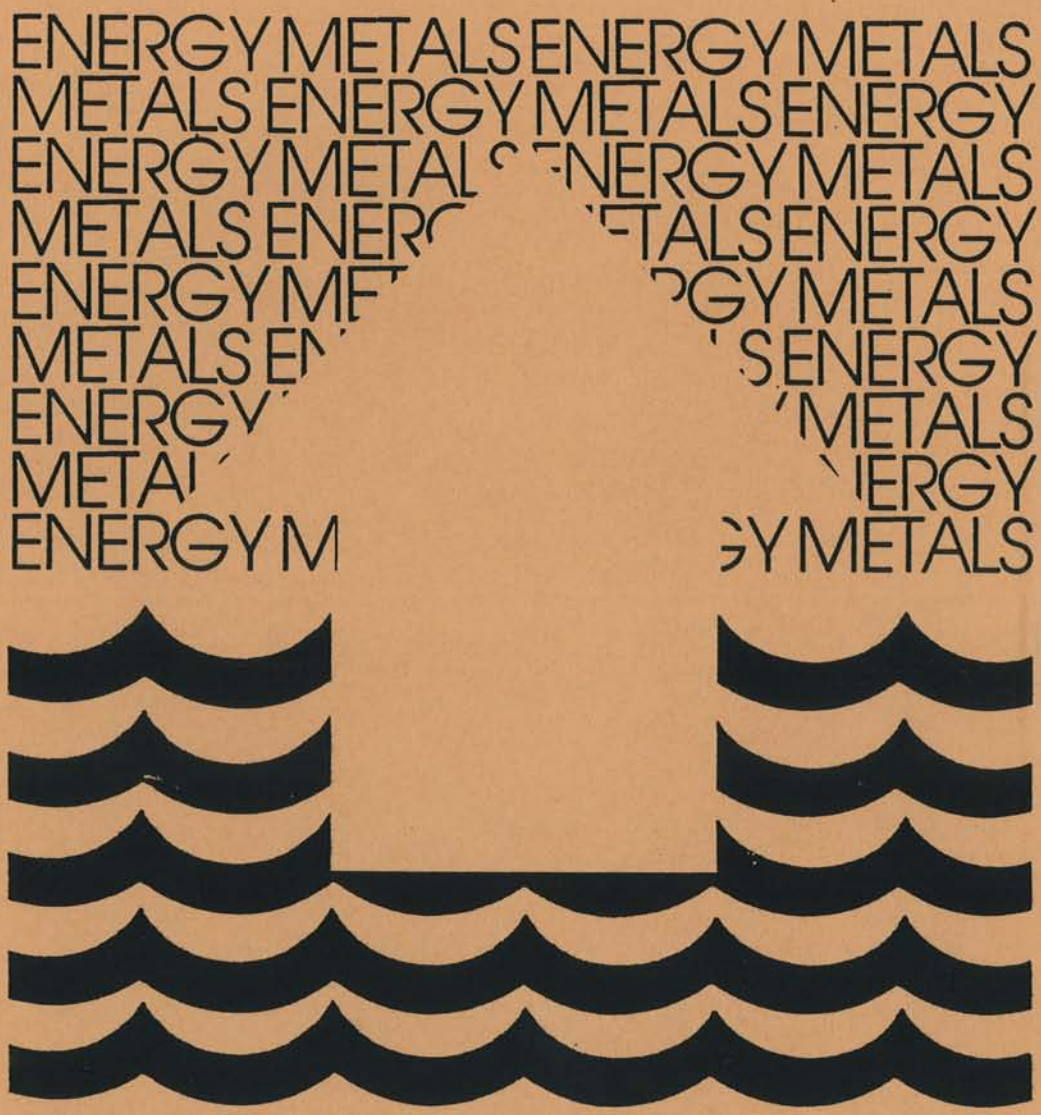

Deep Seabed Mining

Report To Congress

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
December 1991

UNITED STATES DEPARTMENT OF COMMERCE
The Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

DEC 31 1984

Honorable Dan Quayle
President of the Senate
Washington, D.C. 20510

Dear Mr. President:

I am pleased to submit the Deep Seabed Mining Report of the National Oceanic and Atmospheric Administration to the Congress in compliance with Section 309 of the Deep Seabed Hard Mineral Resources Act (P.L. 96-283).

Sincerely,

John A. Knauss

Enclosure

THE ADMINISTRATOR

UNITED STATES DEPARTMENT OF COMMERCE
The Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

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Honorable Thomas S. Foley
Speaker of the House of Representatives
Washington, D.C. 20515

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Deep Seabed Mining

Report To Congress

Prepared by:
Office of Ocean and Coastal Resource Management
Ocean Minerals and Energy Division
1825 Connecticut Avenue, N.W.
Washington, D.C. 20235

December 1991

U.S. DEPARTMENT OF COMMERCE
Robert A. Mosbacher, Secretary

National Oceanic and Atmospheric Administration
John A. Knauss, Under Secretary for Oceans and Atmosphere

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EXECUTIVE SUMMARY

The National Oceanic and Atmospheric Administration (NOAA) activities related to the implementation of the Deep Seabed Hard Mineral Resources Act (the Act), 30 U.S.C. § 1401 et seq., in fiscal years 1990 and 1991 are described in this sixth biennial report to the Congress. The Act establishes an interim domestic legal regime, pending the ratification and entry into force of an acceptable Law of the Sea Treaty with respect to the United States, under which U.S. citizens may conduct exploration for and commercial recovery of manganese nodules.

