

NOTES

INTERIM DEEP SEABED MINING LEGISLATION: AN INTERNATIONAL ENVIRONMENTAL PERSPECTIVE

INTRODUCTION

After eight years of debate and deliberation, Congress has passed a comprehensive deep seabed mining bill, the Deep Seabed Hard Mineral Resources Act.¹ The primary goal of the Act is to establish an interim legal framework for the exploration and recovery of hard minerals from the ocean floor. In addition to promoting the development of seabed resources, the legislation imposes environmental controls upon deep seabed mining operators. The Act appears at a time when other nations are considering similar legislation and when the United Nations Law of the Sea Conference is nearing resolution of its efforts to draft a treaty governing the sea and its resources. This unilateral effort by the United States to regulate deep ocean mining has received both domestic praise and international criticism. The legislation, however, resolutely establishes guidelines to govern domestic enterprises in their worldwide quest for the ocean's mineral resources.

Notwithstanding strong international opposition to the legislation, its proponents have made convincing arguments for its passage.² The

1. Act of June 28, 1980, Pub. L. No. 96-283, § 1, 94 Stat. 553 (codified at 30 U.S.C.A. § 1401 (West Supp. 1980)) [hereinafter cited as Act].

Deep seabed mining legislation has been presented in every session of Congress since the Metcalf Bill was introduced in January 1972. *See Development of Hard Mineral Resources of the Deep Seabed: Hearings on S. 2801 Before the Subcomm. on Minerals, Materials and Fuels*, 92d Cong., 2d Sess. (1972).

The legislative history of the Act provides some insight into the complexity of Congressional deliberations. Representative John Murphy (New York) introduced H.R. 2759 on March 8, 1979. The House Bill was identical to H.R. 3350, which had passed the House during the 95th Congress; that bill later failed to pass the Senate. *See generally Deep Seabed Mining*, H.R. REP. NO. 96-411, 96th Cong., 1st Sess. (1979) [hereinafter cited as 1979 HOUSE REPORT]. On February 26, 1979, Senator Spark Matsunaga (Hawaii) introduced a Senate analogue to the House Bill, S. 493. The Senate bill was similar to S. 2053, which failed to pass the Senate in October, 1979. *See generally Deep Seabed Mineral Resources Act*, S. REP. NO. 96-307, 96th Cong., 1st Sess. (1979) [hereinafter cited as 1979 SENATE REPORT]. On December 14, 1979, the Senate passed S. 493. The House passed H.R. 2759 on June 9, 1980. In its deliberations, the Senate amended the House bill by adopting the wording of S. 493. The amended "House" bill passed the Senate on June 23, 1980. Finally, the House concurred with the Senate's Matsunaga Amendment and passed the reworded version of H.R. 2759 on June 25, 1980. The Senate bill therefore became law with a minimum of House debate, under its new House designation, H.R. 2759.

2. International authorities, citing the intractability of the developing nations opposing ocean mining, argued that United States passage of seabed mining legislation would greatly hinder the Law of the Sea Conference [hereinafter cited as LOS] by polarizing opinion. *See Laylin*,

prospective harmful effects of mining and processing seabed minerals are, nevertheless, lingering problems of great complexity. The purpose of this note is to assess the strength of the interim deep seabed mining legislation in light of the international environmental standards which will ultimately govern ocean mining activity. This note will focus upon the environmental control provisions of the Act and the existing and proposed international environmental controls which are applicable to the deep ocean.

BACKGROUND OF THE PROBLEM: REVITALIZED INDUSTRIAL PROFITS OR ENVIRONMENTAL CHAOS?

Abundant Resources and Profit Projections

Because recent technological developments will permit mining of rich ocean-bottom resources,³ commercial development of manganese nodules may represent the industrial rebirth of the energy-poor Western world.⁴ Optimistic projections have been made that the United States' economic security and balance of payments may greatly improve with the development of deep seabed mining. In addition, many of the world's developing countries may be able to share in the wealth generated by seabed mining, not only because of their proximity to identified mining areas but because of the provisions of the prospective Law of the Sea Treaty.⁵ Thus, the manganese nodule may signal a new

The Law to Govern Deepsea Mining Until Superseded by International Agreement, 10 SAN DIEGO L. REV. 433, 435-437 (1973). As late as 1977, Elliot L. Richardson, Ambassador at Large and Special Representative of the President for the LOS Conference, was calling for a delay to Congressional action on the matter. See *Development of the Hard Mineral Resources of the Deep Seabed: Hearings Before the Subcomm. on Mines and Mining on H.R. 3350 and H.R. 3652*, 95th Cong., 1st Sess. 154 (1977) (statement of Elliot Richardson) [hereinafter cited as *1977 Mines and Mining Report*].

By 1979, however, the executive branch had abandoned its opposition to the legislation. Proponents of the Act pointed to the need for the manganese nodules, the growing dependency on unstable foreign sources of minerals, the need for development capital, the growing environmental hazards of seabed activities, and the uncertainty of the LOS negotiations. See 1979 HOUSE REPORT, *supra* note 1, at 30-44. In 1979, Elliot Richardson testified that progress at the LOS Conference had stalled and that the executive branch no longer found the legislation objectionable. *Law of the Sea: Hearing Before the Subcomm. on Oceanography on H.R. 2759*, 96th Cong., 1st Sess. at 25 & 78 (1979) (statements of Elliot L. Richardson) [hereinafter cited as *1979 LOS Hearings*].

3. The 1979 HOUSE REPORT, *supra* note 1, at 36, estimates potential mineral recovery from a single mine site to be about three million tons per year. That would mean a yield of approximately 42,000 tons of nickel, 37,000 tons of copper, 4,000 tons of cobalt, and 750,000 tons of manganese per year. Thus, a single mine could produce 5% of the world's nickel, 1% of its copper, 12% of its cobalt, and 7% of its manganese. A United Nations report estimates that mine fields in the Pacific Ocean could produce up to 500 billion tons of mineable hard minerals. UNITED NATIONS DEPARTMENT OF PUBLIC INFORMATION, A GUIDE TO THE NEW LAW OF THE SEA, Reference Paper No. 18, at 26 (March 1979).
4. Profits from ocean mining are expected to amount to trillions of dollars over the long run. One authority has estimated that the value of manganese nodules will rival the value of ocean petroleum resources, concluding that ocean mining could save the United States \$40 billion in balance of payments by the year 2000 (assuming that ocean mining began immediately). Welling, *Ocean Mining Systems*, 1977 *Mines and Mining Report*, *supra* note 2, at 299.
5. Articles 136 and 137 of the 1979 LOS Draft Treaty provide that seabed resources are the "common heritage of mankind" and are not subject to the sovereign jurisdiction of any nation. Articles 148 through 155 establish mechanisms to assure developing nations the right to

era of Western industrial might and the birth of a stronger world economy.

Deep seabed nodules are potato-shaped objects, generally found at ocean depths exceeding three miles. Although their precise origin remains subject to scientific debate,⁶ there is general agreement that the nodules originate from a geochemical process involving the accretion of minerals around organic sediment from the ocean floor. The composition of these nodules is unique; they are known to contain over twenty metallic elements.⁷ In addition to manganese, the nodules contain nickel, copper, and cobalt. These elements are strategically important to the United States' economic welfare and national security.⁸ Seabed nodules are also of significant commercial interest because of their high ore content and their easily processed oxide materials.⁹

Start-up Costs and Anticipated Revenue

Since most ocean mining sites are located at depths exceeding three miles, nodule mining demands the development of sophisticated technology. Recovery devices require large investments of "start-up" capital for testing and research. The development of processing technology, the outfitting of vessels for mining and processing, the training of personnel, and the construction of on-shore processing plants will require further acquisition of large sums of investment capital.¹⁰

participate in international joint ventures to mine manganese nodules. See Third United Nations Conference on the Law of the Sea, Informal Composite Negotiating Text, U.N. Doc. A/Conf. 62/WP. 10/ Rev. 1 (April 1979) [hereinafter cited as 1979 LOS Draft Treaty] (one of several drafts of the Law of the Sea Treaty).

6. 1979 HOUSE REPORT, *supra* note 1, at 26.
7. See 1979 LOS Hearings, *supra* note 2, at 166 (prepared statement of Marne A. Dubs).
8. The four primary metals found in manganese nodules are listed as "critical materials" by the General Services Administration. FEDERAL PREPAREDNESS AGENCY, G.S.A., 1978 STOCKPILE REPORT TO CONGRESS (1977), as reported in 1979 HOUSE REPORT, *supra* note 1, at 31. The United States is currently dependent upon foreign sources of certain nonfuel minerals, including cobalt, nickel and manganese. *Id.* Nickel, in metal form, is used almost exclusively in alloys with special strength requirements or for alloys with high corrosion resistance. *Id.* Substitutes for nickel are available, but are less economical and could affect performance of the alloy. *Id.* Copper has special uses in electrical components and thus has both commercial and military importance. Cobalt is a by-product of nickel and copper mining, and has unique applications in the manufacturing of heat-resistant metals. *Id.* Manganese is an essential element in iron and steel production, and in its principle uses there is no known substitute. *Id.* For background on the problem of the United States' shortage of hard minerals, See generally Santini, *The Growing Crisis in Strategic and Critical Minerals of the United States*, 7 J. LEGIS. 63 (1980).
9. Deep seabed minerals vary in mineral content, but they average approximately 24.2% manganese, 14% iron, 1.0% nickel, and .35% cobalt. This composition compares favorably with rich land-source ore deposits. See 1979 HOUSE REPORT, *supra* note 1, at 26.
10. See Flipse, Dubs & Greenwald, *Preproduction Manganese Nodule Mining Activities and Requirements, Mineral Resources of the Deep Seabed: Hearings Before the Subcomm. on Minerals, Materials and Fuels on S. 1134*, 93rd Cong., 1st Sess. 602-700 (1973). That report gives a summary of research and development activities, and describes the unique equipment used in the exploration for and testing of mine sites. See Rothstein & Kaufman, *The Approaching Maturity of Deep Ocean Mining—The Pace Quickens*, *id.* at 201. They state that the average investment cost ranges from \$130-240 million for a one-ton-a-day dry recovery system. Another report estimates that "[a] four consortium industry would represent an investment of

Although the projected start-up costs of deep ocean mining are very high, the estimated profits are proportionately higher. The model ocean mining project, conducted by the Massachusetts Institute of Technology (M.I.T.), indicates that a mining operation will cost in excess of \$560 million, exclusive of yearly operating costs of approximately \$100 million. After taxes, the rate-of-return predicted by the M.I.T. model is approximately eighteen percent, resulting in a gross annual revenue of nearly \$260 million.¹¹ Unfortunately, these projections do not consider the potential "cost" of environmental pollution which may occur during ocean mining and processing or the international consequences which may result from pollution caused by ocean mining operations.

