

# DEVELOPING THE MINERAL RESOURCES OF THE SEABED

*Doug Bandow*

The world's oceans have played a vital role in the development of virtually every nation. They provide the transportation network that binds us together through trade; they yield much of the food that feeds us; and they act as laboratories for scientific research. They also contain the natural resources that can help sustain and encourage economic development in the United States and throughout the rest of the world. Unfortunately, the development of the mineral resources of the seabed is considered more problematical today than was thought to be the case even two years ago. If we cannot surmount the technical, economic, and legal barriers to the development of these resources, we will have lost an important opportunity to enhance the economic well-being of people all over the world.

## The Wealth of the Seabed

The oceans contain vast amounts of mineral resources. As much as 40 percent of the world's recoverable oil resources may lie offshore. Based on potential recoverable reserves of 1,000 to 5,000 billion barrels, there is likely 400 to 600 billion barrels of oil offshore, and possibly as much as two trillion. Economist James Johnston estimates that 80 percent or more of these reserves are within 200 miles of shore (the evolving boundary between coastal state and international jurisdiction over economic resources). Economists David B. Johnson and Dennis E. Logue are more pessimistic, projecting recoverable

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The author is Editor of *Inquiry Magazine*, and a Senior Policy Consultant with the Cato Institute. He formerly served in the Reagan administration as a Special Assistant to the President for Policy Development, and was a Deputy Representative to the Third United Nations Conference on the Law of the Sea.

reserves of 340 billion barrels.<sup>1</sup> This still leaves a substantial portion of the resources, up to 20 percent, in the seabed beyond, though at least one expert doubts that these reserves will become commercially recoverable.<sup>2</sup> In any event, the value of the ocean deposits of oil is immense, and would be worth between \$14 and \$70 trillion, at a price of \$35 per barrel.

There also are significant reserves of gas and natural gas liquids. Johnson and Logue have estimated that close to 2000 trillion cubic feet of natural gas (equivalent to 296 billion barrels of oil) and roughly 52 billion barrels of natural gas liquids (equivalent to 36 billion barrels of oil) lie within roughly 200 miles of the United States.<sup>3</sup> Additional reserves undoubtedly also lie beyond the 200 mile mark, but estimates have not been made.

The ocean's hard mineral resources may rival the energy deposits in value. According to the U.S. Geological Survey, the floor of America's continental shelf contains more than one trillion cubic meters of sand and gravel, 155 billion cubic meters of shell and carbonate sand, three and a half billion metric tons of heavy-metal sand, a similar amount of phosphorite, 70,000 kilograms of precious coral, and 17 trillion metric tons of rock salt.<sup>4</sup> These regions also contain varying amounts of titanium, gold, platinum, zircon, and other heavy metals, as do the coastal areas of other nations.<sup>5</sup>

Significant mineral deposits also lie on the ocean basin—the deep seabed—the most important of which are manganese nodules. Scientists and observers have estimated that the Pacific Ocean has the richest deposits, containing one to one and a half trillion tons, making

<sup>1</sup>James Johnston, "Petroleum Revenue Sharing from Seabeds Beyond 200 Miles Offshore," *Marine Technology Society Journal* 14 (1980): 28–30; David Johnson and Dennis Logue, "Economic Interests in Law of the Sea Issues," in Amacher and Sweeney, eds., *The Law of the Sea: U.S. Interests and Alternatives* (Washington, D.C.: American Enterprise Institute, 1976), p. 59. They believe that changes in U.S. Geological Survey projections make their estimates optimistic (p. 57). But if petroleum prices increase in the future, more deposits of oil that are now uneconomical to develop will become recoverable, increasing estimates of proved reserves. Ross Eckert, *The Enclosure of Ocean Resources* (Stanford, Calif.: Hoover Institution Press, 1979), pp. 91–92. The amount of likely resources yet to be discovered or now discovered, but not yet economically recoverable, is significant (p. 94).

<sup>2</sup>Fred Singer, "The Great UN Snorkel," *The American Spectator*, May 1981, p. 24.

<sup>3</sup>Johnson and Logue, pp. 57, 59.

<sup>4</sup>Department of the Interior (DOI), "Program Feasibility Document OCS Hard Minerals Leasing," August 1979, at Table I. Some people believe the phosphorite deposits could be even larger. Paul Fye, et.al., "Ocean Science and Marine Resources," in *Uses of the Seas* (Englewood Cliffs, N.J., Prentice-Hall, Inc., 1968), p. 34.

<sup>5</sup>DOI, p. 5; Fye, et.al., p. 32; Peter Rona, "Marine Mineral Resources," *Natural Resources Forum* 5 (January 1981): 89–90.

this perhaps the largest mineral deposit on earth.<sup>6</sup> Nodules also are found on the seabed of the Atlantic and Indian oceans, and an estimated 250 million metric tons of them are on America's Outer Continental Shelf.<sup>7</sup>

The nodules are rounded masses of manganese oxide which form through chemical precipitates from the ocean, accreting around objects such as bones, stones, or teeth. The nodules vary greatly in size, from grains of sand to large boulders.<sup>8</sup> They consist mainly of manganese and iron, with important concentrations of nickel, cobalt, and copper, as well as small traces of up to 74 other metals, most of which are not economical to extract.<sup>9</sup> The metallic concentrations of the nodules varies by geographic location, and within particular deposits.<sup>10</sup>

Recently, other deep seabed deposits have been discovered. Polymetallic sulfides have been found in the East Pacific, along the Juan de Fuca Ridge, on the Galapagos Rift off Ecuador, in the Guayamas Basin in the Gulf of California, and even in the Red Sea. The minerals collect near volcanic hot springs, and contain copper, zinc, and silver in addition to sulfur.<sup>11</sup> In September, National Oceanic and Atmospheric Administration (NOAA) researchers found deposits some 1800 miles east of Miami; similar deposits were found by U.S. Geological Survey scientists last year roughly 250 miles off the Pacific Coast.<sup>12</sup> Scientists believe that similar deposits probably exist in unexplored portions of mid-ocean ridges and, more importantly, in U.S. waters.<sup>13</sup> According to Alex Malahoff, chief scientist of the National

<sup>6</sup>Eckert, p. 215; William Hawkins, "Reaffirming Freedom of the Seas," *The Freeman*, March 1982, p. 182.

<sup>7</sup>Eckert, p. 217; Hawkins, p. 182; DOI.

<sup>8</sup>Johnson and Logue, p. 39; Fye, et.al., p. 36; Eckert, p. 215.

<sup>9</sup>Tom Kizzia, "Deep Sea Billions," *Washington Post Magazine*, August 2, 1981, p. 24.

<sup>10</sup>Eckert, p. 219.

<sup>11</sup>Memorandum from Daniel N. Miller, Jr., assistant secretary for Energy and Minerals, Department of the Interior, to Ambassador James L. Malone, Department of State, October 15, 1981; Rona, pp. 93-94; "Polymetallic Sulphides: More Riches from the Sea?," U.N. Doc. DESI FACTS 82/2 (March 1982). The deposits off Ecuador are worth some \$2 billion alone. "Massive Deposit of Copper, Other Ores Found in Ocean," *Baltimore Sun*, October 9, 1981. A more detailed discussion of these metals is available in Congressional Research Service (CRS), "Report of Marine Hydrothermal Metal Deposits," Committee Print Serial No. 97-d (July 1, 1982), pp. 1-49 and Peter Rona, "Criteria for Recognition of Hydrothermal Mineral Deposits in Oceanic Crust," *Economic Geology* 73 (March-April 1978): 135-160.

<sup>12</sup>"U.S. Team Uncovers Rich Manganese Deposit," *New York Times*, September 23, 1982, p. A23; "Confirm Rich Metal Deposits Near Newly Discovered Submarine Hot Springs," Press Release, U.S. Geological Survey, Department of the Interior, September 17, 1981.

<sup>13</sup>Miller memorandum, p. 2; Press Release, U.S. Geological Survey; "Massive Deposit of Copper, Other Ores"; "Polymetallic Sulphides: More Riches."

Ocean Survey, these discoveries "could mark a new and dramatic turnaround in the assessment of the volume of accessible world-wide deposits of strategic minerals."<sup>14</sup>

Last September cobalt deposits were discovered in the Pacific. According to Dallas L. Peck, director of the U.S. Geological Survey, "similar cobalt-rich crustal deposits may be available at relatively shallow depths in water close to the Hawaiian Islands, the Trust Territory of the Pacific Islands, and other U.S. Pacific territories and possessions."<sup>15</sup> The continuing fast pace of mineral discoveries indicates potentially immense resources at our disposal.

