, beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources of the said areas; (b) ... the sea-bed and subsoil of similar submarine areas adjacent to the coasts of islands."

In article 2, paragraph 3, the rights of the coastal State are made explicitly independent of "occupation, effective or notional" or of "any express proclamation". Detailed rules for the delimitation of the continental shelf between adjacent States or States whose coasts are opposite each other are made in article 6. The sovereign rights of the coastal States are subject to the limitations mentioned in article 5 and are declared not to affect the legal status of the superjacent waters as high seas.

61. At the time of its conclusion, the Convention was hailed as a major achievement of the United Nations. So convinced were legal experts of its excellence that revision was made difficult; not before five years after its entry into force, that is not before 1969, can any request for revision be entertained, and even then article 13 (2) provides that "the General Assembly of the United Nations shall decide upon the steps, if any, to be taken in respect of such request".

62. I shall not presume to comment on the virtues of the Continental Shelf Convention; undoubtedly it was believed that prompt and orderly disposition had been obtained of a new problem of international concern. Unfortunately, however, the framers of the Convention were not in touch with developing technology and apparently did not conceive of the possibility that the sea-bed could be exploited both for military and commercial purposes at depths beyond the arbitrarily selected 200-metre isobath.

63. As Grunawalt states in an article published in the New York Law Journal of 24 January 1967, "the definition of the continental shelf, as incorporated in the Convention, is a compromise between the 200-metre rule advocates—proponents of fixity and certitude—and depth of exploitability proponents", that is, advocates of the need for flexibility.

64. In the light of current technological developments, however, the compromise turns out to be no compromise at all; it is clear that the sea-bed beyond the 200-metre isobath will soon be subject to exploitation. The only question is, will it be exploited under national

4/ Permanent Court of International Justice, Series A./B. Judgements, Orders and Advisory Opinions, Fascicule No. 53.

5/ See Laws and Regulations on the Régime of the High Seas (United Nations publication, Sales No.: 51.V.2.), pp. 38 and 112.

6/ International Law Reports 1951 (London, Butterworth and Co., 1957), p. 144.

7/ United Nations, Treaty Series, vol. 499 (1964), No. 7302.

auspices for national purposes, or will it be exploited under international auspices and for the benefit of mankind? The wording of the Convention, whatever may have been the intentions of its authors, provides powerful legal encouragement to the political, economic and military considerations that are inexorably impelling technologically advanced States to appropriate the sea-bed and the ocean floor beyond the 200-metre isobath for their own use.

65. The definition of the continental shelf, as incorporated in the 1958 Geneva Convention, has lent itself to two basic interpretations. The first is based on the idea, first authoritatively enunciated in the Truman Proclamation, that the shelf is but the geophysical extension of the coastal State's land mass and that, therefore, it is just and reasonable that the littoral State should lay claim to its resources. This theory gives considerable weight to the word "adjacent" in the second line of article 1 of the Convention on the Continental Shelf. Thus it is held that there are three elements defining the submarine areas included in the continental shelf: the 200-metre isobath, depth of exploitability and adjacency, or at least some vague degree of proximity, to the coast. In support of this view, it is maintained that a careful analysis of the proceedings of the Fourth Committee of the United Nations Conference on the Law of the Sea shows that the deep-sea floor, with the possible exception of areas immediately adjacent to the coasts, cannot be included within the scope of the Convention on the Continental Shelf.

66. Exponents of this approach recognize the existence of a possible legal problem with regard to submarine areas situated under still undefined depths of water and at a still undefined distance from the coast. They advocate either delaying the establishment of a legal régime for these, I repeat, still undefined areas until their utilization for military or commercial purposes forces the issue, or suggest, in the words of Northcutt Ely, that "until enough international competition and friction develop to justify the creation of some advance licensing system ... recognition of the flag of the raft or other surface mechanism from which the exploration is controlled sufficiently identifies the jurisdiction which ought to have plenary control over the exploration and over the exploitation of the resources so discovered". Apparently the distinguished author did not envisage the possibility either of commercial or military, manned or unmanned permanent installations on the ocean floor without surface support, or the possibility of attempts at competitive exploitation of the same mineral or petroleum deposit.

