

Chapter 4

Managing the Seabeds

Seabed mining⁸ could become a reality in the Pacific within the next 10–30 years. Exploratory cruises have discovered substantial deposits of minerals in the Pacific Islands EEZs, and investor interest is rising. Adoption of suitable legislation and environmental safeguards to regulate seabed mining is therefore a high priority for Pacific Island countries.

First discovered in the Pacific during the 1950's, seabed minerals comprise three types of deposits: manganese nodules are potential sources of copper, nickel, and cobalt (figure 10); cobalt-rich manganese crusts can contain platinum, nickel, copper, and three to five times as much cobalt as manganese nodules; and polymetallic sulphide deposits are potential sources of copper, zinc, lead, silver, and gold.

A. Economic Potential

The potential for seabed mining in the Pacific Island region is significant (table 7). The Cook Islands EEZ, for example, is believed to contain some 7.5 million metric tons of manganese nodules—a potential source of 32 million metric tons of cobalt, or 520 years of supply at current world demand (Ponia 1999; Clark 1999).

Cobalt-rich manganese crusts deposits have been found in the Federal States of Micronesia and the Marshall Islands. And though their volume is unknown, polymetallic sulphide deposits have been discovered in the Lau Basin in Fiji and Tonga's EEZ, and in the Manus and Woodlark Basins in Papua New Guinea and Solomon Islands. Indications that the Pacific polymetallic sulphide deposits may have a high gold content, with the extracted value potentially as high as US\$2,000 per square meter, has led to a recent increase in foreign investors' interest (Clark 1999; Binns and Dekker 1999).

⁸ Except where otherwise noted, this section is based on contributions by Freestone and Müller (2000) and by Simpson, McLeod, Kojima and Lum (1999).

B. Trends Affecting Seabed Mining

Despite the rising interest, there is as yet no exploitation of seabed minerals. The technology for extraction of manganese nodules has been developed, but the great depths—4,000–6,000 meters—and current low world prices hinder their commercial exploitation.

Figure 10. Manganese Nodules on a Seabed

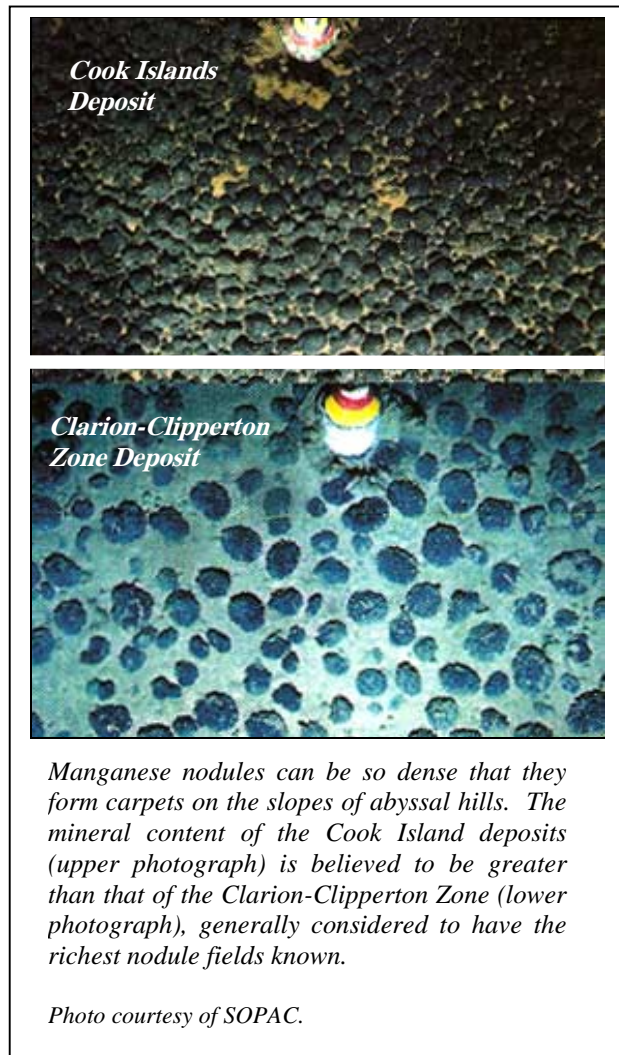


Table 7. Potential of Seabed Mining in the Pacific: Manganese Nodules and Cobalt-Rich Manganese Crusts