Unfortunately, the value of these significant mineral deposits may remain theoretical for some time. As Peter A. Rona, a senior research geophysicist with NOAA noted: "Only a small fraction of the potential mineral resources of the continental shelf and virtually none of the resources of ocean basins are presently exploited. The reasons for this situation are scientific, technical, economic, and legal."<sup>16</sup>

## Barriers to Seabed Development

### *Scientific and Technical Barriers*

The current state of scientific knowledge regarding the process of mineral accretion and concentration does not allow us to accurately predict the full extent of the mineral wealth of the seabed. Scientists are constantly surprised at the vast amounts of new seabed resources that are being discovered. For example, the scientific community was taken by surprise when polymetallic sulfides were discovered in 1979, and when cobalt resources were found only months ago.<sup>17</sup> Even where seabed resources have been thoroughly analyzed, as in the case of petroleum and manganese nodules, there are still major technical barriers to extracting them. The ocean floor is a series of hills and canyons lying 3,000 to 5,000 meters beneath the ocean's surface, and varying in make-up between ooze and a brittle crust. The pressure at such depths is tremendous. This makes the oceans "not only a difficult environment in which to work but also an unpredictable one."<sup>18</sup> This unpredictability extends to the ocean's surface, which is subject to constant change.

<sup>14</sup>"Massive Deposit of Copper, Other Ores."

<sup>15</sup>"Cobalt-Rich Seabottom in South Pacific Offers New Mineral Potential," Press Release, U.S. Geological Survey, Department of the Interior, September 21, 1982.

<sup>16</sup>Rona, "Marine Mineral Resources," p. 94.

<sup>17</sup>Miller memorandum.

<sup>18</sup>"Mining Deep Sea-Bed Minerals," U.N. Doc. DPI/DESI NOTE/587 (August 17, 1981), p. 1.

Despite the difficult environment, technological barriers to seabed development seem to be breaking down. Petroleum exploration and extraction, for example, has steadily advanced, allowing exploitation of deeper and deeper fields. Between 1947 and 1978, offshore drilling platforms went from capacities of 20 feet to 1,000 feet, and significant drilling activity has moved from shallow coastal waters to far more inhospitable climes, such as Alaska and the North Sea.<sup>19</sup> Thus, the Outer Continental Shelf, possessing most of the known oil reserves, is fully within reach of current technology.

The trend toward deeper drilling seems likely to continue, with further technical improvements potentially extending drilling to the deep seabed. Seismic reconnaissance makes exploration cheaper at sea than land, and is accurate up to 5,000 feet. The use of robots, "deep saturation diving," mobile drilling, and underwater wellheads extend the reach of potential development.<sup>20</sup>

The technical problems encountered in the recovery of other minerals vary. Mining minerals on the bed of the continental margin, particularly where the ocean depths are hundreds rather than thousands of feet, is not difficult. Indeed, companies have been mining tin, phosphorite, sand and gravel, and other heavy metals offshore for decades. Offshore sand and gravel mining has proved to be second only to oil and gas in value to the United States; the deposits are thick and abundant, and can be transported to shore by dredge or pipeline. Other minerals mined in coastal areas around the world include titanium sands, zircon and monazite, salt, magnesium, lime mud and shells, pearl, and sulfur.<sup>21</sup>

One mining tool is the "seagoing, self-propelled, trailing suction hydraulic hopper dredge." The dredge collects materials off the seabed, and either transports them to open-water disposal sites, or directly pumps them through a discharge piping system to a shore disposal site. Other systems are theoretically possible, including a continuous-line bucket system.<sup>22</sup>

Developing manganese nodules is difficult. The nodules must be mined, lifted to the surface, transported to shore, and processed. This

<sup>19</sup>Eckert, pp. 94-95; William Pendley, "The U.S. Will Need Seabed Minerals," *Oceanus* 25 (Fall 1982): 13-14. Interestingly, it is also possible to collect natural seepages of oil and gas through fissures in the ocean floor. Drilling is not even required. "Payoff from the Sea Floor," *Time*, October 11, 1982, p. 79.

<sup>20</sup>Edmund Gullion, "Introduction: New Horizons at Sea," in *Uses of the Seas*, p. 2; Johnson and Logue, p. 58; Eckert, p. 94.

<sup>21</sup>Fye, et.al., p. 39; Rona, "Marine Mineral Resources," pp. 89-90.

<sup>22</sup>DOI, appendix 20.

requires a mining operation quite different from that on land. As economist Ross Eckert has observed:

The mining of nodules requires the development of entirely new deep-ocean technologies. Efficiencies are uncertain since there is no previous experience with comparable systems. Reliable methods must be developed for a variety of difficult tasks: surveying areas by remote sensors and evaluating samples having high moisture content; collecting deposits from the ocean floor on a continuing basis at depths of up to three miles and lifting them to the surface; developing viewing systems that permit the mining machinery to be observed in operation and reveal any obstacles lying in the paths of dredge sweeps; developing structural materials that are resistant to corrosion and fatigue; eliminating waste materials such as silt and soil from the nodules at sea before ores are transported to shore for processing; and extracting metals without the use of conventional processes.<sup>23</sup>

The actual mining and lifting of the nodules is the most serious barrier, since the transportation and processing steps require nothing extraordinary. Transportation would be by ship. The selection of processing technology is still unresolved. Five different processing techniques are being considered, with two apparently being extensively tested. The technology to be used won't be chosen until some pilot operations are established, specific deposits surveyed, and the metals to be recovered decided upon.<sup>24</sup>

The basic capability of several different collection systems has been demonstrated, and miners theoretically could proceed to develop commercial mining operations. However, a lot of work remains before the skeptics will be satisfied that commercial feasibility on a large scale and a long-term basis have been proven. Some bankers in particular are not yet ready to lend money for nodule mining because of doubts over the collection technology.<sup>25</sup>

There are three distinct systems which may be used to collect and lift nodules to the surface. The first is hydraulic mining, which relies on a mining vehicle connected to a mother ship to operate on the seabed. The bottom miner is the most complex aspect of the system.

<sup>23</sup>Eckert, p. 219. His view of the difficulties is shared by others. Gordon MacDonald, "An American Strategy for the Oceans," in *Uses of the Seas*, p. 170; J.K. Amsbaugh and Jan Van der Voort, "The Ocean Mining Industry: A Benefit for Every Risk?," *Oceanus*, 25 (Fall 1982): 22.

<sup>24</sup>Eckert, p. 225. The cost of recovering four metals is higher than recovering only three; the demand for manganese will determine whether it is worthwhile to extract. Robert Knecht, "Deep Ocean Mining," *Oceanus* 25 (Fall 1982): 5.

<sup>25</sup>General Accounting Office (GAO), "Impediments to U.S. Involvement in Deep Ocean Mining Can Be Overcome," February 3, 1982, p. 32.

It may be self-propelled (the Ocean Minerals Company has tested one that uses two Archimedes-type cylinders), towed by the lift pipe, or remain stationary with a rotating arm connected to a movable carriage to crush and collect nodules. The moving models require significant additional work for sensing, steering, and monitoring. The self-propelled mode would likely be a more efficient miner, but is more complex; the towed miner requires greater coordination between ship and vehicle. The stationary model is most expensive, and was developed in tandem with the *Glomar Explorer* in trying to recover a sunken Soviet submarine. But its techniques might be adaptable to one of the mobile units. In either case, the nodules collected would be lifted to the surface through a pipe connected with the mother ship: The nodules could be mixed with water and pumped to the surface or sucked upward in slurry form by the injection of compressed air. Both methods have been tested, and both have various advantages and disadvantages.<sup>26</sup>

A cheaper collection system is the continuous line bucket system, which is essentially a line with dredge buckets attached. The line is rotated, causing a constant stream of buckets to scoop up nodules, carry them to the surface, empty the nodules into a ship, and then return to the seabed. Though AFERNOD, the French consortium, and SEDCO, the Japanese consortium, apparently tested this method successfully, it is very difficult to control the buckets, and to prevent the line from tangling. Few observers expect the system to be commercially feasible: Conrad Welling, manager of ocean mining for Lockheed Missiles & Space Co., says the system has had only "very limited success."<sup>27</sup>

The third system is modular mining, which employs a number of free swimming mining units. These units collect minerals from the seabed, transport them to the surface ship and unload their cargo, and return to the seabed. This system has received the least attention, though it is reported that AFERNOD is considering it.<sup>28</sup>

The most experimentation has been with the hydraulic system. The technology itself is fairly well advanced; the next stage is a pilot program, which Lockheed's Welling estimates is a multi-year, two-stage process involving between \$350 million and \$600 million. Establishing the first commercial deep seabed mining operation

<sup>26</sup>Eckert, pp. 219-224; "Mining Deep Sea-bed Minerals," pp. 2-6; Kizzia, p. 28.