Potential Environmental Impact of Ocean Mining

Despite the enormous profits to be reaped from the oceans, the environmental consequences of deep seabed mining may overshadow the projections for revitalized industrial profit. At the present time, no mining company has established a full-scale mining operation. Industry, government, and environmentalists thus cannot predict the precise impact that deep ocean mining will have on the environment.¹² Preliminary testing, however, indicates that serious environmental consequences may be unavoidable.

Since 1976 the National Oceanic and Atmospheric Administration (NOAA) has conducted ocean mining studies, the Deep Ocean Environmental Studies (DOMES).¹³ These studies recommend a cautious approach to commercial development of the ocean floor and monitor-

about \$2.6 million, [excluding research and development], working capital, and exploration expenditures. If these are included, the total [investment] easily exceeds \$3 billion." Tinsley, *Financial Requirements for Deep Seabed Mining, Mining of the Deep Seabed: Joint Hearings Before the Subcomm. on Public Lands and Resources, and Comm. on Commerce, Science and Transportation on S. 2053*, 95th Cong., 1st Sess. 499, 501 (1977).

11. The 1978 M.I.T. Study estimates that the internal rate-of-return for such a project will be approximately 18%, resulting in a pay-back period of about 5.4 years. 1979 HOUSE REPORT, *supra* note 1, at 28. The M.I.T. Study has also been criticised as being overly optimistic. See Diedrich, Müller & Schneider, *Analysis of the M.I.T. Study on Deep Ocean Mining—Critical Remarks on Technologies and Cost Estimates* (March 1979), reported in 1979 LOS Hearings, *supra* note 2, at 403-415.
12. The development of the deep seabed is an experimental penetration into a largely unexplored world. The world's oceans are estimated to cover approximately 139 million square miles, of which 10.4 million square miles cover the continental shelves. See Monard & Smith, *Hypsometry of Ocean Basin Provinces*, 71 J. OF GEOGRAPHICAL RESEARCH, 4305, 4315 (1966). Yet, as recently as 1967 it was estimated that less than 20 percent of the continental shelf areas of the world had been explored. See N.Y. Times, Feb. 12, 1967, § 3, at 1, col. 1. While the continental shelves have been explored in the past decade, the remaining 130 million square miles of "deep ocean" beyond the continental shelves can be analogized to the vast, unexplored regions of outer space. Man is standing at the edge of a pristine world. Contemplation of possibly irreversible effects of pollution is a necessity. See 1979 LOS Hearings, *supra* note 2, at 278 (statement of Sylvia A. Earle). It is also asserted that because no scientist has had an opportunity to observe, test or consider the effects of an ocean mining site, no one can state with assurance what impact such mining will have on the environment. *Id.* at 290 (statement of James N. Barnes).
13. DOMES, NOAA Technical Memorandum ERL MESA-15, Progress Report, Deep Ocean Mining Study, Phase I (Aug. 1976) [hereinafter cited as 1976 DOMES Report].

ing of mining sites and surrounding areas. The results of Phase I of the studies indicate that deep seabed mining will have an adverse impact on the ocean environment; they are inconclusive in determining the ability of the natural processes in the seas to overcome any negative effect.¹⁴

The NOAA studies predict serious environmental consequences can result from ocean mining operations. The most serious problems are the following: (1) damage from mining sediment discharge, (2) chemical changes in the water environment, (3) temperature changes in the immediate area, (4) increased ocean particulate levels, (5) changes in light penetration levels, (6) transportation of deep-water bacteria and organisms to higher levels, and (7) the entry of heavy metals into the food chain.¹⁵ The DOMES also indicate a specific concern for potential pollution caused by dumping insoluble toxic wastes into the ocean during ship-processing operations.¹⁶

A 1979 Senate committee report¹⁷ highlighted environmental impacts associated with deep ocean mining and ship-processing operations. Most notable is the potential discharge of waste material into the ocean. Deep water mining operations will discharge effluent in "plumes" at the bottom as well as at the surface of the ocean. The toxicity of the heavy metals found in the nodules have also raised Senate concern. The release of toxic metals as waste products may not only damage the immediate environment, but also penetrate the food chain and ultimately poison commercial food species such as tuna.¹⁸

14. *Id.* at xii-xiii. See also the Senate's report on environmental impacts of ocean mining, SEN. COMM. ON ENVIRONMENT AND PUBLIC WORKS, DEEP SEABED MINERAL RESOURCES ACT, S. REP. NO. 96-360, 96th Cong., 1st Sess. 2 (1979) [hereinafter cited as 1979 SENATE ENVIRONMENTAL REPORT].

15. 1976 DOMES Report, *supra* note 13, at 133-149.

16. *Id.* Phase II of DOMES involves on-site tests of one mining company's pilot operations in the North Pacific during April and May, 1978. The results indicate that in a small test-operation environmental impacts were not detrimental to the immediate area. 1979 LOS Hearings, *supra* note 2, at 173-176 (copy of correspondence from Marne A. Dubs to Dr. Robert A. Burns, DOMES Project Manager).

17. 1979 SENATE ENVIRONMENTAL REPORT, *supra* note 14. It is an abbreviated, but accurate, summary of the major environmental threats set out in the DOMES, Phase I. The body of this Senate report is only four pages long, contrasting with more than four thousand pages of published hearings and reports in Congress since the 1972 Metcalf Bill.

18. The report makes the following summary of possible adverse effects of mining on the ocean environment:

Significant effects upon the marine environment can be expected from discharges during deep seabed mining activities, including the disposal of wastes generated by mining and any processing of the recovered minerals at sea.

These wastes will include bottom waters, living organisms or biota, sediment, and nodule fragments. Special concerns have been raised with respect to the potential toxicity of those nodule fragments. Elements such as chromium, cadmium, and arsenic, following possible thermal and/or chemical alteration, could be toxic to marine life. In addition, dumping of untreated waste ammonia acid leachate used in the ocean processing of nodules will disrupt and possibly destroy the ecological balance of the mining processing area.

The hydraulic system expected to be used by most of the joint mining ventures will discharge effluent in plumes at the bottom as well as at the surface of the ocean. These activities have a number of potentially adverse environmental impacts. Sediment materials from surface discharges could penetrate the food chain, ultimately

The dumping of processed waste material, following thermal or chemical processing at sea, may have further toxic effects on the environment.¹⁹ Ammonia leachate and other chemicals used in ship-based processing operations pose a particular threat. Dumping toxic chemicals or "sludge" wastes containing such chemicals into the ocean may disrupt or destroy the ecological balance of the area surrounding the processing-ship.²⁰

Full-scale mining operations have not yet begun, therefore, an estimate of the environmental effects of such activity is impossible, unless scientific studies are conducted at test sites. Monitoring of commercial mining and ship-processing is also necessary. However, commercial operations could not be monitored without the establishment of federal regulations requiring private industry to permit scientific tests at sea. The paramount question to be examined is whether United States regulations will meet international environmental standards.

INTERNATIONAL AND DOMESTIC ENVIRONMENTAL PROTECTION STANDARDS FOR THE WORLD'S OCEANS

International Impact of Ocean Mining Pollution

If toxic wastes from United States' commercial mining operations adversely affect the ocean environment, the international repercussions could be dangerous and unpredictable.²¹ Many developing countries

affecting commercial species such as tuna; these discharges could expose the ocean life system to long-term chronic levels of potentially poisonous heavy metals; they could affect the stimulation of bacterial growth through changes in oxygen levels; and they could reduce light penetration essential for photosynthesis and fish propagation.

It is critical that government increase its efforts to improve scientific understanding of the effects of deep ocean mining.

Id. at 2.