Licenses and Permits

Four exploration licenses were issued during 1984. During 1991, NOAA processed and approved applications from Ocean Management, Inc., Ocean Mining Associates, and Ocean Minerals Company for five-year extensions of their exploration licenses and modifications to their exploration plans. There were no other licensing or permitting activities.

Exploration and Commercial Recovery Activities

During the two years covered by this report, licensees' activities have continued to be directed toward analysis of environmental and resource data and integration of these data into computer databases and archives. Analysis of this data has further contributed toward delineation by the consortia of prime areas or subareas that will be selected as the focus of future mining efforts. Equipment development, technical and economic studies have continued. In addition to these efforts the consortia have actively continued to monitor mineral markets and associated economic, technical, legal and political developments affecting mining.

Environmental Assessments and Impacts

There were no licensee at-sea activities during the period covered by this report. NOAA's efforts during these years continued to be directed toward research in support of future regulatory decisions, focussing on international cooperative at-sea environmental studies.

NOAA continued studies begun in 1989 to characterize the environment within the areas of the U.S. licensees designated in 1988 by NOAA as a potential Provisional Interim Preservational Reference Area (PIPRA). Cooperative agreements were signed between NOAA and Yuzhmorgeologiya of the USSR to conduct research and a Benthic Impact Experiment (BIE) in the PIPRA. Three cooperative research cruises were conducted on a Soviet vessel to this area in 1991. A research cruise was also carried out in 1990 on the NOAA ship SURVEYOR. Additional research was conducted at the Ocean Mining Associates test mining site near DOMES Site C.

NOAA has continued to consult with other mining nations to cooperate on at-sea environmental research and to establish a network for exchange of information on research efforts and regulatory measures to protect the environment. An agreement was signed with the Metal Mining Agency of Japan to cooperate in environmental research and for mutual monitoring of the planned Japanese mining system test. An extensive marine minerals geochemical database and bibliography were completed.

Civil and Criminal Proceedings

No civil nor criminal proceedings were instituted under provisions of the Act.

International Conflict Resolution

As further efforts to provide a stable setting for at-sea operations, the United States, Belgium, Canada, Germany, Italy, the Netherlands, and the United Kingdom signed separate identical agreements with the People's Republic of China and the Interoceanmetal consortium for the purpose of avoiding minesite overlaps and conflicts.

Recommendations

There are no recommendations regarding amending this Act.

CHAPTER I
INTRODUCTION

Purpose and Scope

This sixth biennial report to the Congress, submitted pursuant to section 309 of the Deep Seabed Hard Mineral Resources Act, 30 U.S.C. § 1401 et seq., describes deep seabed mining activities conducted by the National Oceanic and Atmospheric Administration (NOAA) during fiscal years 1990 and 1991.

This chapter provides an overview of the nature of the resource, reasons for the national interest, the members of the mining consortia, the status of industrial activities, and a description of the mining technology. NOAA's activities in implementation of the Act are addressed in Chapter II.

Activities included in Chapter II relate to: NOAA's environmental research activities in support of future regulatory decisions, signing of agreements with two foreign mining entities on the avoidance of conflicts and overlaps, and activities under four exploration licenses, including three license revisions and extensions.

Activities reportable under the Act but not yet having occurred include: permit issuance or denial, environmental damage from mining activities, and civil and criminal proceedings.

The Resource

Manganese nodules are small, irregular, fist-sized concretions of manganese and iron minerals that are found on the bottom of many of the world's oceans and some lakes. They were first discovered during the 1873-76 oceanographic voyage of the HMS CHALLENGER but remained scientific curiosities until their value as a potential mineral resource was realized in the late 1950's. Although 79 elements have been identified in Pacific Ocean nodules, only four are of strategic and economic importance: manganese, copper, nickel, and cobalt. While nodules occur on a world-wide basis, their population density on the seafloor and the concentrations of the value metals are highly variable. Main commercial interest therefore focussed on an area in the east-central Pacific Ocean (Figure 1) that contains a higher population of high-grade nodules than other surveyed areas. The nodules in this area have a high average percentage of the value metals, especially nickel (approximately 1.3 percent nickel, 1.1 percent copper, 0.2 percent cobalt, 25 percent manganese). This 13 million km^2 area--commonly known as the Clarion-Clipperton Fracture Zone--was the subject of NOAA's five-year Deep Ocean Mining Environmental Study (DOMES) and so is also referred to as the DOMES area. The DOMES study formed the basis for many of the scientific findings in NOAA's Deep Seabed Mining Final Programmatic Environmental Impact Statement (September 1981). The DOMES area is also

