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## Communications: A Social Scientist Writes on Economic Criteria for Rules Governing Exploitation of Deep Sea Minerals

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# Communications

*The editor welcomes Christy's offer to present other sides to the Bernfeld (October 1967) and Ely (January 1967) articles. Deeming the controls of the ocean floor one of the major current issues of international law, we welcome these articles, and more.*

## A Social Scientist Writes on Economic Criteria for Rules Governing Exploitation of Deep Sea Minerals

FRANCIS T. CHRISTY, JR.\*

Man's growing interest in the mineral raw materials of the deep ocean floor raises several difficult and fascinating problems. An economic approach to these problems may be of value to the current debate on who controls what—not with the idea that economic rationality will prevail, but with the suggestion that economic rationality is one goal by which alternative regimes can be evaluated.

Several alternative regimes for governing mineral exploitation have been suggested. These include the division of the beds of the seas among the coastal nations;<sup>1</sup> the "flag nation" approach, under which nations guarantee claims made by their entrepreneurs;<sup>2</sup> the establishment of an "international registry office";<sup>3</sup> and the establishment of an international agency with the authority to grant leases

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<sup>1</sup> Seymour S. Bernfeld, "Developing the Resources of the Sea—Security of Investment," *The International Lawyer*, 67-76 (1967).

<sup>2</sup> Northcutt Ely, "American Policy Options in the Development of Undersea Mineral Resources," *supra*, pp. 215-23.

<sup>3</sup> L. F. E. Goldie, "The Geneva Conventions," in Lewis M. Alexander, ed., *The Law of the Sea* (Columbus, Ohio: The Ohio State University Press, 1967), pp. 273-293.

and extract rents.<sup>4</sup> While these four are cast as distinct alternatives for the purposes of illustration, a wide range of solutions involve elements and combinations of each to a greater or lesser degree.

The range of solutions should be emphasized because of the tendency of the current debate to polarize between those advocating UN control and those fearing UN takeover. The advocates point out the UN's need for an independent income. The opponents point to the weakness of the UN and its inability to deal with difficult issues of practical import. And more than a little emotion is generated on both sides. I would like to suggest, however, that the UN is irrelevant. It exists, and it might well be used. But if it did not exist, we would still be faced with the problems of providing rules or a regime to govern the exploitation of the deep sea minerals.

Much of the current debate also tends to oversimplify the questions of urgency and knowledge. "Some of us believe that the American objective, for the next several years, should be to keep all options open, and avoid premature commitments. Too little is known about these resources, or the means of exploiting them, to justify great decisions."<sup>5</sup> This is plausible, but inexact. Certainly our knowledge was not particularly great when Truman proclaimed in 1945 that the resources of the subsoil and seabed of the continental shelf contiguous to the United States were subject to its jurisdiction and control. The relevant question is one of the *degree* of knowledge with respect to the *kind* of decision. We may not know enough to write detailed laws and regulations, but it can be argued that we do know enough to seek the establishment of certain principles, such as security of investment, and that we know enough to avoid steps that may be detrimental to our long run interests. For example, a good case can be made, on the basis of present knowledge, for getting "rid of the

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<sup>4</sup> Francis T. Christy, Jr., "Alternative Regimes for Minerals of the Sea Floor," a paper presented at the American Bar Association National Institute on Marine Resources, Long Beach, California, June 8, 1967.

<sup>5</sup> Ely, *op. cit.*, p. 217. It might be noted that the Soviet motion placed before the International Oceanographic Council and referred to by Ely has now been discussed by that body. As a result of that discussion, the IOC voted to concentrate on the conduct of scientific research and not on the exploitation of deep sea minerals. This particular motion, therefore, does not add to the urgency of reaching a solution. More recently, the Maltese delegation to the UN introduced a *note verbale* dealing explicitly with the use and exploitation of the resources of the sea floor (UN General Assembly, 22nd Session, A/6695, 18 August 1967). The *note* which originally called for a treaty has been amended to call for the establishment of a study group. There is, thus, urgency for study and research, if not for decision.

exploitability concept, the rubber boundary notion, altogether.”<sup>6</sup> And I think that a good case can be made for avoiding the conditions that plague international fisheries, where the “rule of capture” has led to gross physical and economic wastes.<sup>7</sup>

### **The Minerals of the Deep Ocean Floor**

The two problems posed by the potential exploitation of minerals are the extent of the limits of the coastal state's rights and the regime that will govern exploitation beyond those limits. In the first case, the rights are presently limited by the criterion of exploitability and by some ill-defined concept of propinquity.<sup>8</sup> The exploitability criterion, as already indicated, provides a rubber boundary that may soon be stretched by the technological ability to exploit oil resources in waters deeper than 200 meters. Attempts, therefore, to arrive at narrowly restrictive limits are not likely to be popular. If we choose not to go to the mid-points of the oceans, some line must be worked out to reflect the genuine interests of the coastal state in its adjacent regions. Some of the difficulties of the rubber boundary and some

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<sup>6</sup> Ely, *op. cit.*, p. 221. The rubber boundary may soon be stretched. “More recently, the Department [of the Interior] has indicated an assertion of jurisdiction beyond the 200 meter line by publishing leasing maps for areas off the Southern California coast as far as 100 miles from the mainland, at depths as great as 6,000 feet. Additionally, oil and gas leases have been issued in an area 30 miles off the Oregon coast in water as deep as 1,500 feet.” Frank J. Barry, Solicitor, Department of the Interior, “Administration of Laws for the Exploitation of Offshore Minerals in the United States and Abroad,” a paper presented at the American Bar Association National Institute on Marine Resources, Long Beach, California, June 9, 1967.

