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Exploring the Last Frontiers for Mineral Resources: A Comparison of International Law Regarding the Deep Seabed, Outer Space, and Antarctica

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NOTE

Exploring the Last Frontiers for Mineral Resources: A Comparison of International Law Regarding the Deep Seabed, Outer Space, and Antarctica

ABSTRACT

The nations of the world have begun to tap three resource areas—the deep seabed, outer space, and Antarctica. These areas are unique insofar as no nation can claim them exclusively as its own. As a result, these three areas raise unique international questions. Not only are they largely undisturbed, but these areas are also the testing ground for recently developed international treaties that attempt to usher in a new era of international cooperation. This Note examines both the exploration and exploitation of mineral resources in the deep seabed, outer space, and Antarctica. The physical nature of each area, the resources available to humankind, the technological and economic feasibility of future explorations, and the environmental concerns surrounding mineral resource development will be examined. Within each section, the author discusses the treaty systems governing each environment, focusing particularly on the most recent attempts to formulate policy. The historical development, structure, and current status of these latest attempts are examined. By comparing the development, successes, and failures of the treaty systems, this Note attempts to highlight past experiences to suggest a system that will better serve the world community in the next century.

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I. INTRODUCTION

Certain regions of the earth's surface, including the deep seabed and Antarctica, as well as the moon and outer space,¹ are considered *res communis*, or the territory of no nation.² Traditionally, sovereignty has determined which nations have possessory control over territory. Because the sovereignty issue remains unresolved for the areas discussed in this Note, mineral exploration and development may be possible only through multinational organizations.

Coastal nations have claimed jurisdiction over the sea at distances up to two hundred miles from shore.³ Beyond this limit, no nation has a

1. In its discussion of the moon and outer space, this Note recognizes the possibility that minerals may be discovered and mined on other celestial bodies such as asteroids.

2. See Schwetje, *Protecting Space Assets: A Legal Analysis of "Keep Out Zones"*, 15 J. SPACE L. 131, 141 (1987).

3. N.E. LEECH, C.T. OLIVER, & J.M. SWEENEY, *THE INTERNATIONAL LEGAL SYSTEM* 213 (3d ed. 1988). Each coastal nation enjoys a territorial sea up to 12 nautical miles from the shoreline, a contiguous zone extending past the territorial sea up to 24

claim of sovereignty over the deep sea and the seabed. Rather, the members of the United Nations have declared this portion of the seabed, and the resources within it, to be the "common heritage of mankind."⁴

Outer space, too, is considered beyond national jurisdiction. The moon is not subject to national appropriation by any claim of sovereignty.⁵ Article 2 of the 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies⁶ (the Moon Treaty), which is considered customary international law, binds all nations to this principle regardless of whether they are parties to the Moon Treaty.⁷

Unlike the deep sea and outer space, however, nations claim sovereignty over a majority of Antarctica's land mass even though it is unclear whether the world community has recognized these claims.⁸ In fact, the claims of many nations overlap.⁹ The Antarctic Treaty¹⁰ is neither a renunciation nor an affirmation of previously asserted rights of territorial sovereignty, and while the treaty is in force, there can be no basis for an assertion of sovereignty.¹¹ Thus, the Antarctic Treaty attempts to pre-

miles from the shoreline, and an exclusive economic zone extending up to 200 miles from shore. See Note, *Antarctic Resource Jurisdiction and the Law of the Sea: A Question of Compromise*, 11 BROOKLYN J. INT'L L. 45, 60-61 (1985); see also Proclamation No. 5030, 48 Fed. Reg. 10,605 (1983) (President Reagan proclaimed that United States sovereignty over the seabed extended seaward from the coastline for 200 nautical miles.).

4. United Nations Convention on the Law of the Sea, *opened for signature* Dec. 10, 1982, art. 136, U.N. Doc. A/CONF. 62/122 [hereinafter Third LOS Convention], reprinted in 21 I.L.M. 1261 (1982). The "common heritage" principle requires that all nations share the benefits of exploited resources. See *infra* Part II.B.3.

5. See *infra* notes 100-01 and accompanying text.

6. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *opened for signature* Dec. 18, 1979, G.A. Res. 34/68, 34 U.N. GAOR Supp. (No. 46) at 77, U.N. Doc. A34/46 (1979) [hereinafter Moon Treaty]. Article 2 states:

All activities on the moon, including its exploration and use, shall be carried out in accordance with international law, in particular the Charter of the United Nations, and taking into account the Declaration on Principles of International Law concerning Friendly Relations and Co-operation among States in accordance with the Charter of the United Nations adopted by the General Assembly on 24 October 1970 in the interest of maintaining international peace and security and promoting international co-operation and mutual understanding, and with due regard to the corresponding interests of all other States Parties.

Id. art. 2. See *infra* Part III.B.2.

7. See Schwetje, *supra* note 2, at 141.

8. See *infra* notes 152 & 156 and accompanying text.

9. See Note, *supra* note 3, at 56-57.

10. Antarctic Treaty, *done* Dec. 1, 1959, 12 U.S.T. 794, T.I.A.S. No. 4780, 402 U.N.T.S. 71 (entered into force June 23, 1961). See *infra* Part IV.B.

11. *Id.* art. 4, para. 2.

serve the status quo on the continent.¹² Although nations have claimed Antarctic territory, the lack of an international consensus on how to preserve or develop the area makes the Antarctic an appropriate comparison to the deep seabed and outer space.

II. THE DEEP SEABED

A. *Natural Resources*

Over a century ago, people began to consider the sea as a source of minerals, and seabed mining was proposed as early as 1876.¹³ Not until the 1970s, however, with the necessary technological innovations and financial opportunities, did research begin on the feasibility of extracting deep seabed resources as an alternative to land-based minerals.¹⁴

Studies reveal that a wealth of resources exist in the deep seabed with the most common minerals being cobalt, copper, manganese, and nickel.¹⁵ These hard minerals¹⁶ are recoverable from both mineral nodules and mineral crusts. Nodules are potato-shaped concretions that lie loosely over much of the deeper portions of the ocean floor.¹⁷ Researchers, however, have discovered only a few areas¹⁸ containing nodules rich

12. *Id.* art. 9.

13. See Simpson, *Battle for the Moon*, SCI. DIG., June 1982, at 12, 13.

14. Note, *Alternative Regimes for the Exploitation of Manganese Nodules and Their Impacts*, 10 J. POL'Y MODELING 317, 317 (1988).

15. Roberts, *Uncertain Prospects for Deep Ocean Mining*, BIOSCIENCE, Jan. 1983, at 14, 15.

16. Hard minerals do not include oil. Oil has yet to become a major concern within the deep seabed debate because the bulk of offshore oil production will continue within 200 nautical miles of the coast and at depths of much less than 1000 meters. See A.M. POST, *DEEPSEA MINING AND THE LAW OF THE SEA* 9 (1983). It is estimated that between 80% and 95% of world oil reserves are located within the 200 nautical mile exclusive economic zone. *Id.*

17. Nodules lie at depths of 5000 meters or more and usually beyond the 200 mile exclusive economic zone. See S. MAHMOUDI, *THE LAW OF DEEP SEA-BED MINING* 28 (1987) (citing Clark & Clark, *Marine Metallic Mineral Resources of the Pacific Basin*, 3 MARINE RESOURCE ECON. 45, 50 (1986)). Therefore, areas with great amounts of minerals in nodules usually are not subject to national appropriation. See *supra* notes 3-4 and accompanying text.

18. The Clarion-Clipperton fracture zone, located in the Pacific Ocean between Hawaii and Central America, contains an estimated 3.5 million to 13.5 million metric tons of nodules, which might support 25 to 30 mining operations. See Roberts, *supra* note 15, at 16. Nodules with significant amounts of minerals also are present in the northeastern equatorial Pacific Ocean, the southern and western Pacific Ocean, and the central Indian Ocean. See Cronan, *A Fortune on the Sea Bed*, UNESCO COURIER, Feb. 1986, at 8.

enough in minerals to make their recovery economically viable.¹⁹ The estimated mass of nodules on the entire ocean floor ranges from over four billion tons to trillions of tons.²⁰

Crusts are the other source of hard minerals found in the deep sea. The crusts, rich in cobalt²¹ and manganese,²² occur as coatings up to several centimeters thick on rock outcrops.²³ Crusts are prevalent at much shallower depths than nodules,²⁴ resulting in two effects. First, it is more likely that crusts will be located within the jurisdictional limits of nations. Second, it will be easier for the nations that exercise jurisdiction to recover the minerals in crusts. More problems exist in the recovery of nodules because they are available only in deeper waters and usually occur outside a nation's territorial waters.

1. Technological and Economic Capability

Various methods for mining the deep seabed have been proposed, ranging from a system of buckets that scrape the ocean floor to remote-controlled submarine shuttles or hydraulic lift systems that collect the nodules.²⁵ Although technologically feasible, these proposals are economically problematic. The value of the metals present in nodules or crusts, the concentration of nodules or the thickness of the crusts at the mine site, the efficiency of recovery, and the costs of deep seabed mining must be compared to the costs of competitive land-based mining.²⁶ Experts

19. See *id.* The economically exploitable nodules have the following concentrations of minerals: 23% manganese, 1.3% nickel, 1% copper, and 0.22% cobalt. See S. MAHMOUDI, *supra* note 17, at 28.

20. See A.M. POST, *supra* note 16, at 11. See generally W. HAUSER, THE LEGAL REGIME FOR DEEP SEABED MINING UNDER THE LAW OF THE SEA CONVENTION 11-14 (1983).