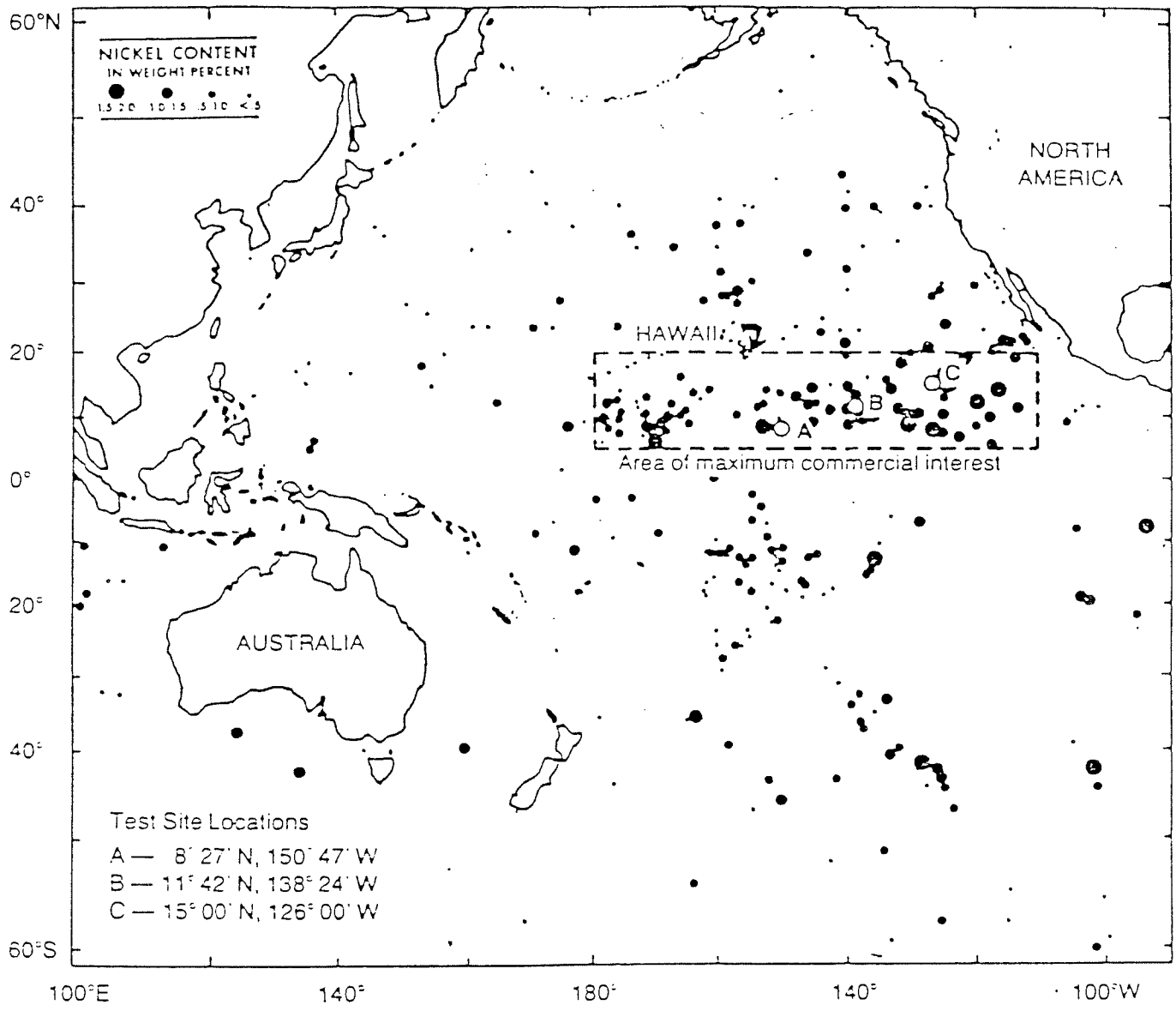

Figure 1 --Area of manganese nodule maximum commercial interest and high nickel concentration in nodules with DOMES test site locations (Horn, Horn, and DeLach, 1972).

where all of the U.S. license sites and most of the foreign sites are located. This area has been estimated to contain from 3.6 to 13.5 billion metric tons (dry weight) of nodules--an apparently enormous resource for the future.

The National Interest

The United States is dependent on foreign sources for two of the strategic metals found in manganese nodules: cobalt and manganese. Cobalt, which we import primarily from Zaire and Zambia, is used for the high-temperature alloys necessary in the aerospace industry. Manganese, imported primarily from Australia, Brazil, and South Africa (which has been projected as our major source in 10 to 20 years), is required in the steel industry. Nickel, used mainly in stainless steel and other high temperature steel alloys, is supplied by Australia and Canada. Copper, in which the United States is nearly self-sufficient, is used mainly in electrical equipment.

Dependence on foreign sources of metals can lead to uncertainties in supply ranging from cost instability to supply disruption. In addition to the possibility of political instability, foreign producers may retain more of their domestic output as they acquire their own capability to manufacture finished products. Also, as the sources of supply become more restricted, the ability of the mines to meet world demand can become a factor in determining both supply and price.

The establishment of a domestic deep seabed manganese nodule mining industry would provide the United States with: (a) a stable supply of strategic metals important to the economy at competitive prices, (b) a reduced annual balance of payments deficit, (c) increased investment in a basic industry, (d) regional employment benefits, and (e) continued leadership in new ocean technologies.