<sup>27</sup>Conrad Welling, "The Massive Technology for Ocean Mining," *Stockton's Port Soundings*, September 1980, p. 9; Knecht, pp. 5-6; Eckert, p. 220; "Sea-Bed Mineral Resource Development: Recent Activities of the International Consortia," U.N. Doc. ST/ESA/107 (1980), p. 9.

<sup>28</sup>"Mining Deep Sea-Bed Minerals," pp. 3-5; Knecht, pp. 5-6.

probably will require between \$1 billion and \$1.5 billion to fully develop, purchase, and set up the technology, and annual costs could run as much as \$400 million.<sup>29</sup>

The technology necessary for mining other deep seabed minerals such as polymetallic sulfides which lie 8,500 feet below the ocean surface is less advanced. Scientists disagree on the exact state of the technology for mining sulfides. Malahoff of the National Ocean Survey says that most of the technology necessary to mine them already exists, while NOAA's Rona argues that the minerals discovered last September are too deep to be reached by current technology, and are instead a resource for the future.<sup>30</sup> In any case, we can apply the technical knowledge gained from the extensive research on manganese nodule mining to mining sulfides, and this should prove very useful. According to the Congressional Research Service (CRS), "While the mining system would not be identical, other aspects such as ship operating and construction costs, processing and transportation may be comparable [with that of manganese nodule mining]."<sup>31</sup> In fact, the sulfides ultimately should be easier to recover because the minerals are more highly concentrated, closer to shore and not as deeply situated.<sup>32</sup> Cobalt deposits are in a similar situation.

#### *Economic Barriers*

Perhaps the most important barrier to mineral development of the seabeds is economic. If seabed mining promises to generate sufficient *capturable* profits, entrepreneurs will have an incentive to undertake the necessary investment. Offshore oil production is a case in point. World offshore production was \$10 billion in 1972, and more than \$30 billion in 1980.<sup>33</sup> Oil production has continually extended further away from shore as oil prices have risen and the cost of the drilling technology fallen. Thus, the potential of deep-sea oil drilling exists: Its economic viability is dependent on the future movement of energy prices, and on expected after-tax profits.

Companies also have been mining hard-mineral resources up to the continental margin for decades. The world, annual value of hard-

<sup>29</sup>Conrad Welling, "Ocean Mining Systems," *Mining Congress Journal*, September 1976; GAO, p. 30; CRS, pp. 64-65.

<sup>30</sup>"Massive Deposit of Copper, Other Ores"; "U.S. Team Uncovers Rich Manganese Deposit." The same factors would seem to apply to the cobalt deposits. "Cobalt-Rich Seabottom in South Pacific."

<sup>31</sup>CRS, p. 61.

<sup>32</sup>Roger Brooks, "The Law of the Sea Treaty: Can the U.S. Afford to Sign?," Background, The Heritage Foundation, June 7, 1982, p. 19; CRS, pp. 66-67.

<sup>33</sup>Rona, "Marine Mineral Resources," p. 91.



mineral production was \$1 billion in 1979 and roughly \$4 billion in 1980.<sup>34</sup> Most U.S. production is of sand and gravel. However, recent studies commissioned by the U.S. Geological Service have concluded that phosphorite mining off the coasts of Georgia and California is economical, despite past instability in the phosphorite market. Moreover, even metals not currently worth mining, such as gemstones, gold, and platinum, may become profitable as market conditions change and technologies advance.<sup>35</sup>

The economic potential for mining manganese nodules is less clear, since deep seabed mining is significantly different from surface mining. In contrast, the economic potential of offshore oil drilling has been relatively easy to determine because it is simply an extension of existing capabilities. Investors have been moving slowly into deep seabed mining. The tens of millions invested over the past few years is but a small proportion of the total investment necessary to get a minesite into commercial operation. Judgments as to the likely costs, as well as likely mineral prices will determine the future pace of investment.

Most industry analysts agree that initial costs will be substantial—as much as \$1.5 billion. These costs could easily rise once practical mining problems are encountered. Among other things, the type and composition of nodules to be collected and the nature of the ocean terrain on which they lie might require specific equipment modifications to fit specific minesites.<sup>36</sup>

The most important minerals contained in the nodules are nickel, copper, cobalt, and manganese. Copper is most widely used, but cobalt is the most expensive and has the most sensitive strategic role: It is produced primarily by one of the world's more unstable countries, Zaire. (The 1978 Angolan invasion caused temporary cobalt price increases of up to 630 percent.)<sup>37</sup> Several other trace metals, such as molybdenum and vanadium, could become by-products rather than waste depending on their market price and the economics of the particular processing technology.<sup>38</sup>

The Interior Department estimates that nickel will contribute about 70 percent of the ocean mining industry's revenues. The demand for nickel is expected to grow only modestly in the years ahead, thus

<sup>34</sup>Ibid.

<sup>35</sup>DOI, pp. 7–8, 24, appendix 2 (p. 5); Rona, "Marine Mineral Resources," p. 89.

<sup>36</sup>Eckert, p. 224.

<sup>37</sup>Eckert, pp. 226–227; C.R. Tinsley, "United States' Interests in the Law of the Sea: Review and Analysis," paper presented to AEI Conference, October 19, 1981.

<sup>38</sup>Welling, "Ocean Mining Systems."

limiting seabed development. However, increased markets for copper, cobalt, and manganese could influence the ultimate success of the industry by providing a profitable margin.<sup>39</sup>

Because of the great uncertainties surrounding future metals markets, world economic growth, and economic performance of seabed mining, the most honest assessment is probably that of the CRS. "At this point no one really knows whether the initial deep seabed mining ventures will be economically viable."<sup>40</sup> But many observers believe that in time it can be. Economist Jim Johnston estimates that seabed mining would yield annual benefits to American consumers on the order of \$100 million annually by 1990, and \$1 billion by the end of the century.<sup>41</sup> Lawyer Frederick Arnold says that its long-term profitability is "ensured" by its "cost and strategic advantages."<sup>42</sup> Johnson and Logue argued in 1976 that:

Even at the mineral prices which prevailed in 1970, deep-sea mining was very nearly profitable, given the technological developments and forecasted costs of such mining, including substantial profit to compensate for risk. Indeed, since that time the prices of those minerals have risen sharply, while the estimated costs have not kept pace. Thus, it is very likely that deep-sea mining could be profitable today.<sup>43</sup>

They may be overly optimistic, given the world-wide recession and consequent slump in metal prices. However, as the world economy revives, metal prices are expected to increase. Moreover, as the more economical land-based mineral lodes are mined out, such as those in Canada which provide nearly half of the world's nickel, prices will rise even more, providing the incentives for seabed min-

<sup>39</sup>Rebecca Wright, "Ocean Mining: An Economic Evaluation," Ocean Mining Administration, Department of the Interior, May 1976; F.L. La Que, "Different Approaches to International Regulation of Exploitation of Deep-Ocean Ferromanganese Nodules," *San Diego Law Review* 15, no. 3 (1978): 483-484; Welling, "Ocean Mining Systems." Only one of the four private seabed mining consortia definitely intends to extract all four major metals. The others are seriously considering only recovering nickel, copper, and cobalt because it might be more economical. GAO, p. 34. See also Johnson and Logue, p. 44.

<sup>40</sup>CRS, p. 66.

<sup>41</sup>James Johnston, "The Economics of the Common Heritage of Mankind," *Marine Technology Society Journal* 13 (December 1979-January 1980): 26, 29.

<sup>42</sup>Frederick Arnold, "Toward a Principled Approach to the Distribution of Global Wealth: An Impartial Solution to the Dispute Over Manganese Nodules," *San Diego Law Review* 17, no. 3 (1980): 565.

<sup>43</sup>Johnson and Logue, pp. 43-44.

ing.<sup>44</sup> Thus, although current economic conditions are not propitious for the industry, in the long run the economic incentives should be sufficient to encourage development. The Reagan administration seems to share this view.<sup>45</sup>

The economic studies are equivocal. A U.S. Geological Survey-sponsored study of mining on the Blake Plateau, east of Jacksonville, Florida, estimated a possible return on seabed mining of between 28 and 32 percent.<sup>46</sup> In contrast, C.R. Tinsley, vice president of the mining division for Continental Bank of Chicago, has estimated a return on investment of only 12.8 percent to 15 percent, which, he noted, was less than then-current interest rates.<sup>47</sup>

Given the high risks involved in seabed mining, the actual returns on investment will have to be very large. The initial generation of seabed mining will be very risky. The industry is capital intensive, and will require a long payback. The market risk of seabed mining is substantial: Even if production costs remain stable, once the nodules are raised and processed, demand may still fall because of new land discoveries and more accessible ocean discoveries, technological advances, or economic slumps.<sup>48</sup> For this reason, Tinsley estimates that a rate of return as high as 30 percent will be necessary to attract investment. Meanwhile, Raymond Kaufman, vice president of Deepsea Ventures, believes that the potential profits have been exaggerated by politicians, and that investments in seabed nodules are "marginal" at best.<sup>49</sup>

The economic viability of mining the polymetallic sulfide and cobalt deposits is also unclear. The CRS cautions that "At [the] present time too little is known of marine polymetallic sulfide deposits to project their economic significance."<sup>50</sup> However, the existence of nodule mining technology at a cost that could make manganese

<sup>44</sup>Welling, "Ocean Mining Systems;" GAO, p. 5. The more economical land-based nickel deposits are being mined out, and the quality of the remaining ore is steadily falling. New deposits also are deeper and more expensive to extract. Nor is this just the case for nickel. Land-based manganese ore deposits could conceivably be mined out by the end of century. And the concentration of copper in seabed nodules has ranged up to 100 times the percentage in land-based ores.