67. The above interpretation of the 1958 Geneva Convention has, however, not gone unchallenged since it is in direct contradiction to the explicit wording of article 1 (a), which states that the continental shelf extends "... to ... the submarine areas adjacent to the coast ... to a depth of 200 metres and beyond that limit to where the depth of the superjacent waters admits of the exploitation of the natural resources of the said areas". Thus an influential school of thought denies the possibility of any legal problem whatsoever. Professor Shigeru Oda of Tohoku University, for instance, points out that: "there is no room to discuss the outer limits of the continental shelf or any area beyond the continental shelf under the Geneva Convention since ... all the submerged lands of the world are necessarily parts of the continental shelf by the very definition of the Convention". Under this concept a coastal State, as its technical capability develops, may extend its jurisdiction across the deep-sea floor up to the midway point between it and the coastal State opposite, in accordance with the rules contained in article 6 of the Convention. Such an interpretation gives the governing Powers of islands such as Clipperton, Guam, the Azores, St. Helena or Easter, sovereign rights over millions of square miles of invaluable ocean floor.

68. More important than the opinion of jurists, however, and however distinguished they may be, is the action taken by governments; and such action appears to be increasingly based on an interpretation of the 1958 Geneva Convention even more far-reaching than that of Professor Oda. For instance, the United States has already leased tracts of land situated under water several hundred fathoms deep and well beyond its territorial waters, basing itself on a Department of Interior legal memorandum which holds that the leasing authority of the United States under the Outer Continental Shelf Lands Act "extends as far seaward as technological ability can cope with the water depth, this is in accord with the Convention of the Sea adopted at Geneva". This practice is spreading.

69. Thus, for instance, following the phenomenal discoveries of natural gas to which we have already referred, the bed of the North Sea was distributed among the littoral States in 1964 in accordance with the rules contained in article 6 of the Geneva Convention, but with little regard either to the geophysical features of the sea-bed—for instance, the deep trench clearly separating the geological continental shelf of Norway from that of the other States—or to the principles of adjacency and depth of water stressed by the first school of thought that we mentioned. Vast deposits of natural gas have been discovered in the Baltic, and no doubt we shall soon be informed that the bed of this shallow sea has also been parcelled out among the riparian States.

70. In citing the action taken by States, I intend no criticism; there is little doubt that the sea-bed of the Baltic and of most of the North Sea can come within a reasonable geophysical definition of the continental shelf. I would stress, however, that much more far-reaching action to appropriate the sea-beds can clearly be foreseen at the present time. When this action is taken it will be irreversible by the international community and will entail not only immense prejudice to all land-locked countries but also to most of the coastal States that do not have the requisite technical competence to exploit the ocean floor. Under-developed States fronting on an ocean might believe that a division of the ocean floor of the world would be advantageous to them. This is a complete—and I should like to reinforce this—and utter illusion. Is it credible that technologically advanced countries would be deterred from exploiting rich mineral resources on the ocean floor situated at some distance from the nearest coast of another country for the sole reason that these deposits happened to be under the theoretical jurisdiction of a State unable to exploit them? Indeed voices are already being raised interpreting article 1 of the 1958 Geneva Convention as giving licence to

a coastal State facing the ocean to extend its jurisdiction over the ocean floor as far as its technology permits exploitation; in the words of Franklin: "the only limitation to exploitation will be that of technology".

71. It is even less credible that technologically advanced countries, encouraged by the terminology of the juridical masterpiece produced by the International Law Commission, would agree to adopt a restrictive interpretation of their rights under the Geneva Convention when their defence needs are directly involved. Only recently the U.S. News & World Report of 16 October 1967—a few days ago—revealed that certain quarters were considering the possibility of sinking nuclear missiles in capsules under the sea "off [potential] enemy coasts with a remote-control mechanism for firing". "Off [potential] enemy coasts ..." of course, outside territorial waters, but there is no longer any question here of respecting theoretical median lines between States whose coasts are opposite each other.