21. Crusts consist of up to 2% of this strategic metal, which has a limited land supply. See Cronan, *supra* note 18, at 8.

22. *Id.*

23. *Id.*

24. Although nodules are richest when located at depths greater than 4500 meters, the highest grade crusts are present at depths less than 2000 meters. *Id.*

25. See Roberts, *supra* note 15, at 16. See generally Broad, *Proliferation of Sophisticated Robots Opens a New Age of Ocean Exploration*, N.Y. Times, Nov. 13, 1990, at B5, col. 3 (discussing technological advances in deep sea robots).

26. See A.M. POST, *supra* note 16, at 14; see also *Deep Seabed Mining: Hearings Before the Subcomm. on Oceanography and the House Comm. on Merchant Marine and Fisheries*, 95th Cong., 1st Sess. 54 (1977) [hereinafter *Seabed Hearings*] (Experts estimate that ocean mining companies must be prepared to spend more than \$2.5 million between initial start-up and commercial recovery on the first few mines located in the Clarion-Clipperton fracture zone.). A 1981 estimate predicted that between \$1 billion

predict that deep seabed mining will not compete with land-based mining in the near future.²⁷ To compete, deep seabed mining technology must become more cost-effective or the price of minerals must rise. Competitive deep seabed mining will be more difficult if international agreements compel those who spend the time and effort recovering the minerals to surrender some of their profits.

2. Environmental Concerns

Mining of the deep seabed not only will disrupt the ocean floor environment, but the sediment discharge from mining ships also will affect the surface water and the remainder of the ocean's ecosystem.²⁸ The effects of these disturbances will be severe if they are not addressed adequately.²⁹

B. *Treaties*

As the nations of the world realized that deep seabed mining would cause various problems in the future, they attempted to create systems regulating its development. Although their early attempts successfully established a basic regulatory framework, subsequent negotiations concerning the specific problems of mineral resources have been less successful.

1. Early Attempts

In 1958, the United Nations created three documents that initiated the modern development of the Law of the Sea. The documents, which comprise the First Law of the Sea Convention (the First LOS Convention),

and \$1.5 billion would be needed for a typical mining operation. See Kindt, *Ocean Resources and Marine Pollution: Putting the Development of Ocean Resources in Proper Perspective*, 6 Hous. J. INT'L L. 111, 135 (1984).

In determining the economic feasibility of such a project, one also must consider that financial institutions may not be willing to loan substantial amounts of money if a significant likelihood exists that a treaty on the Law of the Sea will affect adversely any possible operations. See *Seabed Hearings*, *supra*, at 54; see also *infra* Part II.B.

27. "[M]ining might begin in 1995, 2000, or later." Roberts, *supra* note 15, at 17; see Current Development, *Statement by Expert Panel: Deep Seabed Mining and the 1982 Convention on the Law of the Sea*, 82 AM. J. INT'L L. 363, 363 (1988).

28. See Roberts, *supra* note 15, at 17. Dislocated sediment can take up to five years to settle through 100 yards of water. See Kindt, *supra* note 26, at 137.

29. Environmental concerns have been less of an issue within the deep seabed debate than in the Antarctic context. See *infra* notes 146-51 and accompanying text. The reason may be that Antarctica is less spoiled and the effects of pollution are more visible on Antarctica than under the ocean's surface.

were the Convention on the Territorial Sea and the Contiguous Zone,³⁰ the Convention on the High Seas,³¹ and the Convention on the Continental Shelf.³² Although the First LOS Convention served as a basis for an international law of the sea, it enumerated no guidelines for mining the deep seabed because, at the time these documents were drafted, deep sea mineral resource exploration had not yet developed.

2. The Third Law of the Sea Convention

The international debate regarding mineral resources began with negotiations that culminated in the Third United Nations Convention on the Law of the Sea (the Third LOS Convention), which opened for signature in 1982.³³ The Third LOS Convention created certain entities to facilitate orderly exploration of the deep seabed's natural resources. First, it established the International Seabed Authority (the Authority)³⁴ to license and regulate mineral exploration on that portion of the ocean floor located beyond the limits of national jurisdiction³⁵ known as the "Area."³⁶ The Authority's decisions are made on a one-nation, one-vote basis.³⁷ Most major decisions, therefore, are controlled by the developing countries³⁸ because they outnumber the industrialized nations within the

30. Convention on the Territorial Sea and the Contiguous Zone, *opened for signature* Apr. 29, 1958, 15 U.S.T. 1606, T.I.A.S. No. 5639, 516 U.N.T.S. 205 (entered into force Sept. 10, 1964).

31. Geneva Convention on the High Seas, *opened for signature* Apr. 29, 1958, 13 U.S.T. 2312, T.I.A.S. No. 5200, 450 U.N.T.S. 82 (entered into force Sept. 30, 1962).

32. Convention on the Continental Shelf, *opened for signature* Apr. 29, 1958, 15 U.S.T. 471, T.I.A.S. No. 5578, 499 U.N.T.S. 311 (entered into force June 10, 1964).

33. Third LOS Convention, *supra* note 4. The Third LOS Convention was the result of nearly six years of preparatory work. See Kimball, *Turning Points in the Future of Deep Seabed Mining*, 17 OCEAN DEV. & INT'L L. 367, 371 (1986).

34. "All States Parties are *ipso facto* members of the Authority." Third LOS Convention, *supra* note 4, art. 156, para. 2.

35. See Raclin, *From Ice to Ether: The Adoption of a Regime to Govern Resource Exploitation in Outer Space*, 7 NW. J. INT'L L. & BUS. 727, 740 (1986).

36. See generally Third LOS Convention, *supra* note 4, arts. 133-55.

37. See Raclin, *supra* note 35, at 740.

38. The developing countries commonly are referred to as the "Group of 77." The Group of 77 was established in 1963 by 77 nonaligned nations. The membership of the Group of 77 now exceeds 100 countries. See Note, *supra* note 3, at 61; see also Raclin, *supra* note 35, at 752-53 n.174. Through its voting power, the Group of 77 has dominated the United Nations General Assembly since the mid-1960s. See Kindt, *Ice-Covered Areas and the Law of the Sea: Issues Involving Resource Exploitation and the Antarctic Environment*, 14 BROOKLYN J. INT'L L. 27, 41 n.94 (1988). This alignment has shifted the power structure not only within the United Nations, but also in international negotiations in general.

United Nations.³⁹

The Third LOS Convention also created its own intergovernmental mining company (the Enterprise) to compete with those private companies licensed by the Authority to exploit the resources in the Area.⁴⁰ In addition, the Third LOS Convention created a detailed system for the regulation of mining of the deep seabed.⁴¹

There has not been a consensus on this system because the developing countries, which have the controlling numbers in United Nations negotiations, could not reach an agreement with the industrialized nations, which possess the technology. The Third LOS Convention, which embodies the goals of the developing countries, has split the nations of the world on the issue of deep seabed mining and set the stage for treaty negotiations in other areas. The developing nations view the deep seabed as one of the last remaining common areas owned jointly by all the people of the world.⁴² This view is referred to as the "common heritage" principle.

3. The Common Heritage Principle

The common heritage principle,⁴³ which governs the Third LOS Convention, recognizes that the world's natural resources are being depleted.⁴⁴ At first, the principle was viewed as a philosophical or moral concept, but it now has gained acceptance in legal communities through-

39. See Raclin, *supra* note 35, at 741.

40. Third LOS Convention, *supra* note 4, art. 170. The Third LOS Convention established a parallel system, designed both to provide a profit incentive to industrialized nations and to guarantee an equitable share of the resources to developing countries. See Note, *supra* note 3, at 61.

41. Third LOS Convention, *supra* note 4, arts. 192-237.

42. To be compensated for years of unequal treatment, the developing nations believe that justice requires that they receive a greater share of the deep seabed resources. See Recent Development, *International Agreements—Agreement on the Resolution of Practical Problems with Respect to Deep Seabed Mining Areas*, 30 HARV. INT'L L.J. 216, 224 (1989). See generally Shyam, *Deep Seabed Mining: An Indian Perspective*, 17 OCEAN DEV. & INT'L L. 325 (1986).

43. "The Area and its resources are the common heritage of mankind." Third LOS Convention, *supra* note 4, art. 136.

44. The source of this phrase is disputed. Compare Matte, *The Common Heritage of Mankind and Outer Space: Toward a New International Order for Survival*, 12 AN-NALS AIR & SPACE L. 313, 316-17 (1987) (citing Oscar Schachter, Assistant Director, U.N. Legal Department, who in 1952, five years before Sputnik, suggested that outer space should "be the common property of all mankind") and Raclin, *supra* note 35, at 737 (crediting United Nations Ambassador Arvid Pardo of Malta with raising this point in 1967 when commenting on deep sea resources).

out the world.⁴⁵ Nevertheless, this concept is a source of concern for industrialized nations such as the United States.⁴⁶

Although there is no accepted single definition of the common heritage principle,⁴⁷ most definitions contain five common elements: (1) the area under consideration cannot be subject to appropriation; (2) all countries must share in management of the resources; (3) there must be an active sharing of the benefits derived from the exploitation of the resources; (4) the area must be dedicated exclusively to peaceful purposes, and (5) the area must be preserved for future generations.⁴⁸

Developing countries maintain that the principle requires an absence of private ownership rights in any area that is deemed to be the common heritage of mankind.⁴⁹ These developing countries also argue that the designated area should be managed by a multinational board⁵⁰ and that the benefits of the activities within the area should be shared with all nations, regardless of which nations participate in the exploitation of the resources.⁵¹

Industrialized nations, on the other hand, object to the inclusion of the common heritage principle in treaties,⁵² maintaining that the principle discourages the development of resources.⁵³ These nations contend that deep seabed minerals, and the profits derived from their exploitation, should be retained by those technologically able to retrieve them.⁵⁴ Thus,

45. See Matte, *supra* note 44, at 383-84.

46. See *infra* notes 115-21 and accompanying text (discussing the common heritage principle in the context of the moon); see also *infra* notes 192-94 and accompanying text (discussing the common heritage principle in the context of Antarctica).