<i>Manganese Nodules</i>			<i>Cobalt-Rich Manganese Crusts</i>				
<i>Country</i>	<i>Average Abundance (kilograms per square meter)</i>	<i>Nodule Resource (million metric tons)</i>	<i>Country</i>	<i>Cobalt (million metric tons)</i>	<i>Nickel (million metric tons)</i>	<i>Manganese (million metric tons)</i>	<i>Platinum (million ounces)</i>
Cook Islands	10.68	7,474	Federated States of Micronesia	17.8	9.96	496.0	34.7
Gilbert Islands (Kiribati)	1.54	100	Marshall Islands	10.6	2.5	281.3	21.5
Phoenix Islands (Kiribati)	4.55	630	Guam	0.6	0.3	15.5	0.7
Line Islands (Kiribati)	4.37	670	Samoa	0.03	0.01	0.8	0.04
Tuvalu	2.74	—					

— Not available

Sources: Simpson, McLeod, Kojima and Lum (1999); Clark and others (1995); Kinoshita and Tiffin (1993).

Investors' attention has recently focused on the exploration of polymetallic sulphide deposits. In 1997 Papua New Guinea became the first country in the world to grant commercial licenses for their exploration, to Nautilus Minerals Corporation (Wanjik 1999). Fiji, New Zealand, and Tonga have since been approached by Australian, Korean, and U.S. interests for similar licenses.

C. Key Challenges and Opportunities

Seabed mining would be unlike any other industry seen today. It would involve high risks (operating costs of exploration vessels run at half a million dollars per expedition); it would operate over vast areas (the Papua New Guinea license covers 5,000 square kilometers [Malnic 1999]); and it would require very large and highly sophisticated machinery. Given its potential environmental impacts, seabed mining is also likely to receive intensive public scrutiny.

Extending National Claims beyond the EEZ

Under the Law of the Sea, the International Seabed Authority is responsible for regulating seabed mining on the high seas. However, Pacific Island countries may extend national claims beyond their 200-mile EEZ by delineating their continental margins. Extending these boundaries could give potential claimants the rights to additional seabed mineral deposits.

Recognizing the Risks and Uncertainties Faced by the Industry

The economic viability of the industry remains untested, even though seabed mining has been a prospect for half a century. Seabed mining operations would likely operate in unstable and small markets, facing stiff competition from mining operations on land. For example, the current global demand for cobalt—used primarily as an alloy in the aerospace industry—is limited to 27,000 metric tons a year. A single seabed mining operation producing 10,000 metric tons of cobalt a year could easily flood the market and depress world prices (Exon 1989; Ponia 1999). Polymetallic sulphide mining could be more profitable in the medium-term, but further analysis of global markets is needed.

Much of the future viability of seabed mining will depend on technological breakthroughs and improvements in mineral recovery rates. Seabed mining policies should therefore recognize the level of risk and uncertainties under which the industry would operate.

Handling Potential Environmental Impacts

Seabed mining could have substantial adverse environmental impacts. For example, manganese nodules would most likely be extracted by collectors towed across extensive areas of seabed. Lifting the nodules from depths of 5,000 meters could also release large amounts of sediment. Simulations by the Metal Mining

Agency of Japan suggest that it may take one to two years for organisms living at the sea bottom to recover from this kind of disturbance of the seabed (Kajitani 1999). The release of colder, nutrient-rich water in the upper water column may lead to a boom in primary productivity, but the potential impact such operations on fisheries and migratory species, such as turtles, is unknown. In addition, mining operations might lead to high levels of wastewater discharge—estimated at 9 metric tons of waste per day for a polymetallic sulphide mining operation (EDF undated)—and to sludge disposal from onshore processing facilities (Ponia 1999). More research will be needed to ascertain the full environmental impact of seabed mining.