<sup>7</sup> See Christy, “The Distribution of the Seas’ Wealth in Fisheries,” in Lewis M. Alexander, ed., *The Law of the Sea* (Columbus, Ohio: The Ohio State University Press, 1967), pp. 106-21.

<sup>8</sup> See Note 6, *supra*. It has been argued that it was not the intention of the Convention to limit the extension of exclusive rights by some concept of propinquity. “The objective of the Convention on the Continental Shelf was to divide the beds of the seas among the coastal nations for that was the real need if future conflicts were to be avoided.” Bernfeld, *op. cit.*, p. 72. Griffin, to the contrary, states that “the literal open-endedness of the Convention’s exploitability test has caused erroneous assertions that it allocates the sea bottom underlying entire oceans.” William L. Griffin, “The Emerging Law of Ocean Space,” *The International Lawyer*, p. 573. Griffin further states that “propinquity is the basis for allocating to the coastal states sovereign rights in the seabed and subsoil of internal waters, territorial sea, and the continental shelf. The juridical shelf terminates where propinquity terminates.” *Ibid.*, p. 585.

alternative solutions have been expressed very effectively by Ely and need not be repeated here.<sup>9</sup>

The second problem—that of alternative regimes beyond the limits of the coastal state (however those limits are defined)—arises because of the possibility of commercial exploitation of oil resources from deep water salt domes and of the manganese nodules lying on the floor of the sea in waters 1,000 or more meters in depth. The nodules—high in content of manganese, copper, nickel, and cobalt—have been known since the voyage of the *Challenger*. Until recently, they were viewed as scientific oddities rather than as potential natural resources. Now there are glowing accounts of the vastness of the deposits of these materials and of the great wealth contained therein. While St. Elmo's fire, rather than economic reality, may be responsible for much of the present glow, it is clear that these resources will eventually become of significant value to man.<sup>10</sup>

For our purposes, five points about the possible exploitation of the manganese nodules are significant.<sup>11</sup>

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<sup>9</sup> Ely, *op. cit.*, pp. 220-21.

<sup>10</sup> "On the assumption that an [international] agency would be created in the year 1970, that technology will continue to advance, that exploitation will be commensurate with the presently known resources of the ocean floor, that exploration rights and leases will be granted at rates comparable to those existing at present under national jurisdiction and that the continental shelf under national jurisdiction will be defined approximately at the 200 meters isobath or at twelve miles from the nearest coast, we believe that by 1975, that is, five years after an agency is established, gross annual income will reach a level which we conservatively estimate at around \$6 billion." Pardo, "Agenda Item 92, Examination of the Question of the Reservation Exclusively for Peaceful Purposes of the Sea-Bed and the Ocean Floor, and the Sub-Soil 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)," A/C.1/PV.1516, p. 4. Pardo's figure of \$6 billion does not appear realistic, even with the acceptance of his assumptions. Oil is not now exploited on the U.S. shelf in waters greater than 300 feet in depth. It is not likely that oil exploitation in waters below 660 feet (200 meters) will be as significant as that implied by Pardo, for many years to come. Furthermore, the assumption that the limits of a coastal state's rights will be at the 200 meter isobath is, I think, unrealistic. Royalty incomes from oil beyond the continental slope and from manganese nodules on the sea floor are not likely to be significant within the next decade or two.

<sup>11</sup> The most comprehensive discussion of the technology of the exploitation of manganese nodules is in John Mero, *The Mineral Resources of the Sea* (New York: Elsevier Publishing Company, 1965). For economic analysis see David B. Brooks, *Low-Grade and Nonconventional Sources of Manganese* (Washington, D.C.: Resources for the Future, Inc., distributed by the Johns Hopkins Press, 1966), pp. 93-108, and Brooks, "Deep Sea Manganese Nodules," a paper

1. Commercial attempts to exploit the minerals in deep waters may occur within the next five or ten years. This is admittedly a rough guess since most potential exploiters are notably cautious in revealing their intentions.

2. The capital costs are likely to approximate \$100 million and technological requirements are likely to be high. These factors, together with high risks, will limit the number of participants in the near future.

3. For exploitation to provide a satisfactory return on investment, the area under control of the exploiter will probably have to be large, at the least, 1,000 square miles.<sup>12</sup> Other estimates run up to a circle whose radius is 100 miles—an area of more than 30,000 square miles.