47. Possible definitions of the common heritage principle range from requiring profit sharing, to international control of resources for redistributing wealth and technology among nations, to the opinion that the term merely denotes access to land for mineral exploitation. See Raclin, *supra* note 35, at 738-39; see also Matte, *supra* note 44, at 319; Note, *Extraterrestrial Law on the Final Frontier: A Regime to Govern the Development of Celestial Body Resources*, 71 GEO. L.J. 1427, 1436-37 (1983).

48. See Matte, *supra* note 44, at 320-21 (quoting *Comm. on the Peaceful Uses of Outer Space, Legal Sub-Comm., Sixth Session*, U.N. Doc. A/AC.105/C.2/SR.75 (1967)); see also Note, *Allocation of Mineral Resources in Antarctica: Problems and a Possible Solution*, 10 HASTINGS INT'L & COMP. L. REV. 525, 536 (1987).

49. See Raclin, *supra* note 35, at 739.

50. *Id.*

51. *Id.*

52. See *id.* at 738-39.

53. See *id.* at 739.

54. Larson, *Deep Seabed Mining: A Definition of the Problem*, 17 OCEAN DEV. & INT'L L. 271, 275 (1986); see also Recent Development, *supra* note 42, at 219 (On July 9, 1988, President Reagan indicated that the "United States would not sign the [Third LOS] Convention because of its 'inimical' provisions on mining the seabed beyond na-

the United States disagrees with both the common heritage principle⁵⁵ and the Third LOS Convention's requirement that the Authority should "acquire technology"⁵⁶ and "promote and encourage the transfer to developing States of such technology."⁵⁷

The Third LOS Convention's provision "for the equitable sharing of financial and other economic benefits derived from activities in the Area"⁵⁸ also has generated debate. Industrialized countries find this provision unacceptable because of its implied effects. In their view, this provision could be the basis for production guidelines and limitations⁵⁹ as well as the assumption of decision-making authority by those countries that are technologically and economically incapable of mining.⁶⁰ In addition, the Third LOS Convention cannot assure deep seabed mining companies that they will have access to the deep seabed.⁶¹ Moreover, this provision may require that industrialized nations actively transfer technology⁶² and share other benefits⁶³ of mining with developing countries. As a result, tension exists between the "laissez-faire" interpretation of the industrialized countries and the interventionist approach of the developing countries to deep seabed mineral development.⁶⁴ The result of these concerns and differing approaches is that many nations, including the United States, have not signed the Third LOS Convention.⁶⁵

4. Developments Outside the Third Law of the Sea Convention

Because of their dissatisfaction with the Third LOS Convention, industrialized nations capable of retrieving minerals from the ocean floor

tional jurisdiction.").

55. Because the equitable sharing of benefits is inconsistent with the profit motive, the United States maintains that private enterprise will not take the risks involved in developing new technologies and resources. See Matte, *supra* note 44, at 323; see also Raclin, *supra* note 35, at 742. See generally Larschan, *The International Legal Status of the Contractual Rights of Contractors Under the Deep Sea-Bed Mining Provisions (Part XI) of the Third United Nations Convention on the Law of the Sea*, 14 DEN. J. INT'L L. & POL. 207 (1986).

56. Third LOS Convention, *supra* note 4, art. 144, para. 1(a).

57. *Id.* art. 144, para. 1(b).

58. *Id.* art. 140, para. 2.

59. See Raclin, *supra* note 35, at 742.

60. *Id.*

61. *Id.*

62. See generally Third LOS Convention, *supra* note 4, art. 144.

63. *Id.* art. 140.

64. See Note, *supra* note 47, at 1437.

65. As of March 1, 1990, the Third LOS Convention had received 42 of the 60 ratifications required for its entry into force. See *Training Programme for Enterprise to*

have established, outside the confines of the United Nations, a system regulating deep seabed mining. The United States signed agreements with other industrialized countries⁶⁶ regulating the mining of the deep seabed in 1982,⁶⁷ 1984,⁶⁸ and 1987.⁶⁹ As a result, two competing resource management regimes now exist: the Third LOS Convention and the developed countries' Fee Access Regime (FAR).⁷⁰

France, Japan, and the Soviet Union were the first nations to register as pioneer investors under the Third LOS Convention, despite their signing the non-United Nations agreements.⁷¹ In addition, India and the People's Republic of China recently applied for pioneer investor status.⁷² To qualify as a pioneer investor, a state or enterprise must have spent at least thirty million dollars on deep seabed activities as of January 1,

be in Place by 1991, 27 U.N. CHRONICLE, June 1990, at 38, 39 [hereinafter *Training Programme*]. The United Kingdom and Germany are two other prominent nations withholding their signatures. See Recent Development, *supra* note 42, at 216.

66. Through the Deep Seabed Hard Mineral Resources Act of 1980, 30 U.S.C. § 1401 (1988), the United States Congress has authorized the executive branch to make such agreements with nations that have similar deep seabed mining interests.

67. Agreement Concerning Interim Arrangements Relating to Polymetallic Nodules of the Deep Seabed, *done* Sept. 2, 1982, *reprinted in* 21 I.L.M. 950 (1982) [hereinafter 1982 Agreement]. The 1982 Agreement was signed by France, West Germany, the United Kingdom, and the United States with the purposes of demarcating international claims and resolving conflicts that might arise among explorers. See Larson, *supra* note 54, at 279.

68. Provisional Understanding Regarding Deep Seabed Matters, *done* Aug. 3, 1984, *reprinted in* 23 I.L.M. 1354 (1984) [hereinafter 1984 Agreement]. The 1984 Agreement was signed by Belgium, France, West Germany, Italy, Japan, the Netherlands, the United Kingdom, and the United States. The purpose of the 1984 Agreement was to prevent overlapping mine site claims among the major industrial states. See Larson, *supra* note 54, at 279.

69. Agreement on the Resolution of Practical Problems with Respect to Deep Seabed Mining Areas, *done* Aug. 14, 1987, *reprinted in* 26 I.L.M. 1502 (1987) [hereinafter 1987 Agreement]. The 1987 Agreement resolved conflicting claims within the Clarion-Clipperton fracture zone. Included as parties to this agreement were five signatories to the Third LOS Convention (Belgium, Canada, Italy, the Netherlands, and the Soviet Union), as well as three nonsignatories (the United Kingdom, the United States, and West Germany). See Recent Development, *supra* note 42, at 216.

70. See generally Note, *supra* note 14, at 317. For an evaluation of the FAR and the system under the Third LOS Convention, see Marvasti, *Conceptual Model of the Management of International Resources: The Case of Seabed Minerals*, 20 OCEAN DEV. & INT'L L. 273 (1989).

71. See *France, Japan, and USSR Register as Pioneer Investors*, 25 U.N. CHRONICLE, Sept. 1988, at 52.

72. *China to Apply for Pioneer Investor in Sea-bed Exploration*, Xinhua News Agency, Aug. 20, 1990 (LEXIS, Nexis library, Xinhua file).

1986,⁷³ must continue to contribute a one million dollar annual fee, and must transfer technology to, and train personnel for, the Enterprise.⁷⁴

Although some experts are optimistic that the Third LOS Convention eventually will come into effect, doubts as to its future viability are increasing.⁷⁵ Factors contributing to the delay include the lack of urgency due to changed market conditions, the low demand for minerals found in the deep seabed, and the uncertainty surrounding the potential success of deep seabed mining.⁷⁶ Although the industrialized nations have their own mining system, this cannot be a final solution; ignoring the developing nations, which outnumber the industrialized nations, will create more problems than it solves.

III. OUTER SPACE

A. *Natural Resources*

Discussions on the possibility of mining the moon began when the first lunar samples were brought back in 1969.⁷⁷ The limited information regarding outer space, however, has made much of the research speculative. Space missions, which collected samples at six United States sites and three Soviet Union sites, provide the main source of information regarding minerals on the moon.⁷⁸ The resources known or thought to exist on the moon are aluminum, calcium, carbon, chromium, hydrogen, iron, oxygen, manganese, magnesium, nitrogen, silicon, titanium, and water.⁷⁹ Oxygen makes up about forty percent of the lunar soil samples,⁸⁰ while another twenty percent is silicon.⁸¹ Other significant con-

73. See *Training Programme*, *supra* note 65, at 38.

74. See *Current Development*, *supra* note 27, at 366.

75. See Larson, *When Will the U.N. Convention on the Law of the Sea Come Into Effect?*, 20 OCEAN DEV. & INT'L L. 175, 178-79 (1989).

76. See *Current Development*, *supra* note 27, at 366.

77. See *Matte*, *supra* note 44, at 319.

78. See *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies: Hearings Before the Subcomm. on Science, Technology, and Space of the Senate Comm. on Commerce, Science, and Transportation*, 96th Cong., 2nd Sess. 150 (1980) [hereinafter *Moon Hearings*].