19. See 1979 *LOS Hearings*, *supra* note 2, at 315 (statement of James N. Barnes), where it is reported that "[v]arious processing alternatives would produce different quantities of toxic substances as wastes," but the following would be produced as waste: (1) Barium (76,000 lbs./day); (2) Lanthanum (31,000 lbs./day); (3) Iron (8,600 lbs./day); (4) Vanadium (3,800 lbs./day); (5) Arsenic (864 lbs./day); (6) Thallium (408 lbs./day); (7) Antimony (280 lbs./day); (8) Chromium (171 lbs./day); and (9) Cadmium (12 lbs./day). *Id.* (citing I & II DAMES & MOORE, DESCRIPTION OF MANGANESE NODULE PROCESSING ACTIVITIES FOR ENVIRONMENTAL STUDIES (Aug. 1977)).
20. The alternative mineral extraction processes being considered by industry are (1) an ammonia leaching system, (2) a hydrochloric acid leaching system, and (3) a pyrometallurgical system. Both the ammonia leaching system and the hydrochloric acid leaching system are designed to extract manganese from the nodules. 1979 HOUSE REPORT, *supra* note 2, at 28. The environmental impacts of ammonia leachate has raised the most concern. 1979 SENATE ENVIRONMENTAL REPORT, *supra* note 14, at 2.
21. The sea is an important source of food for many countries. It would be easy to construct a scenario of geopolitical conflict over availability of edible fish. Fish stocks are particularly vulnerable to pollution because their breeding and feeding areas constitute such a small portion of the oceans. See *supra* note 18; Kemp, *Threats from the Seas: Sources for Asian Maritime Conflict*, 19 ORBIS 1037, 1044 (1975), in which the author notes:
 Fish, like oil and gas, are not distributed evenly throughout the oceans. Abundant fish stocks occur where major upwellings of cold, nutrient-rich waters provide food for plant and lower animal life upon which fish feed. The major areas of upwelling consist of less than one percent of the world's ocean surface.
 Historic conflicts over fishing rights have often produced violent international disputes. For example, Japan and the Soviet Union were long in conflict over disputed fishing rights in

are dependent upon the sea for food; sea-dependency increases as world population soars. Developed countries, such as Japan and the Soviet Union, also depend upon the oceans for a large portion of their food supply and are keenly protective of their ocean fishing preserves.²² Ocean mining touches international political issues of the most tender nature. It is therefore in the national interest of the United States to proceed cautiously with commercial mining operations.

Since the oceans cover approximately seventy percent of the earth's surface and are beyond national jurisdiction,²³ international law is the appropriate source of marine pollution control standards. United States' mining activities should meet minimum environmental standards prescribed by the international community. In addition to existing international standards, the pending Law of the Sea (LOS) Treaty will establish an international regime to govern the oceans. The United States should meet the environmental protection standards proposed by the LOS Treaty as well. Conformity with existing and prospective international standards is the appropriate test for domestic deep seabed mining legislation.

Existing International Controls on Ocean Pollution

Current international agreements deal ineffectively with the potential for ocean mining pollution. The international community has only recently become aware of the seriousness of global pollution. Customary international law,²⁴ a slowly evolving body of law, has not kept abreast of technological developments which now make commercial

the North Pacific. During the period 1946-1970, the Soviets seized 1,336 Japanese fishing vessels, with crews totaling 11,316, killing 32 crewmen. *Id.* at 1045.

22. The North Pacific is a critical area for international conflict over marine resources. Japan, Russia, and Asian nations compete in these waters for fish stocks.

Of all the geopolitical areas in the world, none is more replete with sources for conflict [than Asia] . . . [I]ncreasing demand for ocean resources, based on high population growth in the poorer Asian countries and high living standards in the rich Asian countries, will result in intensified competition among regional states for off-shore oil, gas and fish

Id. at 1037 (emphasis added).

On December 10, 1976, Russia moved to protect its ocean fishing claims. The Presidium of the U.S.S.R. Supreme Soviet issued an edict declaring a two-hundred-mile exclusive fishing zone. *Union of Soviet Socialist Republic: Edict on Provisional Measures for the Preservation of Living Resources and the Regulation of Fishing in Marine Areas*, 15 INT'L LEGAL MATERIALS 1381 (1976).

23. While legal authorities agree that the ocean is beyond national jurisdiction, there is historic disagreement in regard to the right of nations or their nationals to lay claim to deep seabed resources. Hugo Grotius, in *Mare Liberum* (1608) and *De Jure Praedae* (1609) wrote that the sea was *res communis*, like the air, and that man may not claim what is the property of all. John Seldon, in *Mare Clausum Sine Dominio Maris* (1635) argued that the ocean was *res nullius*, the property of no one. Seldon's view is the prevalent one today; thus, ocean resources could be claimed by right of dominion. Note, *Exploitation of Seabed Mineral Resources—Chaos or Legal Order?*, 58 CORNELL L. REV. 575, 577 (1973). The emerging view is that the seabed is "the common heritage of mankind." See note 29 *supra*, for the United Nations Resolution (No. 2749) which adopted the modern viewpoint.
24. International legal authorities recognize several elements which make up customary law: (1) "concordant practice" by a number of states relating to a particular situation; (2) continuation of that practice over "a considerable period of time;" (3) a conception

mining feasible. An examination of international accords and agreements, however, reveals a growing concern among nations for the prevention of ocean pollution.

The 1958 Geneva Convention on the Law of the Sea. The earliest attempt to deal with ocean pollution was the Fourth Geneva Convention, the Convention on the High Seas,²⁵ adopted in 1958. Although aimed at the problem of oil-spill pollution, article 24 of the Convention also requires signatory states to prevent marine pollution "resulting from the exploitation and exploration of the seabed and its subsoil, taking account of existing treaty provisions on the subject."²⁶ A liberal interpretation of this article proscribes any form of seabed pollution. Article 25 places a burden on consenting states to prevent pollution of the seas "resulting from any activities with radio-active (sic) materials or *other harmful agents*."²⁷ Unfortunately, this provision could be strictly interpreted as applicable only to ocean pollution caused by oil spills or radioactive wastes.²⁸ The problems of ocean mining pollution, which could not be anticipated by the drafters of the 1958 Geneva Convention, cannot be resolved by reference to this agreement.

United Nations Resolution No. 2749 on the Deep Seabed. On December 17, 1970, the United Nations General Assembly adopted a Declaration of Principles Governing the Deep Sea-Bed (sic) and the Ocean Floor.²⁹ Ratified by the United States, the Resolution declares that the seabed and ocean floor are beyond the limits of national jurisdiction and that the resources located there are "the common heritage of mankind."³⁰ It further declares the need for international measures to prevent marine pollution caused by seabed mining activities.³¹ Members of the United Nations General Assembly who supported this resolution

that the practice is required by or consistent with international law; and (4) general acquiescence in that practice by other states.

H.J. STEINER & D.F. VAGTS, *TRANSNATIONAL LEGAL PROBLEMS* 258 (2d ed. 1976).

25. Convention on the High Seas, Apr. 28, 1958, 13 U.S.T. 2313, T.I.A.S. No. 5200.

26. *Id.* art. 24.

27. *Id.* art. 25(2) (emphasis added).

28. At least one legal authority has argued that the principle *ejusdem generis* could be applied to narrow the scope of article 25(2). See Lancot, *Marine Pollution: A Critique of Present and Proposed International Agreements and Institutions—A Suggested Global Oceans' Environmental Regime*, 24 HASTINGS L.J. 67, 69 (1972). Mr. Lancot's article presents convincing evidence in favor of an international regime for the oceans which provides strong environmental controls.

29. *Declaration of Principles Governing the Sea-Bed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction*, G.A. Res. 2749, 25 U.N. GAOR, Supp. (No. 28) 24, U.N. Doc. A/8028 (1970). The General Assembly vote was impressive with 108 in favor, none against, and 14 abstentions.

30. *Id.*; see, note 22 *supra*, for the conflicting legal doctrines advanced by Grotius and Seldon. The viewpoint adopted by Congress is that existing international law has followed Seldon's doctrine of *res nullius*. Thus, despite United States support for the Resolution, "the common heritage of mankind" remains undefined until the LOS Treaty is ratified.

31. With respect to activities [of the seabed and ocean floor], States shall take appropriate measures for and shall co-operate in the adoption and implementation of international rules, standards and procedures for *inter alia*:

also pledged their cooperation in implementing international rules to avert contamination of the ocean environment.

Although it purports to protect the ocean environment, Resolution No. 2749, like other United Nations resolutions, is "soft law"; unlike a formal treaty, it will not impose binding obligations.³² On the other hand, United Nations resolutions manifest generally accepted jurisprudential values regarding the "spirit" of developing international law.³³

The 1972 Convention on Dumping of Wastes at Sea. The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter was adopted on December 29, 1972. The parties to the Convention, which include the United States,³⁴ promised to "promote the effective control of the marine environment . . . and to take all practicable steps to prevent pollution of the sea by the dumping of waste and other matter [likely] to create hazards to human health,"³⁵ or to the ocean environment. The treaty does not extend to pollution caused by deep ocean mining or ship-processing. Apparently, the drafters anticipated the ultimate adoption of the LOS Treaty and chose to avoid lengthy deliberations and duplication by merely excluding seabed mining activities from the Convention.³⁶

The 1973 Convention on the Prevention of Pollution from Ships. The 1973 Convention to prevent pollution from ships at sea³⁷ suffers from limitations similar to those of the Dumping Convention. Article 2 of

(a) Prevention of pollution and contamination, and other hazards to the marine environment, . . . and of interference with the ecological balance . . .

(b) Protection and conservation of the natural resources of the area and prevention of damage to the flora and fauna.

Id. at 11.

32. KISS, SURVEY OF CURRENT DEVELOPMENTS IN INTERNATIONAL ENVIRONMENTAL LAW 25 (1976). The term "soft law" is apparently an invention of the author, but it accurately describes unenforceable international agreements.

33. *Id.* Social values or ethical considerations promulgate "consensual guidelines" which may ultimately become binding as custom. See note 24 *supra*.

34. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Dec. 29, 1972, 26 U.S.T. 2403, T.I.A.S. No. 8165. The United States ratified the Convention on August 30, 1975.

35. *Id.* art. I.