4. There will be considerable variation in the value of particular sites, because of wide differences in the density of the nodules on the floor, the metallic content of the nodules, the depth of water in which they lie, the topography of the floor, and so forth. The range in value is likely to be as great as that for mineral sites on land.

5. The estimated reasonable scale of production of a single enterprise will be extremely large. Brooks has estimated that the amount of manganese thrown on the market by a single producer might be so great that the price would drop from 90¢ per unit (1963 price) to 50¢.<sup>13</sup> The cobalt price might drop from \$1.50 per pound to \$1.00; and nickel from 70¢ to 65¢ a pound. Two or three producers, of course, would have even greater effect. Clearly, exploitation will require considerable adjustments in the short run—both by the users of the minerals and by the producers of the alternative sources of supply. There will also be difficulties in arriving at a rate of development that is not self-destructive to the exploiters themselves.

The short-run situation will be limited to a relatively few exploiters who will have difficulty in controlling the rate of output with respect to the market for their products. Competition for exclusive rights to particular sites is likely to be severe because of the large size of holding and the great variety in value.

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presented at the 1967 Law of the Sea Institute Conference, University of Rhode Island, Kingston.

<sup>12</sup> Christy, "Alternative Regimes . . .," *op. cit.*, p. 4.

<sup>13</sup> Brooks, *Low-Grade and Nonconventional Sources of Manganese*, *op. cit.*, p. 105.

## **The Criteria for Rules**

Three criteria are suggested for evaluating alternative rules for governing the exploitation of the sea floor minerals—economic efficiency in production; non-arbitrary allocation of exclusive rights; and acceptability. These criteria overlap and are, to an extent, interdependent.

1. *Economic efficiency* in production will require, first of all, the ability of the entrepreneur to acquire security of investment. He must be able to obtain exclusive rights to a sufficiently large area for a sufficient length of time to capture a fair return on his investment. While it is conceivable that an entrepreneur could undertake such an investment and operate it effectively in the absence of rules guaranteeing tenure of rights, most writers believe that the risk would be too high to do so. Therefore, the search is for that regime or jurisdiction that can provide the best protection to the entrepreneur.

Economic efficiency may also call for a set of rules to control the rate of output. In a free-enterprise economy, the market generally serves this function and is preferable to an oligopoly. But in this situation, the output is so great that some form of control may be desirable in the short run. At the least, the rules should avoid creating incentives that would stimulate marginal producers to enter the industry.

In addition, social costs and benefits should be considered within the criterion of economic efficiency. Society should receive some return from the exploiters to cover the costs of protecting and administering exclusive rights. External costs, such as pollution, should be avoided, or paid for by the exploiter. It would be desirable to avoid "high-grading" of manganese nodules. This might occur if there were little or no incentive for the exploiter to sweep the nodules from the floor in an efficient pattern, thereby making ultimate recovery of the nodules more difficult and costly.<sup>14</sup> Insofar as possible, society would also want to reduce incentives that would lead to the inefficient allocation of capital and labor resources.<sup>15</sup>

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<sup>14</sup> The "rule of capture" that prevailed for the exploitation of oil in the early 1900's stimulated excessively rapid rates of output that wasted natural pressure and increased the costs of recovery.

<sup>15</sup> In fisheries, the principle of the freedom of the seas has led to great inefficiencies in the allocation of capital and labor. Since the property is common to all and there are no controls on the number of producers, any shareable profit (or economic rent) becomes dissipated. The industry tends to operate where total costs and revenues are equal rather than where marginal costs and

2. *The non-arbitrary allocation of exclusive rights* may not be relevant to the pioneer exploitation effort, and may seem to be of little importance in the short run, but over the long run, there must be some system for making rational choices among competing claimants.

Property (in this case, an exclusive right to exploit a given area) can be allocated by a number of means—by force or power; by some concept of national or international interest; on a first come, first served basis; or through the market place. Any system can make use of several of these, but it is desirable to reduce, insofar as possible, the degree of arbitrariness.

Most people would abjure the use of power or force in the allocation of exclusive rights to the minerals of the sea floor. But the more arbitrary the means for allocation, the more chance there is that power will become important. Initially, allocation by power may work to the advantage of the big nations, but if decisions are made in some international arena the advantage may lie with the less-developed nations.

Decision on the basis of some concept of public interest is another possibility. In part, this technique is used for the allocation of radio frequencies in the United States where the decision is influenced by the promises for socially valuable programming. For the resources of the sea floor beyond national boundaries, the public interest might be expressed in terms of the need for income, the desirability of regional growth, the spreading of technology, or the closing of the gap between the "haves" and the "have-nots." While all of these are desirable humanitarian goals, they probably can be achieved more effectively through more direct means than by the allocation of exploitation rights.<sup>16</sup>

The third technique is that adopted in the opening of the western United States, when prospecting was done by individuals with rudi-

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revenues are equal. For example, it has been found in the Georges Bank haddock fishery, that 25% fewer vessels would produce the same catch and 50% fewer vessels would produce the maximum net economic revenue. See Christy, "The Distribution of the Seas' Wealth in Fisheries," *op. cit.* Since minerals are not fugitive but geographically fixed, the same dissipation of economic rent is not likely to occur (although it could in the absence of controls). However, misallocation of capital and labor can occur if the exploiters do not pay a fair price for their rights, and are thereby given an advantage over the developers of land minerals.