72. Even the traditional freedom of the high seas, one of the few things explicitly safeguarded in the 1958 Geneva Convention, would be gravely endangered should a militarization of the ocean floor be allowed to take place. The legal argument that could be developed in this connexion might read as follows: It is a traditional principle of international law that a State exercising sovereignty over land also exercises jurisdiction over the superjacent atmosphere up to the still undefined limits of outer space; but the sea is the atmosphere of the ocean floor, hence a State exercising sovereignty over an area of the ocean floor also has a claim to jurisdiction over the superjacent sea despite the wording of article 3 of the 1958 Geneva Convention. Any legal argument of this nature would, of course, be very strongly controverted by the many members of the international community; but the issue will not be decided by legal arguments but by the vital need to control transit in the vicinity of any military installations that may be established on the ocean floor. This is not the fruit of my imagination; it is not an invention of the Government of Malta. I am reproducing here, perhaps crudely but not unfaithfully, views held by military experts of more than one country. For instance, a distinguished and internationally known expert, whose name I shall not mention, stated this year:

> "Military installations are now centred reasonably close to the land mass; that will not be the case ... ten years from now. We will carve out rather large chunks of the ocean away from the land masses which we ... regard as very important to our national defence and ... we shall deny ... access by any other nation to the areas which we will block out."

73. We have seen that the potential implications of the 1958 Geneva Convention on the Continental Shelf are gravely prejudicial to all countries, whether landlocked or not, that do not possess either the financial resources or the technical competence to maintain their position in the oceanographic technology race. By encouraging the establishment of a plurality of national jurisdictions on the ocean floor, the Geneva Convention, unfortunately, also impedes a solution, beneficial to all countries, of the grave problem of the disposal of radio-active wastes.

74. It is true that a complementary treaty, the 1958 Geneva Convention on the High Seas,[8] prescribes in article 25:

> "Every State shall take measures to prevent pollution of the seas from the dumping of radio-active waste, taking into account any standards and regulations which may be formulated by the competent international organizations."

But, apart from the fact that by no means all States have ratified the Convention on the High Seas, the problem by its very nature is hardly susceptible to a satisfactory solution in the present legal context.

75. The question of preventing the pollution of the seas from the discharge of radio-active wastes has been the subject of prolonged consideration by the International Atomic Energy Agency. A panel of experts, convened by the IAEA, concluded preliminary consideration of the problem in 1960 by issuing a report.[9] The report, while recognizing "the subtle and persistent nature of the hazards of radio-activity" which make it desirable in this field that safe waste disposal practices be initiated from the beginning, did not express undue alarm. The attraction of the sea "as an environment for the application of the dilution and dispersal technique for waste disposal" were acknowledged and it was stated that "the bottom of the deep sea can safely receive much greater quantities of radio-active wastes than can be allowed on the continental shelf". And we can all unanimously agree that the sea can receive greater quantities of radio-active wastes than can be allowed on the continental shelf.

76. After a brief, but factual and comprehensive review of the problem, the expert panel in its recommendations, oriented, however, almost exclusively towards avoiding an unacceptable degree of hazard in man as distinguished from plant life and sea living biota, reached the following conclusions:

> "(1) At present, the release into the sea of highly radio-active wastes from irradiated fuel cannot be recommended as an operational practice;
>
> "(2) Wastes of low and intermediate activity may be safely disposed of into the sea under controlled and specified conditions ...".

And in this connexion the panel suggested various precautions that it would be advisable to take with regard to selection of disposal sites, packaging of radio-active wastes, etc.