The presently depressed level of world metal markets has dimmed prospects for commercial mining in the near term. Nevertheless, nodule mining appears to be competitive with new sources of these metals and so must remain an option for United States industry in the decades ahead.

Mining Consortia

The domestic deep seabed mining industry presently includes four multinational private sector consortia with U.S. members (Figure 2) which were issued exploration licenses by NOAA in 1984. The United Kingdom and Germany each have also issued licenses for additional areas under their own respective domestic seabed mining legislation. Figure 3 shows the U.S. areas in relation to all the foreign areas. There are also five national consortia presently developing their own deep seabed mining capabilities: the French consortium, AFERNOD; the Japanese consortium, Deep Ocean Resource Development Company (DORDCO); the USSR's Yuzhmorgeologiya; the Interoceanmetal (IOM) consortium, consisting of the governments of the USSR, Poland, Czechoslovakia, Bulgaria

Fig. 2 Deep seabed mining consortia involving United States firms and parent companies, including dates of consortia formation, as set forth in applications filed with NOAA in February 1982, and subsequently amended, showing NOAA license identification.

Nation	USA-1 Ocean Minerals Company (OMCO) (11/77)	USA-2 Ocean Management Inc. (OMI) (5/75)	USA-3 Ocean Mining Associates (OMA) (10/74)	USA-4 Kennecott Consortium (KCON) (1/74)
United States	Cyprus Minerals Co. (Cyprus Mining Co.) 50% Lockheed Missiles & Space Co., Inc. (Lockheed Corp.) 37.528% Lockheed Systems, Co., Inc. (Lockheed Corp.) 12.472%	Schlumberger Technology Corp. 24.67%	Essex Minerals Co. (USX Corp.) 25% Sun Ocean Ventures Inc. (Sun Co.) 25%	Kennecott Utah Copper Corp. (a U.S. Corporation owned by R.T.Z.) 52%
Belgium			Union Seas, Inc. a U.S. corporation (Union Miniere) 25%	
Canada		INCO, Ltd. 25.11%		Noranda Exploration, Inc., a U.S. corporation 12% (Noranda Mines Ltd.)
Italy			Deep Sea Systems, Inc. U.S. corporation (ENI/Italy) 25%	
Japan		Deep Ocean Mining Co., Ltd. (DOMCO-19 Japanese Companies) 25.11%		Mitsubishi Corp. 12%
United Kingdom				R.T.Z. Deep Sea Mining Enterprises, Ltd. (Rio Tinto-Zinc) 12% Consolidated Gold Fields, PLC 12%
West Germany		AMR 25.11% (Preussag A.G., Salzgitter A.G., Metallgesellschaft A.G.)		

