SAVE THE MUCKWORMS!

ENVIRONMENTAL PROTECTION IN THE 1994 AGREEMENT RELATING TO THE IMPLEMENTATION OF PART XI OF THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA

BY
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I. INTRODUCTION........................................................................................................68
II. EVOLUTION OF THE SEA BED MINING REGIME:
    PART XI AND THE 1994 AGREEMENT .................................................................71
    A. The Seabed Mining Regime in Part XI..........................................................72
    B. Objections to Part XI .................................................................................74
    C. The 1994 Agreement ..................................................................................76
III. DEEP-SEA WEALTH ..........................................................................................77
    A. Mineral Wealth of the Deep Sea .................................................................77
    B. Deep-Sea Life .............................................................................................78
IV. THE THREAT OF SEABED MINING ................................................................80
    A. Importance of Deep-Sea Organisms .............................................................81
V. ENVIRONMENTAL PROTECTION IN THE AGREEMENT AND UNCLOS III ............82
    A. Regulations on Prospecting and Exploration for Polymetallic Nodules
       in the Area .....................................................................................................83
VI. STRENGTHENING ENVIRONMENTAL PROTECTION IN THE REGULATIONS ......86
    A. Detailed Environmental Assessments ..........................................................86
    B. Stronger Guarantee Provisions ....................................................................89
    C. Interpretation .............................................................................................90
VII. CONCLUSION ......................................................................................................91

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I. INTRODUCTION

In the early 1980s, the most controversial aspect of the third United Nations Convention on the Law of the Sea (UNCLOS III) was Part XI, the section regulating deep seabed mining. Negotiated in an international political climate dominated by the Group of 77 (G-77) and in the spirit of the new international economic order between 1973 and 1982, Part XI contains provisions requiring mandatory technology transfers to developing countries, centralized planning mechanisms, and an almost communist profit-sharing scheme. Unsurprisingly, the United States, and other industrialized nations with it, strenuously objected to such provisions and refused to sign the treaty.

Without the participation and endorsement of the industrialized world, it took twelve years to obtain the sixty ratifications necessary for the treaty to become law. The United Nations (UN) reopened negotiations to reach an agreement on the deep-sea mining issue that would allow worldwide participation in and adherence to the convention. In 1994, the nations signed the Agreement

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2 See Joan E. Spero & Jeffrey A. Hart, The Politics of International Economic Relations 162-63 (5th ed. 1997). The Group of 77 (G-77) consisted of underdeveloped countries, primarily from the Southern Hemisphere, that banded together in the United Nations (UN) to increase their influence and clout, and resist the domination of industrialized nations represented in the Group of 7. See id. At the height of the G-77's influence, they introduced a concept known as the New International Economic Order (NIEO). See id. The NIEO included greater northern commitment to aid and transfers of wealth and technology, as well as greater control of multinational corporations. See id. Northern nations overwhelmingly rejected the G-77's proposals. See id. However, their influence was greatest in UN conferences where their vote was equal to those of industrialized nations. See id.


4 See President Ronald Reagan, U.S. Policy and the Law of the Sea (Jan. 29, 1982), in Dep't St. Bull., Mar. 1982, at 54; see also John Alton Duff, UNCLOS and the New Deep Seabed Mining Regime: The Risks of Refuting the Treaty, 19 Suffolk Transnat'l L. Rev. 1, 11-12 (1995) (quoting President Reagan stating that those voting no or abstaining “represented countries which produce more than 60% of the world's gross national product and provide more than 60% of the contributions to the United Nations”); Dick Russell, Deep Blues: The Lowdown on Deep-sea Mining, Amicus J., Winter 1998, at 29 (noting that “the United States refused to endorse the final text; other developed nations followed suit”).

5 See Russell, supra note 4, at 29.

Relating to the Implementation of Part XI (Agreement), thus removing objections to the Law of the Sea's seabed mining regime and facilitating the entry of the industrialized world into the treaty's scope. For the most part, the political problems surrounding the mining issue have been solved.

The “solution” to the mining regime debate has once again piqued the interest of the mining industry. Given the opportunity to profit handsomely from deep seabed mining, exploration is once again underway. Indeed, due to advances in knowledge of the seabed and in mining technology, deep-sea mining is an imminent reality.

Given this technological advancement, new objections and questions are being raised, which are no longer political, but environmental. Since the original negotiations on Part XI occurred during the 1970s, scientists have discovered abundant life on the sea floor, shattering the notion of a deep ocean azooctic, or lifeless, zone. Many new species of fish, worms, clams, anemones, and bacteria are discovered almost daily on the deep ocean's varied topography. Many of these species are extremely specialized, having adapted to life on a particular seamount, burrow or chimney.

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9 See Russell, supra note 4, at 29.
10 See Russell, supra note 4, at 25 (noting “the quiet revival of interest in mining the deep-sea floor”).
12 See Conrad G. Welling, Mining of the Deep Seabed in the Year 2010, 45 LA. L. Rev. 1249, 1249 (stating that “the resource is there and will be mined eventually,” and more specifically that “[g]iven the time scale of exploration tool development and other exceptions . . . the time scale for ocean mining is a reasonable two thousand to two thousand and ten A.D. period”).
13 See, e.g., Stephanie Pain, Mud, Glorious Mud, New Scientist supp. (Nov. 4, 1996); Peter A. Rona, Metal Factories of the Deep Sea, Nat. Hist. (Jan. 1998); Russell, supra note 4, at 29.
15 See generally Pain, supra note 13.
16 See id.; see also Russell, supra note 4, at 27.
This extreme specificity results in high species variation, and a rich collection of biodiversity, perhaps as diverse as the Amazon rainforests.\textsuperscript{17} The unique nature of deep-water organisms makes them potentially attractive to scientists, interested in pure science, and to pharmaceuticals and biotechnology industries, interested in material and financial benefits.\textsuperscript{18} Scientists and environmentalists alike fear that because most political and economic roadblocks have been removed, deep-sea mining will charge ahead, ruining these fragile ecosystems in the process.\textsuperscript{19} The potential uses of deep-sea organisms in medicine, bioremediation, and other biotechnology industries may never be realized. Indeed, it is unclear whether the loss of genetic diversity will outweigh any loss in mineral revenues.