77. The expert panel also recommended that:

> "(8) All authorities setting up disposal sites in the sea should provide to a suitable international authority information necessary to maintain an adequate register of radio-active waste disposal into the sea;
>
> "(9) The IAEA should maintain this register and should receive:
>
> "(a) Notice of the licensing requirements of all sea-disposal areas set up by national authorities ...

[8] Ibid., vol. 450 (1963), No. 6465.

[9] International Atomic Energy Agency, Safety Series No. 5, 1961.

"(b) Annual reports on the state of such sites ...

"(c) The monitoring programme and all relevant scientific findings;

"(10) The IAEA should provide for any necessary standardization of monitoring techniques". 10/

78. My country is not a member of the International Atomic Energy Agency, and unfortunately it has not been possible for us to obtain access to the records of the discussions in the Agency on this subject. The annual Reports of the Board of Governors to the General Conference, however, are not very informative on this question; apparently there has been a considerable amount of research and discussion, technical manuals have been published, note has been taken of the introduction of more stringent national disposal rules, meetings have been held, according to the Annual Report for 1963-1964, "to co-ordinate exchange of information on waste management disposal practices and waste management research" and "much progress has been made in the technology of converting high activity liquid wastes into inert solids" according to the Annual Report for 1964-1965, but little light is thrown in all these reports on the vital question of whether the recommendations of the 1961 expert panel were in fact endorsed by the IAEA and on the extent to which those recommendations have in practice been followed by the international community as a whole. We hope that during this debate it will be possible for my delegation to obtain authoritative information on the following points: whether an international register of radio-active waste disposal into the sea has in fact been established and how comprehensive that register is; whether, and how many, annual reports are received by the IAEA on sea-disposal sites established by national authorities; whether a comprehensive world-wide monitoring programme has in fact been established, and whether monitoring techniques have been standardized.

79. In any case, I have found no evidence that any legally binding international instrument setting limits to and rules for the disposal of radio-active waste materials into the deep sea is in force at the present time, nor does there appear to be in operation any effective international system of ascertaining scientifically and systematically, on a world-wide basis, damage to the marine environment caused by present waste disposal practices.

80. I am aware that this question has attracted some controversy. At the 1966 Vienna Symposium on the disposal of radio-active wastes into seas, oceans and surface waters, some of the papers presented minimized the possibility of hazards, assuming, of course, appropriate disposal techniques. Among the several papers that reached this conclusion, with varying qualifications, however, the one presented by Rodier and others was perhaps the most categorical. I shall quote its conclusions.

"In the course of the seven years that have elapsed, the disposal of radio-active liquid waste products from the Marcoule Centre into the Rhône has been carried out in very satisfactory conditions. Regulation of the amounts of radio-active elements to be disposed of has never been an obstacle to the operation of the production installations. Moreover, no accidental or abnormal pollution of the Rhône has been registered." 11/

81. On the contrary, however, Vdovenko, Gedeonov, Kolesnikov and others presented a paper based on the observations carried out during the 1963-1964 oceanographic campaign of the research vessel Mikhail Lomonosov which concluded that:

"... extremely high concentrations of strontium-90 and caesium-137 were detected in the equatorial zone of the Atlantic, exceeding the mean Atlantic level by a factor of 5-6, and by a factor of 14 at a depth of 1,000 m. This abnormal concentration cannot be explained by reference to the atmospheric sources of contamination. The established fact of a considerably increased content of strontium-90 and caesium-137 in the ocean by comparison with the land, together with the discovery of abnormally contaminated areas in the ocean, point to the possibility of other sources of contamination of the Atlantic in addition to that represented by the atmosphere". 12/

82. A further paper by Belyaev and others demonstrated that strontium-90 concentrations in the Black Sea exceed those of the Atlantic Ocean, that surface contamination rapidly penetrates to the bottom, and that "solid or liquid wastes even if disposed of at the bottom rapidly reach the surface". Feldt, expert of the Bundes forschnungsanstalt für fischerei, studying radio-active contamination of North Sea fish, concluded that there had been "no decrease in the contamination of fish since the cessation of [the atmospheric] bomb testings" and that "The processing of fish meat by boiling and frying has no observable effect on decontamination". 13/

83. Since the papers submitted show marked differences in the conclusions of experts as to present hazards with regard to present practices of radio-active waste disposal into the sea, perhaps the only conclusion that a non-expert can draw at this stage from the available evidence is that, although hazards to man have not yet reached an acute stage, and although serious damage to the marine environment can be demonstrated only in a few areas, the whole question deserves far greater and deeper consideration than it has received heretofore.

