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The Deep Sea Resources

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THE DEEP SEA RESOURCES

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The riches of the deep sea are still largely in the imagination of man, but there is sufficient information on resources available to stimulate their exploration. To ensure that there will be a measure of order in the extraction of this wealth, a viable regime of the deep sea must be developed. While a workable regime must be based on sound geophysical and economic facts, any negotiation of an international convention on the deep ocean must necessarily be of profound interest to the military planner.

INTRODUCTION

The seabeds and ocean floors have recently been thrust into the international arena by a Maltese proposal that the United Nations assume jurisdiction over this new frontier.[1] The proposal made in 1967 by the Maltese Representative included a second requirement: that the resources to be found on the seabed and subsoil should be reserved for all mankind.

Suddenly, nations, even those completely landlocked, could see the possible benefits of such a proposal. The mere statement of this proposal also revived some longstanding questions about "freedom of the seas" and military use of oceanic areas. As well, it highlighted some newer problems, such as the economic exploitation of the seabed and ocean subsoils and the determination of the control of these resources. This paper examines the deep seabeds and ocean floors beyond the Continental Shelf and inquires into the state of oceanology, with regard to the exploration and exploitation of these resources. It aims thus to provide a basis for evaluating between political, military, and economic factors, including an examination of the legal arrangements applicable to the regulation of these interactions as well as of those combined effects upon future military and political planning for the United States.

I--THE SEA ENVIRONMENT

Man has only charted 5 percent of the ocean floor[1]--even though there is no known point more than 7 miles below the surface of the sea--while in outer space he has successfully mapped and charted the hidden side of the moon. True, this land is covered by tons of water and often described as a hostile no-man's-land. Several years ago Rear Adm. John S. Thach, speaking of the hydrospace environment of this planet, described it realistically:

> . . . right off our doorsteps is a relatively unexplored jungle; whole mountain ranges, deep canyons, and many strange creatures are hidden there beneath millions of cubic miles of sea water. This liquid space, about which we know so little, is a murky mass of discontinuities, full of sound ducts, current, and thermal layers. Most incredible of all is the noise racketing through the undersea jungle.[2]

Of this three-dimensional ocean space, only the surface and a small portion of the top layer have been used until recently. Today, the seabed and subsoil of the deep ocean floor are being assaulted as the last frontier on this planet. With respect to the distribution of this ocean space, the Continental Shelf Convention defined the limit of the Continental Shelf as being out to the 200-meter depth line. The limit, however, was made an elastic one, for the Convention added: or, beyond that limit, to where the depth of the superjacent waters admits of the exploitation of resources.[3] The boundary between the Continental Shelf and the deep ocean is a transitional area called the continental slope. From the shoreline out to where the continental slope begins, the ocean is shallow; but once the continental slope is reached, the sea floor plunges downward to 2,000 meters, 3,300 or even 7,000 meters. The continental slope is really the boundary or wall enclosing the deep ocean. Many geologists describe the Continental Shelf as part of the land with the continental slope as the shores of the deep ocean. It is the deep ocean, covering 65 percent of the earth's surface, that is the primary concern in this paper.

The relief features of the ocean floors are similar to those found on land with much greater topographic extremes. Although there are large areas that are flat, modern echo-sounding techniques and underwater photography reveal deep troughs, major submarine mountain chains, and tall, isolated mountains with both steep and gentle slopes. According to one geologist, about 80 percent of the oceans consist of broad elevations and depressions at depths of 3,000 to 6,000 meters.[4] The areas formerly described as "plains" are getting gradually smaller on charts of the ocean, as more and more detail becomes known.[5] The ocean basins are separated by long mountain ranges such as the Mid-Atlantic Ridge which runs the entire length of the Atlantic Ocean. In places the mountaintops rise to form islands, while in other locations seamounts are the predominant feature. The Pacific Ocean contains thousands of seamounts which rise from the seabed several kilometers. In some locations sediment layers cover the ocean floor to depths of 700 to 1,000 meters. The sediment consists of silt and remains of sea creatures that have drifted to the bottom of the sea over the past millions of years. Close to the shore these sediments, or mud deposits, accumulated from large drainage river systems. In deeper water the dominant sediments consist of oozes and clays with various chemical compositions.[6] This cover could mask many irregularities to produce the often described flat surface of the seabed. In other areas of the ocean, for instance between Tahiti and Mexico, the sediment is nonexistent.[7] The thickness of the earth's crust on the ocean floor is only about 3½ miles as compared with 12 to 32 miles on land. This difference has enticed scientists to look to the sea as a quicker way to reach the earth's mantle.

A knowledge of the deep ocean environment is essential to the understanding of the problems concerning the economic, political, or military significance of this area of the globe. It is wholly unlike any other part of the globe and is marked by one special feature: its dynamic nature.

II--EXPLORATION OF THE DEEP SEA

The methods used to explore the deep ocean floors and subsoil are as diverse as its terrain. In a sense it is a revolution of ocean technology: first, in adapting man and machinery to the fairly easy tasks of the Continental Shelf; and second, extending this ability into the abysses of the deep seas.

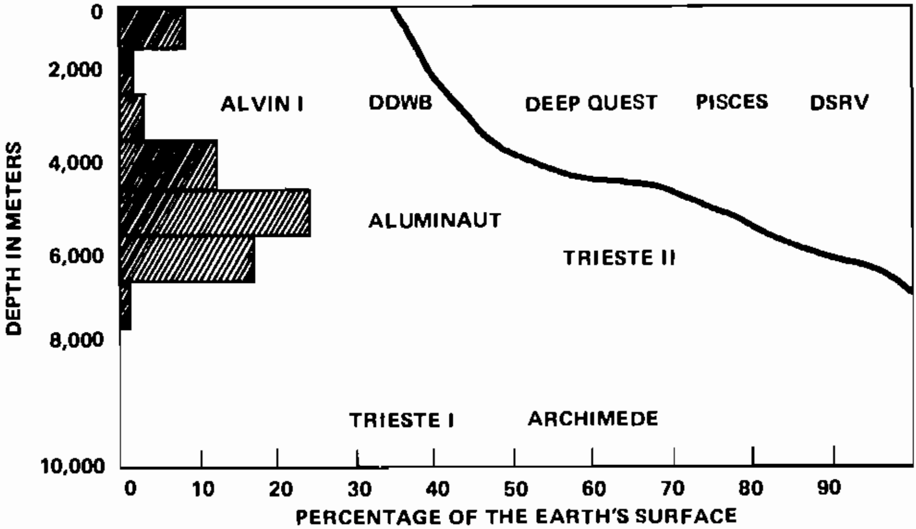
Since World War II there has been an awakening of active interest in the exploration of the sea. Before then the primitive techniques of studying the deep ocean floor consisted of sounding by lead and line and bottom floor sampling. This method was used to survey the ocean floor for the first Atlantic cable laying in 1866.[1] In 1960 ocean exploration was still reaching for the bottom, though the methods were more sophisticated; Professor Piccard's deep probing bathysphere, for instance, reached the ocean's deepest point.[2] The feasibility of man descending deeper into the sea was realized in 1957 by applying the simple lessons learned from aircraft construction practices. The key was to utilize structural materials with higher ratios of strength to density and to design submersibles to such high precision that a low factor of safety was tolerable.[3]

No single item did more to further the exploration of the deep sea than the echo sounder; invented in 1911 by the American physicist Reginald Fessenden, its use has resulted in extensive charting of the ocean floor.