79. See *Raclin*, *supra* note 35, at 728. Robert A. Frosch, Administrator for the National Aeronautics and Space Administration (NASA), stated that all the raw materials on earth currently used for space missions are available in outer space. *Moon Hearings*, *supra* note 78, at 37.

80. See NATIONAL COMMISSION ON SPACE, *PIONEERING THE SPACE FRONTIER* 85 (1986).

81. *Id.*

centrations are aluminum, fourteen percent, and iron, four percent.⁸² The homogeneous nature of the lunar surface indicates that there is little variation in the mineral concentrations.⁸³ Regardless of their abundance, however, the major problem with recovering these resources is the moon's distance from earth.

1. Technological and Economic Capability

Technology exists to retrieve mineral resources on the moon,⁸⁴ but mining will require the adaptation of conventional equipment for use on the lunar surface,⁸⁵ substantial private investment, and a system to develop these resources.⁸⁶ Some experts contend that mining on the moon could be easier than mining Antarctica or the deep seabed.⁸⁷ Because of the great expense of mining minerals in outer space, however, private industry is unwilling to commit large amounts of money without a stable legal environment.⁸⁸ Reducing the costs and improving the reliability of outer space transportation is one way to encourage investment.⁸⁹ Another possibility for reducing costs is to utilize the minerals recovered from the moon on the moon itself, which would eliminate the cost of transporting the resources back to earth.⁹⁰ One author has suggested that lunar minerals could be used to build outer space research laboratories or self-sustaining outer space communities.⁹¹ Silicon, aluminum, and iron could be a source of construction materials for space structures.⁹² Once these stations are established, they could provide other services. For example, moon or space stations could produce and supply spacecraft with liquid oxygen and hydrogen, the main propellants used in chemical rocket fuels, for flights back to earth or deeper into outer space.⁹³

82. *Id.*

83. *Id.* at 85-86.

84. See Raclin, *supra* note 35, at 729. For a discussion of mining methods, see Burt, *Mining the Moon*, AM. SCIENTIST, Nov.-Dec. 1989, at 574, 575-78.

85. See Note, *The Commercial Space Launch Act: America's Response to the Moon Treaty?*, 10 FORDHAM INT'L L.J. 763, 763 n.2 (1987).

86. See Note, *supra* note 47, at 1428.

87. See Raclin, *supra* note 35, at 729.

88. See Note, *supra* note 47, at 1432-33.

89. See Simpson, *supra* note 13, at 13. The Challenger space shuttle disaster stalled the United States space program; the feasibility of a space mining program may depend on the future success of this program.

90. See Raclin, *supra* note 35, at 728-29 n.7.

91. See Simpson, *supra* note 13, at 12. Another plan calls for the creation of self-replicating systems of automated mining operations. See *id.* at 14.

92. See *Moon Hearings*, *supra* note 78, at 37.

93. See Burt, *supra* note 84, at 574.

Currently, unresolved problems such as the lack of an abundance of water, essential for today's mining methods, and difficult living conditions make long term lunar mining expeditions unattractive.⁹⁴ As resources on earth become scarcer and more costly to retrieve, however, the mining of celestial resources may become more economically competitive.⁹⁵

2. Environmental Concerns

Because it is not known how lunar mining will affect the outer space environment, less attention has been devoted to preserving the environment of the moon than to preserving the environments of the deep seabed and Antarctica. Nevertheless, the environment in outer space should be a concern. For example, more than six thousand pieces of outer space junk currently orbit the earth.⁹⁶ On the other hand, industrial processing in outer space and mining on the moon have the advantages of minimizing pollution on earth.⁹⁷

B. *Treaties*

1. Early Attempts

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies⁹⁸ (the Outer Space Treaty) of 1967 was the first attempt to regulate outer space activities. The Outer Space Treaty was a product of the United Nations and established broad guidelines for outer space exploration. The Outer Space Treaty included two important developments. First, the Outer Space Treaty suggests that space exploration should be undertaken for the benefit of all people.⁹⁹ Second, the Outer Space Treaty provides that outer space shall not be subject to national

94. *See id.*

95. *See Note, supra* note 47, at 1428.

96. *See Garrison, Harvested Moon, OMNI*, Apr. 1990, at 30.

97. *See Comment, Outer Space, Like the Sea and the Air, Whose Frontier?*, 6 *HOUS. J. INT'L L.* 175, 178 (1984).

98. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *done* Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 (entered into force Oct. 10, 1967) [hereinafter Outer Space Treaty].

99. "The exploration and use of outer space . . . shall be carried out for the benefit . . . of all countries irrespective of their degree of economic or scientific development. . . ." *Id.* art. I.

appropriation,¹⁰⁰ thereby avoiding sovereignty disputes.¹⁰¹ In addition to the Outer Space Treaty, the Rescue Treaty,¹⁰² the Liability Convention,¹⁰³ and the Registration Convention¹⁰⁴ attempted to establish international guidelines for outer space activities. All four agreements recognized the common interest of mankind in outer space without using the exact language of the common heritage principle.¹⁰⁵ None of these documents, however, addressed the mineral resource issue.

2. The Moon Treaty

As knowledge concerning outer space and the moon increased, nations recognized the need for a new treaty. The Moon Treaty¹⁰⁶ is the most recent attempt to address current problems in outer space. Contrary to expectations, this treaty has not won widespread acceptance.¹⁰⁷ As of March 1989, only seven nations had ratified the Moon Treaty.¹⁰⁸ Although this number was sufficient for the Moon Treaty to enter into force,¹⁰⁹ the Moon Treaty is binding on only those nations who have ratified it.¹¹⁰ The United States and the Soviet Union, along with most nations that possess the technology necessary for outer space exploitation, have not signed the Moon Treaty.

The goals of the Moon Treaty are the safe development and rational

100. *Id.* art. II.

101. *See infra* note 156 and accompanying text (discussing sovereignty claims in Antarctica).

102. Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, *done* Apr. 22, 1968, 19 U.S.T. 7570, T.I.A.S. No. 6599, 672 U.N.T.S. 119 (entered into force Dec. 3, 1968).

103. Convention on International Liability for Damage Caused by Space Objects, *done* Mar. 29, 1972, 24 U.S.T. 2389, T.I.A.S. No. 7762 (entered into force Oct. 9, 1973).

104. Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. No. 8480 (entered into force Sept. 15, 1976).

105. *See* Raclin, *supra* note 35, at 735.

106. Moon Treaty, *supra* note 6.

107. *See* G. REYNOLDS & R. MERGES, *OUTER SPACE: PROBLEMS OF LAW AND POLICY* 116 (1989). The rationale was that the Moon Treaty would give developing nations a chance to share in the benefits of outer space. *See* Recent Development, *Space Law—Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, 21 HARV. INT'L L.J. 579, 583 n.54 (1980).

108. Current Document, *Present Status of Outer Space Treaties, March 1989*, 17 J. SPACE L. 98, 99-102 (1989). These seven ratifying nations are Australia, Austria, Chile, the Netherlands, Pakistan, the Philippines, and Uruguay. *Id.*

109. Moon Treaty, *supra* note 6, art. 19, para. 3.

110. *See* Matte, *supra* note 44, at 323.

management of lunar resources and the equitable sharing of the benefits derived from those resources.¹¹¹ Although the Moon Treaty reiterates the general principles of prior treaties¹¹² and only slightly extends the existing law on outer space,¹¹³ its major development is the regulation of mineral exploration.¹¹⁴

The Moon Treaty has not been accepted broadly, however, because of the inclusion of the common heritage principle and the lack of an international management organization.¹¹⁵ The controversy over the Moon Treaty focuses on two provisions of article 11. The first of these provisions states that "[t]he moon and its natural resources are the common heritage of mankind, which finds its expression in the provisions of this Agreement"¹¹⁶ As in the case of the Law of the Sea, the industrialized nations disagree with the common heritage principle, but the less developed countries consider it essential.¹¹⁷

Each side has its own interpretation of the common heritage principle within the Moon Treaty. Opponents of the Moon Treaty, including the United States, contend that the Third LOS Convention sets the standard by which any common heritage principle will be defined, and therefore, the same meaning used under the Third LOS Convention will be applied to the Moon Treaty.¹¹⁸ Proponents of the Moon Treaty stress that language within the document itself, "the common heritage of mankind, which finds its expression in the provisions of this Agreement,"¹¹⁹ limits its application. The proponents argue that the definition of the common

111. See Note, *supra* note 47, at 1435-36.

112. See Raclin, *supra* note 35, at 735.

113. See Note, *supra* note 47, at 1434.

114. See Raclin, *supra* note 35, at 736.

115. See Note, *supra* note 85, at 768. Both the United States and the Soviet Union opposed an international regime that would rely on a one-nation, one-vote system because such a system would give the developing nations effective control of the development of resources in outer space. See *id.* at 771.

116. Moon Treaty, *supra* note 6, art. 11, para. 1. The latter part of this statement is important only to the extent that it reflects an intent by the drafters to limit the common heritage principle used in the Moon Treaty to the Treaty itself. See *infra* notes 119-21 and accompanying text.

117. The Moon Treaty is the first treaty in force to give effect in international law to the concept of the common heritage of mankind because the Third LOS Convention will not become effective until 60 nations ratify it. See Matte, *supra* note 44, at 319. The common heritage principle in the Moon Treaty applies directly to natural resources and not in the abstract as it did in the Outer Space Treaty. See Matte, *Limited Aerospace Natural Resources and Their Regulation*, 7 ANNALS AIR & SPACE L. 379, 391 (1982); see also Outer Space Treaty, *supra* note 98, art. I.