The extraction of polymetallic sulphide deposits could have significant impacts on the numerous organisms found at active chimneys. Up to 5,000 organisms have been identified in one square meter of a chimney wall (Binns and Dekker 1999). Among them is a group of bacteria, *Archae*, believed to be among the earliest forms of life on earth. The fact that chimney organisms are able to survive under such extreme conditions—a highly toxic environment with temperatures of up to 300°C—renders them as highly promising for biomedical and pollution control research. Care needs to be taken to ensure that seabed mining does not destroy these potentially valuable resources.

D. A Strategy for Seabed Mining

Seabed mining presents both an immense opportunity and an immense challenge for Pacific Island countries. Given the emerging interest and the potential scale of seabed mining operations, it is essential that Pacific Island countries urgently implement two key actions:

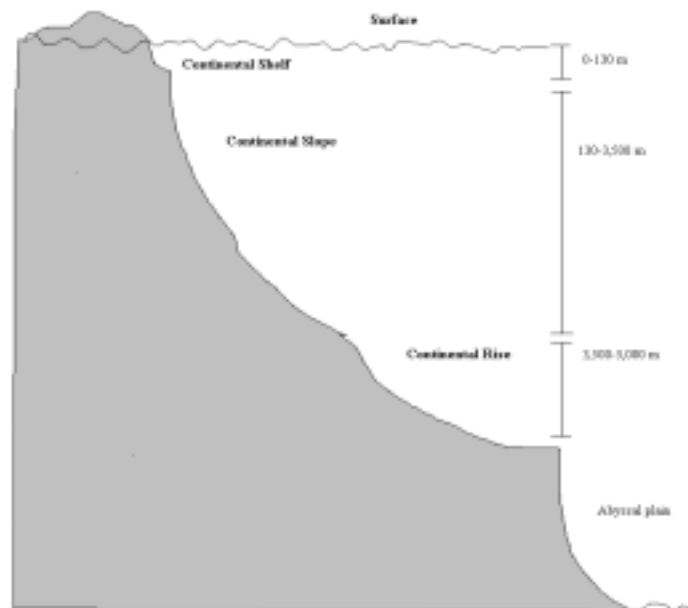
- ❑ Extend their maritime claims to the outer edge of the continental margin.
- ❑ Develop sound national offshore mineral policies.

Extending Seabed Claims

Under the United Nations Law of the Sea Convention, most Pacific Island countries have declared exclusive sovereign rights over resources in their 200-mile EEZs. Pacific Island countries can, however, extend these claims up to the outer edge of the continental margin (figure 11), provided they do so within 10 years of ratification of the Convention—that is, by November 2004—and meet the qualification criteria of the Convention.

Extension of maritime claims over the continental margin would give Pacific Island countries rights over all nonliving resources found in these areas, including seabed minerals, oil, and gas. It would also give them the right to harvest sedentary living resources, such as clams and oysters, and rights over biological communities associated with active chimneys. It would not, however, grant them exclusive rights to migratory tuna resources. Coastal states would also be required to pay a contribution (either in-cash or in-kind) to the International Seabed Authority after the first five years of mineral exploitation (SOPAC 1998).

Figure 11. Transect of a Continental Margin



The continental margin includes three major areas: the continental shelf, the slope, and the continental rise.
 Source: SOPAC (1998).