The methods for exploring the deep oceans and subsoils fall in two distinct groups: manned vehicles and unmanned, remotely directed vehicles and instruments. In the first group, the military submarine has been joined by dozens of submersibles employing techniques learned from their military forerunners. By 1967 there were some 29 research submersibles, either constructed or under construction. Several countries have built and used submersibles including Great Britain, France, Russia, Switzerland, Canada, and the United States. Of this number, 20 are constructed to operate below 330 meters and four down to 3,800 meters, the mean depth of the sea and below which 44 percent of the seabed lies.[4] These submersibles are versatile platforms containing positioning equipment, searchlights, remotecontrol mechanical arms, television monitoring cameras, sonar, and even computers. Speed is sacrificed for endurance and three-dimensional maneuverability. At present, sustained operations are limited to depths above 200 meters, but by the year 2000 increased sophistication in ocean technology could make the ocean floors at 6,000 meters accessible to industrial operations.[5] The second group, exploration by remote unmanned methods, includes robots, television and camera, sonar survey, coring, gravity and magnetic variation surveys. Until manned submersibles reach the depth desired for sustained deep ocean survey work, these remote systems will continue to be relied upon. Many systems are used in both applications, such as television monitoring of both the interior of the submersible and the ocean floor itself. Sonar is an indispensable tool for navigation and survey aboard the submersibles. Sonar not only serves to define the irregular surfaces of the ocean floor but also to identify stratification between the surface and the basement rock. Determination of the sediment layers and the structure of the deep ocean rock beds is possible from these surveys. Thus seismic sections can be constructed identifying the crustal material as well as their thicknesses.[6] The seismic survey of the subsoil uses the refraction method rather than the ordinary echo-sounder method used to measure the depth of the sea. In the refraction method, the time that sound

Fig. 1--Depth Capabilities of Deep Diving Research Submersibles[a]

Seabed areas, as a percentage of the earth's surface are shown on the bar graph at the left edge. Curve represents percentage of earth's surface, on abscissa, above the depth indicated on the ordinate.



[a]John Bardach, *Harvest of the Sea* (New York: Harper & Row, 1968), p. 85.

waves take in passing from one medium into another is a function of the speed of sound through these various layers of material. This method provides fairly detailed information about the upper layers beneath the ocean floor.[7] Variations in the gravity anomalies are small over most of the earth but provide a means of studying the topographic features of the deep sea. These surveys help to identify the edge of the oceanic segments of the earth's crust. Magnetic field studies have also been a means of exploring the relative movement of the landmasses and the resulting change in the ocean floor.[8]

Another method of exploration is direct sampling by means of coring the subsoil to determine the material in the sediment and rock layers beneath the sea floor. The purpose in sampling the sea floor and subsoil is to determine the weight-bearing capabilities of the material in order to design deep sea structures that will not sink or displace when erected on the seabed. In addition, accurate positioning of surface ships and floating platforms is a complex engineering operation in deep water requiring detailed knowledge of the subsoil for the construction of permanent anchorages on the ocean floor. Core samples have been obtained by drilling into the sea floor from platforms anchored in as much as 1,470 meters of water.[9] Core samples in the Red Sea have enabled scientists to identify minerals such as gold, silver, zinc, and copper worth billions of dollars.[10] There are coring devices for obtaining samples or rock layers when the material cannot be penetrated by pneumatic or vibratory corers. Impact-type corers can obtain samples in relatively shallow depths of 30 to 60 meters below the floor. Deeper samples are at present only possible with extremely expensive procedures as used during Project Mohole in attempts to reach the inner layers of the earth's crust.[11] These techniques use rotary drilling and, although similar to land-drilling operations, require fairly accurate positioning equipment to enable the ship or platform to remain over the designated spot on the ocean floor.

Indirect visual survey by photographic equipment has become an important tool in ocean exploration. Like everything connected with deep ocean work, the camera system is complicated by light, water turbidity, positioning requirements, and water pressure. The camera systems in use today can best be described as self-contained stereo, underwater camera assemblies, accurately positioned above the bottom by sonar, provided with a high power light source, and automatic-recorded compass bearings on each frame in order to provide picture orientation; each element requiring not only remote control reliability but pressurized to withstand depths of 6,000 meters and below, with sea water temperatures just above freezing.

The techniques available for deep ocean exploration have been summarized. To date, exploration has been limited in two respects: first, by the immense area of the deep ocean floor, and second, by the enormous lack of knowledge on adapting both man and machines to this hostile environment.

There are engineering firms working on ocean projects without an adequate knowledge of the sea environment; building wave-measuring devices, for instance, that have been destroyed in one day by the waves they were to measure. Before exploitation of the deep ocean resources becomes a reality, greatly expanded engineering programs for the exploration of the deep seabed will be necessary.

III--THE RESOURCES OF THE DEEP SEA AND THEIR EXPLOITATION

Surface and submarine exploration has provided ample indication of potentially exploitable resources in the deep ocean. Although limited, sufficient knowledge has been gained to provide some determination of the available resources. The resources considered here are those which are limited to the ocean floor and subsoil and which hold some chance of becoming economically exploitable. Although this discussion centers on the economic resources and the exploitation of these resources, both military and political interests are also involved, notably the possible interference of sea traffic with installations both on and below the surface of the sea and the need to police and protect these sea installations.[1]

The resources of the oceans can be neatly divided into three categories:

1. Biological plants and animals that live in the water.

2. Chemical materials that are dissolved in the water itself.

3. Geological minerals that occur on or beneath the seabed.

The biological significance of the waters of the deep sea is in its rich supply of nutrient elements. Originating from the sediments, nutrient-rich water is supplied to the shallower layers by the normal circulation of the oceans. In the surface layers, photosynthesis--the beginning of the ocean's life cycle--begins; later, dead organisms settle to the deeper water to again form--through bacterial action--nutrient elements, and the cycle is completed.[2] Studies have indicated that nutrient--rich deep waters can be artificially forced to the surface through the thermocline to increase the food cycle in areas of depleted food supplies. The costs are estimated as extremely high.[3] Chemical resources of the water generally do not vary in depth sufficiently to warrant exploitation of deep sea water rather than shallow layers. One exception to this has been reported in the Red Sea where bottom waters show larger concentrations of base metals such as zinc, copper, and other minerals that could conceivably be economically exploited in the future. A method of extracting high purity uranium from sea water has been reported in Great Britain; this is considered significant even though the cost is $20 per pound, versus $5 for the Canadian-produced U308.[4] Only a few of the 60 known chemical elements in sea water have been commercially extracted; these include magnesium, bromine, salt, and fresh water. There is however, no reason to move offshore for the exploitation of these resources.

Geological Minerals. The geological deposits are of two types, minerals formed in the bedrock of the subsoil and surfacial deposits on the sea floor itself. The experiences gained in the exploration and exploitation of the more readily accessible resources of the Continental Shelf will be important. In one sense the transition from the Continental Shelf to the deep sea will only come as a result of successes on the Continental Shelf and continental slope.