<sup>16</sup> It should be emphasized that this refers *only* to the allocation of rights to exploit, *not* to the distribution of revenues obtained from these rights.



mentary equipment. Under this system, exclusive rights are acquired by the first to stake the claim. The government registers and guarantees the claim and may require some degree of performance by the exploiter to maintain the claim. Once claims are established, they can be bought and sold and, thereby, reallocated by the market.

The use of this technique to allocate rights to the minerals of the sea floor would be accompanied with many difficulties both in the initial stages of development and over the long run. To prevent a headlong race to acquire rights to vast areas of the sea floor, some form of international authority and some international rules would have to be established. This is discussed in more detail later in reference to the flag nation alternative. The major difficulty, in terms of efficient allocation of rights, is that this technique provides no method for choosing among claimants for the same or overlapping areas. In view of the size of areas required and the wide range in values of areas, such conflicts are likely to occur relatively soon after development gets started.

"If expeditions from too many nations cluster too close to the honey pot, the resulting disputes, initially at least, are going to be settled by accommodation among the competing states, or by the evolution of adversary case law."<sup>17</sup> Thus, where competition occurs, this technique would resort to allocation by power or by some concept of public interest or equity, "initially at least." It is not clear from Ely's paper, what would evolve beyond that—what would happen in the long run.

The fourth technique for allocation would be to set up a market for the exclusive rights, a technique used by the United States for the oil resources of the continental shelf. Individual firms and groups of firms bid for exclusive rights to resource areas, and the bids reflect (albeit roughly) the value of those rights.

For such a market to be established for the minerals of the sea floor beyond the edge of the continental shelf (however defined), there would have to be a greater degree of international authority and international rule than for any of the other allocating techniques. However, in principle, the market would be the most efficient and least arbitrary method for the allocation of exclusive rights. Those firms capable of the most efficient exploitation should be able to outbid the less efficient exploiters. To be sure, any such market is likely to be constrained by non-market factors which may tend to reduce the

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<sup>17</sup> Ely, *op. cit.*, p. 222.

efficiency of allocation. Some of these constraints may be desirable (e.g., the avoidance of pollution) and some may be inevitable (recognizing that man is not necessarily an economically rational animal). But even with these constraints, allocation by market would be less arbitrary than by any of the other techniques. Therefore, the best means for meeting the criterion of non-arbitrary allocation of exclusive rights is through a market similar to that for the oil resources on the U.S. continental shelf.

3. *Acceptability* as a separate criterion may seem unnecessary and redundant, since tenure of exclusive rights is so clearly dependent upon rules that will not be violated. But some alternatives have been suggested that are so obviously unacceptable that it seems worthwhile to emphasize that other nations will have an influence on the formulation of rules.<sup>18</sup> In addition, the criterion of acceptability brings into the discussion important non-economic factors such as national security. Unfortunately, at the moment, one can only speculate as to how other nations (and the U.S. Department of Defense) view their interests in the sea floor.

## **The Alternatives**

Four alternative regimes have been suggested for meeting the problems raised by the potential development of minerals of the sea floor. While these might be cast as quite separate and distinct regimes, the distinctions are not clear for all elements of each regime. A flag nation approach, for example, would probably require some degree of international authority, and an international authority might permit coastal states to exercise some rights in waters that are closer to them than to all other states. Nevertheless, the distinctions are useful to maintain for the purposes of discussion and for examining their relevance to the criteria and principles suggested above.

A. *The Division of the Sea Floor.* One alternative is to divide up the sea floor so that none of it remains outside the jurisdiction of some coastal state. Jurisdiction, in this case, would cover only the rights of mineral exploitation. One approach would follow the guides laid down in Article VI of the Geneva Convention on the Continental

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<sup>18</sup> The recognition of non-United States influence on rules is simply a reflection of reality. It does not imply that the resources of the sea floor are *res communes* and not *res nullius*. The distinction between these two points of view provides the basis for some absorbing legal arguments, but these arguments are not likely to have much influence on the decisions.

Shelf—that is, where median lines cannot be arrived at by negotiation, the lines will be drawn so that every point is equal in distance to the nearest points of opposite or adjacent coastal states.<sup>19</sup> Another approach has been suggested by Bernfeld—“provide that the beds of all of the Great Seas shall be deemed divided by a median line through the longest dimension of each, and then run each coastal nation’s rights to the seabed to that median between the lines of latitude and longitude, as the case might be, from the nation’s coastal extremities.”<sup>20</sup> While such schemes might meet the first two criteria, by providing for efficient production and allocation of the resources, it is most unlikely that they would be acceptable.