118. See Raclin, *supra* note 35, at 742-43; see also Matte, *supra* note 44, at 322-23.

119. Moon Treaty, *supra* note 6, art. 11 (emphasis added).

heritage principle is contained within the Moon Treaty, and therefore, does not have to follow the precedent of the Third LOS Convention.¹²⁰ Unless the parties agree to another definition of common heritage, the broadest interpretation, which favors developing countries, is likely to be used in any subsequent treaty regardless of any reservations contained within the subsequent treaty.¹²¹ The effect of a broad interpretation will be a treaty that remains unratified by the industrialized nations.

The second controversial provision found in article 11 of the Moon Treaty provides for the establishment of "an international regime . . . to govern the exploitation of the natural resources of the moon."¹²² This regime would provide for "[a]n equitable sharing by all States Parties in the benefits derived from those resources . . ."¹²³ This compromise provision sought to provide the developing nations with an international regime, while allowing the industrialized nations to retain their right to mine the moon.¹²⁴ Proponents of the Moon Treaty argue that this language will not inhibit private commercial investment in celestial resource exploitation.¹²⁵ Opponents, however, are concerned that private industry in industrialized countries will abandon major exploratory opportunities upon ratification of the Moon Treaty because they will obtain fewer benefits from mining.¹²⁶ In addition, although the Moon Treaty is a compromise attempting to grant each side a fraction of its demands, the Moon Treaty has failed to create a clear and enforceable structure. Because of the uncertainty surrounding the development of an international regime, investors, including those from nations that have ratified the Moon Treaty, are reluctant to proceed.¹²⁷

Opponents also recognize that signing the Moon Treaty will bind the industrialized countries to an international regime similar to the Third LOS Convention, under which they have a limited voice.¹²⁸ The United

120. See Raclin, *supra* note 35, at 743; *cf.* Outer Space Treaty, *supra* note 98, art. I.

121. See Note, *supra* note 47, at 1437.

122. Moon Treaty, *supra* note 6, art. 11, para. 5.

123. *Id.* art. 11, para. 7(d).

124. See Mau, *Equity, the Third World and the Moon Treaty*, 8 SUFFOLK TRANS-NAT'L L.J. 221, 239 (1984).

125. See G. REYNOLDS & R. MERGES, *supra* note 107, at 114.

126. See Matte, *supra* note 44, at 323.

127. See Note, *supra* note 47, at 1443-44. The L-5 Society, a group of some 4000 space enthusiasts, argues that the Moon Treaty imposes a moratorium on the exploitation of celestial resources. *Moon Hearings*, *supra* note 78, at 109 (statement of Leigh Ratiner, Counsel, L-5 Society). *But see* Matte, *supra* note 44, at 323 (Neil Hosenball, former General Counsel of NASA, argues that no moratorium exists.).

128. See Note, *supra* note 47, at 1439.

States and the Soviet Union likely will continue to require that any treaty recognize their dominant participation in space exploration.¹²⁹ Thus, like the Third LOS Convention, the Moon Treaty has little practical value.

IV. ANTARCTICA

A. *Natural Resources*

From the discovery of Antarctica in 1820 until the mid-1970s, the world knew little about Antarctica.¹³⁰ Recently, more attention has focused on this frozen continent as a result of the discovery of its potential for resource exploitation.

The major hard minerals that have been found in Antarctica are copper, tin, and coal.¹³¹ Mineralogists believe these resources are located in the Antarctic Peninsula,¹³² the Transantarctic Mountains,¹³³ and East Antarctica.¹³⁴ There also may be substantial amounts of oil¹³⁵ and natu-

129. See Raclin, *supra* note 35, at 754.

130. See *Antarctica: Hearing before the Subcomm. on Science, Technology, and Space of the Senate Comm. on Commerce, Science, and Transportation*, 98th Cong., 2nd Sess. 46 (1984) [hereinafter *Antarctic Hearings*].

131. See *Recent Development, supra* note 42, at 240. Traces of other minerals found in Antarctica include: chromium, cobalt, gold, lead, manganese, molybdenum, nickel, platinum, silver, titanium, uranium, and zinc. See *Note, supra* note 3, at 46 n.10.

One scientific theory (plate tectonics) holds that the present continents of Antarctica, Africa, and South America were connected approximately 180 million years ago. Thus, the immense South African mineral deposits and the Andean copper and tin deposits might be evidence of similar resources in Antarctica. See *Recent Development, supra* note 42, at 240.

132. This region mainly contains copper and molybdenum, but there also may be deposits of chromium, cobalt, nickel, and silver. See Bergsager, *Basic Conditions for the Exploration and Exploitation of Mineral Resources in Antarctica: Options and Precedents* in *ANTARCTIC RESOURCE POLICY: SCIENTIFIC, LEGAL AND POLITICAL ISSUES* 168 (1983); see also *Note, Hiding Our Heads in the Snow: The Dilemma of Non-Living Resources in Antarctica*, 15 SYRACUSE J. INT'L L. & COM. 431, 434 (1989).

133. This region mainly contains coal. Gjelsvik, *The Mineral Resources of Antarctica: Progress in Their Identification* in *ANTARCTIC RESOURCE POLICY: SCIENTIFIC, LEGAL AND POLITICAL ISSUES* 62 (1983); see also *Note, supra* note 132, at 433.

134. This area contains iron, titanium, and gold. See Gjelsvik, *supra* note 133, at 62; see also *Note, supra* note 132, at 433; *U.S. Policy with Respect to Exploitation of Antarctic Resources: Hearing before the Subcomm. on Arms Control, Oceans, and International Environment of the Senate Comm. on Foreign Relations*, 95th Cong., 2nd Sess. 206 (1978) [hereinafter *Antarctic Resource Hearings*]. Although coal deposits are known to exist in East Antarctica, the coal is inaccessible and relatively impure. See *Note, supra* note 132, at 435; see also Zumberge, *Mineral Resources and Geopolitics in Antarctica*, *AM. SCIENTIST*, Jan.-Feb. 1979, at 68.

ral gas.¹³⁶ In general, lack of knowledge, technological problems, severe environmental conditions, remoteness, and political circumstances have prevented mineral exploration of Antarctica until recently.¹³⁷

1. Technological and Economic Capability

Significant technological problems associated with mining in the highest, driest, and coldest desert¹³⁸ reduce the feasibility of most projects.¹³⁹ The unstable Antarctic environment is even less suited for major exploration than the deep seabed.¹⁴⁰ Over ninety-eight percent of Antarctica is covered with ice, averaging 2300 meters in thickness.¹⁴¹ These conditions make the physical recovery of resources difficult.

The economic difficulties associated with mining Antarctica also are significant. No large mineral deposits have been discovered in the continent,¹⁴² and some experts dispute the existence of any commercially attractive opportunities in Antarctica.¹⁴³ One expert predicts that only neg-

135. Oil has been discovered in Antarctica and deposits may be richer than those found in the deep seabed. In addition, evidence suggests that offshore oil deposits exist, although no oil has been found to date. See Recent Development, *International Agreements—Convention on the Regulation of Antarctic Mineral Resource Activities*, 30 HARV. INT'L L.J. 237, 240 (1989). See generally *Antarctic Resource Hearings*, *supra* note 134, at 204-08. Exploitation of oil would be economically feasible only if there existed substantial geologic reserves coupled with sufficiently high oil prices. See Recent Development, *supra*, at 240; see also *U.S. Policy with Respect to Mineral Exploration and Exploitation in the Antarctic: Hearings Before the Subcomm. on Oceans and International Environment of the Senate Comm. on Foreign Relations*, 94th Cong., 1st Sess. 31 (1975) [hereinafter *Antarctic Exploration Hearings*] (estimating that 45 million barrels of oil exist within Antarctica's continental shelf) (citing Shapley, *Antarctica: World Hunger for Oil Spurs Security Council Review*, SCIENCE, May 17, 1974, at 776, 777).

136. It is estimated that up to 115 trillion cubic feet of natural gas exist under Antarctica. See Kindt, *supra* note 38, at 30.

137. See Zumberge, *supra* note 134, at 68.

138. See Note, *supra* note 132, at 435. Mean temperatures range from -70° celsius to 0° celsius. Also, Antarctica is described as the windiest continent on earth. Zumberge, *supra* note 134, at 70.

139. See Recent Development, *supra* note 135, at 240 (citing Mitchell, *Undermining Antarctica*, TECH. REV., Feb.-Mar. 1988, at 49, 54).

140. For a discussion of the technological problems of exploring Antarctica, see *Antarctic Resource Hearings*, *supra* note 134, at 125-48.

141. See Zumberge, *supra* note 134, at 68; see also Doerner, *Antarctica, How to Open up the Coldest Cache*, TIME, June 20, 1988, at 38. In addition, icebergs have been found off the coast of Antarctica that are as large as Massachusetts. *Id.*

142. See Recent Development, *supra* note 135, at 240. See generally Rich, *A Minerals Regime for Antarctica*, 31 INT'L & COMP. L.Q. 709, 710 (1982).

143. See Shapley, *Polar Thinking on the Antarctic*, N.Y. Times, Oct. 17, 1989, at A27, col. 2 ("[E]xploitation of Antarctic minerals is unlikely to occur for 'three decades,

ligible profits are possible, due to the severe operating conditions on the continent.¹⁴⁴ In addition, the transport of recovered minerals through the ice and snow to ports of export would be costly.¹⁴⁵ Moreover, the mining and transport of these resources raises important environmental questions.