Mineral Deposits within the Bedrock. These deposits include the identical geological formations found on the continents and are generally restricted to the Continental Shelf and continental slope. They include the metallic minerals found in vein deposits and those embedded in sediment rock such as oil, gas, sulfur, and coal. Other subsurface deposits are bedded salts, potash, iron ores, and various metallic minerals in veins.[5] As these minerals are likely to be found only in the top layer of the earth's crust, their existence beyond the continental margins is doubtful. However, traces of oil and sulfur have been reported as deep as 1,830 meters.[6] Beyond the continental slope certain minerals such as chromite, platinum, nickel, and cobalt, which are associated with the lower magmatic rock, can be expected. Pure chromite has recently been discovered by oceanographers of the Soviet Union in the Indian Ocean.[7]

Petroleum Resources. The number of offshore petroleum discoveries is growing every year. Important discoveries have been made on the Continental Shelves of over 20 countries; for example, about two-thirds of the current offshore production comes from Lake Maracaibo in Venezuela, the Persian Gulf, and the Gulf of Mexico. In 1968 the amount of oil taken from the sea increased to 16 percent of the world's production, while 6 percent of the world's natural gas production came from offshore wells.[8] Investigation of the Continental Shelf is still continuing with as yet very meager knowledge available of the geological deposits in the deeper waters of the continental slope and continental rises. The petroleum potential beyond the Continental Shelf is virtually unknown. However, from known geological requirements for petroleum, the deep areas of the continental slope seem favorable for petroleum accumulation.[9] Cooperative projects between petroleum companies have included reconnaissance and drilling in the Atlantic and Gulf Coast as deep as 1,500 meters. To encourage initiation of petroleum exploitation and investment in offshore resources, the U.S. Coast and Geodetic Survey is in the process of extending the geological and geophysical mapping to the continental margins.[10]

There are over 250 drilling barges now operating in the sea, throughout the world, drawing oil from the subsoil. The latest technical breakthrough is an electronic system to position floating platforms over the drilling well and maintain their position by sensing the slightest deviations. Position is maintained by reference to acoustic beacons set on the sea floor nearby which transmit to hydrophones in the hull.[11]

One technical breakthrough that will assist in exploiting oil in deep water is the unmanned removable package for the subsea well. The removable wellhead package is replaced by a submersible service vessel operating at depths below the operational depths for divers. The system is schedaled for testing in the Persian Gulf this year, 1969.[12] In the early 1950's a floating platform was considered unsteady for drilling purposes; however, tests proved it could be done even when the drilling ship listed more than 20 degrees. Later versions were built to withstand 65-miles-per-hour winds and 28-foot waves and allow drilling in hundreds of meters of water. It has now become common to drill in over 100 meters of water.[13] In 1968 *World Oil* predicted that rigs would be able to drill to 5,000 meters in water depths of 500 meters.[14] The problems, however, are formidable. The factors that make operation and construction in deep water unique are:

1. Platform motion.
2. High pressures and low temperatures encountered at great depths.
3. Relative difficulty of locating and maintaining position.
4. Thick deposits of deep ocean sediments that provide little or no foundation-bearing capacity.
5. Biological factors, such as marine borers, perforating lead sheaths of cables at depths of over a mile.
6. Lowering and raising heavy loads through hundreds of meters of water.[15]

Surfacial Deposits on the Deep Sea Floor. The recovery of minerals from the seabeds such as tin, gold, and diamonds is a well-known mining operation in the seas. These minerals occur exclusively on the Continental Shelf in generally shallow water, where alluvial wash from the continents has deposited them. Two important deposits of minerals occur beyond the Continental Shelf; these are the manganese nodules and the phosphorite deposits. The deposits are significant in that they are the first deep ocean minerals found outside the exclusive rights of any coastal state.

Manganese. The manganese nodules contain, in addition to about 30 percent manganese, certain significant quantities of other metals such as iron, copper, nickel, and cobalt. The chemical composition of the nodules varies greatly from one deposit to the next. Deposits have been reported in the Pacific, Atlantic, and Indian Oceans at depths of from 800 to 6,800 meters. As a result of preliminary surveys, the amount of manganese nodules in the sea is considered enormous.[16] Although manganese nodules have been known to exist on the sea floor since 1876, the extent of their distribution has only recently been verified.

The nodules are a unique mineral form in that they continue to grow by chemical reaction involving manganese in the sea water reacting with dissolved oxygen in the water. The manganese precipitates out as manganese dioxide on any solid object such as grains of sand or even a shark's tooth. The nodules grow from a fraction of an ounce to the size of boulders and at a rate estimated at one-tenth of a millimeter per 1,000 years.[17] British oceanographers have recovered one boulder from the Philippine Trough weighing 1,770 pounds.

Photographs of the deep ocean floors show large concentrations on the plains of the deep ocean floor even at depths below 4,000 meters. One study by Scripps Institute has shown that ocean deposits of manganese nodules can extend over several thousand square kilometers. Russian oceanographers have also been working on the distribution and concentration of manganese nodules throughout the central Pacific Ocean.[18] Estimates of the tonnage of manganese nodules available on the sediment crust of the Pacific Ocean vary from 1.66×10^{12} metric tons to 10^{11} metric tons. It is interesting to note that at the rate of one-tenth of a millimeter per 1,000 years, nodules are forming at the rate of 6×10^6 to 10×10^6 metric tons per year in the Pacific Ocean alone, a rate three times greater than the present world consumption of manganese. Cobalt is also forming at a rate twice the present consumption and nickel at a rate equal to the present consumption.[19]

The importance of the manganese nodules is due to the presence of copper, cobalt, nickel, and manganese (see table I). Industry is giving manganese nodules considerable attention from the standpoint of both mining and processing techniques. From initial studies, the cost of the investment to bring a deep sea mining operation, plus the associated onshore processing facilities, into production is from $30 million to $300 million.[20] This naturally raises the question of consumer demands. In this connection, the production of nickel has been below the level of demand since 1964, and free world industrial requirements are expected to double by 1975.[21] With respect to manganese, there appear to be adequate supplies available; however, its sparse distribution on land involves political and economic considerations that make oceanic sources of some attraction.

Cobalt resources on land also exhibit a limited distribution. Over 80 percent of the free world cobalt resources comes from African nations: Congo(K) with 77 percent, Morocco with 13 percent, and Zambia with 10 percent. Copper resources are perhaps better distributed throughout the world with 28 percent concentrated in developing nations of Africa.

Phosphorite. Less publicized than manganese is the occurrence of phosphorite, an important agricultural fertilizer, on the ocean's seabeds. Two-thirds of the world's production is mined in Florida, Tunisia, Algeria, and Morocco, with only eight nations (including the Soviet Union) controlling over 98 percent of the world's reserves. Countries such as Japan, Great Britain, Germany, and Australia import large quantities of phosphorite. Although land-mining costs are low, high transportation costs double the price of the delivered phosphate rock.[22] The first examples found in the ocean were dredged up in 1873 by the H.M.S. *Challenger*. Since 1960 there has been extensive exploration and prospecting off the California coast. There is however, at present, no commercial production of phosphorite from offshore beds. Unlike manganese, phosphorite occurs, in addition to nodules, in sand, mud, and roadlike pavements on the sea floor.