As Bernfeld points out, islands would provide vexing problems. If islands are given full rights (in keeping with the Geneva Convention), such tiny desolate rocks as Clipperton Island would give the French a vast territory in the eastern tropical Pacific, and the United Kingdom would acquire half the South Atlantic because of Ascension, St. Helena, and Tristan da Cunha. If rights are limited only to those islands that are sovereign states, the United States might be able to leap over Bermuda and the Bahamas, but would have to give up areas accruing to Hawaii and the Aleutians. Furthermore, such a principle would tend to increase the already great proliferation of mini-states, brought into being to acquire vast territory.<sup>21</sup>

Aside from the problem of islands, the division of the sea floor is not likely to appeal to the United States Navy. Although the division might be limited to exploitation rights, possibly the rights might become extended to cover more than exploitation and thus affect the use of the subperjacent waters. To the extent that this becomes true, it would impede the mobility of naval vessels.

But the major reason for the unacceptability of this approach is that it would do little or nothing for those nations that have little or no toe-hold on the oceans. In particular, it is most unlikely that the Soviet Union would find any such division to its advantage. While

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<sup>19</sup> See Figure O. An illustration of this will be available in the forthcoming proceedings of the 2nd Annual Conference of the Law of the Sea Institute held at the University of Rhode Island, Kingston, June 26-29, 1967. The map was prepared by the author and Henry Herfindahl as an illustration of the difficulties and unexpected results that might occur by such a division.

<sup>20</sup> Bernfeld, *op. cit.*, p. 73.

<sup>21</sup> Islands already provide difficulties, as manifested by the current dispute between France and Canada over rights to resources on the Grand Banks. The French islands of St. Pierre and Miquelon are so located that a strict interpretation of the Geneva Convention gives them a large area of the Grand Banks.

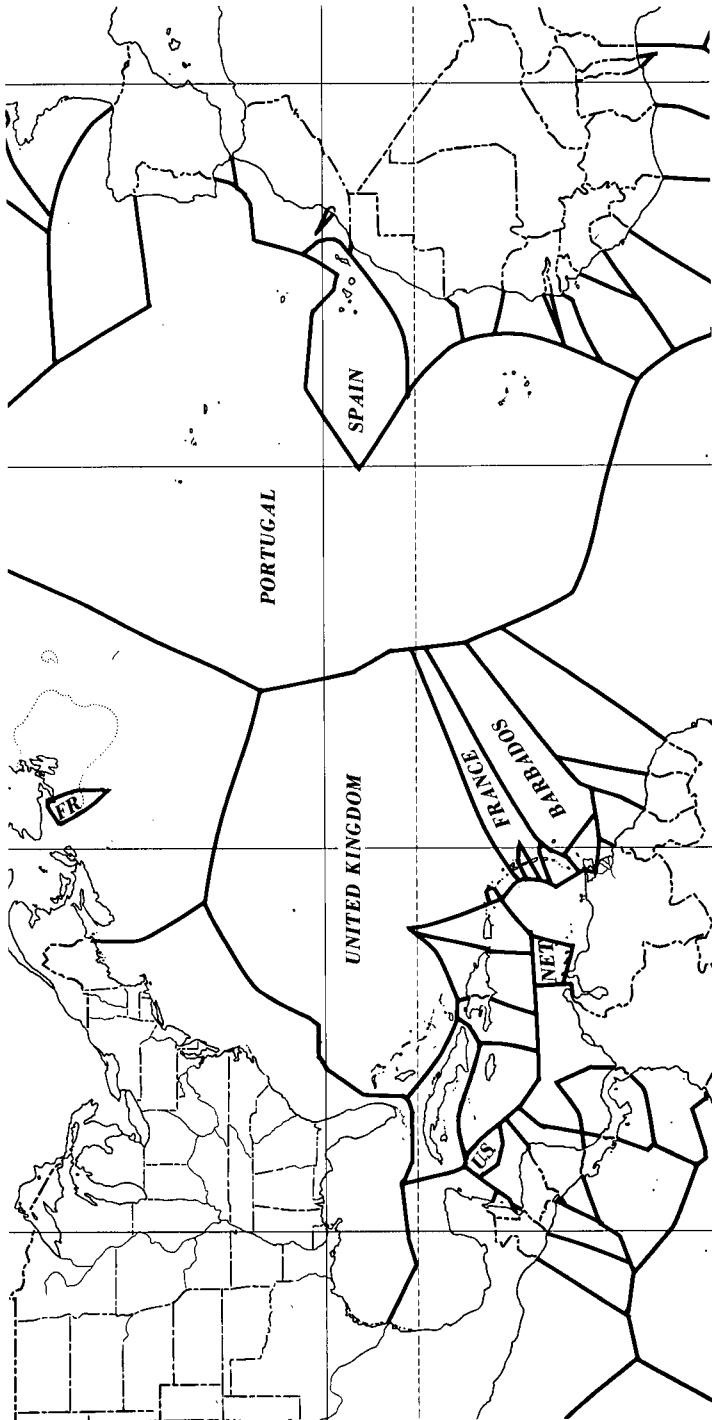


Figure O: A Hypothetical Division of the Sea Floor. This map shows lines drawn on the basis of equidistance, as expressed in Article 6 of the Geneva Convention on the Continental Shelf. It assumes that the criterion of exploitability has been met and that the criterion of adjacency is (contrary to most opinion) irrelevant. The map is a section of one prepared by the author for the Law of the Sea Institute, University of Rhode Island, Kingston, and drawn by Robert H. Warsing.

some may find merit in such a solution, it is unrealistic to think that any solution would be viable in the absence of Soviet acquiescence.