As stated earlier, the political and economic problems of Part XI of UNCLOS III have been "solved" in the sense that consensus has been achieved. Now, however, it is time to analyze the environmental implications of the deep seabed mining regime. Despite the weakness of the environmental provisions in the Agreement, it does grant the International Seabed Authority (Authority), the entity responsible for regulating seabed mining, the power to include environmental safeguards in the prospecting application process. Indeed, in July 2000, the Authority issued the Regulations on Prospecting and Exploration for Polymetallic Nodules, which govern the application process and contain several environmental protection provisions. This Article argues that with a strengthened environmental assessment, environmentalists, scientists, and mining interests can reach a common ground.

Part II of this Article describes the original seabed provisions of Part XI of UNCLOS III, as well as the industrialized nations objections. Part II also discusses the new look of the seabed mining regime embodied in the 1994 Agreement. Part III describes the wealth of the oceans, both mineral and living. Part IV identifies the threats to deep-sea life, and the importance of deep-sea organisms to the biotechnology and pharmaceutical industries. Part V covers the environmental provisions in the seabed mining regime. Finally, Part VI contains proposals for strengthening the environmental protection in the mining regime.

\textsuperscript{17} See Russell, supra note 4, at 27.
\textsuperscript{18} See id. at 28.
\textsuperscript{19} See Russell, supra note 4, at 28 (quoting William J. Broad as saying, "the ominous question . . . is not whether seabed mining will kill sea creatures but how great the carnage will be"). See generally Pain, supra note 13, at 5.
II. EVOLUTION OF THE SEA BED MINING REGIME: PART XI AND THE 1994 AGREEMENT

Mining seabed minerals was not at first thought to be an economically profitable exercise. During the 1960s, U.S. Steel dredged a few tons of manganese nodules from the ocean floor and gave them to refineries and smelters. They asked scientists whether it would be profitable to extract minerals from them. U.S. Steel abandoned its seabed activities when the answer was a unanimous “no.” Deep seabed mining is, after all, “an enormous challenge that has been compared to standing atop a New York City skyscraper on a windy day, trying to suck up marbles off the street below with a vacuum cleaner attached to a long hose.”

With the advent of new technologies, however, many of the participants of the UNCLOSIII believed that work on deep seabed mining would soon commence. Deep seabed mining had the potential to be enormously profitable. Indeed, deposits of polymetallic nodules are scattered over large areas of the Pacific and Atlantic Oceans. These nodules contain nickel, copper, manganese, and cobalt. Cobalt is vitally important to the production of jet engines and nuclear propulsion systems. At present, the major U.S. suppliers of cobalt are Zambia, Democratic Republic of the Congo, and the former U.S.S.R. Because deep seabed mining held the promise of a new source of revenue for both industrialized and developing nations, potential competition and conflict necessitated a detailed international deep seabed mining regime.

Industrialized and developing countries approached these negotiations from two different points of view. Industrialized nations claimed that because the

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21 See id.
22 See id.
26 Burke, supra note 3, at 54.
27 See id.
28 See id.
seabed belonged to no one, anyone could exploit its resources.\textsuperscript{29} Developing countries, on the other hand, asserted that the seabed belonged to everyone, and everyone should enjoy the benefits of its exploitation.\textsuperscript{30} Working as the G-77, developing countries tried to keep deep seabed mining linked to other important issues in UNCLOSIII, giving them a much stronger bargaining position.\textsuperscript{31} These issues include the extent of national territorial seas and economic zones, rights of commercial and military navigation, fishing rights, offshore hydrocarbon development, continental shelves, natural and artificial islands, straits passage, archipelagos, marine environmental protection, and peaceful dispute settlement procedures.\textsuperscript{32} Because “Third World agreement was required for the convention to become effective, Western negotiators were strongly influenced to make concessions to states whose only negotiating asset was the formal right to assent or reject the treaty.”\textsuperscript{33} Given their numeric majority, the G-77 emerged from the negotiations victorious.

\textbf{A. The Seabed Mining Regime in Part XI}

Part XI of the treaty contains provisions that commentators in the industrialized world considered almost “Orwellian” in nature.\textsuperscript{34} During negotiations, the Third World argued that the mining regime “should be a democratic institution responsible for bridging the gap between the rich countries and the poor countries and establishing a fairer and more just system of international relations.”\textsuperscript{35} The communitarian flavor of the mining regime was clearly expressed in Article 136, stating that the seabed “and its resources are the common heritage of mankind.”\textsuperscript{36} More explicitly, Article 140 provides “for the equitable sharing of financial and other economic benefits derived from” seabed mining.\textsuperscript{37}

\textsuperscript{29} See Burke, \textit{supra} note 3, at 48.
\textsuperscript{30} See id.
\textsuperscript{31} See G. Galdorisi et al., \textit{The United States and the 1982 Law of the Sea Convention: The Cases Pro and Con} 17 (1994).
\textsuperscript{33} Burke, \textit{supra} note 3, at 49.
\textsuperscript{34} Galdorisi, \textit{supra} note 31, at 75.
\textsuperscript{35} Burke, \textit{supra} note 3, at 47.
\textsuperscript{36} See UNCLOS, \textit{supra} note 1, art. 136.
\textsuperscript{37} See id. art. 140.
The treaty also envisioned substantial UN involvement in the mining process. For example, according to the provisions of the treaty, all activities in the mining area are to be “organized, carried out, and controlled by the Seabed Authority.” The driving policies of the Authority include:

- a) responsible conduct in the Area and on the world’s mineral markets,
- b) acquisition and transfer of technology,
- c) raising and use of all kinds of revenues from activities in the Area,
- d) enhancement of opportunities for activities for all states, and
- e) taking at each step the interests and needs of particular states or particular groups of states into consideration.