Phosphorite deposits result from the movement of rich phosphorite-bearing cold waters moving to shallow warmer waters where the phosphorite is then precipitated as nodules, flat slabs, or coatings on rocks. Deposits are more common at depths of 37 to 370 meters, although formations have been found at 3,800 meters along the base of the continental slope.[23] The size of the nodules varies from small pebbles to rocklike nodules 80 centimeters in diameter. The most favorable areas presently known, on the California and Mexican coasts, do not have sufficiently

TABLE I--ELEMENTS IN MANGANESE NODULES, PACIFIC OCEAN[a]

Element	Percentage by Weight Maximum	Minimum	Average
Manganese	41.1	8.2	24.2
Iron	26.6	2.4	14.0
Copper	1.6	0.028	0.53
Cobalt	2.3	0.014	0.35
Nickel	2.0	0.16	0.99

[a]John L. Mero, *The Mineral Resources of the Sea* (New York: Elsevier, 1965), p. 180.

high-grade nodular phosphorite to compete with even the low-grade land product.[24] Phosphorite nodules are also found along the Atlantic coast of North America, the coasts of South America, Africa, and the Indian Ocean. Other locations throughout the world have been reported by Soviet oceanographers working on phosphorite exploration. As the highest concentrations of phosphorite are distributed throughout the world on the Continental Shelves, it appears less likely that deposits in deeper water will be exploited.

Summary. Although offshore oil and gas production was virtually nonexistent before 1948, by 1967 worldwide production of oil from offshore wells rose to 11 percent and by 1968 to 16 percent. Within 15 years it is estimated that over 25 percent of the world's petroleum may come from the subsoil of the sea, and as the need for petroleum products increases, industry will move in the only direction possible, the deeper ocean.

Although oil and gas exploitation is presently limited to depths of about 200 meters, there are clear indications of no technical limitation to prevent operations in much deeper water. The final report to the United Nations Economic and Social Council concluded that:

> There is no reason to doubt that substantial mineral deposits await development in the ocean environment beyond the continental shelf . . . . Current technology, developing with great ingenuity, is already capable of locating and evaluating many of these deposits. . . . Because of the relatively high exploration costs and the vastly greater outlay on exploitation, operations in the ocean environment can only be contemplated by the very largest organizations in a few industrialized countries and will not be undertaken without reasonable expectation of economic development.[25]

Although cost may be a determining factor, there are changing political considerations that could be far more overriding. The rising nationalism in the developing areas of the world could cause unforeseen changes in the political alignment of these nations. The prospective movement of oil exploration into deep water is most certainly influenced by the unsettled conditions and possible changes in the alliances in the Middle East Arab world and elsewhere.

The exploitation of mineral resources of manganese and phosphorite will depend on several factors:

1. The engineering design and development of the means to recover the minerals. Even though the nodules of manganese and phosphorite lie exposed on the seabed, harvesting techniques at depths of thousands of meters in the open ocean have not been developed. None of the methods of dredging commonly used in shallow water are completely satisfactory for deep ocean mining. Platforms for continuous work on the sea floor lack stability and safety for open sea conditions. Submarine and bottom habitats are still not advanced enough to be considered feasible. However, systems for dredging, lifting, and transporting manganese nodules have been designed; and components are being tested. Initial investment is high and will depend upon considerations of investment protection in an unknown legal regime.

2. Nodules of manganese are complex and metallurgically an unfamiliar matrix of chemicals. Existing separation methods do not lend themselves to the more complex manganese nodules. Research and development work on a new extraction method is being tested and shows promise; though, ironically, such a breakthrough would also bring vast quantities of low-grade ores on land into competition with sea resources.[26]

3. The physical distribution of manganese nodules with varying chemical composition will allow selection of the sea area for the desired proportion of minerals. At present the distribution

patterns are not well established, requiring greatly expanded oceanographic mapping.

4. The effect on the world prices of minerals of a successful breakthrough in engineering and metallurgy is not difficult to envisage. Large quantities of manganese thrown on the world market could cause the price to drop. This is also true for cobalt and nickel. Because the world land resources are generally concentrated in developing countries, this reduction could be particularly harmful. The distribution of land resources and the political alignment of nations possessing these resources might require the have-not nations to proceed with exploitation of certain strategic minerals, even though not economically feasible.

Economically important minerals have been discovered on the deep seabeds beyond the jurisdiction of the coastal states. The next question is: Who has title to these resources? In order to obtain beneficial utilization, control appears inevitable but involves complex questions on the principle of freedom of the seas. To avoid controversy, congestion, and waste, an equitable law regarding jurisdiction in the deep sea will be necessary.

IV--JURISDICTION IN THE DEEP SEA

The implication of the preceding chapters is that the future will be marked by a movement from the Continental Shelf into the ocean depths. Consequently, questions of jurisdiction are certain to follow exploration and exploitation. As long as the movement is confined to waters adjacent to the Continental Shelf, exclusive jurisdiction is somewhat ambiguously covered by the Geneva Convention of 1958. Petroleum and potential phosphorite extraction thus fall within the scope of the Convention at the present time. But, for the deep ocean floor, where manganese and related minerals lie, no agreed jurisdiction exists; the Geneva Convention provides only a starting point for its development.

Two distinct situations arise concerning jurisdiction in the deep sea: first, those operations for exploiting mineral resources that progress from the shore to the Continental Shelf and continue to follow the mineral resources out onto the continental slope and to the deep ocean floor and subsoil; and second, the exploitation of resources that have no connection with the continental margin but have been formed and deposited in the deep ocean.

Jurisdiction on the Territorial Sea, Contiguous Zone, and Continental Shelf. Though it is universally agreed that states do enjoy special rights to areas of the sea and seabed adjacent to their coasts, the precise nature and extent of these rights is a continuously disputed matter. The Conventions on the Law of the Sea adopted by the United Nations Conference at Geneva in 1958 concerned not only the Convention on the Continental Shelf but also Conventions on the Territorial Sea and the Contiguous Zone and the Convention on the High Seas.[1]

The width of the territorial sea is the first disputed issue. Instead of the once almost common agreement on the "3-mile limit," states now prescribe widths varying from 3 to as much as 200 miles. The Convention at Geneva did not specify what the width of the territorial sea should be but only provided the rules for establishing the limits. A large number of states now specify a 12-mile width for their territorial sea; however, the United States, Great Britain, and others continue to affirm the 3-mile limit. A contiguous zone, generally 12 miles wide and thus overlapping the territorial seas, is a special zone recognizing the coastal state's rights to exercise control in matters of custom, fiscal, immigration, and sanitary regulations.

Lewis: The Deep Sea Resources

The Continental Shelf represents a special zone within which coastal states under international law possess certain regulating rights. The unilateral proclamation by President Truman in 1945 was the first action to recognize a state's special rights to offshore resources of the subsoil and seabed of the Continental Shelf. The proclamation stated: "... the Government of the United States regards the natural resources of the subsoil and the seabed of the Continental Shelf beneath the high seas but contiguous to the coasts of the United States as appertaining to the United States, subject to its jurisdiction and control."[2] The proclamation added: "The character as high seas of the waters above the Continentul Shelf and the right to their free and unimpeded navigation are in no way thus affected."[3] Within a few years thereafter, several states issued similar proclamations. This addition to the laws of the sea should come as no surprise, for traditionally such "laws" have followed the expression of states' self-interest and the course of technical advances in the use of ocean resources.