84. We are reinforced in our view by the knowledge that the use of nuclear power is rapidly increasing and may be expected to continue to increase, with the possible consequence that ever-increasing quantities of radio-active waste may be dumped in the sea, chiefly because that method of disposal is cheaper and more convenient in some cases than reducing the wastes to solids and disposing of them in safe burial grounds. The ultimate implications of the continuation

10/ Ibid., p. 78.

11/ Quoted in French by the speaker. Source: International Atomic Energy Agency, Disposal of Radio-active Wastes into Seas, Oceans and Surface Waters, Vienna (1966), p. 722.

12/ Ibid., p. 425.

13/ Ibid., p. 751.

of present popular methods of radio-active waste disposal in the sea is well described by Jacques-Yves Cousteau in a passage of his book The Living Sea. Describing a meeting convened by the Délégation Générale à la Recherche Scientifique he writes, and I quote from the translation:

"However, the most popular refuse dump with the atomists was the ocean. Several delegates spoke matter-of-factly of how their countries were already sinking the stuff in the sea.

"The differences between the physicists and biologists were now pronounced. After the meeting adjourned, dignified gentlemen exchanged impassioned dialogues. I heard one biologist say 'Strontium -90 will contaminate fish.'

"A nuclear physicist replied, 'Strontium-90 concentrates only in the bones. Who eats the bones?'

"'Chickens eat them', the oceanographer said. 'Bone-meal is a by-product of fish canning. Our children's eggs will become radio-active.'

"Professor A is a calm, reflective person. He said gently, 'Jacques, this is not the problem. There is only one problem for the future of mankind, and that is the population explosion. Soon we will have ten billion people, later twenty. Perhaps it will reach a hundred billion. We will have to feed all these people. The natural resources of the sea and land put together will fall far short. But, thank God, there is an equivalence between food and energy. We will have to develop nuclear energy without limit to run factories that will produce the protein to feed the whole of mankind, no matter how many.

"That is why we must go full ahead with atomic energy, even at the cost of closing the sea to all human use, including navigation.' "14/

85. Cousteau comments: "... we risk poisoning the sea forever just when we are learning her science, art and philosophy, and how to live in her embrace."15/

86. Does the international community wish this to happen?

87. The question of the prevention of the pollution of the seas from the dumping of radio-active wastes is, of course, but one aspect of the wider problem of marine pollution. Uncontrolled dumping of detergents, pesticides and heavy metal and petrochemical wastes into the sea can be almost as hazardous to health and food supplies as the dumping of radio-active wastes. Outlining this wider problem recently, Prof. Korringa of the Netherlands Institute for Fishing Investigations described the effect on marine life of a comparatively small amount of copper sulphate dunped into the North Sea: "... in two weeks' time the poisonous body of water, killing both fish and invertebrates, had moved along the coast quite a distance, but it was not yet diluted as much as five times ... ". Wastes create such dramatic phenomena as the notorious "red tide", poisonous phytoplankton which destroys whole populations of fish. Various aspects of the question of waste disposal into the marine environment are the concern of a number of United Nations agencies in addition to IAEA; the Intergovernmental Maritime Consultative Organization (IMCO) has competence over wastes discharged from vessels—a competence with which it has been actively concerned, particularly since the recent wreck of the Torrey Canyon created a certain problem off the coasts of the United Kingdom and France; the Food and Agriculture Organization (FAO) is, of course, concerned with the results of pollution in so far as they affect fish while the Intergovernmental Oceanographic Commission (IOC) related to the United Nations Educational, Scientific and Cultural Organization (UNESCO), has considered in some detail the general scientific aspects of pollution. Plurality of jurisdiction, fragmentation of competence, a general lack of a sense of urgency, have unfortunately not resulted in effective international action to contain the massive problem of marine pollution.