Further, “the Authority must adhere to a detailed production policy for polymetallic nodules, which is to be calculated on the basis of the projected world nickel consumption” in order to cushion the impact of increased supply on land-based mineral producers. The treaty also stated that the Authority “may implement compensation schemes or take economic measures for developing countries which might suffer adverse effects as a result of the production policy issued.”

Part XI also created a complicated bureaucracy to administer its provisions. The International Seabed Authority is the government of the seabed; specifically, it “is the organization through which States Parties shall . . . organize and control activities in the Area, particularly with a view to administering the resources of the Area.”

The Assembly may be thought of as the “legislative branch” of the Authority. It is made up of all members of the Authority, and is responsible for developing the policies of the Authority. It also is responsible for establishing subsidiary bodies, assessing contributions from members, and considering and approving rules, regulations and procedures.

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38 Bernaerts, supra note 3, at 56.
39 Id.
40 Id.
41 Id.
42 See UNCLOS, supra note 1, art. 157.
43 See id. art. 160.
44 See id.
45 See id.
The administrative arm of the authority is the Secretariat, comprised of the Secretary-General and Authority staff.\(^4\) The Enterprise is the operative body of the Authority.\(^4\) It is essentially a mining company operated by the Authority "for the benefit of mankind."\(^4\) Specifically, the Enterprise is responsible for "transporting, processing and marketing" the minerals found on the seabed, as well as "receiving" mining technology from contractors.\(^4\)

Finally, the Council is the executive body of the International Seabed Authority.\(^5\) It establishes the specific policies of the Authority, and is charged with supervising and implementing the provisions of Part XI.\(^5\) The Council itself has two subsidiary bodies: the Economic Planning Commission and the Legal and Technical Commission.\(^5\) The Economic Planning Commission is responsible for analyzing trends affecting the minerals industry and for proposing a system of compensation for nations negatively impacted by seabed mining.\(^5\) The Legal and Technical Commission (the Commission), on the other hand, reviews work plans to evaluate their impacts on the environment, and to monitor the compliance with rules, regulations and procedures.\(^5\) The Commission is the most important body for the purposes of this article.

**B. Objections to Part XI**

This arrangement, however, was unacceptable to the North, especially the United States. On July 9, 1982, President Reagan announced that the United States would not sign the convention, arguing that "the U.S. was paying dear with seabeds for something cheap like navigation rights."\(^5\)

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\(^4\) See id. art. 166.
\(^5\) See id. art. 170.
\(^6\) See id; art. 140; see also Brown, supra note 6, at 83.
\(^7\) See UNCLOS, supra note 1, at art. 170; see also Brown, supra note 6, at 84.
\(^8\) See UNCLOS, supra note 1, art. 162.
\(^9\) See id.
\(^10\) See id. art. 163.
\(^11\) See id. art. 164.
\(^12\) See id. art. 165.
\(^13\) See Bernaerts, supra note 3, at 12; see also Galdorisi, supra note 31, at 27. It is interesting to note, however, that roughly 95% of known ocean resources occur within two hundred miles from the world’s coastlines. Welling, supra note 12, at 1263. Since they are within two hundred miles of the coasts, the vast majority of minerals are found within Exclusive Economic Zones (EEZs), and are therefore subject to national, not international, jurisdiction. See id.
Industrialized nations refused to sign the treaty because of ideological objections to provisions of Part XI that provide disincentives to mine, mandate technology transfers and authorize international taxation. One objection, for example, was to the "site-banking" provision of Part XI that requires applicants for mining permits to designate an area large enough to allow two mining operations. The Authority may then claim either of the two sites for the Enterprise, or a developing nation. Another provision of the treaty places an obligation on contractors to transfer technology to the Enterprise.

Part XI also imposes tremendous financial burdens on potential mining operations. For example, the treaty provides that the Authority may levy taxes on mining companies. Specifically, the treaty states that some of the "funds necessary for operation are to come from activities in the Area, i.e., from royalties paid by operators in the Area, from payments by the Enterprise, or from coastal states for exploration of the outer shelf." Specifically, "miners will also have to pay their overseer, the Authority, and competitor, the Enterprise: $500,000 to apply, $1 million annually, plus a royalty fee." The royalty fees are "equal to 2% of gross revenues and 35% of any mining profits. For projects that are extremely successful, payments include a 4% royalty and a 70% share of the marginal profit dollar from mining operations during later years of the operation." These objections to Part XI threatened international consensus on the Law of the Sea, therefore obviating the need for further compromise.

56 See Brown, supra note 6, at 82-83.
57 See Brown, supra note 6, at 83-84.
58 See id.
59 Id.
60 Burke, supra note 3, at 52.
61 BERNAERTS, supra note 3, at 58. See also UNCLOS, supra note 1, art. 82; 171(b); 171(c); Annex III, art. 13; Annex IV, art. 10.
62 Galdorisi, supra note 31, at 76.
63 Burke, supra note 3, at 88.
C. The 1994 Agreement

Changes in the international political and economic climate provided the impetus for a re-negotiation of Part XI. Secretary-General Perez de Cuellar commented that

The present situation in which there is the unprecedented number of 159 signatories to the Convention, but only 51 ratifications and accessions — all but one from developing countries — is highly unsatisfactory. There is a real possibility that such a situation could lead to the erosion of the delicate balance contained in the Convention.\(^6\)

The UN Resolution on the Law of the Sea by the General Assembly on December 12, 1991 later called “upon all states to take appropriate steps to promote universal participation in the Convention ... through dialogue aimed at addressing the issues of concern to some states.”\(^65\) This call for re-negotiation resulted in the Agreement Relating to the Implementation of Part XI of the 1982 United Nations Convention on the Law of the Sea (Agreement), which was adopted and opened for signature at the UN in New York on July 29, 1994. The stated purpose of the Agreement was to remove the objectionable language contained in Part XI and to reflect the political and economic changes that have taken place since 1982.\(^66\)