Moving along the Continental Shelf, additional divisions are delineated such as the continental slope and rise, both of which describe the geographic conditions on the sea floor. These are transitional zones between the continent and the deep sea plain and within which some dividing line or boundary should exist to divide the seabed pertaining to the continent from the deep seabed. The drafters of the 1958 Geneva Convention on the Continental Shelf actually selected 200 meters (109.4 fathoms) as the limiting boundary and described it as follows:

> The term continental shelf is used as referring (a) to the sea bed and subsoil of the submarine areas adjacent to the coast but outside the area of territorial sea, to a depth of 200 meters, 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) to the sea bed and subsoil of similar submarine areas adjacent to the coasts of islands.[4]

The drafters of the Convention specifically rejected the concept of complete sovereignty in this area because of the fear that it might encourage a coastal state to claim exclusive control of the high seas above the Continental Shelf and so run counter to the concept of the freedom of the seas as spelled out by the Convention on the High Seas. The intention was to provide legal protection without restrictions on free movement on the surface of the sea. Although the Convention provides that the waters above the Continental Shelf are high seas, coastal states have, in fact, extended application of their laws to the seas over the Continental Shelf. The tendency has been to expand the exclusive sovereignty for other than mineral rights and thus further reduce the area of freedom to others. The Soviet Union opposed proposals by some states to apply the regime of the high seas to the Continental shelf as a "struggle by states for appropriation of submerged areas of the high seas" leading to the strongest capitalist powers acquiring the riches of the Continental Shelf.

But in 1968, by edict, the Soviet Union expanded the definition of the Continental Shelf of the 1958 Convention with the addition that, "the sea bed and subsoil of depressions situated in the continental shelf of the U.S.S.R. irrespective of their depth, shall be part of the continental shelf of the U.S.S.R."[5] The edict further prohibits individuals and companies from carrying out research, exploration, and exploitation of natural resources and *other work* on the Continental Shelf of the Soviet Union.[6] In October 1968 the Soviet Union, Poland, and East Germany signed a joint declaration on the Continental Shelf. They declared:

> First, the continental shelf of the Baltic should be used 'exclusively for peaceful purposes.'

> Second, although it is specified that the exploration, exploitation, or other uses of the continental shelf of the Baltic must not unjustifiably interfere with navigation, fishing, or conservation of living resources of the sea, no reference is made in this connection to fundamental oceanographic or other scientific research.
>
> Third, the participants agree not to give over parcels of the continental shelf of the Baltic to non-Baltic states or to citizens or firms of those states for the purpose of exploration, exploitation, or *other uses.*[7] [Emphasis added]

Communist China in 1958 declared that China's territorial sea extended to 12 nautical miles.[8] In 1958, although not participating in the Geneva Convention, Communist China issued a semi-official expression of freedom of the high seas in the Peking press.

> The high seas are that part of the ocean or sea the use of which is shared by all nations. On the high seas ships and nationals of all states are free to navigate, to fish, to hunt, and to engage in other maritime enterprises as well as to lay submarine cables. The principle of the freedom of the high seas has been recognized by international law for all nations.[9]

Communist China has, however, declared certain areas of the high seas along the coast as "military security areas."[10] Communist China has also taken unilateral action to protect fisheries in areas of the high seas and has further declared a contiguous zone for enforcing customs out to 15 miles.[11]

It appears that the elastic definition of where the jurisdiction of the state ends will result in conflicting claims. The United States, in some instances, has extended application of its laws to the Continental Shelf, i.e., to treat it as a contiguous zone.[12] Indonesia and the Philippines have made efforts to establish a single zone of territorial waters around the entire archipelago that constitues their national territory. The 200-meter line of the 1958 Convention is no geological limit, nor does it delineate the geological limits of potential mineral resources. The definition includes non Continental Shelf seabed and excludes portions of a coastal state's real Continental Shelf. The second portion of the definition, the "elastic capabilities clause," allows the state to extend its limits to that which it can essentially reach. This heavily favors nations that are highly industrialized or that are willing to subsidize offshore mining. The Soviet jurists have argued that the outward boundary of a coastal state should not depend upon the technical capability of that state but, rather, upon the capabilities of all states, i.e., those of the most technologically advanced state simultaneously expand the outer limits of the Continental Shelf for all states as it develops its own shelf at ever-greater depths.[13] The United States has, in fact, issued leases beyond the 200-meter depth, nor has it refused to lease beyond the 200-meter depth on grounds of nonjurisdiction of the nation.[14]

If there is to be some order to regulate the development of the deep seabed and subsoil, some more realistic definition of the freedom of the seas is required. It is, however, difficult to see how to retain the freedom of the seas as a medium for passage yet provide legal protection for the development of the sea's resources. One author describes this changing attitude:

> The implication is that freedom of the seas cannot be conceived of as being static, especially since increasing intensity and sophistication of ocean exploitation require legal arrangements beyond the traditional understanding of this concept. An evolving concept of freedom of the seas does not imply that more suitable versions must reflect narrow conceptions of our national interests. The problem is to adapt the principle of freedom to the general interest rather than to any exclusive interest of our own.[15]

The development of a legal regime for the Continental Shelf, imperfect as it is, was a big step forward. To develop an equivalent legal regime for the deep ocean would, in comparison, be a gigantic accomplishment. Possible regimes for this purpose are discussed below, with their implications for developed and developing countries.

Regime One. This would derive from the possibility of using an existing international agreement, the Convention on the Continental Shelf. This provides that practices for the Continental Shelf could be extended "beyond that limit, to where the depth of the superjacent water admits of exploitation of the natural resources of the said area."[16] Although this clause provides a means of following the resources out to deep water, the exploitability clause was added principally to provide those countries without a Continental Shelf, such as Peru and Chile, "equal treatment" with more fortunate states. The idea was that if a coastal state achieved the capability to exploit beyond the 200-meter boundary, no renegotiation of the convention would be necessary.[17]

This extension would generally assume that, for all practical and economic purposes, mineral exploitation would be sufficiently close to the coastal state, that the Convention would apply. "The key phrase in this connection is the reference in Article 1 to 'submarine areas adjacent to the coast.' While 'adjacency' is not specifically defined, it undoubtedly conveys a notion of limitation which cannot be reconciled with indefinite extension into the great oceans."[18] This is the development that appears most likely for the near future and is favored by those who say that no new law is required until the extent of the resources are better defined. Opposing views are that the time for new law is before the need arises. One pertinent view is that if the jurisdiction of the coastal state continues to the limit of technology, a boundary is defined somewhere in midocean where it meets the boundaries of other nations.[19] Thus, without further law, the seabed would be divided among the coastal states. To those who view ocean resources as a legacy of all mankind, which is essentially implicit in the Maltese proposal to the United Nations General Assembly in 1967, this solution is unacceptable. Developing nations, in particular, view the resources of the sea as common to all and not open only to the technologically advanced nations.

As far as oil and gas, and even phosphorite, are concerned, the simple extension of the provisions of the 1958 Convention would be possible, with some extensions beyond the 200-meter limit. However, with respect to manganese and its component minerals, this regime would most likely result in no control since it fails to provide a legal environment for exploitation with some guarantee of exclusive rights to the exploiter. Politically, this solution appears most favorable to the more industrialized nations and less to the developing nations, with no favor for the noncoastal states. The Soviet Union would certainly oppose this attempt to divide up the ocean, as it would result in an unequal distribution of the resources. Perhaps the greatest disadvantage is that under this regime the extension of the coastal states' jurisdiction beyond the Continental Shelf would pose difficult questions about the freedom of the seas.