December 1989

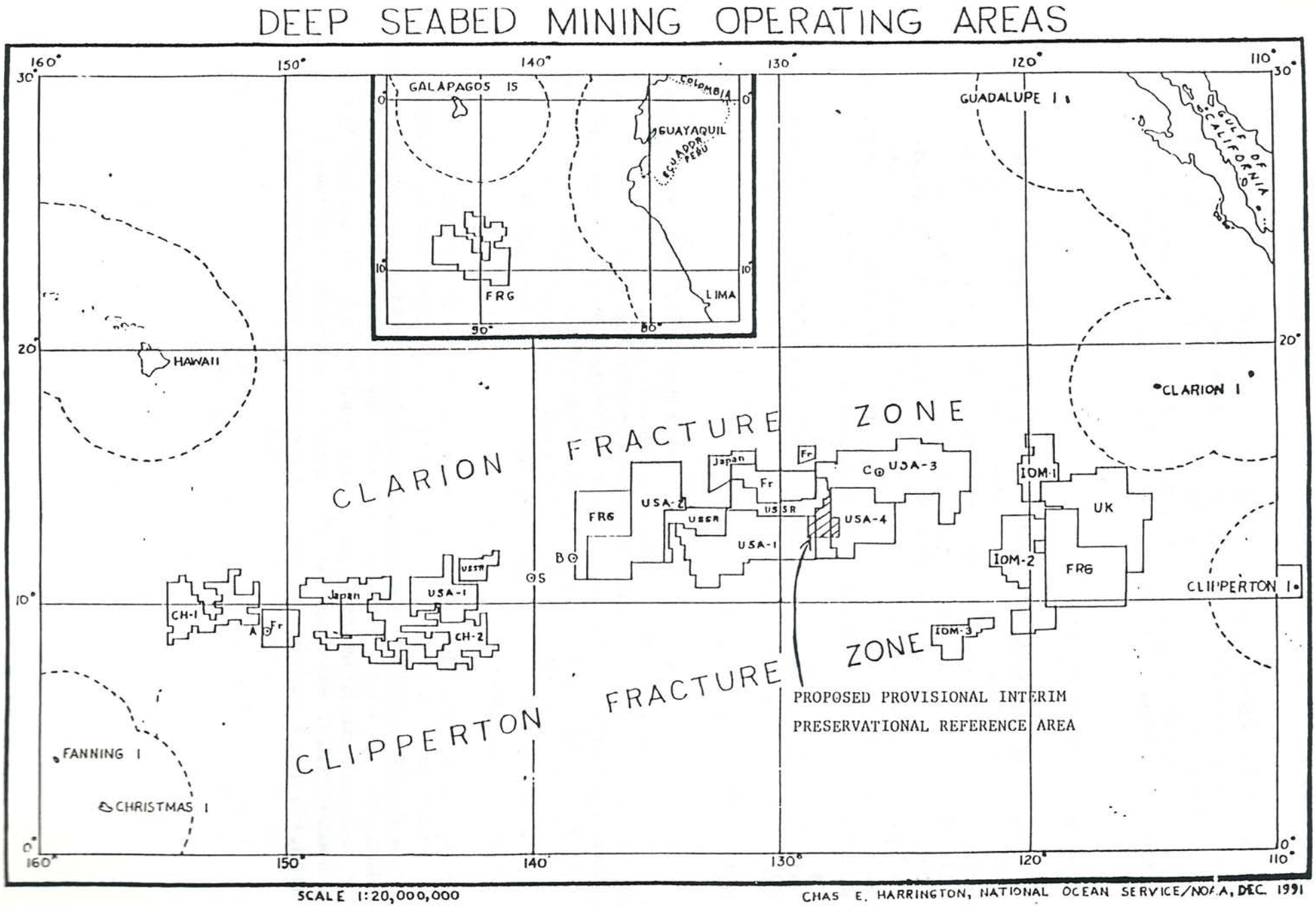

Figure 3. U.S. and Foreign Operating Areas and Proposed Provisional Interim Preservational Reference Area

and Cuba; and the People's Republic of China consortium, COMRA (China Ocean Mineral Resources Research and Development Association). Germany also issued one license to the wholly-German consortium AMR. In addition to these eight consortia, each of which has been involved in nodule mining research and development activities, exploration has been conducted in the Indian Ocean by India and in the Clarion-Clipperton Zone by the Republic of Korea.

Overview of Industrial Activity

All of the NOAA-licensed consortia, prior to enactment of the Act, had already conducted extensive seafloor studies, including at-sea testing of mining systems. License activities presently consist primarily of the analysis and integration of exploration data collected by each consortium or received from other consortia as a result of conflict resolution of overlapping claims. Activities also include the continued monitoring of technological developments, economic assessments and other planning activities for future development of the operators' respective sites. Although further mining system tests may be authorized under the license, no additional tests are presently planned by the licensees.

As mentioned above, a discussion of specific activities conducted by each licensee over the last two years is presented in Chapter II.

Technology Presently Contemplated for Mining

The first generation mining technologies under consideration by the United States consortia are all hydraulic type lift systems. Hydraulic systems, using either submerged centrifugal pumps or air lift systems, will recover nodules in a seawater slurry and pump them through a pipeline from a seafloor collector to a mining ship on the ocean surface. The hydraulic collector likely will sweep the bottom in nearly adjacent swaths; each swath may be up to 20 meters (65 feet) wide. One consortium's collector will be self-propelled. The other collectors probably will be towed across the seafloor by the mine ship. Both types of systems have been tested by the consortia.

In addition to the nodules, bottom water, sediment, and some benthic fauna will be drawn into the collector. Most of this extraneous material will be ejected at the seafloor; however, some of this material will be transported up the pipeline and, after separation from the nodules, discharged at the sea surface. The two activities, ejection near the seafloor and sea surface discharge, are the two perturbations toward which NOAA has directed most of its environmental effects research. Direct collector contact, while having an environmental impact, will affect a relatively small area and is unavoidable if nodules are to be mined.

CHAPTER II

IMPLEMENTATION OF THE

DEEP SEABED HARD MINERAL RESOURCES ACT

Licenses and Permits

In 1984 NOAA issued exploration licenses to four mining consortia:

USA-1 - to Ocean Minerals Company (OMCO)
USA-2 - to Ocean Management, Inc. (OMI)
USA-3 - to Ocean Mining Associates (OMA)
USA-4 - to Kennecott Consortium (KCON)

These actions followed the resolution of originally overlapping site applications by the above consortia and the French and Japanese consortia. Part of their overlap settlement agreement led to the exchange of extensive exploration data pertaining to relinquished areas. All four consortia were authorized to conduct exploration activities in their respective areas for the original 10-year duration of the license.

The terms, conditions and restrictions (TCRs) issued with each license require the licensee to pursue exploration activities in accordance with its approved exploration plan. In order to show that it is following its exploration plan and achieving the major objective of exploration--the ability to apply for a commercial recovery permit by the end of the 10-year license period--each licensee must submit an annual report to NOAA within 90 days of each anniversary date of the license. Annual reports have been received each year from the four consortia.

The information included in the annual reports indicates that in spite of the continued depressed mineral markets and a general reduction in all staff levels, the NOAA licensees have been diligent in each license year in pursuing the activities that are appropriate and are authorized under NOAA licenses and the accompanying TCRs.

On November 14, 1990 and November 20, 1990, Ocean Management, Inc. (OMI) and Ocean Mining Associates (OMA), respectively, submitted to NOAA applications for five-year extensions of their exploration licenses and also proposed related modifications to their exploration plans. These changes were requested because of significant changes in world market conditions. Industry feasibility studies indicated that a downward trend in world metals prices over the past several years, combined with the production cost of nodule commodities, make commercial mining impractical in the near future. The substantial amount of license area data acquired during conflict resolution with other consortia also

reduced the need for further data collection until later in the exploration license phase or early commercial phase.