In general, the newly negotiated Agreement was very favorable to the United States and other industrialized nations.\(^67\) Specifically, the parties agreed that “it would be neither necessary nor prudent at this stage” to establish detailed production policies, to develop a system of assistance to land-based producers, or to develop a system of taxation.\(^68\) The Agreement also removes the objectionable mandatory transfer of technology provisions, and replaces Part XI's interventionist economic planning approach with provisions to ensure that market-oriented approaches are used in the management of resources of the deep sea-

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\(^64\) Brown, supra note 6, at 81.
\(^65\) Id. at 81-82.
\(^66\) Id. at 99. The preamble of the Agreement, for example, states that the parties, “not[e] the political and economic changes, including market-oriented approaches, affecting the implementation of Part XI.” See Agreement, supra note 7, preamble.
\(^67\) See Oceans Conference, supra note 11, at 2.
\(^68\) See Brown, supra note 6, at 102.
It also reduces the size of institutions and links their activation and operation to the development of concrete interest in deep seabed mining. Perhaps most importantly, the new Agreement guarantees the United States a seat on the Council, which makes most of the substantive decisions of the Authority, and allows it, with at least two other industrialized nations, to veto any decisions of the Council. Thus, the northern countries' concerns appear to be solved.

III. DEEP-SEA WEALTH

A. Mineral Wealth of the Deep Sea

Another impetus for the political negotiations discussed above were, of course, new discoveries of significant sources of mineral wealth on the sea floor. By 1974, for example, "it was well established that a broad belt of sea floor between Mexico and Hawaii and a few degrees north of the equator (the so-called Clarion Clipperton zone) was literally paved with nodules over an area of more than 1.35 million square miles." More recent discoveries of deep-sea vents and "smoker chimneys" have also revealed a significant source of mineral wealth, as they are rich in valuable minerals such as zinc, copper, silver, and gold. One group of chimneys near the Galapagos Islands, for example, are estimated to contain $2 billion worth of copper alone.

Several nations have already taken the first steps toward the development of seabed mining operations. Japan and Germany, neither of which possess domestic mineral wealth, have expressed much interest in exploration. South Korea and China have already begun exploration in the Pacific. Saudi Arabia and the Sudan are conducting feasibility tests for mining the wealth of chimneys

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69 See id. at 101; Oceans Conference, supra note 11, at 2.
70 Id. at 100. Section 1(3) of the Annex to the Agreement states that the "setting up and the functioning of the organs and subsidiary bodies of the authority shall be based on an evolutionary approach." See Agreement, supra note 7, Annex, § 1(3).
71 See Oceans Conference, supra note 11, at 2. See also Agreement, supra note 7, Annex, § 3(15)(a).
72 See Russell, supra note 4, at 26.
73 See Rona, supra note 13, at 53.
74 See Russell, supra note 4, at 26.
75 Id.
76 Id.
77 Id.
located at the bottom of the Red Sea.\(^78\) In September 1998, the International Seabed Authority approved work plans from several “pioneer investors.”\(^79\) These investors come from nations as diverse as India, France, Japan, Russia, and China.\(^80\)

Technology, while still not completely developed, is improving. According to Conrad Welling, Senior Vice-President of Ocean Mineral Company, “there is no known technology barrier preventing the development of a commercial deep ocean mining system.”\(^81\) Indeed, Ocean Management Inc. is currently developing “tractor-like devices for scooping large quantities of minerals off the sea floor and hoisting them back to the surface for at-sea processing.”\(^82\) Without a doubt, the future of deep-sea mining is rapidly moving forward. The political problems with the Law of the Sea have been worked out, and the will, demand and investment dollars are all present. According to John Flipse, a retired professor and ocean-prospecting pioneer, “ocean mining is going to work. The feasibility has been demonstrated. Ultimately, it’s the sea or metal substitution.”\(^83\)

B. Deep-Sea Life

Political and technological developments in seabed mining have been more than amply matched by recent discoveries of life on the ocean’s benthic communities. Thousands of meters below the surface, abyssal plains are relatively unaffected by storms, swift currents, or other forms of turbulence.\(^84\) With such erosive powers absent in these deep sea “deserts,” very specialized forms of life have developed in tiny niches, crevices and borrows.\(^85\) For example, there are some organisms that subsist solely on terrestrial wood that has slowly worked its way down to the ocean floor.\(^86\) There is another species that creates spiral burrows which “encourage the growth of manganese-oxidizing bacteria, perhaps a food

\(^{78}\) See Rona, supra note 13, at 54.
\(^{79}\) See Russell, supra note 4, at 29.
\(^{80}\) See id.
\(^{81}\) See Welling, supra note 12, at 1262.
\(^{82}\) Russell, supra note 4, at 26.
\(^{83}\) Id. at 29.
\(^{84}\) See Russell, supra note 4, at 27-28 (noting the lack of storms, and describing seabed as “undisturbed and stable”). But see Pain, supra note 13, at 7. This disagreement highlights the current state of scientific understanding of the seabed.
\(^{85}\) See Russell, supra note 4, at 27.
\(^{86}\) See id.
source."87 Samples taken from the mud on the ocean bottom have retrieved at least one new species in each square foot of mud.88 These invertebrate animals include polychaetes, sipunculids, and tanaids though many still await classification.89

Even more exciting, and bizarre, are discoveries of the variety of life surrounding deep-sea vents. It is surprising that life is found in these vents and chimneys that create such incredibly harsh environments. Like volcanoes, deep-sea vents (the result of geothermal activity deep within the Earth) form enormous mounds. One such mound was described as being "about the size and shape of the Houston Astrodome."90 On top of these mounds are chimney-like structures reaching as high as 75 feet.91 Despite their imposing height, the chimneys are quite fragile formations that "vary in thickness from 5 inches to as little as .25 of an inch."92 Heated by magma from deep within the Earth, the mineral-rich water spewing from these chimneys may reach temperatures ranging from 350–700 degrees Celsius.93

Not only is this sulfur-laden water extremely hot, but it also contains a toxic cocktail of metals and minerals.94 Another factor in the harshness of this environment is its extreme depth ranging from 2000 to 4000 meters below the surface.95 At these depths, pressure can reach as high as 400 bars, and sunlight, the vital ingredient in the process of photosynthesis, cannot penetrate to the bottom.96