<sup>45</sup>"U.S. Votes Against Law of the Sea Treaty," statement by President of the United States, July 9, 1982.

<sup>46</sup>DOI, pp. 7-8, 24.

<sup>47</sup>Tinsley. Another observer suggests a rate of return of 25 percent may be necessary. Knecht, p. 7.

<sup>48</sup>GAO, pp. 32-33; Singer; Alan Abelson, "Who Buried the Law of the Sea?," *Barron's*, July 26, 1982, p. 19.

<sup>49</sup>Kizzia, p. 28.

<sup>50</sup>CRS, p. 50.

nodule mining competitive suggests that sulfide deposits may eventually be economical to mine. Future sulfide mining costs will most likely be lower because, as noted earlier, the minerals are more concentrated and easier to reach. No projections about the economic potential of cobalt deposits have been made because they were just recently discovered.

### *Legal Barriers*

Unfortunately, there are also legal barriers which affect the economics of seabed mining. For resources within our continental margin, whether oil, sand, or manganese nodules, the legal barrier is primarily the restrictive leasing policies of the U.S. government. Oil and gas leasing offshore, for example, has been severely limited: Four percent of the federal government's offshore acres have been leased, and 2.5 percent are currently under lease.<sup>51</sup> Leasing for hard minerals has been restricted even more, with barely a half dozen leases granted over the years. A recent federal study concluded that the economic incentives for development already existed, but what was needed was "a Federal policy to allow such development."<sup>52</sup>

Development also has been limited by the states. Though few states oppose development per se, many are very concerned about the environmental impact of mining. Thus, state practices toward potential seabed mining vary from cooperative to overtly hostile.<sup>53</sup>

The Law of the Sea Treaty (LOST), approved on April 30, 1982, by a United Nations Conference (but not yet ratified), also restricts continental shelf mineral development. Article 82 mandates revenue sharing for the exploitation of mineral resources, primarily oil and gas, which lie under the continental shelves beyond 200 miles. The percentage of the tax begins at one percent in year six, and increases to seven percent by year 12. Johnston points out that the tax "raises the already high cost of recovery of petroleum" from these areas. He and other observers conclude that the disincentive effect of this tax could be significant. If the world supply of oil shrank by just five percent, world oil consumers could conceivably be paying a third of a billion dollars more, and American consumers would be shouldering 30 percent of that bill.<sup>54</sup>

<sup>51</sup>Robert James Lee, "How Uncle Sam Keeps Us All Energy Poor," *Libertarian Review*, February 1981, p. 26.

<sup>52</sup>DOI, cover memo and p. 3.

<sup>53</sup>Ibid., pp. 40-41, appendix 22. The conflict over oil leasing off California gives an indication of the opposition in some areas.

<sup>54</sup>Johnston, "Petroleum Revenue Sharing," p. 29; Stephen Chapman, "Underwater Plunder," *The New Republic*, April 21, 1982, p. 19.

The Reagan administration possesses the legal authority to increase leasing and is exercising it. For oil and natural gas, the Interior Department is planning a five-year program to offer one billion acres of the Outer Continental Shelf for lease—most of America's coastline. The industry's response has been enthusiastic.<sup>55</sup>

For the hard minerals, including gravel and sand, shell, and coral, an OCS Mining Policy Task Force evaluated a number of different leasing strategies to encourage mineral development. These strategies include developing a regional leasing schedule, granting leases on a case by case basis when requested, and setting up a prototype site.<sup>56</sup> Though the administration's attention has focused on oil and gas leasing, the task force supported giving greater attention to hard mineral leasing, including leasing for manganese nodules off the coasts of Florida and Georgia. Hopefully, the administration's general emphasis on increased leasing will carry over to hard minerals.

The Outer Continental Shelf leasing act needs to be amended for manganese nodule and polymetallic sulfide mining, since the current OCS framework might be legally inadequate for mining these minerals even within U.S. waters.<sup>57</sup> Some state opposition to mining could be defused through federal-state discussions,<sup>58</sup> though California's opposition to federal oil and gas leasing demonstrates how determined states can block development. As for the LOST inhibition to petroleum production, it can be solved only by failing to adhere to the treaty. (The most compelling reasons *not* to sign the treaty involved deep seabed mining and will be discussed below.)

Since the OCS Act only covers the continental shelf, the administration and Congress need to develop a legal framework to cover the area beyond the continental shelf out to 200 nautical miles. In this regard, the United States could extend its economic jurisdiction—"a better system of dealing with the change in hydrocarbon values and technologies" than increased international regulation.<sup>59</sup> Congressman John Breaux, chairman of the House Subcommittee on

<sup>55</sup>James Watt, "Challenging Industry: A New Ocean Development Program," speech before the National Ocean Industries Association, March 8, 1982; Dale Russakoff, "Bids on Alaskan Oil Rights Top \$2 Billion," *Washington Post*, October 14, 1982, pp. A1, A6.

<sup>56</sup>DOI, p. 58.

<sup>57</sup>CRS, pp. 88-89.

<sup>58</sup>DOI, p. 41.

<sup>59</sup>Eckert. In general, such systems are most likely to result in the creation of ocean resource rights most closely resembling land-based private property rights. Idem, "The Wealth Distribution and Economic Efficiency Consequences of the New Law of the Sea," paper presented to the 14th Annual Conference on the Law of the Sea Institute, October 20-23, 1980, p. 1.

Fisheries and Wildlife Conservation and the Environment, has introduced just such a bill declaring a 200-mile exclusive, economic zone for the U.S., within which the U.S. would have normal sovereign rights over the natural resources.<sup>60</sup> This legislation would extend U.S. jurisdiction over hard minerals just as the Fisheries Conservation and Management Act of 1976 extended U.S. control over fishing out to 200 nautical miles.

Alternatively, the Reagan administration could emulate President Truman's 1945 declaration of U.S. jurisdiction over the continental shelf and proclaim economic jurisdiction over 200 miles, while vowing to respect the freedom of navigation by other nations within that area.<sup>61</sup> Once such a jurisdiction was established, specific leasing legislation to govern hard minerals mining could be passed. Such legislation perhaps could be patterned after the Deep Seabed Hard Mineral Resources Act (discussed below), which was passed in 1980 to provide an interim framework for deep-seabed mining.<sup>62</sup>

The legal barriers facing deep-seabed mining are significant. The American Mining Congress has stated that: "The U.S. ocean mining industry possesses the technology, capital and skilled manpower to develop these mineral resources but lacks a stable and realistic legal regime under which the major investments necessary for commercial development can be prudently made."<sup>63</sup>

There is no general agreement on what form such a legal regime for the seabed must take. Traditionally, it has been argued that if seabed investment is to be encouraged, miners must be guaranteed security of tenure—the exclusive right to mine a specific minesite—through an international treaty.<sup>64</sup> Such a treaty would prevent poaching from competing miners and would resolve conflicting minesite claims.

This desire to forge an international agreement to cover seabed mining led to the inclusion of seabed mining in the LOST process, which turned into an effort to reach a comprehensive agreement to

<sup>60</sup>John Breaux, "Are There Alternatives to the Law of the Sea Treaty?" paper presented to AEI conference, October 19, 1981, p. 11.

<sup>61</sup>CRS, pp. 101–102, 94.

<sup>62</sup>Knecht, p. 8.

<sup>63</sup>"Undersea Mineral Resources," statement of American Mining Congress, September 27, 1981.