Regime Two. This would consider the minerals on the floor of the deep ocean as common property of mankind, but would recognize that states must have exclusive mining rights to areas sufficiently large to be economically mined. By charging fees, indirectly all nations of the world would benefit. The Convention on the Continental Shelf would require modification to limit the boundary of the Continental Shelf and to ensure that no nation has any claim beyond that limit. The proponents of this regime see it as a preventive measure to forestall a race to divide up the seabed.[20] Senator Claiborne Pell has proposed that the United States take steps to obtain international agreement that would declare the floor of the deep sea and the resources of the seabed and subsoil, beyond the Continental Shelf, as free for exploration and exploitation of all nations. His proposal included setting a boundary for the Continental Shelf and ensuring that no nation obtain sovereignty beyond that boundary.[21] An appropriate international body would be established to administer and distribute exclusive mining rights. Such a body could be the United Nations.

The international community has established a framework to determine the character of a regime that could be supported by all nations. The Ad Hoc Committee formed by the United Nations General Assembly had as its initial task a survey dealing with the mineral resources and the food resources excluding fish.[22] Their report has been completed, but as yet no proposal for a legal regime has been sponsored by the United Nations. Considerations affecting such a regime are discussed in chapter V.

Regime Three. This would treat the seabed and subsoil as the property of no one and thus subject to appropriation by any state. But for a state to declare sovereignty over an area traditionally requires occupation which, in the case of the deep seabeds is at present not clearly conceived. Although actual occupation is not an ironclad requirement, mere proclamation would not substantiate a suitable claim. Two difficulties are pointed out by Dr. Emery, famed oceanographer at Woods Hole Institute. Not only is it uncertain what types of activities would be sufficient to constitute effective occupation on the seabed, but the physical characteristics of the seabed make it difficult to establish the boundaries of an area claimed.[23] The lack of any technical ability to establish jurisdiction would clearly deprive developing states of any access to the resources of the deep sea under this type of legal regime.

Regime Four. A regime in which the property of the seabed would be considered world communal property and not subject to the jurisdiction of any one state can be visualized. Resources are open to exploration and exploitation by all nations. Such a legal system is similar to an open-range policy. The exploiting state would operate under a national flag as provided under the convention on the High Seas.[24]

Two problems are usually associated with such an unregulated legal regime. The first concerns the possibility of exhausting the resources if no constraints are provided, unless the resources are inexhaustible; while the second involves the desire by the person mining for some reasonable opportunity to recover his investment without interference. Even if the resources are vast, competition will result; for there still remains the fact that some claims are bound to be better than others, if not just closer to markets.[25] The "flag state" of the exploiter would assume police protection and insure noninterference under the rules of international law.

Regime Five. Finally, there is a possible regime which combines two of the above and envisions the registry of claims with an international body, in conjunction with a system of "flag state" jurisdiction.[26] This alternative retains the best advantages of the freedom of the seas aspect of Regime Four and provides some degree of control to restrict the possibility of unwarranted "grab" for all the resources. The international agent could develop a code of mining regulations, including the size and amount of safety zone required for each claim.

Summary. Possible solutions for existing and future regimes of the sea range from a completely open sea, for all to use as they desire, to a fully controlled internationalized sea. The choice of a regime will depend ultimately on how the majority of the world nations view their own roles in the sea. Many of these nations are unable to even verify what they have heard or read concerning the "riches of the sea." It is not surprising, then, that agreement on a regime for the deep seabed and subsoil is not forthcoming.

But the law of the sea is changing; and somehow questions of the rights of coastal and noncoastal states will need clarification, the extent of the Continental Shelf will need to be defined, the freedom of scientific research ensured, military uses controlled, and a determination made of how ultimately to exploit the resources and for whose benefit. The proponents of a quick solution are opposed by those who suggest the necessity to learn first what is there before attempting to control it; the latter add that no solution is better than a hasty one based upon limited knowledge. The U.N. report on the resources of the sea suggested that there was a need for further scientific and technological research on the seabed and added, "Present-day assessment indicates that at a chart scale of 1:1,000,000 only 15-20 percent of the sea area is adequately covered by bathymetric data."[27]

V--NATIONAL INTERESTS

The development of a legal regime for the seabed and subsoil may develop on a case-by-case basis, with precedents provided upon which to build further international law of the sea. Professor McDougal has said: "The development of the resources of the seas will not take place in a vacuum, but rather under the laws of the particular states which are doing the exploiting."[1] In the end, national interests will determine the type of legal regime for the deep seabed; thus an examination of the national interests of developed and developing states may lead to conclusions concerning the most acceptable regime. Important national interests are at stake, for ecomonically advanced states are no more willing to place control of the sea resources in the hands of an international organization than are the developing nations to agree to a status of no regulation. The meeting point, or agreement if there is to be one, will depend upon how each faction views its needs. Developing nations desire much needed revenue; while for developed nations, security and freedom to exploit are paramount.

It is not difficult to see how interest and motivation in the seabed and subsoil are generated, with published phrases expounding: potential of incredible wealth, ocean's fabulous minerals, a treasure chest, bountiful crops, and inexhaustible resources. Nations with nothing see their chance to reap a harvest from the seas, in spite of Secretary General Thant's caution to such countries against hope of quick wealth from mineral deposits or untapped food resources on the sea bottom.[2]

One study estimates that in 20 years, 70 percent of the world's consumption of nickel, copper, cobalt, and manganese will be supplied by the ocean. If unsupervised, the study notes, there would be disastrous effects upon developing nations, many of which depend on the current high prices of raw materials for their existence.[3] According to another estimate, world market prices could be affected by a single producer mining oceanic manganese, to the extent of a drop from 90 cents per unit to 50 cents; cobalt prices from $1.50 per pound to $1; and nickel from 70 cents to 60 cents a pound. Similar action by two or three producers would have a greater effect.[4] And therein lies one of the main stumbling blocks to international control. Clearly, if exploitation of these new resources proceeds as favorably and as fast as seems likely, it will considerably rearrange industrial and trading patterns in the world, increase the power of certain fortunate states and, by the same token, reduce the advantages now held by certain developing nations supplying strategic minerals. African nations, for instance, provide a considerable portion of the world's mineral production. Table II lists only those minerals that are included in the resources of the sea.

TABLE II--AFRICAN NATIONS' PERCENT OF WORLD SUPPLY OF CERTAIN MINERALS[a]

Mineral	Percent of World Supply
Cobalt	81
Chromita	50
Manganese	50
Copper	26
Phosphate Rock	28

[a]"African Mineral Production," *World Business,* April 1968, p. 22.

These figures, although important, are only a part of the story. What is more relevant is the degree to which these African countries depend upon minerals for their very existence. Table III indicates the percent of exports that were attributed to minerals in 1966.

TABLE III--AFRICAN NATIONS' MINERALS AS A PERCENT OF EXPORTS[a]

Country	Percent	Mineral
Libya	98	Petroleum
Mauratania	95	Iron
Zambia	93	Copper, Cobalt
Congo (K)	80	Coppar, Cobalt
Liberia	70	Iron
Gabon	54	Manganese
Algeria	50	Patroleum
Morocco	36	Phosphate, Cobalt
Ghana	25	Manganese

[a]"African Mineral Production," *World Business,* April 1968, p. 23.