2. Environmental Concerns

Environmental concerns have dominated the Antarctic negotiations¹⁴⁶ and have had a drastic effect on the organization of the mineral resource system. The opponents of an Antarctic mineral regime emphasize that not enough is known about the potential adverse effects of mineral exploitation in the Antarctic environment.¹⁴⁷ Some opponents of exploration propose a moratorium on mineral development until more information can be obtained about the environmental impact that mining would have on Antarctica.¹⁴⁸ Recent oil spills¹⁴⁹ and new evidence suggesting that the Antarctic climate influences the earth's climate¹⁵⁰ have added

if ever.'"); see also Note, *supra* note 132, at 436 (stating that only about 1% of the ice-free surface of Antarctica has been explored).

144. Rich, *supra* note 142, at 709.

145. See *Antarctic Resource Hearings*, *supra* note 134, at 111.

146. See Colson, *The Antarctic Treaty System: The Mineral Issue*, 12 L. & POL'Y INT'L BUS. 841, 843 (1980). Not only will the mining operations pollute the environment, but significant environmental problems already exist due to the presence of scientists and tourists on the Antarctic continent. See Carpenter, *Opening the Last Frontier*, U.S. NEWS & WORLD REP., Oct. 24, 1988, at 64, 65-66; see also Anderson, MacKenzie, & Dickson, *Should Antarctica be Left on Ice?*, NEW SCIENTIST, Oct. 14, 1989, at 28; Joyner, *Protection of the Antarctic Environment: Rethinking the Problems and Prospects*, 19 CORNELL INT'L L.J. 259 (1986). See generally *Antarctic Resource Hearings*, *supra* note 134, at 216-17.

147. See *Antarctic Hearings*, *supra* note 130, at 61; see also *id.* at 87-88 (statement by the Oceanic Society).

148. See *id.* at 61-64.

149. See Browne, *France and Australia Kill Pact on Limited Antarctic Mining and Oil Drilling*, N.Y. Times, Sept. 25, 1989, at A10, col. 1. For example, the Argentine resupply ship, *Bahia Paraiso*, ran aground in January 1989, producing a 7.4 mile oil slick. The following month, two more ships ran aground. Kielmas, *Pollution Liability Rules for Antarctica to be Considered*, BUS. INS., July 30, 1990, at 23, 24. The severe Antarctic climate exacerbates the effects of oil spills because ice interferes with traditional clean-up methods and low temperatures retard the biological decomposition of oil. See Colson, *supra* note 146, at 843 n.5.

150. See Larmer, *The Great White Heap?*, SIERRA, Mar.-Apr. 1990, at 27, 28. Oil spills not only damage the ecosystem and upset the entire Antarctic food chain, see Note, *supra* note 48, at 529, but they also have a negative impact on the ozone layer, see Kindt, *supra* note 38, at 35-36.

vigor to calls for a permanent ban on exploration of Antarctica. Others doubt that a voluntary moratorium could be enforced, but note that without any system in place, more environmental damage will occur.¹⁵¹

B. *Treaties*

Antarctica differs from the deep sea and outer space because nations have made claims on portions of it. Seven countries assert claims of sovereignty over eighty-five percent of Antarctica.¹⁵² Even with these assertions of sovereignty, nations of the world have attempted to create an international regime to govern Antarctica.

1. Early Attempts

The Antarctic continent is regulated by the Antarctic Treaty System, a conventional regime comprised of several international agreements.¹⁵³ The Antarctic Treaty, the first and most important document of the system, created a regime to facilitate peaceful international cooperation for scientific research¹⁵⁴ and environmental preservation.¹⁵⁵ The Antarctic Treaty was intended to ease the tension surrounding various sovereignty claims¹⁵⁶ by preserving the status quo as to those territorial claims. In 1991, however, the Antarctic Treaty will be subject to change because any of the signatory nations may call for a conference to review its

151. Carpenter, *supra* note 146, at 66 (quoting R. Tucker Scully, Director, Office of Oceans and Polar Affairs, U.S. Dep't State).

152. Argentina, Australia, Chile, France, New Zealand, Norway, and the United Kingdom all have claims. See Barceló, *The International Legal Regime for Antarctica*, 19 CORNELL INT'L L.J. 155, 156 (1986); see also Larmer, *supra* note 149, at 27. The total land mass of Antarctica is over 5.5 million square miles. *Id.*

153. The Antarctic Treaty System consists of the following agreements: The Antarctic Treaty, *supra* note 10; Agreed Measures for the Conservation of Antarctic Flora and Fauna, done June 2-13, 1964, 17 U.S.T. 996, T.I.A.S. No. 6058; Convention for the Conservation of Antarctic Seals, done June 1, 1972, 29 U.S.T. 441, T.I.A.S. No. 8826; Convention on the Conservation of Antarctic Marine Living Resources, done May 20, 1980, 33 U.S.T. 3476, T.I.A.S. No. 10240; Convention on the Regulation of Antarctic Mineral Resource Activities, opened for signature Nov. 25, 1988, reprinted in 27 I.L.M. 859 (1988) [hereinafter Antarctic Mineral Convention].

154. See *Antarctic Resource Hearings*, *supra* note 134, at 9.

155. See Barceló, *supra* note 152, at 157.

156. See Note, *supra* note 3, at 47. The seven nations that assert sovereignty over portions of Antarctica, see *supra* note 152, are all original signatories of the Antarctic Treaty, see *Antarctic Hearings*, *supra* note 130, at 9. The other five original signatories, Belgium, Japan, South Africa, the Soviet Union, and the United States, neither assert, nor recognize, these claims. See *id.*

operation.¹⁵⁷

2. The Antarctic Mineral Convention

Although the Antarctic Treaty successfully promoted international research with a minimum amount of environmental damage,¹⁵⁸ it did not address mineral exploitation.¹⁵⁹ Consequently, discussions that addressed mineral development began in 1982¹⁶⁰ and resulted in the Convention on the Regulation of Antarctic Mineral Resource Activities (the Antarctic Mineral Convention).¹⁶¹ The Antarctic Mineral Convention was completed on June 2, 1988, by the United States and thirty-two other countries.¹⁶² Unlike the negotiations surrounding the conventions on the Law of the Sea and regarding the moon, the negotiations for the Antarctic Mineral Convention occurred entirely outside of the United Nations.¹⁶³ In addition, the Antarctic Mineral Convention was designed and negotiated entirely between the industrialized nations, thereby negating any influence the developing nations may have had in the negotiation of other conventions.¹⁶⁴

The goal of the Antarctic Mineral Convention is to create a system to regulate future development of mineral resources¹⁶⁵ and to protect the Antarctic environment.¹⁶⁶ The Antarctic Mineral Convention follows,

157. Antarctic Treaty, *supra* note 10, art. XII; *see* Zumberge, *supra* note 134, at 75. Before 1991, any amendment to the Antarctic Treaty requires unanimous approval; after 1991, any changes will require a majority vote. *Id.* at 75-76.

158. *See* Note, *supra* note 48, at 547.

159. The Consultative Parties to the Antarctic Treaty agreed in 1977 to a "voluntary restraint" on "all exploration and exploitation of Antarctic mineral resources." Mitchell, *Antarctica: A Special Case?*, *NEW SCIENTIST*, Jan. 13, 1977, at 64, 65, reprinted in *Antarctic Resource Hearings*, *supra* note 134, at 66.

160. *See* Note, *Death of a Treaty: The Decline and Fall of the Antarctic Minerals Convention*, 22 *VAND. J. TRANSNAT'L L.* 631, 647 (1989).

161. Antarctic Mineral Convention, *supra* note 153.

162. *Id.* preamble.

163. *See* Starke, *International Legal Notes*, 62 *AUSTL. L.J.* 956, 956 (1988).

164. The industrialized countries have an incentive to work outside the United Nations because the more numerous developing countries will dominate any United Nations regime on account of the United Nations one-nation, one-vote system. *See supra* notes 37-39 and accompanying text.

165. *See* Starke, *supra* note 163, at 956.

166. *See* Recent Development, *supra* note 135, at 237. The Antarctic Mineral Convention lays "the foundation to do things sensibly" in Antarctica. Sun, *Antarctica Pact Could Open Way for Mining*, *SCIENCE*, June 17, 1988, at 1612 (quoting James Barnes, general counsel of the Antarctic and Southern Ocean Coalition, a group representing a consortium of 175 environmental groups internationally).

but also expands, the guidelines of the Antarctic Treaty to include mineral exploration.¹⁶⁷ The Antarctic Mineral Convention provides for five institutions—the Antarctic Mineral Resource Commission (the Commission),¹⁶⁸ the Scientific, Technical, and Environmental Advisory Committee,¹⁶⁹ various Regulatory Committees,¹⁷⁰ a special meeting of party states,¹⁷¹ and a Secretariat¹⁷²—to regulate the exploration and development of mineral resources.¹⁷³ Mining can take place only with the unanimous agreement of all the signatories. Thus, one state's opposition would be sufficient to veto an application.¹⁷⁴ Like the Antarctic Treaty, however, the Antarctic Mineral Convention sidesteps the issue of territorial claims.¹⁷⁵

Originally, the Antarctic Mineral Convention was to enter into force after ratification by all sixteen Antarctic Treaty Consultative Parties.¹⁷⁶ A moratorium on exploitation and development exists until this occurs.¹⁷⁷ The Antarctic Mineral Convention, however, effectively has collapsed since France and Australia have withdrawn their support.¹⁷⁸ In

167. The Antarctic Mineral Convention recognizes the role of the Consultative Parties to the Antarctic Treaty in the minerals regime and follows the guidelines established in the original Antarctic Treaty. *See Note, supra* note 160, at 648.