<sup>64</sup>Elliott Richardson, "Elliott Richardson on the Seabed Talks," Congressional Record, March 11, 1981, E1029; Samuel Levering, chairman of the Marine Environmental Subcommittee of the Law of the Sea Advisory Committee, et.al., "U.S. Interests and Objectives Furthered by the Law of the Sea Treaty," memorandum, July 28, 1981.

govern the use of the oceans. The LOST process was sparked by President Truman's 1945 declaration of national jurisdiction over the continental shelf, and the subsequent haphazard extension of such national jurisdiction by other countries. The First Conference on the Law of the Sea was convened in 1958, and drafted four agreements dealing with national ocean jurisdiction and fishing. However, it was unable to resolve certain navigation and fishing questions. A Second Conference met in 1960 and similarly failed.<sup>65</sup>

About the same time the navigational and fishing problems went unresolved, the potential for deep seabed mining was popularized by John Mero, then a graduate student at the University of California, Berkeley. In 1967, the Maltese U.N. representative proposed that the seabed be declared the "common heritage of mankind." This led to the creation of an ad hoc Seabed Committee, and eventually to the organizing of the Third Conference in 1973. It took 11 sessions, but the conference finally completed its task on April 30, 1982, when 130 countries approved the treaty: Four countries voted against the treaty, and 17 nations abstained, including the United States. The 21 nations not supporting the treaty account for over 60 percent of the world's GNP.<sup>66</sup> The treaty, of course, must still be signed and ratified by 60 countries to take effect. It is likely that the necessary signatures will be obtained, but the countries expected to sign and ratify the treaty have virtually no potential for developing the seabeds; those that do—the United States, West Germany, England, France, and Japan—may end up opposing the treaty.

The LOST is by far the greatest obstacle to deep seabed mining. The treaty creates an International Seabed Authority, ruled by a one-nation, one-vote Assembly and a 36-member Council, to regulate deep-seabed mining. A subsidiary body, the Enterprise, would be established to mine the seabed for the Authority, while being subsidized by the industrialized countries. The Authority would be empowered to deny access to the seabed, limit mineral production, mandate the transfer of mining technology, and redistribute revenue to developing and disadvantaged countries.

By imposing a regulatory scheme on an otherwise free market, the LOST threatens seabed development. The treaty will breed inefficiency and cause development costs to increase, which will decrease

<sup>65</sup>Martin Glassner, "The Law of the Sea," *Focus*, XXVIII (March-April, 1978): 6-9.

<sup>66</sup>Kizzia, pp. 24-28; Glassner, pp. 7-9; James Malone, testimony before the House Merchant Marine and Fisheries Committee, July 20, 1982, pp. 3-4.

seabed mining activity.<sup>67</sup> One especially burdensome requirement of the treaty is that contracts for development must be approved by a Legal and Technical Commission, the membership of which could be stacked by opponents of seabed mining.<sup>68</sup> Development contracts must also be approved by the 36-member Council. The Council would be dominated by Third World nations, and the United States is not even guaranteed a seat. Efforts were made last spring to assure the U.S. a Council seat by stipulating that one seat be reserved for the largest mineral consuming country. However, depending on the definition used, the U.S. could be crowded out by the Soviet Union or Japan.<sup>69</sup> Thus, despite America's disproportionately large interest in seabed mining, America would have little hope of protecting its interest in the Council. Indeed, U.S. seabed investors would be dependent on the good will of countries that either oppose seabed mining, since they are domestic mineral producers, or which are America's political adversaries, such as the Soviet bloc (which is already guaranteed three seats by name).

The Council would have plenty of excuses to reject private miners' requests for permission to mine. A company first would have to gain an exploration contract, survey two potential minesites at its own expense, and allow the Authority to choose one for the Enterprise to mine. Then the company would have to apply for a production authorization, which could be denied if the Authority decided to award the one remaining minesite to a competing private company, a developing country, or even conceivably the Enterprise. The request could,

<sup>67</sup>Eckert, *Enclosure of Ocean Resources*, pp. 297, 245-250; Johnson and Logue, pp. 47-56; Johnston, "Economics of the Common Heritage." *Some treaty proponents have admitted that the treaty has created some unnecessary obstacles to seabed development, but believe them to be minor or, at the time, remediable.* Letter from Lee Kimball, United Methodist Law of the Sea Project, to Doug Bandow, November 24, 1981; Levering, et.al., memorandum. Indeed, even Elliott Richardson, before he started defending LOST as his personal legacy, said the treaty had "serious deficiencies." Elliott Richardson, "Power, Mobility and the Law of the Sea," *Foreign Affairs* 59 (1980): 916.

<sup>68</sup>Lilliana Torre-Bayouth, "UNCLOS III: The Remaining Obstacles to Consensus on the Deepsea Mining Regime," *Texas International Law Journal* 16 (1979): 103; testimony of Northcutt Ely before the Senate Foreign Relations Committee, September 30, 1981, appendix, pp. 7-9; Theodore Kronmiller, "Reconciling Public and Private Interests in Multilateral Negotiations: The Law of the Sea Conference," *St. Louis University School of Law Public Law Forum* 1 (1981): 164-165; W. Scott Burke and Frank Brokaw, "Law at Sea," *Policy Review* 20 (Spring 1982): 74.

<sup>69</sup>Kronmiller, p. 165; Leigh Ratiner, "The Law of the Sea: A Crossroads for American Foreign Policy," *Foreign Affairs*, Summer 1982, p. 1016; memorandum from Bob Keating to James Buckley, August 3, 1982; National Association of Manufacturers, "Law of the Sea," *Issue Brief*, July 1982.



be turned down if allowing mining would violate the so-called "anti-density" restriction on the number of sites per country in a geographical area or the "anti-monopoly" limit on the total number of contracts awarded to any particular country. Finally, mining would be disallowed if the added production would break the overall limitation on mineral production.<sup>70</sup>

Some people have suggested that the Preparatory Investment Protection resolution, passed in April 1982, would guarantee the access to mining that the treaty lacks. That resolution, however, only grandfathers seabed mining companies into the treaty, not out of it. Thus, they still would be subject to all of the vagaries of the treaty. The resolution also imposes financial obligations on the companies being "protected." And, though the resolution guarantees existing consortia priority in getting production authority, it only applies to a limited number of companies—four Western private consortia plus the USSR, Japan, France, and India—that have already made some investments. New entrants could not avail themselves to even its limited protections, and the latter four countries are placed on an equal basis with the four Western consortia even though their investment activities to date have been minimal.<sup>71</sup>

The fundamental goals of the Authority, instead of encouraging mining, discourage it. For example, article 150 of LOST directs the Authority to promote "orderly and safe development," "rational management," "just and stable prices remunerative to producers," and "the protection of developing countries from the adverse effects [of mining]." Article 151 formalizes the bias against mineral development by explicitly setting a production ceiling and providing for commodity agreements (how severe the restriction is likely to be in practice is a matter of debate and depends on future mineral market trends). Enforcement of the production ceiling will limit not only production, but also the number of minesites. Furthermore, since the limit is based on nickel (ironically, to protect Canada, not poor or developing nations), changes in demand for the other minerals cannot be accommodated if increasing production would push the amount of nickel produced above the limit.

In article 5 of annex III to the treaty, private companies, as a precondition to receive a production authorization, are required to

<sup>70</sup>Northcutt Ely, "One OPEC Is Enough!" *Regulation*, November/December 1981, pp. 19-21.

<sup>71</sup>Leigh Ratiner, testimony before the House Foreign Affairs Committee, June 17, 1982, pp. 6-7; Report of the United States Delegation, June 1982, pp. 8-10; Malone testimony, p. 6; American Mining Congress statement; Brooks, p. 8.

obligate themselves to sell their proprietary seabed mining and processing technology to other operators, and to transfer such technology to the Enterprise and developing states. Theoretically, transfer can be forced only if the Enterprise is unable to purchase the technology, and compensation is provided for. In reality, the provision creates a forced sale, making it impossible for private business to negotiate a fair deal. The provision also provides no effective redress for unauthorized disclosure of secrets. It would affect technology used to mine other minerals in the area, and would include technology that has broader use, including for offshore oil and gas development. Technology is left undefined, and could conceivably include navigational, computational, and communications equipment, as well as the "very essence of engineering skill." There would be no patent protection, and the incentives for technological innovation would be sharply reduced. Consequently, some equipment suppliers have made it clear that they would not provide equipment to seabed mining companies subject to such regulations.<sup>72</sup>

Indeed, the mere threat of invoking these articles is enough to place private business at a great disadvantage, which is why businessmen have reacted with something akin to apoplexy. And rightly so. Proprietary technology is their private heritage, not that of the U.N. or foreign governments.

Private miners are grossly discriminated against by the treaty. They must prospect a site for the Enterprise and transfer their technology to it on demand. Moreover, the Enterprise is subsidized by the developed countries—the U.S. is to cover 25 percent and is to be exempt from taxes and payments to the Authority. These competitive disadvantages extend to article 152, which grants special consideration for developing countries and particularly to "land-locked and geographically disadvantaged" countries, which comprise a 119-nation majority.<sup>73</sup> This disadvantage is exacerbated by the taxes and fees on private miners. Miners face an application fee, annual fee, production charge and/or royalty charge. The total would be very large, and though it is difficult to predict, some estimates range from \$250 million to \$2 billion over the life of the contract.<sup>74</sup>

<sup>72</sup>Richard Legatski, testimony before the Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries, October 22, 1981, pp. 3–7.