Another example is Saudi Arabia whose economy is vitally dependent on oil revenues, which account for more than one-third of the GNP and 80 percent of all government revenues and 90 percent of foreign exchange receipts.[5]

From the point of view of the advanced countries, on the other hand, foreign resources are often withdrawn by expropriation or for other political reasons. In Peru, where the United States has millions invested in one of the world's largest copper operations, a recent change in government has endangered American investments in both petroleum and copper.[6] The result is a desire by private investment to obtain minerals from less politically affected sources, and the sea offers an attractive alternative.

Even before the pace of progress in developing science and technology allows assault on the deep seabeds and subsoil, there may be an effect upon prices of land resources. The current prices of minerals can be affected by technological advances which bring deep sea resources within reach, resulting in the downward trend of mineral prices even before new exploitation takes place. Atomic energy had a direct effect upon fossil fuel prices long before it became commercially available. The effect could even be reversed; for instance, one headline recently read: "Big U.S. government and industrial investment in underwater research is threatened by Maltese proposal that UN be given control of ocean floor--and the wealth of its minerals."[7]

Other proposals stir the self-interests of developing nations:

> The Maltese proposal that an international body having jurisdiction over the sea floor could gross $5 billion and net $4 billion annually within a decade from licenses and royalties has become a stumbling block in the attitude of the Declaration of Santiago countries, represented on the *Ad Hoc* Committee by Argentina, Brazil, Chile, Ecuador, El Salvador and Peru, all of whom claim all the sea bed and over-lying

> waters out to 200 miles from their coastlines. The Italians have also complicated further the problem by proposing to UN that 'internal seas' (such as the Adriatic) be left to the bordering countries to decide among themselves the arrangements for exploration and exploitation of mineral resources.[8]

During the debate on the Maltese proposal at the 22d General Assembly, the Governments of Afghanistan, China, Cyprus, Ghana, India, Libya, Nigeria, Sierra Leone, Somalia, Trinidad and Tobago, and the UAR emphasized that future exploitation of the ocean should primarily benefit the developing countries.[9] The need to protect the interests of the smaller nations is often voiced, but a less restrictive view is that any regime which threatens or leads to the unilateral division of the spoils must be rejected.

Interests of Developing Nations. There are three major identifiable interests which developing nations have in common:

1. Obtain economic gain through a "share-the-resources" scheme which falls within the overall desire to narrow the division between the have and have-not nations.

The costs of exploration and exploitation are beyond the resources of developing nations. Their only hope of economic gain would be through leases of "their property rights" or through an international ownership and the distribution of gains to developing countries.

2. Protect the price level of raw materials essential to many developing nations' economy. This requires control of exploitation through an international organization which could stabilize the prices of minerals.

3. Acquisition of new territory, in this case seabed and subsoil, is a means by which the leaders of the developing countries focus attention on rising nationalism, often plagued by tribal, religious, and ethnic differences.

Interests of Developed Nations. The interests of the developed nations of the world in a legal regime are far more complicated and diverse, including security on a global basis, worldwide trade which includes freedom of the seas, aid to and development of other nations, use of nuclear power, industrial needs for minerals, scientific research, exploration and exploitation as a challenge.

Security. Both the United States and the Soviet Union have urged that the question of controlling the emplacement of weapons of mass destruction on the sea floor beyond the limits of the present territorial waters be negotiated in the Geneva Arms Control Conference. A measure barring the use of nuclear weapons on ocean floors would, they suggest, be a logical sequel to the treaties that have already banned these weapons from the Antarctica and space.[10] However, military research in the deep oceans is directed toward a multitude of national defense systems. A recent article lists items such as undersea facilities for purposes of fuel caches, supply depots, refueling stations, submarine repair facilities, and nuclear weapons shelters.[11] The Navy's Director of Research and Development, Robert A. Frosch, commented on how some people, "... frequently look to the improvement of the underdeveloped nations. Potential benefits of such proposals must be weighed against the implications to the United States security of vesting even informal control of the sea bed in an international organization."[12] Adm. David L. McDonald put it more strongly when he emphasized two things to protect the national interest of the United States: "... we must maintain an invulnerable strategic force, to ensure that our deterrence is effective; and we must make certain that the United States is the nation that enjoys the benefits of prior presence and continued use in the ocean areas of greatest importance to us."[13] President Johnson stated still another national interest in an address in July 1966:

> . . . under no circumstances, we believe, must we ever allow the prospects of rich harvest and mineral wealth to create a new form of colonial competition among maritime nations. We must be careful to avoid a race to grab and hold the lands under the high seas. We must ensure that the deep seas and the ocean bottoms are, and remain, the legacy of all human beings.[14]

World Trade. The U.S. interests in world trade rest heavily on the freedom of the seas. Any legal regime that limits the ability of the United States to carry out its commitments throughout the world would not be considered in this country's interest. With the increased worldwide involvement of the Soviet maritime fleets, a similar interest must also be considered for the Soviet Union. Both countries have political interests in foreign aid and assistance in nation building to present a strong basis for a legal regime that would not inhibit the free and unrestricted use of the world oceans. With the increased use of nuclear-powered ships, any international regulation limiting their use would be viewed by several leading nations as unpopular, yet there are nations in the world that have voiced their fear of nuclear contamination.

Industrial Need for Minerals. With only 6 percent of the world's population, the United States produces nearly 50 percent of the world's goods. Although the United States has an economic state in preserving the freedom of developing nations, the United States is also dependent on other nations, especially those developing nations from which certain vital resources are obtained. As an example, the United States must import 100 percent of its tin, 95 percent of manganese, 97 percent of nickel, and 88 percent of cobalt. If imports such as these were cut off, the economic and military strength of the United States would suffer.[15] As the needs of the developing nations increase, the demand for minerals by both the United States and other nations for the type of goods in which American industry excels, such as heavy machinery, trucks, and washing machines, will increase the need for scarce minerals. These same developing nations will, in time, require the use of their own resources for home industries.

As a result of the exchange program with the Soviet Union during 1964, Soviet scientific and technical work in oceanographies became known. Actual Soviet exploration offshore has been largely confined to oil production in the Caspian Sea. However, experts consider the Continental Shelf of the seas contiguous to the Soviet Union to have excellent oil and other mineral potential. In the last 15 years the Soviet Union has increased its efforts in oceanographic work, their expeditions and research teams aboard almost 200 ships are on all the world's oceans. Although more extensively involved in fishing research, Soviet cartography is considered of high quality, and underwater seismic exploration and earth's core sampling on the ocean floor have been carried out. The Soviets have formed research expeditions for exploring the resources of the Atlantic and Pacific Oceans and have recently commenced a joint research program on deep sea marine resources in the Mediterranean with France.[16] The general Soviet interests in a legal regime for the exploration of the deep ocean floors have not been made explicit; however, either through competitive need or economic requirements, the Soviet Union will most likely continue to pursue a widening interest in the oceans and a specific interest in the deep seabeds and subsoils.