36. *Id.* art. I, para. (c). See Leitzell, *The Ocean Dumping Convention—A Hopeful Beginning*, 10 SAN DIEGO L. REV. 502, 505 (1973) regarding the duplication of LOS Treaty provisions. The LOS convention was called for by General Assembly resolution in the same year the Dumping Convention was being negotiated.

Article III of the Dumping Convention expressly provides that pollution associated with the exploration or exploitation of the seabed "will not be covered." *Id.* art. III, para. 1(c).

In Article XII, however, the parties pledge to promote international measures to prevent pollution caused by wastes "directly arising from, or related to . . . off-shore processing of seabed mineral resources." *Id.* art. XII(f).

37. International Convention for the Prevention of Pollution from Ships (Nov. 2, 1973) (London Draft) [hereinafter cited as London Draft], reported in 4 LAY, CHURCHILL & NORQUIST, NEW DIRECTIONS IN THE LAW OF THE SEA 345 (1973). The Convention is intended to replace the 1954 London Convention for Prevention of Pollution of the Sea by Oil. Although the London Draft was approved for form and content by 58 delegates, it has not been ratified by a sufficient number of nations to take effect. The 1973 Draft Convention extends shipping restrictions to include an extensive list of chemical and metallic compounds, many of which are indexed in note 19, *supra*.

the Convention precludes controls over pollution which might result from ocean mining activities.³⁸ This restrictive language does not permit sanctions for pollution caused by ocean mining, even where the offending mining operator dumped toxic wastes into the sea from its mining or processing ships.

The 1972 Stockholm Declaration on the Human Environment. The 1972 Stockholm Conference on the Human Environment, held under the auspices of the United Nations, issued formal recommendations concerning international efforts to prevent and control pollution.³⁹ One of the recommendations obliges all nations to take steps to prevent harm to the seas from substances dangerous to marine or human life.⁴⁰ The Stockholm Conference has been praised by ecologists as being a significant step toward developing international cooperation to protect the environment. Like other informal resolutions and international conferences, however, it cannot legally bind any nation to follow its "principles of environmental action."⁴¹

The United Nations Law of the Sea Conference

The First United Nations Conference on the Law of the Sea, the 1958 Geneva Convention,⁴² codified international agreements regarding the use of the oceans and sovereign rights and set forth limited controls on oil spill and radioactive pollution. A second conference, which convened in 1960, failed to reach agreement on fundamental issues, including the right of nations and their nationals to develop deep ocean resources beyond their territorial jurisdiction. During this period of delay and debate, critical international issues relating to the use and development of the oceans were handled on a piecemeal basis. This approach resulted in a disjunctive array of agreements concerning various types of ocean pollution.⁴³

In the meantime, ocean mining technology evolved to the point that commercial recovery of deep seabed nodules became feasible. International debate on the question of commercial development of the ocean floor increased, and in 1972 the United Nations General Assembly

38. London Draft, *supra* note 37, at art. 2(3)(b)(ii).

39. See KISS, *supra* note 32, at 56, for a discussion of the purposes and principles issued by the Stockholm Conference.

40. Principle 7 of the action plan created by the Stockholm Conference is a statement on the obligation of nations to prevent pollution of the ocean. It reads:

States shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

Stockholm Declaration, Declaration on the Human Environment, Stockholm (June 5-16th, 1972), reported in 2 LAY, CHURCHILL & NORQUIST, *supra* note 37, at 715.

41. See KISS, *supra* note 32, at 26.

42. See text accompanying note 25 *supra*.

43. 1979 HOUSE REPORT, *supra* note 1, at 43.

called for an international conference on the law of the sea to deal with all aspects of ocean law.⁴⁴

The goal of this Third United Nations Conference on the Law of the Sea is to develop and implement an international regime for the ocean and its resources. Issues under discussion at the Conference include the exploitation of deep ocean minerals, a two-hundred mile economic zone, freedom of scientific research and exploration, and pollution of the marine environment.⁴⁵ If adopted, the LOS Treaty would establish an International Seabed Authority (Authority)⁴⁶ to govern the enforcement of the ocean regime and commercial development of seabed resources. The Authority is granted broad enforcement powers by the draft convention⁴⁷ and is analogous to the United Nations in its organizational structure and powers. The Authority, through its administrative organ, the Enterprise,⁴⁸ is empowered to engage in seabed mining activities for the benefit of the "common heritage of mankind" and to collect revenues from approved mining operations. Indeed, the dominion of the Authority borders on that of a sovereign nation. It will possess exclusive power to determine the rights of both nations and private entities to explore and exploit the seabed resources of the high seas.⁴⁹

Proposed LOS Treaty Controls on Deep Seabed Mining Pollution. The most recent "Informal Composite Negotiating Text" (draft treaty)⁵⁰ proposes strong environmental protection controls for the oceans. Part XII of the Treaty, entitled "Protection and Preservation of

44. G.A. Res. 2881, 26 U.N. GAOR, Supp. (A/8429) 38, U.N. Doc. A/8429 (1971). The resolution was adopted on December 21, 1971 by a vote of 123 in favor, none opposed and no abstentions.

45. Other important issues being discussed include the right of innocent passage by military vessels and aircraft through straits, settlement of disputes involving the seas, national security and defense, width of the territorial seas, and the definition of internal waters and archipelagoes. See 1979 HOUSE REPORT, *supra* note 1, at 44.

46. 1979 LOS Draft Treaty, *supra* note 5, at art. 156.

47. Among these broad powers are the right to assess contributions from nations, the adoption of rules and regulations for the sharing of economic benefits derived from the seabed, and the right to implement regulations to carry on commercial operations on the seabed for the benefit of mankind. See generally *id.* arts. 153, 160, & 162.

48. The Enterprise is empowered to carry out "transportation, processing and marketing of minerals" from the seabed. *Id.* art. 170.

49. *Id.* arts. 153, 160, 162 & 170. By the LOS Treaty, nations affirm that they have no sovereignty over the deep ocean floor. They thereby grant to the Authority the sole right to develop the area "for the benefit of mankind." While an examination of the organization of the Authority is beyond the scope of this note, it should be understood that such broad powers created an ideological stumbling block to United States consideration of the LOS Treaty. An example of industry's concern that the Authority would be dominated by the "Third World" can be found in 1979 LOS Hearings, *supra* note 2, at 170 (statement of Marne A. Dubs).

50. Draft Convention on the Law of the Sea (Informal Text), U.N. Doc. A/Conf.62/WP.10/Rev. 3 (Aug. 27, 1980) [hereinafter cited as 1980 Draft LOS Convention]. This draft negotiating text was prepared for the Ninth Session of the United Nations LOS Conference, held in Geneva from July 28 to August 29, 1980.

the Marine Environment,”⁵¹ sets forth broad guidelines which obligate nations to protect and preserve the ocean environment. For example, article 209 requires the coastal states “adopt laws and regulations . . . to prevent, reduce and control pollution . . . from activities in the [a]rea undertaken by vessels, installations or structures [under their jurisdiction, registry or operating under their authority].”⁵² Under article 194 of the Treaty, nations must take precautions to see that “rare or fragile ecosystems” are protected and that they will “take all necessary steps” to prevent, reduce and control marine pollution arising “from any source.”⁵³ Article 195 obliges nations to take care not to transfer damage or hazards of pollution from one area to another,⁵⁴ while article 196 requires nations to take “all necessary steps” to avert pollution caused by the introduction of new or alien species into the environment.⁵⁵

Signatory parties are also required to take precautions against environmental contamination resulting from the development or use of new technology.⁵⁶ Nations must monitor activities conducted under their jurisdiction or control that are likely to cause environmental harm.⁵⁷ They must also cooperate to promote international studies, scientific research, and the exchange of information on marine pollution.⁵⁸

Consequences of the Law of the Sea Treaty for the United States' Mining Program. Beyond requirements for strong environmental protection after ratification, the Treaty apparently compels signatory states to pass interim domestic legislation. The interim provisions protect the environment during the period between final negotiation of the treaty and the date of its implementation. For example, several treaty provisions require nations to “take all necessary measures” to combat pollution of the ocean or to “adopt domestic laws and regulations” designed to “prevent, reduce and control” pollution from various sources.⁵⁹ It would be impossible for a nation to live up to its treaty obligations, unless it acted immediately to pass interim legislation to control marine pollution arising from seabed mining or other sources.

Several years may pass between the successful negotiation of the LOS Treaty and its implementation. Because the United States did not

51. *Id.* The Draft Treaty is organized into comprehensive sections (Parts) with subsections (Articles) indicating major topical areas within each section.

52. *Id.* art. 209, para. 2(c); see Appendix I.

53. *Id.* art. 194, para. 3(c); see Appendix I.

54. *Id.* art. 195; see Appendix I.

55. *Id.* art. 196, para. 1; see Appendix I.

56. 1980 Draft LOS Convention, *supra* note 50; see Appendix I.

57. *Id.* art. 204, para. 1. The Treaty requires nations to “keep under surveillance the effects of any activities which they permit [or engage in] to determine whether these activities are likely to pollute the environment.” *Id.* art. 201, para. 2 (emphasis added).

58. *Id.* art. 200; see Appendix I.

59. *Id.* arts. 194, 196, 205, 206, 207, 208, 210, 217, & 209, para. 2. See Appendix I.

support the United Nations moratorium on deep seabed mining,⁶⁰ United States' nationals were free to engage in unregulated ocean mining operations. Passage of the Act established interim global regulations on American nationals involved in the development of ocean mining. By enacting legislation designed to forestall mining activity and prevent pollution, the United States acted prospectively to avoid violation of future LOS Treaty obligations.