<sup>73</sup>Ely, "One OPEC Is Enough!," p. 24.

<sup>74</sup>Ely testimony, appendix, pp. 20–26; Brooks, p. 7. This should hardly be surprising. The U.N. Secretary General estimates start-up costs in the hundreds of millions of dollars. "Law of the Sea Conference to Resume Tenth Session at Geneva Beginning 3 August," U.N. Doc. SEA/140 (1981), pp. 6–7.

Finally, even if private miners were not discouraged by these provisions, and believed that over the estimated 20- to 25-year life of the minesite they could recoup their investment in the face of an uncertain minerals market, they would have to accept the risk that their investment might be prematurely terminated. Article 155 of the treaty provides for a Review Conference to convene 15 years after the commencement of commercial mining under the treaty, and allows a three-fourths majority to amend the treaty, with a dissenting nation only able to denounce the treaty as a whole and withdraw.

Since the G-77 special interest lobby—a coalition of developing countries—contains roughly 80 percent of the member states and the Soviet bloc adds another 10 percent, the United States would not be able to block an amendment at the Review Conference eliminating all private mining, a concession the G-77 demanded when the LOST negotiations first began. Withdrawing from the treaty after it had been in effect for two decades would be politically difficult and therefore unlikely. Moreover, the operation of the treaty for two decades may then have changed customary international law, precluding unilateral private mining.<sup>75</sup>

Even if none of these provisions in isolation unduly discouraged investment, their combined effect is to “create a political climate hostile to private investment, and . . . [to] restrict the usefulness of the investment as to make it unattractive even if the political climate were benign.”<sup>76</sup> The result is to make it difficult, if not impossible, for companies to raise the money necessary to mine. Welling bluntly declares that it would be “impossible” to raise funds, and bankers across the United States have made it clear that they do not want to lend money for operators under the treaty.<sup>77</sup> The head of America’s delegation to the Conference told Congress that the deep-seabed mining consortia “could not and would not carry out commercial mining under the treaty.”<sup>78</sup>

<sup>75</sup>Torreh-Bayouth, p. 107; John Breaux statement, *Congressional Record*, March 10, 1981, p. S1968.

<sup>76</sup>Ely testimony, p. 3. His sentiments are shared by other observers. Roger Geddes, “The Future of United States Deep Seabed Mining: Still in the Hands of Congress,” *San Diego Law Review* 19 (April 1982): 616; American Mining Congress statement; Tinsley, pp. 14–15; Johnston, “Economics of the Common Heritage,” p. 28.

<sup>77</sup>Abelson, p. 10; Susan Jenks, “Sea Treaty Refusal Seen Bad for U.S.,” *Washington Times*, September 22, 1982, p. 4A; GAO, pp. 32–33; Ann Hollick, “Seabed Minerals for the Future,” paper presented to AEI conference, October 19, 1982, p. 7. Tinsley’s study shows that LOST would result in a lower rate of return than even under an unilateral American system. Tinsley, p. 14.

<sup>78</sup>Malone testimony, p. 8. This is not the unanimous view. Elliott Richardson, who headed the negotiations under President Carter, has argued that the treaty assures access for American companies. (“On the Seabed Talks.”) But it is difficult to find anyone who would have to put up the money and operate under the proposed system who agrees with Richardson.

Of course, most any disincentive could be overcome by federal subsidies or loan guarantees. But the industry has not asked for such special privileges, and subsidies would make no sense. The minerals on the seabed are of value if they can be economically developed; encouraging uneconomic development would merely waste resources.

The treaty also places a moratorium on mining polymetallic sulfides and cobalt deposits. Mining for these resources, which are potentially more accessible than manganese nodules, must wait until a different set of rules and regulations are adopted to cover them, which could be never. The treaty does require the adoption of such rules and regulations *within three years*, but any nation opposing seabed development which sat on the Council could, and probably would, block them by preventing their approval by unanimous consent. Since there is nothing to force the Authority to adopt rules and regulations, mining would remain forbidden indefinitely. As long as the Authority is controlled by the G-77, they would control the process for resolving treaty impasses as well.<sup>79</sup>

### Alternative Seabed Development Strategies

Since the administration has decided that it will not sign the treaty, it is now seeking to create some alternative arrangements to allow seabed development to proceed. This is the only possible course of action. Speaking on behalf of the American Mining Congress, Wellington in his congressional testimony stated:

There are those who argue that outside of the framework of the Law of the Sea Treaty, deep-sea minerals mining is doomed. If one agrees that the treaty text is deeply flawed, it makes no sense to say, "yes, the treaty is flawed, but we should join, because that's our only real hope." I submit that if something is fatally flawed, you don't join it; you seek something better.<sup>80</sup>

Alternative arrangements are important for two reasons. The most obvious is that such mining is beneficial, and is unlikely to proceed without some sort of legal system (the reasons why will be discussed in greater detail later). The more subtle, but just as important, reason is that there is a pervasive belief that the administration will be forced to reverse itself, or that a future administration will reverse policy

<sup>79</sup>The former delegation deputy chairman has argued that the three-year requirement solves the problem. Ratiner, "Crossroads," p. 1016. Ironically, before becoming a consultant to the U.N., he told the U.S. delegation of one negotiating session with Alvaro deSoto, the head of the G-77, in which deSoto stated quite clearly that the moratorium would remain in place as long as regulations had not been adopted.

<sup>80</sup>"Comment," *Oceanus* 25 (Fall 1982): 2.

and sign the treaty.<sup>81</sup> However, if the United States is able to establish a functioning alternative system, it will be less pressured to sign the treaty. Only so long as the rest of the world has LOST, while the U.S. has nothing, is there a danger of U.S. acceptance and ratification.

One option is to accept the treaty if the rules and regulations proposed by the Preparatory Commission, which will meet in the years ahead, resolve the problems extant in the treaty.<sup>82</sup> For example, the Prep Com, as it is known, will adopt the definition of what the largest consuming nation is, determining whether or not the U.S. is guaranteed a seat on the Council. Unfortunately, the flaws in the treaty are too fundamental to be remedied by rules and regulations, particularly since they cannot overrule the treaty itself.<sup>83</sup> It is curious that anyone would believe the Prep Com will behave any more favorably than the Conference that drafted the treaty. The developing countries chose to create a regime to redistribute international wealth and to discourage deep seabed mining; the Prep Com will almost certainly reinforce that system.

A related option would be to seek to amend the treaty. The best opportunity to do so was in September 1982, when the Conference met to approve technical changes recommended by the so-called Drafting Committee. It is also conceivable that an agreement could have been reached before December 1982, when the treaty was ready for signature.<sup>84</sup> However, both of these dates are now past, and the U.S. failed to gain any fundamental amendments last spring in a far more positive negotiating and procedural climate. Thus, it is very unlikely that the U.S. could get any significant changes in the treaty at this time. And, even if changes were possible, they would undoubtedly fall far short of the package necessary to make the treaty acceptable.<sup>85</sup>

<sup>81</sup>Jennifer Whitaker, "Outside the Mainstream," *Atlantic Monthly*, October 1982, p. 26; Ratiner, "Crossroads," p. 1021; "Koh: Mining Issue May Go to World Court," 8 (June/July 1982): 6; Abelson, p. 19.

<sup>82</sup>Jenks.

<sup>83</sup>Robert Lagomarsino statement, Congressional Record, March 10, 1981, p. S1968; Breaux statement.

<sup>84</sup>Ratiner, "Crossroads," pp. 1020-1021; Whitaker, p. 26; "Law of the Sea Pact To Be Signed in Jamaica," *New York Times*, September 26, 1982, p. 5.

<sup>85</sup>Norway's delegation head, Jens Evensen, suggested a compromise package much more moderate than the most important compromise set of proposals offered at the final LOST session. That set, offered by the so-called Group of 11 smaller industrialized nations, fell far short of meeting American objectives—even in the opinion of the pro-treaty former delegation deputy chairman. Ratiner, "Crossroads," p. 1016. The comparison can be made by reviewing the relevant documents. "Law of the Sea," State Department Bureau of Public Affairs, Policy No. 371, January-February 1982; "Changes Suggested by the Heads of the Delegations of Australia, Canada, Denmark, and Norway on Behalf of a Group of Ten Heads of Delegations" (the 10 later expanded to 11), U.N. Doc. WG.21/Informal Paper 21, March 25, 1982.