B. *The Flag-Nation Approach.* Under this approach, the "mineral resources which are beyond the limits of the coastal state's exclusive seabed jurisdiction (howsoever those limits are defined) would be treated as open to appropriation and exploitation under the laws of the flag of the discovering nation."<sup>22</sup> In an earlier paper, Ely stated that "as a practical matter, the explorer thereby appropriates a segment of the seabed, and the jurisdiction—let us go further and say sovereignty—of his flag attaches to the discovery. . . . There is no argument about the geographical extent of the appropriative right unless and until a neighbor sets up operations close enough to create friction."<sup>23</sup>

This system assumes that a nation's prevailing jurisdiction over one of its vessels can be extended down the dredge line and through the dredge to cover an unspecified area of the floor of the sea (or in the case of oil, down the drill, through the floor of the sea, and into the pool of oil). Since the connection between jurisdiction over a vessel and jurisdiction over the sea floor is tenuous at best, this system would presumably require some affirmative declaration by the flag nation, *i.e.*, a declaration that would assure the entrepreneur that he would be protected in exploiting a sufficiently large area for a sufficient length of time to get an adequate return on his investment.

I shall leave to the lawyers the several interesting questions of law raised by this approach. Instead, I will examine one of the fundamental assumptions questionable from an economic point of view and discuss the alternative in the light of the criteria suggested above.

Ely states that "there is plenty of room on the world's deep seabeds." Hugo Grotius advanced the principle of the freedom of the seas, in part, because of the apparent inexhaustibility of the resources. And McDougal and Burke have stated that the resources of the sea are so vast that they can be shared by all to the detriment of none.<sup>24</sup> If this is true, then the resources are free goods (like the air we breathe); there is no incentive or need for the acquisition of exclusive

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<sup>22</sup> Ely, *op. cit.*, p. 222.

<sup>23</sup> Ely, "The Laws Governing Exploitation of the Minerals Beneath the Sea," a paper presented before the New York Section of the American Institute of Mining, Metallurgical, and Petroleum Engineers, New York, January 13, 1966.

<sup>24</sup> McDougal and Burke, *The Public Order of the Oceans* (New Haven: Yale University Press, 1962), pp. vii-viii.

rights; and the property has no price. This condition has certainly not proven correct for marine fisheries. Indeed, the principles of the freedom of the seas is the primary cause for the gross physical and economic waste that has accompanied the exploitation of fisheries.<sup>25</sup>

For the condition to exist for the minerals of the deep sea there would have to be uniformity of value for resources sites over vast areas. That is, there would be no significant variation in the costs of obtaining and extracting the desirable minerals no matter where they occurred. This is highly questionable. As indicated above, the range in value for the different areas in which manganese nodules occur is probably as great as the range in value on land. This, plus the large size of area that an enterprise would want to hold, will inevitably lead to competition for the high-valued sites. In short, there is not plenty of (economic) room; the resource sites will have a price; and exclusive rights, clear in extent and tenure, will be necessary.

But the difference of opinion is not so much about the inevitability of the results as it is about the timing. The "plenty of room" approach assumes that there will be plenty of time to work out rational administrative and management schemes in the future. The danger of this approach (even if it is not challenged by other nations) is that the assumption may be incorrect, and that our actions will have established principles and set patterns that will be difficult to change and that may be detrimental to our interests.

With respect to the criteria, this approach provides no clear cut guarantee of exclusive rights, either in extent or tenure. Many entrepreneurs may be unwilling to bear the risks that would be associated with this lack of clarity.

The approach provides no means for non-arbitrary allocation of exclusive rights. To settle disputes "by accommodation among the competing states" is to leave the entrepreneur to the mercy of diplomats who are subject to all sorts of pressures, not just those of protecting the interests of the entrepreneur.

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<sup>25</sup> See Note 15 *supra*. The long list of depleted stocks of fish continues to grow. It includes the whales of the Antarctic; tuna of the eastern Pacific and now of the Atlantic; salmon throughout the world; cod and haddock of the Grand Banks; halibut off Northwest America; herring of the North Sea; shad; sturgeon; and a host of other stocks of fish. Depletion has been controlled in some cases by forcing the adoption of inefficient fishing techniques, thereby worsening the already wasteful applications of capital and labor. These consequences will continue to worsen until some form of property right (perhaps through controls on the number of producers) is established.

The acceptability of such an alternative is doubtful. Assuming that a nation is willing to declare that it has jurisdiction—or sovereignty—over a segment of the sea floor that is being exploited by one of its nationals, how would other nations react? If they ignore the implicit provision that jurisdiction can only be acquired through actual exploitation, the race would be on to assert claims to vast areas of the sea floor. If that provision is accepted, then nations not anticipating exploitation would have nothing to gain by this approach. Since not more than a handful of nations are likely to have bonafide interests in exploitation, the opposition to the flag nation approach would indeed be heavy.