168. *See Antarctic Mineral Convention, supra* note 153, arts. 18-22. The membership of the Antarctic Mineral Resource Commission (the Commission) includes the Antarctic Treaty Consultative Parties as of November 25, 1988, and any other party involved in substantial scientific, technical, and environmental research on the continent. *Id.* art. 18, para. 2. The Commission collects data on the impact of any proposed mining operation, deciding where or if a site will be allowed. *Id.* art. 21; *see also* Anderson, *Antarctic Minerals Deal Heads for Rocks*, *NEW SCIENTIST*, May 20, 1989, at 21.

169. Antarctic Mineral Convention, *supra* note 153, arts. 23-28.

170. *Id.* arts. 29-32.

171. *Id.* art. 28.

172. *Id.* art. 33.

173. *See Joyner, The Evolving Antarctic Minerals Regime*, 19 *OCEAN DEV. & INT'L L.* 73, 73 (1988).

174. *See* Anderson, MacKenzie, & Dickson, *supra* note 146, at 28. This veto, however, is likely to be used sparingly, because a nation that vetoes the activities of another state later may find itself blocked from exploring a desirable area. *See* Sun, *supra* note 166, at 1612. Arguably, a major weakness of the Antarctic Mineral Convention is that it does not give nonmembers, such as environmental groups, the right to participate in the various committee meetings. *Id.*

175. *See* Doerner, *supra* note 141, at 38.

176. This would require the signature of the seven territorial claimants. *See* James, *The Fragile Continent*, *FAR E. ECON. REV.*, June 8, 1989, at 40; *see also supra* note 152 (listing the seven states with territorial claims).

177. *See* Starke, *supra* note 163, at 957. This moratorium was agreed upon by the Consultative Parties to the Antarctic Mineral Convention. *Id.*

178. *See* Kielmas, *supra* note 149, at 24, col. 4. Jacques Cousteau, the French

stead, these nations seek to declare Antarctica a "world wilderness park."¹⁷⁹ Similarly, opponents of the Antarctic Mineral Convention argue that an agreement which endorses even strictly regulated development of mineral resources is unacceptable.¹⁸⁰ The withdrawal of support by France and Australia effectively destroys the Antarctic Mineral Convention because their ratification as Consultative Parties is required for the Convention to go into effect.¹⁸¹ Since these nations announced their withdrawal, no nation has ratified the Antarctic Mineral Convention.¹⁸²

marine naturalist, is credited with successfully influencing many nations against supporting the Antarctic Mineral Convention. See Browne, *supra* note 149, at A10, col. 4.

The French have shown a lack of concern for the Antarctic environment in the past, however. The French airstrip in the Pointe Geologie Region, one of the areas richest in Antarctic fauna, has sparked international concern about environmental damage. See Joyner, *supra* note 173, at 268. By building this airstrip, the French government appears to have breached the Antarctic Treaty System's environmental protection mandate. *Id.* at 269.

One author asserts that Australia may have withheld support for the Antarctic Mineral Convention because ratification of the Convention threatened Australian sovereignty over Antarctic territory. See Morgan, *Australia Reconsiders Claims to Antarctic Mineral Resources*, NATURE, Dec. 1, 1988, at 417.

179. See James, *supra* note 176, at 40. As the first step to protecting Antarctica as a wilderness park, a resolution adopted at the Second World Conference on National Parks in 1972 called on the parties to the Antarctic Treaty System to "negotiate to establish the Antarctic Continent and the surrounding seas as the first world park under the auspices of the United Nations." *Antarctic Hearings*, *supra* note 130, at 68. The term "wilderness park," rather than "world park," is used today because the latter implicates the use of the common heritage principle and a lack of control by the treaty nations. See *Antarctic Antics*, NEW SCIENTIST, June 3, 1989, at 20.

180. See Browne, *supra* note 149, at A10, col. 1. Environmental groups, such as Greenpeace, propose a permanent moratorium on mineral development in Antarctica. See Note, *supra* note 48, at 540. They contend that no valuable resources exist in the Antarctic continent, and even if such resources exist, the environmental concerns drastically outweigh the monetary gains. See Tempest, *France Urges Antarctic "Nature Reserve"*, L.A. Times, Oct. 10, 1989, at 7, col. 1.

"In order for companies to justify the massive cost of mining in Antarctica, supergiant reserves must be discovered there With the exploitation of supergiant reserves there would be catastrophic damage to the Antarctic environment from facilities, towns, roads, airstrips, waste disposal facilities and spills." Shabecoff, *U.S. Seeks Ban on the Exploration of Minerals and Oil in Antarctica*, N.Y. Times, Nov. 14, 1990, at A4, col. 1 (quoting Will Martin, Director of the Wilderness Society's Antarctica Project).

181. See *supra* note 174 and accompanying text.

182. See Tempest, *supra* note 180, at 7, col. 1. Belgium, Brazil, Mexico, India, and Italy, *id.*, as well as Austria, Bulgaria, and Greece have indicated their opposition to ratification since the withdrawal of France and Australia, see *Talks in Paris on Protecting Antarctica Fail*, N.Y. Times, Oct. 22, 1989, at 16, col. 3. Spain is the most recent nation to withdraw its support. *Spain Backs Ban on Mining in Antarctic, Opposes Con-*

As of last year, however, the United States, the United Kingdom, and New Zealand still advocated the ratification of the Antarctic Mineral Convention.¹⁸³ These proponents of the Antarctic Mineral Convention argued that the regulations under the Convention are tougher than any current national environmental protection legislation and, therefore, would protect the fragile environment adequately.¹⁸⁴

Recently, New Zealand, a proponent of the Antarctic Mineral Convention, softened its position and now supports the position of France and Australia.¹⁸⁵ In a similar action to strengthen its position, Australia, an opponent of the Convention, has taken a tougher stance by prohibiting its companies from mining or drilling for oil within the Australian Antarctic Territory, which comprises about forty percent of the continent.¹⁸⁶

The debate over the permanent moratorium continued at the Fifteenth Antarctic Treaty Consultative Meeting held in Paris during October 1989.¹⁸⁷ Although the thirty-nine nations that participated in the meeting failed to agree on a definite solution,¹⁸⁸ the group agreed to hold

vention, Reuter News Rep., Sept. 20, 1990 (LEXIS, Nexis Library, Reuter file).

183. See Tempest, *supra* note 180, at 7, col. 1. *But see* Shabecoff, *supra* note 180, at A4, col. 1 ("The United States has not ratified the [Antarctic Minerals Convention] and is not likely to do so.")

184. See James, *supra* note 176, at 40. If, however, sufficient quantities of minerals are found in or near Antarctica before the establishment of an international regime or an agreement on a permanent moratorium, a chaotic, ill-conceived development might result. Uncontrolled mineral exploitation would be much more detrimental to the continent's environment than development under the Antarctic Mineral Convention. See Anderson, MacKenzie, & Dickson, *supra* note 146, at 20.

185. Louissou, *New Zealand to Fight for Antarctic Park Among Treaty Nations*, Reuter News Rep., July 6, 1990 (LEXIS, Nexis library, Reuter file). In 1975, the New Zealand government proposed that Antarctica be made a world park and that New Zealand would surrender its territorial claim if other nations did the same. See Tempest, *supra* note 180, at 7, col. 2. New Zealand now appears to have come full circle.

In a similar change of position, a resolution proposed by Senator Albert Gore, Jr. would postpone the United States ratification of the Antarctic Mineral Convention until it has been studied exhaustively. *Id.* Recently, both the United States House of Representatives and the United States Senate have passed bills urging the Secretary of State to negotiate a ban on mineral resource activities in Antarctica. See Shabecoff, *supra* note 180, at A4, col. 2.

186. See Martin, *Australia to Ban Polar Oil Drilling*, Daily Tel., Aug. 20, 1990 (LEXIS, Nexis library, Telegr file).

187. U.S., *Britain Rebuff Bid to Reserve Antarctica for Wildlife*, L.A. Times, Oct. 21, 1989, at A14, col. 2.

188. For a discussion of the recommendations, see *Antarctic Treaty Consultative Parties Gather in Paris for 15th Meeting*, ANTARCTIC J. U.S., Mar. 1990, at 1.

another meeting in Santiago, Chile, during November and December 1990.¹⁸⁹

As the negotiations on the Antarctic Mineral Convention progressed, less developed countries began to voice their opinions. As a result of a 1983 Malaysian initiative, the Antarctic was included on the agenda of the United Nations General Assembly.¹⁹⁰ Nations not party to the Antarctic Mineral Convention objected to its limited participation of only industrialized nations.¹⁹¹ These developing nations sought greater international cooperation and an equitable sharing of the benefits according to the common heritage principle.¹⁹²

Those who support the Antarctic Mineral Convention recognize that "it is in the interest of all mankind that the Antarctic Treaty area shall continue forever to be used exclusively for peaceful purposes,"¹⁹³ but that the Antarctic Mineral Convention lacks any language resembling the common heritage principle. Instead, the wording "all mankind" was substituted¹⁹⁴ to avoid the common heritage principle. To satisfy both the developing and industrialized nations, an agreement on Antarctica's resources must resolve the common heritage debate.