A better plan would be to create a totally separate system, one based on free enterprise and minimal regulation. Doing so would rely on individual nations to extend the "proportization" (or "enclosure") of the ocean to create seabed mining regimes that recognize property rights in seabed resources.<sup>86</sup> Such a system would not preclude some sort of compromise measure involving profit-sharing with Third World countries, joint ventures, equity participation, or whatever. Such expedients, though otherwise undesirable, might help limit international opposition to a separate American system.

In fact, it has been argued that such a system need not be governmentally created because it would evolve naturally. Private individuals and companies now possess a right to mine the deep seabed under the doctrine of freedom of the high seas: The resources are *res nullius*, owned by no one, and can be collected by whoever expends the labor and capital to do so.<sup>87</sup> Moreover, the sheer abundance of the resources provides enough for many miners, making poaching and claim-jumping unnecessary. The physical characteristics of the terrain requires extensive surveying and exploration to avoid damage to delicate mining equipment and to efficiently collect the nodules, making it just as cheap to find a new site.<sup>88</sup>

There are many historical examples of people implementing the Lockean notion of establishing property rights with those who identify resources and mix their labor with them: "As much land as a man tills, plants, improves, cultivates, and can use the produce of, so much is his property."<sup>89</sup> The American West developed in this way, with government institutions and legal order only following informal economic order. Civil law was entirely absent during the California Gold Rush, but traditional miners' law arose. By mutual agreement among the miners, title "was derived from the first locator, and continuity

<sup>86</sup>Gary Knight, "Legal Aspects of Current United States Law of the Sea Policy," paper presented to AEI conference, October 19, 1981, p. 13; Eckert, "Wealth Distribution," p. 1; Robert Keating, "Positive Alternative to International Seabed Authority for Seabed mining," memorandum to Theodore Kronmiller, June 17, 1981, p. 1; Eckert, *Enclosure of Ocean Resources*, p. 218.

<sup>87</sup>John Murphy, "The Politics of Manganese Nodules: International Considerations and Domestic Legislation," *San Diego Law Review* 16 (1979): 536-541; Knight, pp. 7-8; Torreh-Bayouth, pp. 84-98; Kronmiller, p. 160; American Mining Congress statement, p. 2. Another observer believes the arguments on both sides to be "unconvincing." Arnold, p. 574.

<sup>88</sup>Singer; Johnson and Logue, p. 47; Eckert, *Enclosure of Ocean Resources*, pp. 217, 241-245.

<sup>89</sup>Robert Goldwin, "John Locke," in *History of Political Philosophy*, 2nd ed., L. Strauss and J. Cropsey, eds. (Chicago: University of Chicago Press, 1981), p. 462.

of work sufficed to maintain persistence of ownership."<sup>90</sup> Even at the international level a similar result occurred with the Spitzbergen Archipelago, where a multinational treaty recognized the right of those individuals who had previously occupied and used the land.<sup>91</sup>

At least one of the mining consortia, Deepsea Ventures, has said it may mine the seabed without any treaty. Its president, Jeffrey Amsbaugh, has been quoted as saying: "We would hope the United States would protect us just as if we were fishing out there."<sup>92</sup> Unfortunately, this appears to be the minority position. Most companies are concerned about their security of tenure against other American or foreign firms, and most observers believe that investment will occur only when such rights are institutionalized. In the absence of some legal regime, it appears that seabed mining would be limited to areas within America's 200-mile limit.<sup>93</sup>

This is probably true today simply because of the existence of the LOST. Were there no conflicting international regime, American companies might be willing to venture forth because of the realities of deep-seabed mining explained by Eckert and others. But where miners would face a competing—and hostile—international system, the need for countervailing legal protection is greater. This desire for legal sanction, however, does not mean industry support for the treaty. Industry leaders have made it clear that they prefer no treaty to the current one, which guarantees that virtually no mining would be undertaken.<sup>94</sup>

Legal recognition of title to minesites could be granted unilaterally by the U.S. government through legislation similar to the Deep Seabed Hard Minerals Act of 1980. This Act was specifically designed as an interim measure and was passed to encourage exploration of the seabed before LOST was signed, when the Act was to be superseded. Though the legislation helped keep the American deep seabed min-

<sup>90</sup>Knight, p. 13; Terry Anderson and Peter Hill, "The Evolution of Property Rights: A Study of the American West," *Journal of Law and Economics* 18 (1975): 168-179; Robert Poole Jr., statement to the Subcommittee on Oceanography, House Committee on Merchant Marine and Fisheries, October 22, 1981, p. 5; T.A. Richard, *A History of American Mining* (1932), p. 33; Michael McMenamin, "Battle of the Seabed," *Inquiry*, July 6 & 20, 1982, p. 22.

<sup>91</sup>L.F.E. Goldie, "A General International Law Doctrine for Seabed Regimes," *International Law* 7 (1973): 807-811.

<sup>92</sup>Kizzia, p. 23.

<sup>93</sup>Murphy, p. 549; American Mining Congress statement; David Dickson, "Scuttling the Sea-Law Treaty," *The Nation* May 30, 1981, p. 666; "Drilling Awaits Sea Treaty," *Energy*, March 1982, p. 23.

<sup>94</sup>Richard Legatski, statement to Subcommittee on Arms Control, Oceans, International Operations and Environment, Committee on Foreign Relations, March 5, 1981, p. 1.

ing industry alive as the treaty was being negotiated, virtually no one believes that the Act as it now stands can support a mining industry.<sup>95</sup>

The Act could be amended to eliminate the prohibition of mining through 1988 and to transform it into a permanent system. It should also be amended to reflect the differences between mining manganese nodules and polymetallic sulfides. It is not clear that the Act as written covers the latter deposits.<sup>96</sup> In the meantime, the NOAA could invite a second round of applications for exploration licenses under the Act, and process them.

Amended legislation would clearly establish legal tenure Americans, and other nations arguably would respect such a system because it would be more viable than that theoretically established by LOST. However, opinion is sharply divided over whether such a unilateral system would be adequate to encourage development. In the past, advocates of LOST feared that a unilateral American system would succeed, but now they argue it would not; opponents of LOST are also split.<sup>97</sup> Former Ambassador Elliot Richardson has been on both sides of the issue. He now claims that only LOST can guarantee seabed minesites, but he told Congress in 1978 that "Seabed mining can and will go forward with or without a treaty. . . . We have the means to protect our ocean interests. . . . And we will protect those interests if a comprehensive treaty eludes us."<sup>98</sup>

Some people have argued that non-mining countries would respond to unilateral American legislation with boycotts of mineral resources, sabotage, expropriation of assets, and lawsuits in the International Court of Justice.<sup>99</sup> The threat of such actions, if thought likely, would obviously make lenders uncomfortable loaning money to private seabed mining companies. Such actions, however, are unlikely to occur. Boycotts would hurt those boycotting, particularly cash-poor Third World nations. Boycotts are therefore likely only if crucial

<sup>95</sup>Torreh-Bayouth, pp. 87-89; F. Patterson Willsey, "The Deep Seabed Hard Minerals Resources Act and the Third United Nations Conference on the Law of the Sea: Can the Conference Meet the Mandate Embodied in the Act?," *San Diego Law Review* 18 (April 1981): 510; Conrad Welling, "The Oceans' Waiting Mineral Resources," *Stockton's Port Soundings*, August 1980, p. 8. Former House Merchant Marine and Fisheries Chairman John Murphy was more positive, though this was before it looked like the U.S. would be opposing an international sea law treaty. Murphy, p. 551.

<sup>96</sup>CRS, pp. 88, 102.

<sup>97</sup>Compare Arnold, p. 574, and Gullion, p. 8, with Levering, et.al.; compare Hawkins, p. 184 with Michael Molitor, "The U.S. Deep Seabed Mining Regulations: The Legal Basis for an Alternative Regime," *San Diego Law Review* 19 (April 1982): 608.

<sup>98</sup>Compare Department of State Bulletin, February 1981, p. 57, with "2 Negotiators Say U.S. Should Sign Sea-Law Treaty," *Los Angeles Times*, September 21, 1982.

<sup>99</sup>Torreh-Bayouth, p. 89.



issues are at stake, and there is no evidence that anyone in the Third World, aside from a few international lawyers, diplomats, and propagandists, believes LOST is crucial. Sabotage would be difficult, and expropriation would occur only if the issues were important; unilateral mining could provide an excuse, but it would hardly be sufficient cause. Finally, the International Court of Justice is political and routinely ignored. If American minesites cannot be challenged in a meaningful way despite Third World claims to ownership of the seabed, a legally unsupported adverse opinion of the ICJ would not change matters.