The Deep Seabed Hard Mineral Resources Act

While an international regime for the oceans was being delayed by international debate, United States and foreign mining consortia were being formed for the expeditious development of the deep seabed.⁶¹ The growing need for interim ocean mining controls culminated in Congressional enactment of the Deep Seabed Hard Mineral Resources Act, designed to promote the "orderly development"⁶² of the manganese nodule by United States mining operators. The act has six main purposes:

Transition to the International Regime for the Oceans. The Act recognizes the need for an international regime to govern ocean mining.⁶³ It also provides for federal regulation of United States' nationals involved in ocean exploration or mining activities. Upon ratification of the LOS Treaty, the provisions of the Act that are inconsistent with the Treaty will no longer govern deep ocean mining.⁶⁴

Establishment of Taxes for the Provision of a Trust Fund. The Act establishes an extraction tax to ensure the formation of a revenue-sharing trust fund. The United States may use this fund to meet financial obligations imposed by the LOS Treaty.⁶⁵ The imposition of this tax provision is also intended to show the United States' good faith compliance with the LOS Treaty obligation to develop ocean floor resources for the "common heritage of mankind."

Promotion of LOS Negotiations and Definition of International Obligations. The legislation encourages the successful negotiation of a

60. G.A. Res. 2574 D. Supp. (No. 30) 10, U.N. Doc. A/7630 (1969). The vote was 62 in favor, 28 against and 28 abstentions.

61. See Appendix II.

62. 1979 HOUSE REPORT, *supra* note 1, at 1.

63. Act, *supra* note 1, at § 2(a).

64. *Id.* §§ 2(b)(1), (2), (3), 201 & 202.

65. Under the provisions of The Deep Seabed Hard Mineral Removal Tax Act of 1979, 26 U.S.C.A. § 4495 (West Supp. 1980), the amount of tax imposed is 3.5% of the imputed value of all mineral resources removed by the operator. The Deep Seabed Revenue Sharing Trust Fund is incorporated as § 403 of the Act. The act provides that "[i]f an international deep seabed treaty is ratified [by the United States within ten years after] the date of enactment of this Act, . . . the Trust Fund shall be available . . . for making contributions [which are required under the treaty]."

comprehensive LOS Treaty.⁶⁶ The Act also describes United States concern that the phrase "common heritage of mankind" has never been legally defined. It not only requests that the term be defined by future LOS negotiations,⁶⁷ but also posits a formula for other nations to follow in defining the parameters of such language. In establishing controls on pollution, setting up a trust fund, and requiring conservation of resources, the Act proposes itself as a model for other nations to adopt.

Provision for Agreements with Other Nations to Mine the Seabed. The Act authorizes the United States to enter into agreements with other nations regarding the development of seabed mineral resources. The President is empowered to designate as "reciprocating states" those foreign countries willing to meet United States standards (or comparable standards)⁶⁸ for exploration and recovery of seabed minerals. In granting such power, the legislation authorizes executive agreements with foreign powers regarding mining of the ocean floor.

Securement of Investment Capital to Develop Seabed Resources. Prior to the passage of this legislation, banks were unwilling to lend the huge sums necessary for development of the ocean floor, because the legal status of seabed mining was uncertain.⁶⁹ By providing domestic mechanisms facilitating ocean exploration and recovery operations, the United States eliminated the need for mining consortia to rely on international law to justify their mining operations. The Act will thus enable domestic mining companies to obtain investment capital for the development of seabed nodules.

66. First, the Act acknowledges that "it is in the national interest of the United States and other nations to encourage a widely acceptable Law of the Sea Treaty, which will provide a new legal order for the oceans . . . including [the development of the seabed]." Act, *supra* note 1, at § 2(a)(8). Second, the Act indicates that it is designed "to establish an interim legal regime under which technology can be developed and the exploration and recovery of [seabed nodules] can take place until such time as the Law of the Sea Treaty enters into force with respect to the United States." *Id.* § 2(a)(16). Third, Congress declares that among the purposes of the Act are ". . . to encourage the successful conclusion of [the LOS Conference] which will give legal definition to the principle that the hard mineral resources of the deep seabed are the common heritage of mankind and which will assure [nondiscriminatory access to seabed resources for all nations]." *Id.* § 2(b)(1). Fourth, the Act disclaims any assertion of national sovereignty over the deep seabed resources and merely extends jurisdiction over United States nationals and vessels, and foreign nationals and vessels coming under United States maritime jurisdiction. *Id.* § 3(a)(1) and (2). Finally, the Act encourages the Secretary of State to negotiate a comprehensive LOS Treaty which will, among other things, adequately protect the ocean environment from adverse impacts of commercial mining. *Id.* § 3(b)(1) & (2).

67. *Id.* § 2(b)(1); see also notes 23 & 30 *supra*.

68. Act, *supra* note 1, at § 118. Under § 118(e) the President is empowered to enter into Executive Agreements with other nations to designate them as "reciprocating states."

69. In his prepared statement before the Subcommittee on Oceanography, Mr. Marne A. Dubs, Director of Ocean Resources Development with Kennecott Copper Corp. and a representative of the American Mining Congress, noted that banks were unwilling to loan funds needed by the consortia, because the LOS Treaty might "vitiate that investment." 1979 LOS Hearings, *supra* note 2, at 160.

Provision for Regulation of the Mining Industry and Protection of the Environment. The Act empowers the NOAA to administer the legislation, regulate ocean exploration and mining activity, issue permits and licenses, and conduct environmental testing.⁷⁰ Pursuant to these powers, the NOAA will issue licenses to citizens engaging in exploration for seabed resources⁷¹ and mining permits to citizens seeking to establish commercial recovery operations.⁷² It will also delimit mining areas subject to ongoing environmental testing and control standards.⁷³

Environmental Protection Provisions of the Act

Monitoring and Testing. The Act establishes strong environmental protection standards. The NOAA is directed to expand and accelerate its deep ocean studies, the DOMES, in order to assess the immediate consequences of exploration and mining on the environment.⁷⁴ In addition, the legislation requires the ongoing testing and assessment of ship-based and land-based mineral processing operations.⁷⁵ The NOAA must also monitor mining operations for environmental affects "through[out] the period of exploration and commercial recovery authorized by [the] Act."⁷⁶

Permits and Licensing. The legislation authorizes the NOAA to set the terms, conditions, and restrictions for licenses and mining permits. The standards for licensure and permit issuance are strictly administered to ensure that commercial operators "use the best available technologies for the protection [of the marine environment]."⁷⁷ The Administrator of the NOAA may ease these standards whenever the benefits derived from them are outweighed by adverse "incremental costs."⁷⁸

The legislation also adopts a framework for environmental control set out in the Clean Water Act.⁷⁹ This framework ensures that com-

70. See Act, *supra* note 1, at §§ 4, 12, 102, 103, 105, 106, 109, 114, 301, 304 & 308.

71. *Id.* §§ 102, 103, 105, 106 & 107.

72. *Id.* §§ 102, 103, 105, 106 & 107.

73. *Id.* § 109(f).

74. The Administrator shall expand and accelerate the program assessing the effects on the environment from exploration and commercial activities, including seabed processing and the disposal of processing wastes, so as to provide an assessment, as accurate as practicable, of environmental impacts.

Id. § 109(a)(1).

75. *Id.* § 109(a)(2). This monitoring activity is called "supporting ocean research." It includes projected studies of (a) natural diversity of seabed biota, (b) life histories of major benthic, midwater, and surface water organisms most likely to be affected by seabed activities, (c) long and short term effects on seabed biota, and (d) assessment of seabased processing of minerals. *Id.*

76. *Id.*

77. *Id.* § 109(2)(b).

78. *Id.*

79. *Id.* § 109(e). The Clean Water Act, 33 U.S.C. § 1251 (1977) [hereinafter cited as *CWA*], is applied to the ocean by this section, excluding that portion of CWA which exempts "vessels

mercial recovery operations on the high seas will meet Environmental Protection Agency (EPA) standards set down by the National Pollutant Discharge Elimination System (NPDES).⁸⁰ The inclusion of the NPDES regulations in the Act establishes appropriate norms for the testing of mining pollutant levels. In addition, it enables the Administrator of the NOAA to set reasonable criteria for the issuance of licenses and permits, as well as for their suspension or revocation.⁸¹

Environmental Impact Statements. The Act requires Programmatic Environmental Impact Statements (PEIS)⁸² to assure future compliance with its environmental protection standards. It establishes the NOAA and EPA as "joint lead agencies" for the preparation of PEIS's. Additionally, the Administrator of the NOAA is required to consult with other federal agencies⁸³ regarding the issuance of PEIS's at the beginning of commercial activity.⁸⁴ In order to guarantee the submission of outside comments to the administrative body, reasonable notice must be given to all interested parties whenever PEIS's are proposed. Finally, an additional measure of administrative notice results from a requirement that final PEIS's be published.⁸⁵

Sanctions for Noncompliance. Beyond administrative action to suspend or revoke licenses and permits,⁸⁶ the Act provides civil and criminal penalties for violation of either the Act or NOAA regulations.⁸⁷

and other floating craft" from federal water control standards, *CWA* § 502(12)(B). The Environmental Protection Agency (EPA) regulations on the discharge of pollutants under the CWA are thus made applicable to high seas mining operations.

80. The National Pollution Discharge Elimination System (NPDES) is a set of federal regulations which proscribe the discharge of any form of pollution (defined by law) into internal domestic waters or the ocean, under *CWA*, *supra* note 79, §§ 402 & 403.

81. See the standards set by the NPDES, published by the federal government in EPA National Pollution Discharge Elimination System, 40 C.F.R. § 125 (1973).