Scientific Research, Exploration and Exploitation as a Challenge. Dr. Julius

A. Stratton, Chairman of the Commission on Marine Science, Engineering and Resources, after almost 2 years of study, reported:

> How fully and wisely the United States uses the sea in the decades ahead will affect profoundly its security, its economy, its ability to meet increased demand for food and raw materials, its position and influence in the world community and the quality of the environment in which its people live.[17]

The report indicated that the growth of scientific understanding of the world oceans will not be accomplished quickly or easily and estimated that by 1980 an annual operating budget of $2 billion would be needed. The forecast visualized a total expenditure of $8 billion for the next 10 years.[18]

Summary. The expanding world demand for minerals makes seabed and subsoil resources attractive for exploitation. However, in planning for and exploiting these new resources, there may be a threat to worldwide mineral prices. Developing nations, whose economies depend, sometimes exclusively, on export of important industrial minerals, see the unrestricted exploitation of the sea resources as not in their national interest. Developed nations, on the other hand, are interested in exploiting additional sources for critical minerals, presently available in only a few land areas of the world. The interests of developed nations tend toward broader areas such as security, world trade, and freedom to explore and exploit; while smaller nations, many of them emerging from colonial status, look to the sea for needed capital for nation building.

VI--CONCLUSIONS

The activities on the high seas are increasing, as access to the deep seabed and subsoil becomes technically possible. While there are no vast, superrich lodes of rare minerals concentrated for easy pickup, a manganese mining operation in the deep ocean is possible and could be economically feasible. Although technological advances in oceanology have made mining possible, it has also created an international dilemma that threatens the traditional concept of freedom of the seas. The limitless seas are perhaps already becoming restricted. There are ominous warnings by scientists that man's unrestricted use of the oceans as a dump for nuclear waste, industrial by-products, and oil and chemical pollution could eventually result in making the sea, and thus the earth itself, uninhabitable. The economic, political, and military short-range requirements must be adjusted to fit the present, very limited knowledge of the ocean's complex role in the cyclic functioning of the earth's atmosphere.

A further concern is that uncontrolled exploitation would rapidly deplete the resources of the sea. A regime for the deep sea must strive to sort out the interplay between two factors: jurisdictional claims and economic values. The dominant controlling force will be the national interests of states. The choices, considering these interests, are between an international organization, the United Nations for example, by multilateral negotiation; or, in the absence of control, by conflict. As exploration continues in the oceans, changing economic values will modify jurisdictional significance and ultimately raise security issues.

Thus, some form of legal regime is likely to develop. A basis already exists in the Geneva Convention on the Continental Shelf, and resources now being exploited fall within the agreements of this Convention. A variety of proposals have been advanced for the deep ocean beyond the Continental Shelf; the variations stem primarily from how each views the development of law. On the one hand, it is said that the evolution of international law should proceed together with the development. This has been the traditional evolution of international law. On the other hand, there are advocates for establishing a regime *now*, before the deep ocean is completely defined and before nations establish hard and fast positions, leading to increased tensions and perhaps conflict. Underlying this last proposal is the belief that more powerful nations can preempt all others in the use of ocean resources if a "wait and see" solution is adopted.

In the last analysis, however, any workable regime must be based on solid fact and a full understanding of the geophysical nature of the seabed and subsoil rather than optimistic estimates and enthusiastic speculation. This, in fact, is where it stands today; there is no sound and generally acceptable basis for negotiating an international convention on the deep ocean. There is, however, little doubt that the question is on the agenda for the future and that every item on the discussion list will be of profound interest to military planners.

BIOGRAPHIC SUMMARY

Col. John D. Lewis, U.S. Army, did his undergraduate work at Virginia Polytechnic Institute, is doing graduate work in international relations with The George Washington University, and is a graduate of the U.S. Army Command and General Staff College and of the U.S. Armed Forces Staff College. He has had extensive experience in artillery, especially air defense artillery. His most recent duty assignments have been as Commanding Officer of the 5th Battalion, 2nd Artillery, in Vietnam (1966-67) and as a staff officer in the Millitary Assistance Advisory Group, Italy (1967-68). Colonel Lewis is currently a student at the Naval War College, School of Naval Warfare.

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THE BAROMETER

I read Captain M.D. Blixt's article "Soviet Objectives in the Eastern Mediterranean" in the March *Review* with interest and general agreement.

Capt. Blixt opined that the newly constructed Soviet aircraft carriers appear to be designed for helicopter assault but undoubtedly possess an antisubmarine capability.

I translated the enclosed article from the 22 December 1968 issue of *Red Star,* as perhaps the first Soviet commentary regarding their aircraft carriers.

Of interest is the obvious attempt by the Soviets to emphasize the effective ASW role of the carrier to the exclusion of any assault mission.

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The 22 December 1968 issue of the Soviet Ministry of Defense newspaper, *Red Star,* carried a front page photograph and article concerning the new Soviet antisubmarine cruiser, presumably the *Moskva.* This, if not the first public mention of the helicopter cruiser, is the most extensive Soviet internal publicity given this class of ship to date. Two photographs were shown: one an aerial port quarter view of the ship, and the other of six aviators walking on deck after a flight.

The accompanying article was written by Capt. 2nd Rank N. Radchenko, a correspondent for *Red Star.* His article is of interest as it is, perhaps, the first official Soviet commentary on this new type of ship and its operations. The article is titled "Antisubmarine Cruiser Conducts the Search" and translates as follows:

The presence of an enemy nuclear submarine is assumed in square "N." Detect and destroy her--is the training problem received by the crew of the antisubmarine cruiser.

Raising a resilient wave, the cruiser proceeds to the search area at full speed. No matter how complicated the training problem may be, the ship's commander firmly believes that the high readiness of the crew, and the modern equipment and techniques with which the ship was armed, would permit her to successfully solve the problem.

Such confidence arose from the strenuous training days, in frequent sea cruises. For example, on a recent cruise in the Mediterranean Sea, the commander of the cruiser once again satisfied himself of the excellent seaworthiness of his ship. The cruiser is steady in waves of any stormy weather, which provides her crew the best of working conditions.

In contrast to other ships of such displacement, narrates the commander, the cruiser possesses good maneuverability. This quality, during the search and tracking of submarines, allows an uninterrupted tracking of any maneuvering target. Such a bulky and cumbersome thing--said Fedor Tetovich--but it can literally turn around on a five kopeck coin.

The ship is able to make good speed and has high self-sufficiency. Thanks to this, the cruiser is able to sail in any area of the world ocean, retaining full fighting efficiency.

Sailors, petty officers, and officers pride themselves in serving in such a ship. Sailors of the mine-torpedo unit, headed by Capt. 3rd Rank B. Popov, took first place in the socialist competition. This experienced and authoritarian officer knit together a friendly collective fighting unit, and managed with high marks to fulfill all the problems of the past training year.

Close behind the minemen and torpedomen followed the rocketmen. The electromechanical specialist section also produced good work. Several thousand miles lay astern the ship, and its main and auxiliary mechanisms always operated without a hitch.

The cruiser entered the search area. Now it is the business of the aviators. One after another the helicopters rise above the sea and depart in search of the submarine. One of such machines carries the outstanding crew of pilot "high class" Maj. L. Dmitrienko. Flying under any conditions, this crew always distinguishes itself with high military skill. And that time it was equal to the occasion--and was the first to establish contact with the submarine.

After this followed the attack, shattering and inevitable. The enemy nuclear submarine was destroyed.

Excellent! So was evaluated the exact and coordinated assignment carried out by sailors and aviators of the cruiser. Having fulfilled an orderly training problem, the cruiser set a new course.

The moral effect of an omnipresent fleet is very great, but it cannot be weighed against a main fleet known to be ready to strike and able to strike hard.

Sir John Fisher: To Lord Stamfordham, 25 June 1912