Despite these seemingly inhospitable conditions, researchers have discovered life in abundance in areas immediately surrounding the chimneys. Instead of light and photosynthesis as a base for life, the food chain in vent communities "is supported by bacteria that draw their nourishment from chemicals dissolved from the rocks by the water venting in the hot springs."97 This bacteria feeds anemones, sponges, crabs, tube worms, fish, mussels, and other unidentified

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87 Id.
88 See id.
89 See id.
90 Rona, supra note 13, at 52.
91 See id.
92 Tivey, supra note 14, at 68-69; see also Rona, supra note 13, at 88; Suter, supra note 24, at 8.
93 See id. at 69; Russell, supra note 4, at 27.
94 See Russell, supra note 4, at 28.
95 See id. at 69.
96 See id.
97 Rona, supra note 13, at 52.
animals.\textsuperscript{98} During a visit to one vent community in the mid-Atlantic Ridge, Peter Rona described the abundant life he witnessed:

Clumps of bacteria drifted like snowflakes. Looking like daisies sprouting from a field of red soil, white anemones, with tentacles several inches long, were scattered on the rocks. White crabs crawled in and out of rock crevices.\textsuperscript{99}

Obviously, these discoveries of abundant life have shattered the old notion of ocean deserts.

IV. THE THREAT OF SEABED MINING

Because deep seabed mining is still in the developmental stage, its environmental impacts are uncertain. However, a few educated guesses can be made. For example, deep-sea mining is not likely to be a precision process. After all, as noted earlier, current proposals for mining technologies include the use of a "tractor-like device" to collect manganese nodules.\textsuperscript{100} Those benthic species laying in dredging paths are almost certain to be destroyed. According to William J. Broad, the question "is not whether seabed mining will kill sea creatures but how great the carnage will be."\textsuperscript{101} For example, the plume effect of disturbed sediments, and possible releases of toxic chemicals that will result from the mining process, are unknown. Sylvia Earle argues that mining of manganese nodules can release into the surrounding seawater chemicals or substances that have been stabilized over the ages. Some of these metals are toxic to many creatures, but favored by others that prosper in the presence of the compounds. Their extraction could have widespread downstream impact.\textsuperscript{102}

Scientists are simply unsure as to the effect deep seabed mining will have.

Compounding the likely environmental impact of the mining process itself is the extreme fragility of deep-sea ecosystems. For example, smoker chimneys are only inches thick.\textsuperscript{103} Commenting on this fragility, one research team


\textsuperscript{99} Rona, supra note 13, at 52.

\textsuperscript{100} Russell, supra note 4, at 26.

\textsuperscript{101} Id. at 26.

\textsuperscript{102} Id.

\textsuperscript{103} See Tivey, supra note 14, at 68.
observed, "[a]s we hit the chimney with the leading edge of a sample basket mounted at the front of the submersible, the chimney broke and fragments glittering with metallic crystals fell into the basket."\textsuperscript{104} Harvesting minerals from vent communities, it seems, may well wreak the same havoc that clear cutting does in forest ecosystems.

A related problem is that many of the deep-sea species are very specific to their particular habitats. Organisms found in one vent community may differ greatly from organisms found in another vent community. Indeed, "every hydrothermal vent field examined to date has some species that are not found in any other vent field."\textsuperscript{105} Also significant is the fact that life on the ocean floor happens at a very slow pace. For example, \textit{Tindaria callistiformis}, an abyssal clam, takes 100 years to grow to the length of one third of one inch.\textsuperscript{106} According to Elliot Norse, founder of the Marine Conservation Biology Institute in Seattle, "[s]low growth rates and the sluggish reproduction that accompanies this might make deep-sea ecosystems especially slow to recover even after stresses have been removed."\textsuperscript{107} Thus, the clumsy art of mining may potentially inflict considerable injury on these deep-sea ecosystems.

\textbf{A. Importance of Deep-Sea Organisms}

Why would we care if a few worms and crabs were killed in a process that will reap billions of dollars in profits? Casting aside the argument that all life has an intrinsic value, there are several sound environmental, biological, and even economic reasons for preserving deep-sea ecosystems. The first is that these ecosystems contain incredible biodiversity. Fred Gassle, working for the U.S. Minerals Management Service, argues that "at present, it is not possible to get a good estimate of the number of species in the deep sea. But there's got to be at least a million and 10 million is not unreasonable."\textsuperscript{108} In his opinion, the deep sea may contain as much genetic diversity as the media popularized tropical rain forests.\textsuperscript{109}

\begin{footnotesize}
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\item\textsuperscript{104} Rona, \textit{supra} note 13, at 54.
\item\textsuperscript{105} Russell, \textit{supra} note 4, at 27.
\item\textsuperscript{106} See \textit{id.} at 28.
\item\textsuperscript{107} Id.
\item\textsuperscript{108} Pain, \textit{supra} note 13, at 6.
\item\textsuperscript{109} See Russell, \textit{supra} note 4, at 27.
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Unfortunately, there are few people working to identify and classify these new discoveries.\textsuperscript{110} Indeed, there are only a handful of people in the world trained to identify cirratulid worms and tanaids found on the ocean floor.\textsuperscript{111} According to Dr. Lambshead, a London scientist, “[i]f the numbers are correct it would take 5000 years to identify all the species.”\textsuperscript{112} He goes on to state that if deep-sea mining becomes a reality, “many species could be forced into extinction before they’re even described.”\textsuperscript{113}

In addition to their contribution to the Earth’s overall biodiversity, deep-sea organisms may prove useful to the biotechnology industry. Sulfur-vent microbes, for example, provide enzymes that are useful at temperatures much higher than those of their land-based relatives.\textsuperscript{114} Also, given their ability to process toxic chemicals, these new enzymes may be developed into agents that can break down hazardous wastes.\textsuperscript{115} Thus, it is quite possible that we will lose more value in genetic diversity and biotechnology applications of deep-sea organisms than we may gain from deep-sea mineral extraction.