On July 31, 1991, NOAA approved extensions to these licenses and the exploration plans for five years, from 1994 until 1999 (56 FR 37344, August 6, 1991).

OMI has proposed the following activities for years 7 through 15 of the extended license period under the approved exploration plan revision: To monitor technological, legal and metal market developments and to obtain any necessary environmental data for an environmental impact statement relating to commercial permit application. In the latter years of the license, OMI will assess the need for foreign processing, reassess the timeliness of applying for a commercial permit, and prepare for a permit application or seek extension of the license.

OMA has proposed the following activities for years 7 through 15 of the extended license period under the approved exploration plan revision: To complete their data archives; to monitor legal, technical, and economic aspects of ocean mining; and to participate in cooperative environmental research efforts. In years 13 through 15, OMA will develop environmental monitoring plans, acquire the needed survey capability, and plan for process plant siting. If economic conditions look favorable, OMA will prepare for commercial permit application by selecting a logical mining unit and initial mining subareas and planning for fine-grid seafloor mapping.

On May 16, 1991, Ocean Minerals Company (OMCO) submitted to NOAA an application for a five-year extension of its exploration license and also proposed related modifications to its exploration plan. NOAA determined that this request constituted an application for a major, but not significant revision to the exploration plan and terms, conditions, and restrictions of the license. These changes were requested because of changes in world market conditions and to reflect accomplishment of objectives in OMCO's current exploration plan, including receiving substantial amounts of data from other operators as a result of conflict resolution.

On November 1, 1991 NOAA approved the extension of OMCO's license and exploration plan for five years from 1994 until 1999.

OMCO has proposed the following activities for years 7 through 12: To continue to monitor technical, legal, economic and political developments in ocean mining; to compile environmental data; assess improved exploration methods and techniques; and to perform economic evaluations to determine whether to proceed with Phase II of the original plan. Phase II, scheduled for years 13 through 15, will consist of survey operations, selection of commercial recovery areas, and scale-up activities preparatory to filing a commercial permit application in conjunction with the investment decision of whether or not to proceed with commercial mining.

Exploration and Commercial Recovery Activities

USA-1 - Ocean Minerals Company (OMCO)

OMCO's license activities during the two reporting periods between September 1, 1989 and August 31, 1991 consisted of equipment development studies, data analysis and integration, and commercial re-evaluation.

The equipment development effort was limited to paper studies that involved review of available relevant technical information pertaining to emerging technologies that would improve the basic design of OMCO's mining system. Technologies reviewed included fiber optics for improved data transmission; new polymers for lower cost, lighter weight pipe; and advanced sonar and navigation systems for obtaining high resolution bathymetry and more accurate positioning.

Data analysis and integration activities included preliminary archiving of OMCO's computer data files and the documentation of the exploration database and other exploration data and samples.

Since the world price of nickel dictates the economics of deep ocean mining, OMCO continued to monitor the trends in the nickel market.

OMCO transferred all of its environmental and exploration data to the Marine Minerals Technology Center (MMTC) in Honolulu, Hawaii. OMCO is funding a small effort by MMTC to do some environmental analysis of this data. The geographical distributions of the benthic megafauna in the Clarion-Clipperton Zone is presently being determined by analyses of the bottom photos taken by OMCO during exploration cruises.

USA-2 - Ocean Management, Inc. (OMI)

OMI's license activities during the two reporting periods between August 30, 1989 and August 29, 1991 consisted of continuing to monitor developments in the legal, scientific, and economic areas for impact on the prospects for commercial mining.

OMI concluded an agreement with the ocean mining agency of the USSR and exchanged exploration data for their respective license sites. OMI has begun to evaluate this data and will integrate it into their database.

OMI also continued its cooperation with German scientific institutions engaged in research on the potential environmental impact of deep seabed mining. Scientific personnel from an OMI partner (AMR) participated in a cruise on the research vessel SONNE during a study of the re-colonization of a previously disturbed area of the seafloor. To supplement scientific research on the biology of the deep seabed, OMI has also made its entire environmental database available to German research institutes.

OMI has continued to monitor ongoing technical developments relating to deepsea mining by attending conferences and meetings with experts from industry and academia. OMI has also followed developments pertaining to the Law of the Sea regime.

USA-3 - Ocean Mining Associates (OMA)

OMA's license activities during the two reporting periods between September 1, 1989 and August 31, 1991 involved continued analysis and integration of resource data and the monitoring of world mineral markets and environmental activities.

OMA completed the documentation of all resource and environmental data and samples taken in prior years in its license area, or obtained by OMA from the public domain or as a result of conflict resolution. Documentation consisted of developing a permanent inventory and explanation of the marine science archive so as to allow future users to locate, retrieve, understand, validate, evaluate, and use the data and findings. A 13-volume report, the "OMA Marine Science Consolidation Report," was completed and issued to the OMA partners.