88. I have spoken at some length, yet I am deeply aware that I have not succeeded in treating the question before us as comprehensively as I would have wished. I dare not take too much more of your time. I shall therefore make some final observations on those aspects of the question which we have tried to elucidate, briefly review action taken within the United Nations system, and then submit the proposals which my Government has instructed me to put forward for the consideration of this Committee.

89. The sea-bed and the ocean floor constitute nearly three-quarters of the land area of the earth.

90. Current international law encourages the appropriation of this vast area by those who have the technical competence to exploit it.

91. The known resources of the sea-bed and of the ocean floor are far greater than the resources known to exist on dry land. The sea-bed and the ocean floor are also of vital and increasing strategic importance. Present and clearly forseeable technology also permits their effective exploitation for military or economic purposes. Some countries may therefore be tempted to use their technical competence to achieve near-unbreakable world dominance through predominant control over the sea-bed and the ocean floor. This, even more than the search for wealth, will impel countries with the requisite technical competence competitively to extend their jurisdiction over selected areas of the ocean floor. The process has already started and will lead to a competitive scramble for sovereign rights over the land underlying the world's seas and oceans, surpassing in magnitude and in its implication last century's colonial scramble for territory in Asia and Africa. The consequences will be very grave: at the very least a dramatic escalation of the arms race and sharply increasing world tensions, caused also by the intolerable injustice that would reserve the plurality of the world's resources for the exclusive benefit of less than a handful of nations. The strong would get stronger, the rich richer, and among the rich themselves there would arise an increasing and insuperable differentiation between two or three and the remainder. Between the very few dominant Powers, suspicions

14/ The Living Sea (New York and Evanston, Harper & Row, 1963) pp. 306-307.

15/ Ibid., p. 313.

and tensions would reach unprecedented levels. Traditional activities on the high seas would be curtailed and, at the same time, the world would face the growing danger of permanent damage to the marine environment through radio-active and other pollution: this is a virtually inevitable consequence of the present situation.

92. These are the prospects that the world faces, not in a remote future, but as an immediate consequence of forces and pressures already at work.

93. Can these pressures be restrained through the continuation and normal expansion of the work already being undertaken within the United Nations system and by related inter-governmental bodies?

94. Nearly all United Nations agencies are directly or indirectly, actively or potentially, concerned with the seas: we have seen that the IAEA has done useful research on the question of radio-active waste disposal into the seas; the International Labour Organisation (ILO) is concerned with the conditions of work of seafarers; FAO and other agencies with fisheries; IMCO and the United Nations Conference on Trade and Development (UNCTAD) with shipping; the World Health Organization (WHO) has a potential interest in the health of aquanauts. There are also the World Meteorological Organization (WMO), UNESCO and other agencies.

95. The United Nations itself has been somewhat slow in entering the field: the basic resolutions are Economic and Social Council resolution 1112 (XL) of 7 March 1966 and General Assembly resolution 2172 (XXI) of 6 December 1966.

96. The former requests the Secretary-General:

"(a) To make a survey of the present state of knowledge of these resources of the sea, beyond the continental shelf, and of the techniques for exploiting these resources ...

"(b) ... to attempt to identify those resources now considered to be capable of economic exploitation, especially for the benefit of developing countries;

"(c) To identify any gaps in available knowledge which merit early attention ...

"(d) To report on the progress of the survey at an early session of the Council".