\section*{V. Environmental Protection in the Agreement and UNCLOS III}

Given the great biological wealth potentially threatened by deep seabed mining, one must determine what provisions in the seabed mining regime exist to protect this wealth. When negotiators gathered to hammer out the Law of the Sea Convention, they were preoccupied by political and economic controversies surrounding deep-sea mining, not environmental protection.\textsuperscript{116} Indeed, discoveries of deep-sea life and the concomitant concern for its preservation was, in many cases, relatively recent.\textsuperscript{117} As a result, specific environmental protection measures are sparse in the original treaty. Part XI and the Agreement do, how-

\textsuperscript{110} See Pain, supra note 13, at 7.
\textsuperscript{111} See id.
\textsuperscript{112} Id.
\textsuperscript{113} Russell, supra note 4, at 28.
\textsuperscript{114} See id.
\textsuperscript{115} See id.
\textsuperscript{116} See Brown, supra note 6, at 81-83.
\textsuperscript{117} See, e.g., Pain, supra note 13, at 5 (noting that “the study that really put deep-sea diversity on the ecological map was a series of 233 cores, each 30 centimeters square, taken along a 176-kilometre track off the coast of New Jersey and Delaware in the mid-1980s”); Suter, supra note 24, at 8 (stating that “discoveries in the last decade or so have shown that there is a new world in some parts of the seabed, teeming with life and presenting fresh challenges for scientists”).
ever, contain provisions requiring the preparation of environmental assessments prior to the commencement of mining operations. These provisions allow the Council to reject applications, but only "in cases where substantial evidence indicates the risk of serious harm to the marine environment" (emphasis added). Part XI also provides for action by the Authority in the event of environmental emergencies.

The most significant aspect of Part XI and the Agreement, from the perspective of environmental protection, are the mechanisms they created through which specific protective measures may be drafted. Article 145 of Part XI, for example, provides that "[n]ecessary measures shall be taken in accordance with this Convention with respect to activities in the Area to ensure effective protection for the marine environment from harmful effects which may arise from such activities." Specifically, Article 145 instructs the Authority to develop rules, regulations and procedures for the prevention of environmental harms and for the protection and conservation of natural resources on the seabed. The Agreement reiterates this command for the adoption of rules, regulations and procedures by the Authority. Therefore, Part XI and the Agreement provide the foundation on which to create specific environmental protections in the seabed mining regime.

A. Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area

On July 13, 2000, the Authority enacted its first piece of legislation, the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area (Regulations), providing a first glimpse at the details of environmental protection in the seabed mining regime. The Regulations apply only to the prelimi-

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118 See UNCLOS, supra note 1, art. 165(2)(d); Agreement, supra note 7, Annex, § 1(7). Interestingly, Part XI requires that the Council prepare the environmental assessments, while the Agreement requires that an assessment accompany an application. Id.
119 UNCLOS, supra note 1, art. 165(2)(l).
120 See id. art. 165(2)(k).
121 Id. art. 145.
122 See id.
123 See Agreement, supra note 7, Annex, § 1(5)(g).
nary stages of the mining process: prospecting and exploration. Further, the Regulations apply only to exploration of polymetallic nodules, not sea vent chimneys. Specifically, the Regulations govern the content of prospecting and exploration applications, fees, processing of applications, the contents of exploration contracts, protection of the marine environment, confidentiality, settlement of disputes and other general provisions.

Environmental protection in the Regulations takes essentially three forms. First, Regulation 18 requires applicants to submit and collect certain environmental data with their proposed work plans. This data must include a description of the applicant's program for carrying out environmental baseline studies and monitoring the effects of exploration on the marine environment. A contractor must also submit a preliminary assessment of the possible impact of the exploration on the marine environment. Finally, the contractor must submit a description of plans for the "prevention, reduction and control of pollution

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125 See Regulations, supra note 124, preamble. As defined in the Regulations, "exploration" includes the exclusive right to search for nodules, analyze deposits, carry out studies, and test "collecting systems and equipment, processing facilities and transportation systems." See id. Regulation 1(3)(b). "Prospecting" is a more cursory examination of mining possibilities, without exclusive rights. See id. at Regulation 1(3)(e).

126 See Press Release, supra note 11, at 2.

127 See Regulations, supra note 124, Regulations 10-18.

128 See id. Regulation 19.

129 See id. Regulations 20-22.


131 See id. Regulations 31-34.

132 See id. Regulations 35-36.

133 See id. Regulation 39.

134 See id. Regulations 37-38.

135 See id. Regulation 18.

136 See id. Regulation 18(b); see also id. Regulation 31(4) (stating that "[e]ach contract shall require the contractor to gather environmental baseline data and to establish environmental baselines . . . against which to assess the likely effects of its program of activities under the plan of work for exploration on the marine environment and a program to monitor and report on such effects."). The contractor, after developing the monitoring program, must report annually to the Secretary-General on its implementation and results. See id. Regulation 31(5).

137 See id. Regulation 18(c). Section 5.5 of the Standard Clauses for Exploration Contract requires the contractor to submit to the Authority "a site specific environmental impact statement based on available meteorological, oceanographic and environmental data collected during the preceding phases of exploration and containing data that could be used to establish an environmental baseline," in addition to an assessment of the likely effects of exploration on the marine environment. See Regulations, supra note 124, Annex 4.
and other hazards, as well as possible impacts, to the marine environment.”

These pollution prevention measures must protect the environment “as far as reasonably possible using the best technology available to it.”

If any data is missing from the exploration application, the application may be sent back to the applicant for revision. If such data is absent in the amended application, the Commission may withhold approval of the application. Further, the Commission may only recommend approval of the application if the plan of work provides for “effective protection and preservation of the marine environment.” Therefore, collection and evaluation of environmental data is one of the environmental protections embedded in the Regulations.