C. *An International Registry Office.* Certain modifications of the flag nation approach have been suggested as ways of avoiding some of the above difficulties. One of these is the establishment of an international registry office and the other would add to this, a provision for the distribution of a share of the revenue to the UN.

Both of these suggestions call for some form of international agreement and might be considered as falling somewhere between the flag nation approach and that of an international authority.

L. F. E. Goldie has stated that

the main policy goals of secure title, limited access to a resource to insure the prevention of over-capitalization, over-production and congestion, and the avoidance of 'first come, first served' tactics and the ensuing conflicts, could be gained if regional agencies (with, necessarily, a central index in the United Nations Secretariat) could be established to carry out *evidentiary* (notice) and *recording* functions.<sup>26</sup>

Like the flag-nation approach, the initiative would lie with the entrepreneur. He would record his claim with his country, and his country would then record "its international claim to exercise jurisdiction and control over the individual's [or enterprise's] activity with the [recording] agency."<sup>27</sup> The agency "would have power to issue instruments defining the recording state's Zone of Special Jurisdiction." The zone of jurisdiction would be limited with respect to purpose, duration, area, and time in which to prove development.

An effective regime of this sort would provide more security of title than a flag nation regime. Over-capitalization and congestion, as a consequence of common property (as in fisheries) would auto-

<sup>26</sup> Goldie, *op. cit.*, p. 280. Emphasis in original.

<sup>27</sup> *Ibid.*, p. 281.

matically be avoided by the establishment of the exclusive rights.<sup>28</sup> However, it is difficult to see how this regime would operate on anything but a "first come, first served" basis, and it would tend to stimulate overproduction rather than avoid it.

That the exclusive rights would go to the first entrepreneur to record them, is not, of itself, necessarily undesirable. However, as pointed out in the discussion of criteria, this technique provides no means for resolving conflict when two or more entrepreneurs are in competition for the same or overlapping zones. And such conflicts are likely to become common, particularly in view of the magnitude of the area that an entrepreneur would require and the (presumed) scarcity of valuable sites. Furthermore, assuming the claims are non-transferable, the first to record would not necessarily be the most efficient producer. In the Cherokee Strip, the rewards went to owners of the fastest horses, not the best farmers. The losers are not only those who might be best equipped to exploit the resources, but also society in that less productive units of capital and labor may be employed. If the claims are transferable, and the claim holder can market his rights, then the race is on. An entrepreneur has little to lose by recording a claim, and may make a lucky strike.

In addition, the performance requirement ("use it or lose it") would tend to stimulate excessively rapid rates of output. Those who had recorded claims would have the incentive to produce even though net returns were inadequate or negative, since they might lose the claim by not producing. All of these (and other) difficulties reflect the fact that the property (the exclusive right) may be acquired at a cost that does not approximate its value to the holder—that there is no market by which the value of the property can be expressed and which can be used as a method for allocating capital and labor. While the thought of these inefficiencies may be painful only to an economist, the results of non-market allocation of rights may be painful to all.

In terms of the acceptability of such a regime, the same questions might be asked that were asked of the flag nation alternative. To get around this, it has been suggested that a certain portion of the revenues of production be devoted to some international purpose. The revenue could be acquired by license fee, income tax, yield tax, or royalty. This presumes, of course, that there is some form of international authority that has the ability to extract revenues. It goes beyond

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<sup>28</sup> This would not be true for oil, if the rights did not fully cover the pool.



Goldie's recording agency (that would apply only to the signatories of his proposed convention) and would apply to all exploitation beyond the limits of the coastal states. The collection agency might be the United Nations, some agency of the United Nations, or, conceivably, some special purpose agency outside the aegis of the United Nations. The purpose of the acquisition and distribution of the revenues would be to make the regime acceptable—to buy out the interests of nations in order to prevent them from breaking the regime.<sup>29</sup> The distribution of revenues might follow any of several different patterns, meeting only the criterion of acceptability. One pattern that has a good deal of appeal is the devotion of the funds for the purpose of overcoming malnutrition.

Aside from the questions about the establishment of an international agency, this regime raises questions about the determination of tax rates and their effect on production. Fees, such as license fees, to be paid prior to exploitation would be likely to deter initial efforts. Fixed taxes per area or per unit of output would not differentiate between high and low valued sites, unjustifiably rewarding one and penalizing the other. A tax on net income might avoid these difficulties, but the question of determining an appropriate rate still remains. Negotiation of this rate would be fraught with difficulties and would provide no assurance that the entrepreneur would receive a fair return on his investment, or conversely, that the public share would be appropriate. As in the allocation of exclusive rights, it would be desirable to avoid, insofar as possible, arbitrary decisions.

D. *An International Authority.* The fourth alternative regime is an extension of the above, the chief difference being that it would establish a market for the exclusive rights to exploit the minerals of the deep sea. This regime would be analogous to that which governs the exploitation of the oil resources of the U.S. continental shelf.