97. General Assembly resolution 2172 (XXI) is later in date but vaguer in terminology. This resolution:

"Requests the Secretary-General—in co-operation with the United Nations Educational, Scientific and Cultural Organization and, in particular, its Intergovernmental Oceanographic Commission, the Food and Agriculture Organization of the United Nations and, in particular, its Committee on Fisheries, the World Meteorological Organization, other intergovernmental organizations concerned, and the Governments of interested Member States, ...—to undertake ... a comprehensive survey of activities in marine science and technology, including that relating to mineral resources development, undertaken by Members of the United Nations family of organizations, ...

"... to formulate proposals for:

"(a) Ensuring the most effective arrangements for an expanded programme of international co-operation ... in the exploitation and development of marine resources, ...

"(b) Initiating and strengthening marine education and training programmes ..."

98. The General Assembly further requested the Secretary-General:

"... to set up a small group of experts ... to assist him in the preparation of the comprehensive survey called for in paragraph 2 above and in the formulation of the proposals ...",

and requested that the survey and proposals be submitted to the Advisory Committee on the Application of Science and Technology to Development for its comments and that subsequently the survey, the proposals and the comments be submitted to the twenty-third session of the General Assembly through the Economic and Social Council.

99. Quite a long and arduous journey, and it will be noticed also that the action so far is confined to surveys of progress made in the technology and in the identification of resources that were identified many years ago.

100. Among inter-governmental bodies related to the United Nations system, there is no doubt that the fifty-eight-member Intergovernmental Oceanographic Commission, created by UNESCO in 1960 to co-ordinate oceanographic research at the inter-governmental level, has been the most active with regard to the specific question which we are now considering, that is the sea-bed and the ocean floor beyond the geophysical continental shelf.

101. The Commission has interpreted its terms of reference broadly and has been most active in promoting scientific co-operation at the inter-governmental level in all matters concerning the marine environment.

102. Recently the Commission has become increasingly concerned by the uncertainties and grave inadequacies of current international law in so far as it affects scientific investigation of the oceans. This year the Soviet Union proposed that the IOC create a special working group on legal aspects of the studies of the ocean and utilization of oceanic resources in order to:

"... prepare drafts of: (a) a convention on the basic principles of conducting scientific research on the high seas, and (b) a convention on the international norms of exploration and exploitation of the mineral resources of the high seas".

In addition the working group was to provide the IOC secretariat with advice on legal aspects of scientific studies of the ocean. Finally, an international conference was envisaged to discuss and adopt the draft conventions. I have not before me the records of the fifth session of the IOC now meeting at the UNESCO headquarters; it is possible, however, that some delegations may have observed that the Soviet proposal concerning the preparation of a convention on the exploration and exploitation of the mineral resources of the high seas went somewhat beyond the competence

of an exclusively scientific organization. In any case the IOC in its resolution adopted a few days ago, on 27 October, limited itself to establishing a "working group on legal questions related to scientific investigations of the ocean", and charged this group with:

"(a) Considering legal aspects specifically related to scientific investigations of the nature and ... resources of the ocean ... with a view to indicating legal principles which should facilitate and guide scientific research ...

"(b) Preparing documentation concerning the effect of the law of the sea on scientific research and proposals relating both to the contribution of scientific knowledge to the development of the law of the sea and to the participation of the IOC in the deliberations of the United Nations and appropriate specialized bodies to assist them in taking proper account of scientific interests ... in the consideration of the further development of the law of the sea."

I am sorry the language is so involved, but it is not my language. The IOC in that resolution also informs the United Nations of the establishment of this working group and declares its readiness:

"(a) To assist in the consideration of the possible future development of the law of the sea, from the point of view of the scientific interests involved, and

"(b) To assist in the acquisition and distribution of scientific knowledge ... necessary for the optimum use of the seas in the interests of mankind. ..."

This information, I think, should be considered by the General Assembly as an invitation to it to act in this matter.