The second prong of the Regulations’ environmental protections is provisions governing environmental emergencies, and is perhaps the strongest protection measures in the regime. When the Secretary-General becomes aware of any incident that has or will likely cause serious harm to the marine environment, she or he shall take such measures “as are practical and reasonable in the circumstances to prevent, contain and minimize serious harm to the environment.” After receiving a report of the incident from the Secretary-General and hearing recommendations from the Commission, the Council may issue emergency orders. These orders may require the contractor to suspend or alter operations. If the contractor does not act to prevent serious harm, the Council will take measures to prevent, contain and minimize the harm.

The third prong of the Regulations’ environmental protections is in the form of financial guarantees to pay for any environmental emergencies. For example, the contractor must provide the Council with a “guarantee of its financial and technical capability to comply promptly with emergency orders or to assure that the Council can take such emergency measures.” If the contractor does

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138 Id. Regulation 18(d).
139 Id. Regulation 31(3).
140 See id. Regulation 21(8).
141 See id.
142 Id. Regulation 21(4)(b), 21(5).
143 See id. Regulation 32.
144 Id. Regulation 32(2).
145 See id. Regulation 32(1). In addition to the Council and the Commission, the Secretary-General will also make the report available to all members of the Authority, international organizations, and other concerned organizations. See id.
146 See id. Regulation 32(5).
147 See id. Regulation 32(6).
148 Id. Regulation 32(7).
not provide the Council with this guarantee, the contractor's sponsoring state will be responsible for ensuring that assistance is provided to the Council in the event that it has to respond to emergency orders.\textsuperscript{149}

Therefore, the Regulations provide the first concrete protections for the environment in the seabed mining regime. So far, the environmental protection embedded in the Regulations consists primarily of data collection and evaluation, emergency response provisions, and provisions placing financial responsibility of such emergency response on either the contractor or the sponsoring state. These measures are an impressive first step by the Authority toward meaningful environmental protection. However, because the Regulations are the product of a delicate compromise,\textsuperscript{150} they leave room for improvement.

VI. STRENGTHENING ENVIRONMENTAL PROTECTION IN THE REGULATIONS

Since the Authority has adopted the Regulations, after significant compromise, it can now strengthen environmental protections in the seabed mining regime within the Regulations' established framework. The Regulations contemplate such strengthening, stating that the Regulations "may be supplemented by further rules, regulations and procedures, in particular on the protection and preservation of the marine environment."\textsuperscript{151} The recommendations discussed below may be divided in three main categories: 1) creating more detailed requirements for environmental assessments by establishing a database of environmental baselines; 2) strengthening provisions requiring financial and technical guarantees for emergency orders; and 3) interpreting certain terms so as to provide the environment the greatest possible protection.

A. Detailed Environmental Assessments

In order for the environmental assessments to effect meaningful protection, they must be sufficiently detailed. Several specific measures should be included in the environmental assessments.\textsuperscript{152} First, in line with its mandate to

\textsuperscript{149} See id.
\textsuperscript{150} See Press Release, supra note 11, at 1.
\textsuperscript{151} Regulations, supra note 124, Regulation 1(5).
\textsuperscript{152} Many of the following proposals are inspired by provisions of the California Environmental Quality Act (CEQA). See Cal. Pub. Res. Code §§ 21000-1177 (Deering 1996). An excellent reference on CEQA is
"apply a precautionary approach," the Authority must make environmental protection and conservation an explicit, overriding goal.\textsuperscript{153} For example, there must be a clear statement of policy that work plans, which involve substantial environmental harm, will not be approved.\textsuperscript{154} Such a policy statement would send a signal to both applicants and to the members of the Commission that environmental protection is a priority.

Second, the environmental assessment must include a detailed description of the baseline environment.\textsuperscript{155} A properly described baseline should be the result of serious scientific study\textsuperscript{156} and should include findings from explorations and feasibility studies as well as current knowledge regarding the particular site or ones similar to it. An Authority workshop recently recommended that environmental assessments should include discussion of exploration techniques and potential mining systems, the biological environment, the chemical environment, the physical environment, and geochemical impacts.\textsuperscript{157} In addition,

\textsuperscript{153} Regulations, supra note 124, Regulation 31(2).

\textsuperscript{154} Such a statement of policy could be added to the governing rules of the Commission under Regulation 1(5). An example of such a statement is that "Environmental assessments which reveal that mining operations will result in significant loss of unique marine life, significant pollution, or any other significant environmental harm, as determined by the Council, will result in the denial of the mining application."

\textsuperscript{155} See, e.g., Guide, supra note 152, at 98-105 (describing "baselines" for purposes of CEQA analysis).

\textsuperscript{156} CEQA defines "environment" as "the physical conditions which exist within the area. See Cal. Pub. Res. Code § 21060.5 (Deering 1996). The CEQA Guidelines (a non-binding, but very authoritative implementation guide found in the California Code of Regulations, § 15000 [hereinafter Guidelines]) state that environmental impact reports must include "a description of the environment in the vicinity of the project, as it exists before the commencement of the project . . . " See Guidelines § 15125. Requiring a description of the pristine, untouched environment is important because environmentalists are most concerned with discoveries of unique species and fragile ecosystems.

\textsuperscript{157} Because the Agreement puts the responsibility of the assessments on the applicants, the responsibility of the study would also fall on the applicant. See Agreement, supra note 7, Annex, § 1(7).

\textsuperscript{157} See generally Office of Resources and Environmental Monitoring, International Seabed Authority, Deep-Seabed Polymetallic Nodule Exploration: Development of Environmental Guidelines 1 (1999) [hereinafter Development]. Requiring a catalogue of resources in the physical and biological environment sections would serve multiple goals. First, it would increase scientific knowledge of the seabed. Second, it would force both the applicant and the Council to consider a fuller range of ramifications of mining activities, and lead to a more economically and environmentally rational result. Third, it creates the possibility of a genetic biodiversity bank of organisms and knowledge of the area. While the biodiversity bank might address the fears of environmentalists and scientists, it raises questions of ownership that are beyond the scope of this Article.
endangered species existing at or near the site should receive special consideration.  

Including a detailed baseline description makes clear the opportunity costs involved in a mining operation, and should lead to more rational decision making. For example, if the proposed mining site contains only a few unique species, the value of minerals at a site may outweigh the value of biodiversity found there. If the site contains a wealth of unique species diversity, on the other hand, it may well be a more rational choice to leave the site unmined and the genetic resources available for exploitation instead.