82. Act, *supra* note 1, at § 109(c) & (d). Additionally, § 109(d) provides that the issuance of any license or permit is deemed to be "a major Federal action significantly affecting the quality of the human environment," which thereby applies § 102 of the National Environmental Policy Act, 42 U.S.C. § 4332 (1969), to ocean mining activities.

83. The Act requires the Administrator of the NOAA to consult with the EPA, the Secretary of State, and the Secretary of the branch of government that is in charge of the United States Coast Guard, before promulgating regulations. Act, *supra* note 1, at § 109(b).

84. PEIS's are required whenever a license or permit is issued. *Id.* § 109(d). PEIS's are also required to be completed immediately for areas of the ocean which are expected to be sites for exploration and mining soon after the Act's passage. *Id.* § 109(c). The Act also establishes the NOAA and EPA as joint lead agencies for the preparation of PEIS's. *Id.* § 109(c). In those areas of the ocean which are likely to be first exploited, the NOAA is required to issue PEIS's within two hundred and seventy days after passage of the Act. *Id.* § 109(c)(2)(A). In addition, § 109(c)(2)(B) requires that all PEIS's shall be published in final form within one hundred and eighty days after the draft environmental impact statement is published.

85. *Id.* § 109(c)(2)(B).

86. *Id.* § 106(a)(2). Any permittee or licensee is entitled to a full adjudicative hearing on the modification, suspension or revocation of a permit or license. *Id.* § 106(a)(2)(B).

87. See *id.* at §§ 301 (defines prohibited acts), 302 (civil penalties), 303 (criminal penalties); see Appendix I.

The Act schedules daily assessments of penalties, encouraging early compliance with its provisions.⁸⁸ Civil penalties may be assessed by the Administrator of the NOAA,⁸⁹ and enforcement of the Act on the high seas is within the purview of the United States Coast Guard.⁹⁰

Private Civil Action. The Act grants standing to any person "having a valid legal interest which is or may be adversely affected"⁹¹ by commercial exploration or mining activity. Jurisdiction is established in the United States District Court for the District of Columbia, without regard to the amount in controversy or the nationality of the plaintiff.⁹² Suit may be brought against any person for alleged violations of the Act or against the NOAA Administrator for improper enforcement of the Act.⁹³ The Act provides for equitable remedies, monetary damages, and the award of costs and fees when the court finds that such an award is appropriate.⁹⁴

ASSESSMENT OF THE ACT'S ENVIRONMENTAL PROTECTION STANDARDS IN LIGHT OF DOMESTIC AND INTERNATIONAL CONSIDERATIONS

Domestic Considerations

The Act will afford reasonable protection for the marine environment and establish interim guidelines to regulate seabed mining activity. It guarantees gradual transition to full-scale mining operations by prohibiting seabed mining until 1988,⁹⁵ yet permits exploration and technological development with concurrent environmental monitoring. Finally, it adopts a mechanism to incorporate international treaties which may be ratified in the coming years.

Administration of the Act by the NOAA will assure effective enforcement of its provisions. The NOAA provides flexibility for future environmental control objectives. The Act leaves the NOAA free to expand its DOMES monitoring and adopts a cautious approach to the enactment of specific environmental control regulations. Thus, it attempts to balance the interests of the mining industry against the protection of the marine environment.

Ocean mining is an infant industry, and its future is unsettled.

88. See Appendix I.

89. Act, *supra* note 1, at § 302(a). Any person subject to a civil penalty under the preceding section may obtain review in a federal district court upon proper filing of notice of appeal. *Id.* § 302(b).

90. *Id.* § 304.

91. *Id.* § 117(a).

92. *Id.* §§ 117(a) (jurisdiction of the court), 117(a)(2) (standing).

93. *Id.* § 117(a)(2).

94. *Id.* § 117(c).

95. The Act proscribes any issuance of an exploration license before July 1, 1981. Mining permits are to be prohibited until January 1, 1988. *Id.* § 102(c)(1)(D).

While the NOAA is currently recognized in the international sphere for its oceanic research programs, it is also a relatively small and highly specialized federal agency.⁹⁶ Its specialization may make the NOAA more efficient in dealing with ocean mining problems than a larger administrative body. For example, the NOAA may be more efficient in granting a ruling on aspects of mining technology or environmental criteria crucial to the future of a particular mining operation than would a larger, more established agency.

The Act imposes relatively moderate economic sanctions upon industry for noncompliance with federal standards. While higher civil and criminal penalties may encourage compliance with environmental protection regulations, two arguments may be set forth in favor of the penalties set by the Act. First, severely penalizing an infant industry during its critical developmental stage is unwise. Although the mining industry is an industrial giant, the tremendous outlays of capital required to set up an ocean mining operation present a significant risk, especially in view of the unknown environmental consequences. Secondly, even severe economic sanctions may not deter mining companies from violating the law. In certain instances, administrative action to suspend or revoke a license or permit may be more effective than high penalties. In situations where the mining operation is earning high profits, economic sanctions would be of only relative effect. Ultimately, the desirability of heavy sanctions must be weighed against the drawback of excluding smaller mining operators from participating in ocean exploration or recovery operations. For these reasons, it is better to delay passage of legislation imposing heavier economic sanctions until the mining industry begins to generate significant profits or an enforcement problem arises.

From the viewpoint of the mining industry, the Act represents a compromise forged during protracted Congressional hearings and deliberations. The mining consortia required a seabed mining act in order to acquire investment capital. To achieve that end, industry was willing to recognize the need for strong environmental provisions to assure that deep ocean mining activity would not pollute the seas.⁹⁷

96. The National Oceanic and Atmospheric Administration (NOAA) was formed on October 3, 1970. The primary mission of the NOAA is to explore, map and chart the global ocean and its environs. It is responsible for monitoring and predicting weather conditions affecting the ocean, atmosphere and sun, and to issue warnings about destructive natural events. In addition to environmental monitoring, the NOAA provides weather reporting service for the United States and territories. The NOAA also oversees an integrated program of management, research and service related to the protection and use of marine resources. See OFFICE OF THE FEDERAL REGISTER, NATIONAL ARCHIVES AND RECORDS SERVICE, UNITED STATES GOVERNMENT MANUAL 167-169 (rev. ed. 1980).

97. Testimony of mining industry officials before Congress reveals a gradual appreciation for the arguments of environmentalists. While industry spokesmen cannot be characterized as being convinced of environmental hazards, they have shown a willingness to compromise in order to secure a balanced deep seabed mining act which would allow securement of bank capital. For example, Mr. Marne A. Dubs, representing the American Mining Congress, ex-

From the viewpoint of environmentalists, however, the Act is beneficial. Environmental groups have standing under the Act to obtain either equitable relief against noncomplying mining operators or a writ of mandamus against the Administrator of the NOAA. Under the constitutional standard for standing to sue for "esthetic" or environmental injury, environmental groups must show some "particularized injury" to themselves or to individual members of the group.⁹⁸ While such a showing may be difficult in cases involving ocean pollution, it will be possible for an environmental group to join its claim to that of another party who suffers a more tangible injury. In fact, it is conceivable that a foreign plaintiff may be joined by an international environmental group pursuing remedies in a United States court for injuries arising on foreign shores due to mining operations conducted on the high seas.

International Considerations

Whether or not the United States ultimately ratifies the LOS Treaty, ocean pollution continues to be a significant international issue. While full-scale ocean mining does not yet exist, ocean mining companies are now expanding their operations.⁹⁹ Even experimental ocean mining could have an impact upon the ocean environment. Some form of international control on the mining consortia is necessary. Domestic legislation creates needed controls over United States mining operators to assure that seabed exploration and recovery programs will be monitored.

The legislation also establishes strong environmental controls similar to those required by the LOS Treaty. The Act thereby signals to the delegates of the LOS Conference the United States' commitment to environmental protection and deep seabed mining.

Several years may pass before the LOS Treaty is ratified. During this period, domestic legislation will foster continued scientific exploration of the oceans and, at the same time, compel environmental monitoring of exploration activity. Furthermore, the Act delays full-scale

pressed the willingness of the mining industry to support the final version of S. 493. As he stated:

[F]or all practical purposes, we believe that industry, the Administration, the environmental community and other interested groups have [made] a very successful attempt to develop a more uniformly acceptable bill Our assessment is that this Senate bill, now S. 493, probably commands the widest range of support among all interested parties, primarily because of the painstaking efforts to hammer out compromise provisions which reflect the balance of interests at stake.

1979 *LOS Hearings*, *supra* note 2, at 163.

98. *Sierra Club v. Morton*, 405 U.S. 727 (1972) (an individualized noneconomic injury may amount to an "injury in fact"); *United States v. SCRAP*, 412 U.S. 699 (1973) (an allegation that individual members of the plaintiff organization will suffer in their use of the environment adequately raises standing); *Duke Power Co. v. Carolina Env. Study Gp.*, 438 U.S. 59 (1978) (a causal connection between the environmental injury complained of and the constitutional rights being asserted need not be demonstrated for the purpose of standing).
99. See Appendix II.

mining operations until 1988. In the event that the LOS Treaty has not been fully implemented by that date, the Act guarantees that the harmful environmental effects of such operations will be studied. The Act thereby establishes a framework for domestic compliance with the LOS Treaty and coordination with an international regime for the oceans.¹⁰⁰

Domestic legislation makes possible the transition to the oceanic regime being devised by the LOS Conference. Its taxation of the mining industry will establish a trust fund that will eventually be used to meet United States obligations imposed by the International Seabed Authority.¹⁰¹ More importantly, the Act imposes strong environmental control regulations on exploratory and mining operations in the oceans. These regulations not only create a framework for domestic adoption of the LOS Treaty but provide a pattern for other nations to follow in establishing their own marine pollution standards.