Now that the Antarctic Mineral Convention effectively has failed,¹⁹⁵ the developing countries likely will try to create a treaty within the United Nations based upon the examples set forth in the Third LOS Convention¹⁹⁶ and the Moon Treaty.¹⁹⁷ These two treaties have no prac-

189. See Kielmas, *supra* note 149, at 23, col. 1. It appears that the United States supports a moratorium of up to 30 years since "it would be at least that long before mining activities could be technologically and commercially feasible in Antarctica's inhospitable climate." Shabecoff, *supra* note 180, at A4, col. 3. Although the United States representative to the Santiago talks was "confident that some form of moratorium on mineral development would emerge from the Santiago meeting . . . the creation of an Antarctic world park or ecological preserve 'will not be on the table . . .'" *Id.* (quoting E. U. Curtis Bohlen, Asst. Sec'y, Oceans and International Environmental and Scientific Affairs, U.S. Dept. State).

190. *Antarctic Hearings*, *supra* note 130, at 42 (statement by John V. Byrne, Administrator, Oceanic and Atmosphere Administration, U.S. Dep't Commerce). The Antarctic Treaty Consultative Parties opposed the initiative, stressing the validity of the Antarctic Treaty System. See Barceló, *supra* note 152, at 277.

191. *Antarctic Hearings*, *supra* note 130, at 55.

192. See *supra* notes 43-65 & 117-21 and accompanying text.

193. Antarctic Mineral Convention, *supra* note 153, preamble.

194. Using the term "all mankind," rather than "common heritage," recognizes the sovereignty dispute in the area, while also acknowledging the importance of this land mass to the world community.

195. See *supra* note 178.

196. See *supra* notes 33-42 and accompanying text.

197. See *supra* notes 106-29 and accompanying text.

tical effect, however, and any new United Nations Antarctic Treaty must address the problems that caused the demise of these two previous treaties.

V. COMPARISON AND PROPOSALS

The laws regarding mineral exploration of the deep seabed, outer space, and Antarctica are interrelated, even though historically each area has been approached separately. Recognizing their interdependence and similarities is essential if successful agreements are to be negotiated in the future. The basic similarities between the areas are threefold: the minerals lie outside any nation's territory; important technological difficulties require substantial expenditures for mineral exploration now and in the future; and environmental concerns are a high priority. All three areas also face the problems of resolving the debate over the common heritage principle and establishing an international management regime that emphasizes environmental protection.

The treaty negotiations for each area underwent two stages—one in the 1950s and 1960s¹⁹⁸ and one within the past twelve years.¹⁹⁹ The earlier treaties did not address the mineral resource issue. Increased recognition of the potential value of minerals, the energy crisis of the 1970s, and the shifting balance of power toward the developing countries have helped set in motion the new era of treaty negotiations in all three systems.

In the various negotiations concerning each area, the views of two adversarial camps have conflicted on how these new resources should be allocated and governed. The developing nations embraced the common heritage principle,²⁰⁰ and the industrialized nations sought to secure free access to mineral sites without sharing the benefits with those nations that lack the necessary mining or exploration technology. The first step to a successful agreement for these areas is the creation of an international management framework.

Chaos would result if substantial development of minerals in any area began without a management system already in place. Although the Antarctic Mineral Convention achieved the greatest degree of apparent success of the three recent sets of negotiations, its long term effect would have been to create more problems than it solved, since it ignored a

198. The First LOS Convention, *see supra* notes 30-32 and accompanying text, the Outer Space Treaty, *see supra* note 98 and, the Antarctic Treaty, *see supra* note 10.

199. The Third LOS Convention, *see supra* note 4, the Moon Treaty, *see supra* note 6, and the Antarctic Mineral Convention, *see supra* note 153.

200. *See supra* notes 43-65 and accompanying text.

growing section of the world community. All truly substantive negotiations must include both developing and industrialized nations, and the negotiations likely will occur within an international organization that has a one-nation, one-vote system. Because the industrialized countries make up a minority of nations, they must recognize at least some of the demands of the developing countries.²⁰¹

Industrialized nations, like the United States, however, do not want developing countries that are not contributing technology or money to the development of the resources to control the regime. Although the developing countries should have both a voice in forming the regime and the potential to share in benefits, they should not have ultimate control over the parties who bear the risk.²⁰²

Therefore, a regime should be structured that both the numerous developing countries and the wealthy, technologically advanced countries will ratify under a one-nation, one-vote system. Preferably, this system will provide immediate gains and control of development to the countries or entities that take the initial risks and will provide the developing countries with a future opportunity to take part in either the development or conservation of the areas.

Once a consensus is reached on the international management system, this framework should be used to reach an agreement on the common heritage principle in terms of benefit sharing or ownership rights and technology transfer. One possible solution to the benefit sharing or ownership issue is to divide the deep seabed, the moon, and Antarctica into distinct geographic portions, with each nation getting a share.²⁰³ Those nations possessing the technology could exploit their portions today; developing nations would reserve their region for future development. Another possibility is to allow those nations possessing the necessary technology to exploit any region they choose on the condition that they place a percentage of their profits into a fund that would be available in the future to countries in earlier technological stages.

Another solution, proposed by environmental groups,²⁰⁴ is a permanent moratorium on resource exploitation. This only would delay a solution to the problem. Such a voluntary measure is not legally enforceable and ignores the needs of the future.²⁰⁵ It is true that the environment is a

201. See Raclin, *supra* note 35, at 756.

202. See *id.* at 759. Not only should developing countries have seats on the regime, but specific sites could be reserved for their future development. *Id.* at 758.

203. See *id.* at 758.

204. See Note, *supra* note 48, at 540.

205. See *id.*

major concern, and any regime adopted must provide for an agency to protect against environmental damage. Avoidance is no solution, however. Although some factions would like to hinder exploration, the effect of the developing nations and environmental groups insisting on a permanent moratorium on exploration would be to drive the industrialized nations away from a universal agreement.

However the ownership issue is resolved, a satisfactory definition of the common heritage principle also must address the transfer of technology from industrialized to developing nations. One solution is for industrialized nations to concede to share the benefits of their resource exploitation on the condition that the developing nations agree that they would utilize transferred technology only after a specified period of time,²⁰⁶ much like a patent system.²⁰⁷ The United States patent system gives creators exclusive rights to enjoy the benefits of their inventions for a specific amount of time.²⁰⁸ Using the United States patent system as a model would provide those countries possessing the technology with time to exploit it, while also transferring the technology to nations who could use it at a later date. Such compromises must be examined if both groups are to agree to a workable solution.

Cooperation is essential if any agreement is to be reached among the conflicting groups. The developing countries must recognize that allowing some structured development is preferable to uncontrolled mining by industrialized countries. Industrialized countries, for their part, must recognize that they can obtain more benefits within an international system than from exploitation in the absence of such a system. If an agreement is not reached, no group will be satisfied because all three areas will suffer from erratic development, which eventually will destroy both the environment and the opportunities for peaceful, profitable development.

Thus, the same structure of an international regime can be used in each area with some adjustments made for each area's unique features.²⁰⁹ Combine this with a common heritage principle that resolves

206. One suggestion for Antarctica would be for the Antarctic Treaty Consultative Parties to lease Antarctic drilling and mining areas to the Enterprise of the Third LOS Convention so that equitable sharing would occur without the technology transfer. See Note, *supra* note 3, at 76-77.

207. The enormous start-up costs required for exploitation of all three areas, which will lead to profits only in the longer term, may cause problems with this suggestion. This may be acceptable, however, if the developing nations agree to a sufficiently long period of technology protection.

208. See Raclin, *supra* note 35, at 759 & n.202.

209. Although there are similarities among the areas, it is essential that the negotiat-

the technological and profit sharing problems, and successful treaties in each area are possible. Recognizing the interdependence of these three areas' development will facilitate the success of these systems in the future.

VI. CONCLUSION

The future of mineral resource exploration outside the confines of national jurisdiction is unclear. Important changes have occurred between the first successful rounds of treaties in 1959 and the latest attempts to regulate mineral exploration. Most significantly, technological advances have made mineral exploitation more plausible. Moreover, there is growing concern that land-based mineral resources may be exhausted in the near future. As a result, nations are searching for new resources, hoping to become less dependent on imports from other countries. Finally, the early treaties were made when the developing countries were not a significant, unified voice. Now, even though the developing countries lack the economic strength and the technology to engage in resource exploration, they outnumber the developed nations and are asserting their power.²¹⁰

Instead of working within each area individually, the two problems that plague all three areas, the common heritage principle and the management regime, should be resolved at one time. Once these issues are resolved, separate discussions can begin for each area using common definitions and adapting the scheme agreed upon earlier to each area's own specific needs.

Answers to the problems presented above must be found soon. The near future holds opportunities for change with the review of the Antarctic Treaty in 1991,²¹¹ the International Space Year in 1992,²¹² and the review of the Moon Treaty in 1994.²¹³ Recognition that the deep seabed, outer space, and Antarctica have an impact beyond their boundaries is the first step toward the cooperation needed in the future. In the end, all nations involved will benefit from a clear system of man-

ing parties recognize the areas' differences. Any agreement reached on either the common heritage principle or the management regime must be flexible enough to accommodate these variations without sacrificing definiteness. The basic differences between the deep seabed, outer space, and Antarctica concern the uniqueness of recoverable minerals, location, and the time when future exploration will be reasonable.

210. See Raclin, *supra* note 35, at 755.

211. Antarctic Treaty, *supra* note 10, art. XII.

212. See Raclin, *supra* note 35, at 760.

213. *Id.*

agement for each of the three areas that incorporates a unified definition of the common heritage principle.

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