OMA also made a provisional selection of an initial mining sub-area and completed the sampling, environmental assessment, waste classification and archiving or disposal of its nodules and test processing alloys, slags and wastes. Processing test samples were collected according to standard Environmental Protection Agency protocols and analyzed for toxic metals, corrosivity, reactivity and ignitability. No known listed hazardous wastes were found in the samples.

OMA continued to encourage cooperative international programs for deep seabed environmental research. OMA donated its Advanced Survey System and its extensive inventory of Pacific and Atlantic Ocean manganese nodule samples to NOAA for use in governmental and multinational research.

Further, OMA continued to monitor legal and political events involving the legal rights acquired by, and the obligations imposed upon, them under international law, the NOAA license, various intergovernmental agreements, and the private overlap settlement agreements to which OMA is a signatory.

Additional activities conducted by OMA during the reporting period include: 1) efforts to obtain Law of the Sea Treaty reform; and 2) monitoring of mineral markets and associated economic, technical, legal and political developments and other factors influencing changes in the OMA Venture Analysis.

USA-4 - Kennecott Consortium (KCON)

Kennecott Consortium (KCON) received its exploration license October 29, 1984, therefore its seventh annual report to NOAA is not due until January 1992. KCON's license activities

during the two reporting periods between November 1, 1988 and October 31, 1990 consisted mainly of continuing to evaluate the economic feasibility of mining and processing manganese nodules based on projected metal prices.

KCON continued to work with government officials and other interested consortia in establishing a framework which would permit a restructuring of Part XI of the Law of the Sea Treaty in a form acceptable to KCON.

The Safford, Arizona storage site for nodules and other sample materials was maintained as were all technical files.

KCON plans to review the long-term viability of the deep seabed mining project and will determine if there is sufficient economic potential to continue the project.

Environmental Assessments and Impacts

The major area of NOAA's efforts under the Deep Seabed Hard Mineral Resources Act has been the continuation of environmental studies to support future regulatory decisions. NOAA's environmental research efforts have focussed on determining the biological effects of the increased sedimentation on the seafloor that would result from deep seabed mining operations. The following is a brief description of the environmental research conducted since 1989 or currently in progress.

NOAA continues to evaluate the suitability of a site within the areas of the U.S. licensees to be designated as a Preservational Reference Area (PRA) (Figure 3). This site was designated by NOAA in 1988 as a potential Provisional Interim Preservational Reference Area (PIPRA). NOAA also designated an area within the Ocean Mining Associates mine site as a proposed provisional impact reference area (PIRA) to be used for monitoring benthic impact during commercial operations. A preservational reference area is a stable reference area unaffected by mining activities and environmentally similar to the mining sites. The PRA will serve as a control area for measuring environmental impacts. The available data on the variability of deep-sea fauna in this area of the Pacific Ocean suggest that the site being considered by NOAA as a PRA will be biologically similar to the mining sites. Additional research is currently being conducted to determine the composition of the benthic fauna at this site, to determine its similarity to the fauna of the mining areas, and to further describe the benthic environment. In September 1989, 16 box core samples were taken and a current meter and transmissometer mooring was deployed in the PRA. Macrofauna from the box core samples are currently being classified to species. The final goal of this study will be a comparison of the deep-sea benthic community in the PRA with the deep-sea benthic communities described in the previously conducted DOMES studies. Preliminary results indicate a greater abundance of macrofauna at this site than at DOMES Site C.

To complement the information on benthic fauna, a SEABEAM survey of a large portion of the PRA was conducted by the NOAA ship SURVEYOR in March 1990 to provide contemporary bathymetric survey data in the PRA.

Another study was conducted in January 1990 by scientists from the University of Southern Mississippi on the Soviet research ship YUZHMORGEOLOGIYA. The abundance and flux of marine snow in the water column was measured using an innovative sediment trap and camera system. Marine snow are aggregates of particulate matter, biogenic in origin, formed in the upper water column. Because of its high settling velocity, marine snow captures fine slower moving particles during descent to the seafloor. Marine snow aggregates thus could have an effect on the settling of the fine sediments found in the benthic plume. Nearly 3000 photographic images of marine snow aggregates were obtained. Although the results show the absolute abundances of the aggregates to be lower than those observed in other low productivity ocean areas, they do indicate that marine snow aggregates are a ubiquitous feature of the world's oceans.

NOAA has been seeking and has achieved international cooperation for efficient use of our resources to address environmental issues associated with deep seabed mining. Prime examples of this international cooperation are NOAA's agreements with the Union of Soviet Socialist Republics' (USSR's) Yuzhmorgeologiya for coordinated at-sea research and exchange of scientists. Agreements were signed in September 1989, November 1990, and August 1991. Plans for a cooperative Benthic Impact Experiment (BIE) to be conducted in the U.S. Preservational Reference Area were agreed to at a meeting held in November 1990 in Gelendzhik, USSR. A meeting was also held in Washington, D.C. in August 1991 to review results of the research already in progress and to discuss cooperative research planned for 1992.

The BIE is a project designed to assess the environmental impact of deep seabed mining on the organisms living in and on the seafloor. The experiment consists of blanketing an area of the seafloor with sediments in a manner simulating the mining of manganese nodules. The response of the benthic organisms to different levels of sediment burial will be indicative of the impacts to be associated with commercial mining. The results of this research effort will be used by NOAA in establishing the terms, conditions, and restrictions that will be issued with a commercial recovery permit.