CONCLUSION

After years of deliberation and compromise, the United States has passed an interim deep seabed mining act with strong controls for environmental protection. The mining consortia involved in the development of deep ocean mining have displayed a willingness to cooperate in establishing such controls, because their cooperation aided the passage of legislation promoting the timely development of investment capital. Prospective profits are substantial. Mining operators can, therefore, afford to proceed with caution. Without compulsion by international agreement, the United States has undertaken the responsibility to impose upon domestic mining operations stringent requirements for the protection of the shared ocean environment. In so doing, the United States has not only demonstrated its commitment to achieving international environmental goals but also set the stage for ultimate ratification of the oceanic regime established by the Law of the Sea Treaty.

The Deep Seabed Hard Mineral Resources Act has addressed forthrightly the complex problems involved in establishing federal guidelines to protect the marine environment. While passage of legislation, alone, is merely a first step, it permits deep ocean mining to proceed at a cautious pace—given optimal cooperation among industry, environ-

100. See Appendix I.

101. See note 65 *supra*.

mentalists, and government.¹⁰²

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102. The Reagan Administration has announced a program to reevaluate government regulations which impact domestic industry. A shift in federal policy could require administrative agencies to ease environmental control regulations. While some softening of government regulation may be desirable to ease economic stagnation, it would be extremely unwise for the United States to ease environmental regulations on deep seabed mining operations. In addition to raising the international issues discussed in this note, such a change in policy would destroy legislation which has been eight years in the making. The mining industry has expressed its willingness to live with the Act. Given the prospective impact of mining on the ocean environment, and the obligations for environmental protection imposed by the pending oceanic regime, the Administration should permit this legislation to fulfill its intended objectives.

The Reagan Administration has also announced deferment of final conference action on the LOS Treaty. While it is understandable that the new administration would want to review these complex negotiations, it would be inadvisable for the government to abandon compromises which were won in "tough and protracted battles" with other nations. See *The Wallstreet Journal*, Mar. 9, 1981, at 17, col. 4 (letter to the editor by Elliot L. Richardson).

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APPENDIX I

SIGNIFICANT ENVIRONMENTAL CONTROL PROVISIONS OF THE LOS TREATY¹ COMPARED TO
RELEVANT PROVISIONS OF THE DEEP SEABED HARD MINERALS RESOURCES ACT²

Relevant Treaty Provision	LOS Treaty Requirements of Signatory States	Relevant Provisions of the Act
Art. 194	(1). Shall "take all necessary measures" to prevent, reduce and control marine pollution "from any source."	§ 109(a) (1) DOMES research accelerated. (a) (2) Increased on-site research required.
	(2). Shall see that pollution arising under national jurisdiction or control does not spread to areas beyond such sovereign control.	§ 109(b) Licenses and permits are contingent upon the use of the "best available technology[y]."
	(3). Shall not release any "toxic, harmful or noxious substance" into the environment.	§ 109(c) PEIS's (environmental impact statements) required for prospective mining areas.
	(4). Shall protect "rare or fragile ecosystems."	
Art. 195	Shall not transfer damage or hazards of pollution from one ocean area to another.	§ 109(d) Issuance of licenses or permits requires PEIS's under § 102 of the National Environmental Policy Act, 42 U.S.C. § 4332 (1969).
Art. 196	Shall "take all necessary measures" to prevent, reduce and control pollution related to new technological developments, or the introduction of new or alien species into the environment.	§ 109(e) The Clean Water Act is applied to ships operating on the high seas, 33 U.S.C. § 1362 (1977).

Relevant Treaty Provision	LOS Treaty Requirements of Signatory States	Relevant Provisions of the Act
		<p>§ 109(f) Stable reference areas established for study.</p> <p>§ 114 On-site monitoring of commercial operators is required.</p> <p>§ 308 NOAA Administrator is empowered to issue regulations to enforce the Act.</p>
Art. 197	Shall cooperate to establish global and regional rules, standards and procedures to protect the ocean environment.	<p>§ 118(f) International Consultations regarding oceanbed research or mining is required, especially where the foreign nation plans seabed activities.</p> <p>§ 109(f) Stable reference areas are to be established in consultation with other nations, under § 118(f).</p> <p>§ 118(a) "Reciprocating" nations are required to meet United States' or comparable environmental protection standards.</p>
Art. 198	Shall notify other nations "likely to be affected" by marine pollution, whenever there is "imminent danger" of harm; in addition, "competent international organizations" are to be notified.	Emergency consultations per se are not required.

Relevant Treaty Provision	LOS Treaty Requirements of Signatory States	Relevant Provisions of the Act
		§ 118(f) Requires the Administrator of the NOAA to provide foreign nations with environmental impact projections and technical assistance to design environmental protection measures.
Art. 199	Shall jointly develop contingency plans to cooperate with other nations and international bodies to prevent, minimize or eliminate effects of pollution.	SAME as art. 197, 198.
Art. 200	Shall cooperate to promote international studies, scientific research and the exchange of information about marine pollution.	SAME as art. 197, 198, 199.
Art. 201	Shall cooperate to establish scientific criteria for the formulation of rules, standards and procedures to prevent and control pollution.	SAME as art. 197, 198, 199, 200.
Art. 202	(1). Shall promote programs for education, technical and scientific assistance to developing nations for protection of the marine environment. (2). Shall provide assistance to developing states for environmental assessments and to minimize effects of pollution.	SAME as art. 197, 198, 199, 200, 201.

Relevant Treaty Provision	LOS Treaty Requirements of Signatory States	Relevant Provisions of the Act
Art. 204	Shall observe, monitor, evaluate and analyze risks or effects of pollution, especially those activities permitted or engaged in which are "likely to pollute the marine environment."	SAME as art. 194, 195, 196.
Art. 205	Shall publish reports and results of evaluations conducted under art. 204.	<p>§ 109(c) PEIS's for prospective mining areas required; PEIS publication is required.</p> <p>§ 109(d) Issuance of licenses or permits requires PEIS's under § 102 of the Environmental Policy Act, 42 U.S.C. § 4332 (1969), PEIS publication is required.</p> <p>§ 113(c) Public disclosure of documents, reports and other records of the NOAA is to be made available upon request by "any person."</p> <p>§ 309(b) (3) Biennial submission of NOAA reports to Congress regarding environmental impacts and assessments is required.</p>
Art. 206	Shall assess potential harmful effects of planned activities under sovereign jurisdiction and control which "may cause substantial pollution, or significant and harmful changes" in the marine environment.	SAME as art. 194, 195, 196, 204.

Relevant Treaty Provision	LOS Treaty Requirements of Signatory States	Relevant Provisions of the Act
Art. 207	Shall adopt domestic laws and regulations to prevent, reduce and control marine pollution from <i>land-based</i> sources.	<p>§ 4(1) (C) Any waste material from hard mineral resources, regardless of its industrial origin, is covered by the Act if disposal will be made at sea.</p> <p>§ 102(c) (5) As a general rule, all land-based processing plants must be located in the United States. This section requires the NOAA to approve all locations outside the United States.</p>
Art. 208	Shall adopt domestic laws and regulations to prevent, reduce and control marine pollution from <i>seabed activities</i> .	SAME as art. 194, 195, 196, 204, 206.
Art. 209	<p>(1). Provides for the establishment of international rules and standards related to marine pollution arising from activities conducted on the ocean floor, beyond the national jurisdiction of any nation.</p> <p>(2). States shall adopt domestic laws and regulations to prevent, reduce and control pollution arising from <i>national vessels</i>, installations, structures or devices.</p>	<p>(1). Not applicable. Certain provisions will aid in the establishment of international standards. <i>See</i>, art. 197, 198, 199, 200, 201.</p> <p>(2). same as art. 194, 195, 196, 204, 208.</p>

Relevant Treaty Provision	LOS Treaty Requirements of Signatory States	Relevant Provisions of the Act
		§ 305 establishes liability <i>in rem</i> for any national vessel in violation of civil or criminal provisions of the Act. Domestic case law defines "vessel" to include any "floating structure capable of transporting something over water."
Art. 210	Shall adopt domestic laws and regulations to prevent, reduce and control pollution related to <i>dumping</i> .	SAME as art. 207.
Art. 211	Shall cooperate to establish international standards to control pollution related to national vessels, <i>foreign vessels in internal waters</i> , off-shore terminals and foreign vessels operating within the territorial sea or economic zone.	SAME as art. 209, item (1). Foreign vessels in internal United States waters must comply with domestic laws regarding pollution. Foreign vessels in the territorial sea or economic zone are not covered by the Act.
Art. 217	<i>Penalties</i> set by <i>domestic laws</i> and regulations related to pollution from national vessels shall be "adequate in severity to discourage violations."	§ 106(a) (2) Grants the NOAA the power to suspend or revoke any license or permit, or to suspend or revoke or modify any activities covered by the license or permit. § 301 Broadly defines "prohibited acts" to include any provision of the Act, or any term, condition or restriction on any license or permit, or any regulation set by the NOAA.

Relevant Treaty Provision	LOS Treaty Requirements of Signatory States	Relevant Provisions of the Act
		§ 302 Permits the NOAA to set civil penalties at \$25,000 (max.) for each violation. Each day of noncompliance is deemed to be a separate offense.
		§ 303 Sets criminal fines and punishment at \$75,000 (max.) for each day of noncompliance. Imprisonment for not more than six months, or both.
		§ 305 Vessels in violation of § 301 may be held liable <i>in rem</i> for civil or criminal fines or penalties assessed by a federal court.
		§ 306 Vessels, mineral resources and equipment may be subject to forfeiture to the United States.