Third, the environmental assessment should include a serious discussion of alternatives and mitigation measures. Alternatives should, of course, include a no-action option, as well as alternative locations and extractive methodologies. This section should include a discussion of the costs and benefits of each option. Costs should include operational costs and opportunity costs of not developing the particular site, as well as the environmental costs including the type and number of organisms sacrificed or disrupted as a result of the operations. Requiring a serious discussion of alternatives provides another safeguard to ensure rational and informed decision-making.

Environmental assessments should also require a discussion of reasonable mitigation measures that will be taken to offset the environmental costs of the operation. The Authority should make clear that it may suggest additional mitigation measures and require its implementation as a condition of plan approval. Adding this provision would force applicants to account for externalities of mining operations in their applications.

Finally, the Authority should require that environmental assessments be made available for public comment and review, excluding confidential and proprietary portions of the assessment, prior to authorizing the plan. To ensure

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158 CEQA requires that an environmental impact report, as opposed to a simpler environmental assessment or negative declaration, be performed if the project has the potential to affect endangered species. See Guidelines § 15065; Cal. Pub. Res. Code § 21083 (Deering 1996); see also Guide, supra note 152, at 106-07.


160 Consideration of alternatives under CEQA must include the "no project" alternative. See Guidelines, supra note 155, § 15126(d)(4).


162 See Regulations, supra note 124, Regulation 35 (discussing proprietary data and information and confidentiality).
SAVE THE MUCKWORMS!

maximum dissemination of the information and obtain the widest array of com-
ment, the proposed environmental assessment should be made available on the
internet.\textsuperscript{163} Public review would provide a check on the Authority's decision
making. It would also give further recognition to the principle that the resources
of the Area are the "common heritage of mankind."\textsuperscript{164} In addition to making the
environmental assessments available to the public, the Authority should create a
database of environmental baselines.\textsuperscript{165} Doing so would increase scientific knowl-
edge and potentially decrease exploration costs in the Area.

B. Stronger Guarantee Provisions

Another needed supplement to the Regulations is a stronger guarantee of
technical and financial resources in the event of an environmental emergency.
First, requirements of technical and financial capability to carry out proposed
work plans should also be explicitly required.\textsuperscript{166} Second, the Regulations state
that contractors must prove that they have the financial and technological capa-
bilities to comply with emergency orders.\textsuperscript{167} If they can not make such a guaran-
tee the Regulations provide that the sponsoring state must ensure that assistance
is provided to the Authority to carry out emergency orders.\textsuperscript{168} Instead, the Au-
thority should reject applications if the contractor cannot make such a guaran-
tee, or find some other entity to make the requisite guarantee, thus placing
the burden squarely on the contractor. Finally, future rules should be adopted
that require financial and technical capabilities not only to "prevent, contain or
minimize serious harm to the marine environment,"\textsuperscript{169} but also to perform any
reasonable clean-up.

\textsuperscript{163} See DEVELOPMENT, supra note 157, at 236 (recommending that "[e]nvironmentally important data . . .
should be freely available for scientific analysis and an inventory of the data holdings from each contractor
should be accessible on the World Wide Web").
\textsuperscript{164} UNCLOS, supra note 1, art. 136 (declaring that seabed resources are "the common heritage of man-
kind").
\textsuperscript{165} See supra notes 157-161.
\textsuperscript{166} See, e.g., Regulations, supra note 124, Regulation 12(1) (stating that "[e]ach application for approval of a
plan of work for exploration shall contain specific and sufficient information to enable the Council to
determine whether the applicant is financially and technically capable of carrying out the proposed plan of
work for exploration and of fulfilling its financial obligations to the Authority.")
\textsuperscript{167} See id. Regulation 32(7).
\textsuperscript{168} See id.
\textsuperscript{169} Id. Regulation 32(5).
Finally, the Authority should issue guidelines in order to interpret the Regulations in the most protective manner possible. For example, the Regulations currently require that contractors “take necessary measures to prevent, reduce and control pollution and other hazards to the marine environment arising from its activities in the Area as far as reasonably possible using the best technology available to it” (emphasis added). The words “to it” create a subjective “best available technology” standard. However, this provision should be interpreted as requiring the use of the best available technology on the market, not simply the best technology that the contractor can afford.

Further, the Regulations state that the contractor will be responsible for any damage “arising out of wrongful acts” during its operations (emphasis added). “Wrongful” should not be interpreted as requiring an element of intent. Mere negligence should suffice for liability to attach.

Finally, the Regulations provide extensive protection for confidential and proprietary information. “Confidential” should be interpreted as excluding scientific facts, such as the information collected for the determination of environmental baselines. An interpretation that would consider such information confidential or proprietary would seriously impede the progress of scientific knowledge of the Area.

Adopting the above recommendations would tighten the Regulations' environmental protection, reduce the possibility of escaping liability, and contribute to a greater scientific understanding of the Area. The recommendations should also allay the fears of environmentalists of massive, unchecked environmental destruction. The collection of information regarding species diversity also addresses the concerns of scientists and the biotechnology industry who fear biodiversity loss. Further, these recommendations are consistent with Part XI's mandate for protection of the marine environment and the Regulations' commitment to a “precautionary approach.” Finally, the recommendations do not alter the delicate balance struck during the drafting of the Regulations.

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170 Id. Regulation 31(3).
171 Id. Regulation 30.
172 See id. Regulations 35-36.
173 See UNCLOS, supra note 1, art.145.
174 Regulations, supra note 124, Regulation 31(2).
175 See PRESS RELEASE, supra note 11, at 1.
VII. Conclusion

The recommendations detailed here have the primary virtue of mandating informed decision-making. They may also be a way to strike the balance between entrepreneurs and environmentalists. While not completely precluding the possibility of mining operations, these measures should ensure that such operations would give due attention to their environmental consequences. Not everyone will be happy under such a regime. But at least people will, in theory, know what they are doing.