103. From what I have stated I believe it can be reasonably deduced that while the specialized agencies and the United Nations itself may be doing valuable technical work in the fields within their competence, their activities have no prospect in any way of diminishing the pressures making for the competitive appropriation for national purposes of the sea-bed and ocean floor, nor do their activities give much prospect of coping effectively with massive problems of world-wide scope such as the problem of the pollution of the marine environment, since there is a complete lack of a general institutional framework which can provide focus and efficient direction to the fragmented activities that are now going on. Furthermore, reliance by some agencies on the universal and spontaneous implementation by States of recommendations, however desirable, made by technical bodies may perhaps, we submit, be a little optimistic. We also note that the basic political problem has been carefully avoided in all the activities going on so far, and even in General Assembly resolution 2172 (XXI), which is the basic General Assembly resolution, everything is mentioned except the basic political problem. The only result that we can hope for from the study which is now being carried out by the Panel of Experts, which will meet again next year, is a long study and a long discussion of the scientific and engineering aspects of the question.

104. In the circumstances, it is not surprising that increasing concern has been expressed in unofficial quarters over the apparent lack of awareness in the international community of the implications of recent developments in technology in the context of the 1958 Geneva Convention on the Continental Shelf. Increasingly numerous voices have been raised stressing the urgency of considering the vital political questions involved and urging that clear legal provision be made for an international régime, administered by an efficient international authority over the sea-bed and the ocean floor beyond a variously defined continental shelf. I should like to pay a tribute in this connexion both to the Commission to Study the Organization of Peace and to the International Law Association for their excellent work in alerting public opinion, and I would commend for careful study the documentation produced by them on the question we are considering. The latest proposal in favour of an international régime was put forward in July this year by the World Peace Through Law Conference which was attended by over 2,000 lawyers and judges from over 100 countries. That proposal was contained in resolution 15 which deserves to be cited:

"Whereas, new technology and oceanography have revealed the possibility of exploitation of untold resources of the high seas and the bed thereof beyond the continental shelf and more than half of mankind finds itself underprivileged, underfed and underdeveloped, and the high seas are the common heritage of all mankind,

"Resolved, that the World Peace Through Law Center:

"(1) Recommend to the General Assembly of the United Nations the issuance of a proclamation declaring that the non-fishery resources of the high seas, outside the territorial waters of any State, and the bed of the sea beyond the continental shelf, appertain to the United Nations and are subject to its jurisdiction and control." 16/

105. Among the supporters of an international régime for the sea-bed and the ocean floor there are two main currents of opinion. One favours the creation of a new agency responsible for all oceanographic activities, including those concerning mineral resources of the sea. The other prefers to entrust all responsibility to the United Nations.

106. As an illustration of the former current of opinion I will cite the recommendation of the Joint Working Group of the Advisory Committee on Marine Resources Research (ACMRR), the Scientific Committee on Oceanic Research (SCOR) and the World Meteorological Organization (WMO), to the effect that:

"member governments of the United Nations family and the various United Nations agencies give early and thorough consideration to the advisability and feasibility of establishing a central inter-governmental oceanic organization to deal with all aspects of ocean investigation and uses of the sea".

That recommendation is contained in the records of the meeting of the Joint Working Group held from 17 to 21 July 1967.

16/ See United States Congressional Record, Washington, D.C., 1967, vol. 113, p. S 12274.

107. On the other hand, other experts believe, like Christy, that an effective international régime can best be developed under the auspices of the United Nations since this:

> "... is the one public international body ... that comes closest to meeting the requirements ... to achieve an international régime. The United Nations authority must acquire jurisdiction of the resources on and under the sea floor. This jurisdiction must permit it to part and protect exclusive rights of entrepreneurs ... and must also have the ability to tax or extract rent or royalty payments for the use of the resources and it must be given the ability to utilize or distribute these revenues in an acceptable manner."

108. Mr. Chairman, I wonder whether I could take the recess now?

109. The CHAIRMAN: In response to the request of the representative of Malta, we can adjourn now and resume at 3 o'clock.

The meeting rose at 12.55 p.m.

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