¹ Draft Convention on the Law of the Sea (Informal Text), A/Conf.62/WP.10/Rev.3 (27 Aug. 1980).

² Act of June 28, 1980, Pub. L. No. 96-283, § 1, 94 Stat. 553 (codified at 30 U.S.C.A. § 1401 (West Supp. 1980)) [hereinafter cited as Act].

APPENDIX II

DEEPSEA MINING CONSORTIA

Manganese nodules, potato-shaped objects which pave sections of the sea floor beneath 3,000-6,000 metres of water, have long been the subject of scientific interest. Recently, a number of companies have become interested in mining nodules as a business: nodules, after all, constitute an ore, basically of manganese, but with commercially interesting proportions of nickel, copper, cobalt and various trace metals.¹

The main actors on the commercial stage are eight consortia, six of which are actively engaged in operations. Bringing these resources into full commercial production will require considerable research and development work, capital, skilled labour and sophisticated hardware, all of which are beyond the ability of one company to put its resources to risk. So, consortia perform a division of labour and a sharing of risk. The information given below on the composition and activities of the consortia has been gathered from published sources and from consultations with industry insiders and analysts. Its purpose is to identify the actors and their work to date, and it is not, by any means, an analysis of the industry.

1. KENNECOTT EXPLORATION CORPORATION

Commonly known as: Kennecott Group. Established: January 1974.

Equity capital: \$50 m.

Composition:

Kennecott Copper Corp. - USA		50%
	Subs: RTZ Deepsea	
Rio Tinto Zinc (RTZ) Ltd. - UK	Enterprises Ltd.	10%
Consolidated Goldfields Ltd. - UK		10%
British Petroleum (BP) Co. - UK	Subs: BP Minerals Ltd.	10%
Noranda Mines Ltd. - Canada		10%
Mitsubishi Corp. - Japan		10%

Exploration activities: Extensive exploration in the Clarion-Clipperton Zone; last cruise in 1977; no longer actively exploring.

Test mining activities: Collector test, at one-fifth scale, in 1975. Pipe system tested at sea.

Test processing activities: Finished construction of a pilot processing plant in 1976; capacity is about one-half ton per day. Essentially inactive since 1976.

Plans: To test mining system of one-fifth scale including collector as well as ore-lifting method.

2. OCEAN MINING ASSOCIATES (Acronym: OMA)

Commonly known as: US Steel Group or Deepsea Ventures Group.

Established: 1974. Equity capital: \$50 m.

Composition:

United States Steel (USS) Corp. - USA	Subs: Essex Minerals Co.	33-1/3%
United Minière S.A. - Belgium	Subs: Union Seas Inc.	33-1/3%
Sun Co. Inc. - USA	Subs: Sun Ocean Ventures	33-1/3%

This consortium evolved out of Deepsea Ventures Inc. (DVI), which started as a wholly-owned subsidiary of Tenneco - USA and was joined by Japanese Manganese Nodule Development Co. (JAMCO), a Japanese group consisting of C. Itoh, Nichimen and Kanematsu-Gosho. Later, US Steel and Union Minière joined the venture, but Tenneco and JAMCO withdrew. With Sun as a recent partner, OMA was formed.

Exploration activities: Extensive exploration in Clarion-Clipperton Zone by exploration ship *Prospector*; 1974 — claims announced for a 60,000 sq. km. minesite in the Zone, between latitudes 14°16' N and 15°44' N, and between longitudes 124°20' W and 127°46' W.

Test mining activities: 1970 - DVI demonstrated airlift system offshore Florida at depth of 800 m; late 1978 — completed prototype testing with Deepsea Miner II, recovering 500 tons of material.

Test processing activities: Finished construction of pilot processing plant.

Plans: Plans to convert ore carrier *Weser Ore* as test mining ship.

3. OCEAN MANAGEMENT INCORPORATED (Acronym: OMI, OMINC)

Commonly known as: INCO group. Established: February 1975.

Head Office: New York, New York. Equity capital: \$45 m.

Composition:

International Nickel Co. (INCO) Ltd. - Canada	25%
Sedco Inc. - USA	25%
Metallgesellschaft AG - FRG) Cons: Arbeitgemeinschaft	
	Meerestechnischege-
Preussag AG - FRG) winbare	25%
Salzgitter AG - FRG) Rohstoffe (AMR)	
23 companies - Japan Cons: Deep Ocean Mining Co. (DOMCO) Ltd.	25%

The Japanese companies include nine from Sumitomo group, Bank of Tokyo, Dowa Mining, Idemitsu, Industrial Bank of Japan, Komatsu, Kyokuyo, Marubeni, Mitsui OSK Lines, Nippon Mining, Nissho-Iwai, Shinko Electric, Tokyo Rope Manufacturing and Toyo Menka. 1977 — Rheinische Braunkohlenwerke - FRG, which was the fourth partner in AMR, withdrew.

Exploration activities: Extensive exploration in Clarion-Clipperton Zone by exploration ships *Valdivia* and *Sonne*.

Test mining activities: Mid-1978 — three successful test runs by *Sedco 445*, a drillship converted to a test mining ship; sea trials established technical feasibility of lifting capability, pumping system and air lift method.

Test processing activities: A pilot processing plant for testing purposes has been developed.

Plans: In the process of evaluating the data gathered during test mining in order to use them in the design of commercial mining system; nodule bulk sample mined during test operations will be used in the pilot processing plant. German partners are continuing exploration work.

4. OCEAN MINERALS COMPANY (Acronym: OMC, OMCO)

Commonly known as: Lockheed Group. Established:

November 1977.

Head Office: Mt. View, California, USA. Equity capital: \$50 m.

Composition:

Lockheed Missiles and	
Space Co. - USA	53.3%)
Billiton BV - Netherlands	53.3%) Cons: Ocean
Bos Kalis Westminster (BKW)	
Ocean Minerals BV	53.3%) Minerals Inc. 75%
Standard Oil of Indiana -	Subs: Amoco 75%
USA	Ocean
	Minerals Co.

Exploration activities: Exploration in Clarion-Clipperton Zone by exploration ship *Governor Ray*; mid-1978 — recovered 450 samples (several thousands lbs.) of nodules by free-fall grab samplers; planned programme of six cruises began.

Test mining activities: Successfully completed one-fourth scale collector test in mud pit. Late 1978 — *Glomar Explorer*, on lease to the consortium, completed shallow water test at depth of 1,800 m; November 1978 — deepsea testing at depth of 5,000 m cancelled due to rough seas and mechanical problems with doors at the bottom of *Glomar Explorer*.

Test processing activities: Ground broken for test plant in Hawaii; operation scheduled by mid-1979, at 50 mt/day for 3-5 years.

Plans: Test mine at depth of 5,000 m; operate pilot processing plant.

5. ASSOCIATION FRANCAISE POUR L'ETUDE ET LA RECHERCHE DES NODULES (AFERNOD)

Commonly known as: French Group. Head Office: Paris, France.

Composition: Several French Government agencies, including Centre National pour l'Exploitation des Océans (CNEXO), Commissariat à l'Energie Atomique (CEA) and Bureau des Recherches Géologiques et Minières (BRGM) and a few private companies including

Société Le Nickel (SLN) and Chantiers de France-Bunkerque, a member of the Empain Schneider Group.

Exploration activities: Perhaps the most systematic exploration of Clariton-Clipperton area, using optimised grid patterns.

Plans: Focus on detailed exploration and equipment development.

6. CONTINUOUS LINE BUCKET (CLB) SYNDICATE

Commonly known as: CLB Group.

Composition: About 20 companies from 6 countries — USA, FRG, France, Canada, Japan and Australia. These include US Steel — USA, AMR - FRG, CNEXO and SDN from France, INCO and Noranda Mines from Canada, DOMCO, Sumitomo Heavy Industries and Furukawa from Japan and Broken Hill Proprietary (BHP) from Australia. Composition of CLB Group varies by test.

Test mining activities: Tested one ship system in 1970-1972.

7. DEEP OCEAN MINERALS ASSOCIATION (DOMA)

Commonly known as: Japanese Group. Head Office: Tokyo, Japan.

Composition: An association between Japanese industry and government. Thirty-five Japanese companies including three from Mitsubishi group, four from Mitsui group, six from Nippon group, four from Sumitomo group and C. Itoh, Dowa Mining, Furukawa, Kanematsu-Gosho, Kyokuyo, Marubeni, Nichimen, Nissho-Iwai and Tokyo Menka.

Exploration activities: Carried out by Metal Mining Agency, a semi-commercial entity, linked to MITI of Japanese Government; co-operative arrangement with Geological Survey to use vessel *Hakurei-Marui*; survey on southern Hawaiian seas.

Plans: Extensive exploration by new ship launched in 1980.

8. EUROCEAN

Established: 1970

Composition: Twenty-four European companies; France — 2, Belgium — 3, Netherlands — 4 including Bos Kalis, UK — 1, Italy — 3, Sweden — 8 including Boldien, Graenges and Kockums, Norway — 1, Spain — 1, and Switzerland — 1.

Activities: Of non-commercial nature, directed to scientific research and survey.

¹ For an up-to-date evaluation of the scientific, technical and economic aspects of the nodule industry, see *Manganese Nodules: Dimensions and Perspectives*, Proceedings of a U.N. Expert Group Meeting on Sea-Bed Mineral Resource Assessment (D. Reidel Publishing Co., Netherlands, in press).

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