The multi-year BIE began in June 1991 utilizing the Russian research vessel YUZHMORGEOLOGIYA. In this first part of the BIE project NOAA successfully tested the Deep Sea Sediment Resuspension System (DSSRS) at a depth of 4000 meters off the California coast. The DSSRS was designed to the specifications of NOAA scientists and is a critical piece of equipment for simulating a mining disturbance. The success of DSSRS on this test cruise demonstrated that large scale mining disturbances could be simulated allowing the direct measurement of mining impacts on benthic community structure.

In July 1991 the second part of the BIE project took place in the near-equatorial North Pacific Ocean (approximately 13° N and 128°W). During this part of the experiment current meters were recovered and deployed, a transponder net was deployed and calibrated, information about the topography in the BIE area was collected using sidescan sonar, and TV/camera transects were made across the BIE site to assess manganese nodule coverage and the abundance of large, surface-dwelling deep-sea animals.

In August 1991 pre-impact benthic sampling was conducted using 7 box core and 10 multicore samples to characterize the benthic community structure. Samples were also collected to assess sediment porewater chemistry and radionuclide inventories. In order to map the extent of sediment deposition during the experiment, sediment traps and current meters were also deployed. The DSSRS was then towed to blanket the BIE study area with sediment. Due to winch problems on the ship only one DSSRS tow was completed. Scientists from Japan and Germany participated in these cruises. A French biologist is evaluating the videotapes taken in the BIE area for megafauna data.

In the spring of 1992, NOAA will finish blanketing the BIE experimental area with varying thicknesses of sediment using the DSSRS. Immediately after sediment deposition, samples will be taken to map the sediment deposition using radionuclide analysis. Approximately six months later, the experimental area will be sampled to assess the short term effects of the sediment deposition on the benthic animals. Subsequent sampling of the impacted area is planned at yearly intervals for 1993 and 1994.

Additional benthic impact experiments similar to the BIE are under discussion for the USSR mining claim area and in the western DOMES area in cooperation with Japan. Also, NOAA has reached an agreement with the Metal Mining Agency of Japan to cooperate in environmental research studies related to deep seabed mining and for mutual monitoring of their planned mining test. A Memorandum of Implementation was signed in July 1990 outlining the areas of responsibilities for this multi-year cooperative effort. Meetings of the Joint Committee were held in Honolulu in October 1990 and 1991 to plan research activities and review those in progress.

In another example of international cooperation, a U.S. scientist will participate in the 1992 cruise of the German research ship SONNE during its investigation of the environmental effects of mining in the eastern South Pacific. The objectives of this study are to create a large scale disturbance on the seabed and then observe its recolonization over several years.

The predecessor of the BIE research currently underway was research conducted from 1983 to 1990 through Scripps Institution of Oceanography (SIO). This project involved examining the environmental impact at the site of Ocean Mining Associates (OMA's) mining test in 1978 (DOMES Site C) and conducting a small-scale sediment redeposition experiment near this same site. This project was concluded in May 1990 with a SIO cruise to conduct a "critical dose experiment." Scripps Remote Underwater Manipulator (RUM 3) was to be used to deposit varying amounts of sediment on small areas of the seafloor to determine the

quantity necessary to smother the benthic organisms. Although 12 box core samples were taken, technical difficulties with RUM prevented completion of the planned sampling program.

Civil and Criminal Proceedings

No civil nor criminal proceedings were instituted under provisions of the Act.

International Conflict Resolution

In accordance with the Act, in previous years the United States had concluded two agreements, with a total of eight other countries, resolving mine site overlaps and assuring against future conflicts.

During this reporting period, NOAA and the U.S. Department of State continued their efforts to avoid minesite overlaps and conflicts by concluding agreements between the United States and countries representing two foreign deep seabed mining entities. On February 22, 1991, a "Memorandum of Understanding on the Avoidance of Overlaps and Conflicts Relating to Deep Seabed Areas" was signed by the United States and the governments of Belgium, Canada, Germany, Italy, the Netherlands, and the United Kingdom, with the government of the People's Republic of China. On August 20, 1991, a Memorandum of Understanding with identical provisions was signed between the U.S. and the same nations, on the one hand, and with the Interoceanmetal (IOM) consortium on the other. IOM consists of the governments of the USSR, Poland, Czechoslovakia, Bulgaria and Cuba. Both the People's Republic of China and IOM filed applications with the U.N. Law of the Sea Convention Preparatory Commission for registration of their mine sites and have received pioneer investor status.

NOAA's review of the site coordinates indicates that there are no overlaps with the U.S.-licensed sites. Although there were no conflicts, the memoranda were signed because all the governments involved felt that it would be beneficial to have an agreement to ensure that conflicts would continue to be avoided. These agreements state, in summary, that each party agrees to respect the others' mining areas and to take all appropriate measures not to interfere with the activities of the other relating to exploration and exploitation of the resource. NOAA is responsible for implementing these agreements on behalf of the United States.

Recommendations

There are no recommendations regarding amending this Act.