Greater security of tenure could be provided through an agreement on a system to allow resource development among the most likely seabed mining nations. One form of agreement, such as the proposed Reciprocating States Agreement (RSA), would build upon domestic legislation. The RSA, envisioned between the United States, England, West Germany, France, and Japan, would resolve differences on national legislation, current and future mining claims, and so on. Such an agreement was drawn up in early 1982, and was nearly signed, but technical problems and the imminent final LOST Conference led to a breakdown.<sup>100</sup>

Since the RSA was designed to provide an interim system until the treaty itself came into effect, most supporters of such an agreement now envision its expansion into a mini-treaty, creating a permanent seabed mining system apart from that established by LOST. The core members of such a treaty would be the potential seabed mining nations, but non-seabed mining nations could also join. They would be able to participate in joint ventures or corporate consortia. Mining would be regulated not by an international bureaucracy, but by the respective nations sponsoring the individual mining companies.<sup>101</sup>

There are two serious criticisms of both the RSA and a mini-treaty. The first is that they are unattainable, since the other industrialized nations will sign and ratify LOST rather than a separate treaty with the United States. The reasons vary. Some might sign because they believe LOST would give them better "color of title," others to ensure friendly relations with the Third World, and others to gain benefits from other sections of the treaty, including navigation. For instance, supporters of the treaty argue that West Germany has a

<sup>100</sup>"Agreement Concerning Interim Arrangements Relating to Polymetallic Nodules of the Deep Sea Bed," draft document 1982; Brooks, p. 15; Lee Kimball, "Is There a Mini-Treaty? Will There Be One?," *Neptune*, March 1982, pp. 1, 7; Whitaker, pp. 21-22.

<sup>101</sup>Brooks, pp. 15-17; American Mining Congress statement; Kizzia, p. 24.

special incentive to sign since the Law of the Sea Tribunal is to be based in Hamburg, giving Germany new international legitimacy.<sup>102</sup>

On the other hand, Germany, France, and Great Britain joined the United States in signing an agreement in September 1982, to help resolve any conflicts between potential minesites. The agreement was a surprise to LOST supporters, and endorses an earlier private arbitration agreement signed by companies from nine different nations.<sup>103</sup> Though this agreement is modest, it is an indication that at least these three countries—and Japan, which didn't sign for rather technical reasons—may ultimately be willing to join the United States in a separate agreement.

There are other reasons to believe a number of the industrialized nations might join the United States as well. In Germany, for instance, the criticism of the treaty has most closely paralleled that in the United States, and harsh attacks have been made by CDU-CSU members of the Bundestag, who recently took power. Even the LOST Conference president admits that the potential financial burden without the United States paying its 25 percent share may cause a number of European countries to hesitate signing and ultimately ratifying the treaty. This is particularly true of the Soviet Union, which dislikes the financial obligations and other treaty restrictions, and has an interest in resolving potential minesite claim conflicts by joining in an agreement with the United States.<sup>104</sup> Moreover, other nations will have great difficulty mining the seabed under LOST because even if they find the treaty's investment environment satisfactory, they will need American technology. However, because of LOST's technology transfer provisions, Richard Legatski of the National Ocean Industries Association says: "U.S. companies won't do business with them."<sup>105</sup> This gives other nations an incentive to join in a separate agreement with us.

<sup>102</sup>Ratiner, "Crossroads," p. 1010; Whitaker, p. 26; "Koh: Mining Issue," p. 1.

<sup>103</sup>U.S. State Department "Agreement Concerning Interim Arrangements Relating to Polymetallic Nodules of the Deep-Sea Bed," final agreement, 1982; Steve Beckner, "Bypassing Sea Treaty Makes Good Business Sense," *Washington Times*, October 22, 1982, p. 6B; Steve Beckner, "U.S. Seeks to Develop Ocean Floor Minerals," *Washington Times*, October 20, 1982, p. 4A; Thomas Lippman, "U.S., 3 Allies Sign Deep-Sea Mining Pact," *Washington Post*, September 4, 1982, p. A12; Amsbaugh and Van der Voort, pp. 26–27.

<sup>104</sup>Whitaker, p. 26; "Koh: Mining Issue," p. 6; Hans Jurgensen, "Vote At UN Law of the Sea Conference Ends Debate But Begs Question," *Frankfurter Allgemeine*, May 3, 1982; Elmer Rauch, "Political Consequences and Possibilities for Development of Sea Law from the Point of View of the USSR," Final Report, German Institute for East/West and International Studies, 1982, p. 110; Brooks, p. 16.

<sup>105</sup>Beckner, "U.S. Seeks to Develop"; Brooks, p. 18.

The second criticism of a mini-treaty is that it would fail to give sufficient legal title to minesites to allow companies to get bank financing. The Conference president has appointed himself "one of the guardians of the 'common heritage of mankind'," and has threatened to sue the United States in the World Court. Such litigation, it is argued, would help create enough uncertainty over security of tenure to discourage investment.<sup>106</sup> One observer has argued:

The right to mine the deep seabed must be conferred upon those nations that have the technical and financial means to do so by the entire community of nations. A reciprocating State regime composed of a handful of deep seabed nations has no better chance of circumventing the global character of the deep seabed than do the municipal efforts of an individual State.<sup>107</sup>

In fact, this misperceives the issue. As previously discussed, international law currently allows deep seabed mining; only a universal treaty can change that. LOST, without the relevant actors' consent, cannot. More importantly, though a universal treaty would at least appear to give better title than a mini-treaty, LOST will not be universal. For this reason, the "rights" created by LOST would not be superior to those created by a separate treaty, depending on the quality of participants. In the real world, what the United States and Germany and the other likely seabed mining states think about seabed mining is far more important than what, say, Bolivia and Zaire think.

Thus, even the Conference president apparently believes that an agreement with all of the potential seabed mining countries would succeed.<sup>108</sup> An agreement, for example, with the 21 nations that did not support LOST last April would involve countries controlling more than 60 percent of the world's GNP and contributing more than 60 percent of the UN's budget.<sup>109</sup> Why would a treaty involving these countries and including all of the parties most interested in seabed mining be considered inferior? Indeed, Marne Dubs, then-Kennecott Copper's spokesman, has stated that while two nations would not be enough for a separate agreement, four would allow development to proceed, with the evolution of the system determining whether commercial production could eventually result.<sup>110</sup>

<sup>106</sup>Zoriana Pysariwski, "Law of the Sea: Uncertainty Follows the Euphoria," *South*, August 1982, pp. 62-63; "Koh: Mining Issue," p. 6; Ratner, "Crossroads," p. 1017; Abelson, pp. 10-11; GAO, p. 32.

<sup>107</sup>Molitor, p. 608.

<sup>108</sup>"Koh: Mining Issue," p. 6. His opinion appears to be shared by others. Knecht, p. 11.

<sup>109</sup>Malone, pp. 3-4.

<sup>110</sup>Kimball, pp. 7-8.

Therefore, with a mini-treaty among enough seabed mining nations, investment would likely proceed. As the American Mining Congress said: "While the best of all worlds would be a comprehensive, universally acceptable treaty, a treaty such as the current UNCLOS draft that fails to protect American interests is no basis for investment. We can easily do without the 'comprehensive' and 'universal,' but we cannot do without 'acceptable.'"<sup>111</sup>

## Conclusion

The Reagan administration will determine the future of deep seabed mining by its efforts to create an alternative legal system. The more countries it gets, the more likely it is to thwart LOST with its socialistic intent and anti-development effect. The administration must also take the long view. Even if some Europeans and the Soviets sign the treaty, they are unlikely to ratify for years, while the Prep Com is debating rules and regulations. As an independent system takes shape and seabed development proceeds, other nations will realize that it is this system, and not a hollow propaganda shell created by a non-universal LOST, which is their real competition, and the one that they must ultimately deal with.

The critical element again is probably economic. The lack of a universally recognized right to mine is merely another risk. If the rate of return is high enough, this risk will be assimilated with all of the others, and investment will take place. If the rate of return is not high enough, it will not.

The use of the ocean has been expanding dramatically in recent decades. Exploitation of resources of all forms in both the continental margin and ocean basin is technically feasible and, in many cases, probably profitable. But just because it is feasible and profitable does not mean that it will occur. Unfortunately, international politicians are holding economic development hostage to political demands.

The political barriers they have constructed may cause potential investment to flow into other channels that offer more certainty of an adequate rate of return. But if world demand continues to increase and mining technology advances, we may find an inexorable expansion of development, after which more effective and just legal systems will develop to conform to the informal institutions that developed to reflect economic reality.

<sup>111</sup>American Mining Congress statement. Welling testified that the AMC views such an agreement as the most viable basis to create acceptable legal arrangements. "Comment," p. 2. Other observers agree. Hawkins, p. 184.

The oceans offer us much in terms of economic development for all nations and peoples. Much of that development will take place if the U.S. government allows American ingenuity and innovation to thrive. But much more is in doubt since it must take place in international areas. Perhaps the greatest tragedy would be if the desire for political favoritism on the part of some nations blocked economic development that would benefit their people the most.