To achieve such a regime, the authority would have to acquire jurisdiction over the disposal of exclusive rights to the minerals resources of the deep sea floor. This jurisdiction must include the ability of the authority to extract rents, or royalties, through some form of market. It is suggested that the authority should *not* have the function of distributing the revenues received from the market.

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<sup>29</sup> To those (myself included) who hold the *res communes* theory, it might also be considered as a justifiable payment to the "owners" of the resources. Or, to go a step further, it might be considered ethical and humanitarian for all peoples, but particularly those of the disadvantaged countries, to share in the wealth of the seas.

The authority need not operate under the aegis of the United Nations. Obviously, the United Nations does not have, at present, an agency that is equipped to deal with such an authority, nor does the UN have the expertise required for management. These problems do not, however, preclude the establishment of such an authority within the UN structure. If the agency is so established, it would be clearly desirable for the authority to have a high degree of autonomy (similar, perhaps, to that of the World Bank), so that it might operate without pressure from the General Assembly.

The authority might be directed by a board with majority representation from the exploiting nations. These nations would be best equipped to provide the required expertise and it would be in their self-interest to provide rules that would permit efficient exploitation. The revenues above the costs of administration should be turned over to another agency for distribution. The revenues might be distributed in any of several ways. At one extreme, they might be used for the general support of the UN (although this is not likely to be acceptable in view of the possible use for peace-keeping forces). At another extreme, the revenues might be returned to the exploiting nations (although this would defeat the purposes of the market). A more likely possibility is that the revenues would be earmarked for some widely accepted goal, such as the overcoming of malnutrition. But in any case, the function of management should be separated from the function of revenue distribution.

In its operation, the authority would follow the general principles that the U.S. Department of the Interior follows on the continental shelf. Markets would be held at certain intervals for certain areas of the sea floor (which might have been nominated by the entrepreneurs). Rights would be awarded to the highest bid. And the bid might be expressed as a percent of net income.<sup>30</sup> Certain rules might be invoked to ensure efficient operation, to ensure performance, and to prevent the abuse of the rights. But there would be no basis, outside of these rules, for vetoing an award to the highest bidder.

These suggestions for the operation of an international authority do no more than characterize its nature. Clearly, many difficulties would have to be overcome and many interesting questions of law

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<sup>30</sup> Bids might be expressed in other ways as well—a bonus payment (such as that used on the U.S. continental shelf), as percent of gross income, as a payment per unit of output, etc. For an excellent discussion of these and other economic institutions that might be acceptable, see Brooks, "Deep Sea Mangane Nodules," *op. cit.*

would have to be answered. However, some form of market mechanism would appear to meet the economic criteria better than any of the alternative regimes.

The guarantee of exclusive rights would depend, of course, upon the degree to which the nations find this regime acceptable. Deciding which blocks or areas to open for auction would be difficult, but to the extent that some control could be exercised, this system would reduce the incentive to exploit at an excessively rapid rate. The auction should not deter the pioneers since no one, at this stage of the game, is likely to bid very much for such a high risk venture. As experience is gained, the amount of the bid is likely to increase, but it would still reflect the value to the entrepreneur of the exclusive right. It would be high for the high-valued sites and low for the low-valued sites. The allocation of rights through such a market place would benefit efficient producers and would solve the problem of deciding among competing claimants.

The acceptability of such a regime would depend upon how the exploiting nations would view their ability to compete in the market and upon how the non-exploiting nations would view their returns. With respect to the latter, the flag nation regime would provide them nothing. A registry office would provide nothing unless there is a provision for sharing revenues. Whether they do better by negotiating shares than by auction would depend upon their ability to negotiate. If they negotiate too well, then the registry office scheme would not be acceptable to the exploiting nations.

Admittedly, some of the advantages of the market mechanism have been painted in terms too glowing to be real. Obviously there will be imperfections. And obviously, too, nothing has been said about the great difficulties that would be experienced in establishing the laws and institutions that would govern such an authority. And yet, the principles are valid and should not be discarded simply because we do not know how to write the laws.

Several points might be kept in mind in the examination of this and of the other alternatives. (1) It is useful to distinguish between the pioneer effort, the short run situation, and the long run situation. Certain rules that might be desirable to stimulate the pioneer may not be desirable as exploitation develops. (2) My assumption that the resource sites will have economic scarcity in the short run is important to the criterion of non-arbitrary allocation of exclusive rights. If this assumption is incorrect, disputes over access to resource sites may

not occur for many years. This may give us time to arrive at a system for the rational allocation of rights. I do not believe that this is the case, but the point should be fully explored. (3) My purpose in suggesting an international authority is *not* to provide an independent income for the UN but to meet the need for efficient development and exploitation of deep sea minerals. (4) The presence of the UN is not relevant to the discussion of alternative regimes. Even if the UN did not exist, some regime would be required to govern exploitation. (5) It may be advisable to adopt general principles now, while adoption is possible, even if this requires "great decisions."