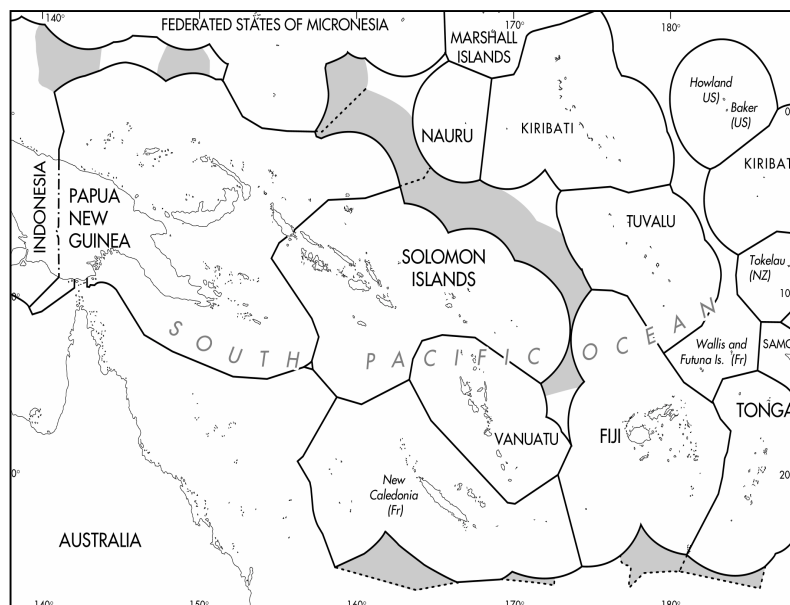
The extension of claims could give Pacific Island countries rights over potentially valuable mineral deposits. Six areas could be claimed, based on surveys conducted by the South Pacific Geoscience Commission (SOPAC) (figure 12 and table 8). Fiji, the Solomon Islands, Tonga, and Vanuatu could potentially claim new polymetallic sulphide deposits. The Cook Islands, the Federal States of Micronesia, Kiribati, the Marshall Islands, Nauru, Niue, and Tuvalu could extend their EEZ to claim deposits of manganese nodules and crusts (Simpson and others; Boyes and Larue 1996).

Pacific Island countries' claims for potential extension of maritime areas would need to be submitted to the International Commission on the Limits of the Continental Shelf. To qualify, a country's continental margin would need to extend beyond the 200-mile EEZ. Pacific Island countries could then claim continental margin areas of up to 350 nautical miles from coastal baselines, or up to 100 nautical miles from the 2,500 meter isobath (a line connecting depths of 2,500 meters) (SOPAC 1998).

Before submitting their claims, countries should complete three major technical and legal steps:

- *Define coastal baselines.* The Law of the Sea Convention allows island states to define archipelagic baselines, which could extend offshore claims by thousands of square miles. Fiji, the Solomon Islands, and Vanuatu have all claimed archipelagic status.

Figure 12. Potential Extension of Maritime Claims



Pacific Ocean: Continental Shelf Areas Beyond the Exclusive Economic Zone

— POTENTIAL CLAIMABLE AREAS
 - - - 200 MILE LIMIT EEZ BOUNDARIES
 - - - INTERNATIONAL BOUNDARY

This map was produced by the Map Design Unit of the World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

Source: Modified from SOPAC (1998)

Table 8. Continental Margin Areas that Could Be Claimed By Pacific Island Countries

Location	Area (square kilometers)	Potential claimants
Euripik Ridge	110,000	Federated States of Micronesia, and Papua New Guinea
Mussau Ridge	60,000	Papua New Guinea and Federated States of Micronesia
Ontong Java Plateau	60,000	Solomon Islands, Papua New Guinea
Rotuma Ridge	40,000	Fiji
Tonga-Kermadec Ridge	—	Tonga, Fiji, New Zealand
Norfolk Ridge	12,000	New Caledonia, Australia

— Not Available
 Source: SOPAC (1998)

- *Negotiate maritime boundaries with adjacent states.* Once coastal baselines have been accurately delineated, countries need to negotiate the boundaries of the outer shelf with adjacent coastal states. Potentially adjacent claims are shown in figure 12.
- *Survey the outer edge of the continental margin.* SOPAC has completed preliminary work to assess where claims to continental margins could be made. However, more work is needed to meet the data requirements of the Commission on the Limits of the Continental Shelf.

The 2004 deadline for submission of seabed claims puts pressure on key Pacific Island countries to urgently complete these tasks. It would be prohibitively costly for Pacific Island countries to undertake the surveys on their own. Close regional collaboration through SOPAC could help achieve economies of scale in offshore surveying and facilitate the exchange of information needed to help coastal states prepare their claims.

Developing National Offshore Mineral Policies

The granting by Papua New Guinea of two licenses for exploration of polymetallic sulphide deposits in 1997 led to a surge of interest in seabed mining in the region. Following the example of Papua New Guinea, Fiji and the Cook Islands have started to draft national offshore mineral policies. SOPAC has assisted in this process by providing advice to these countries and by issuing general guidelines on marine mineral policies such as the Madang Guidelines (Box 3.5).

Pacific Island country governments have correctly recognized that seabed mining poses a very different set of challenges from land mining. These challenges require new policies that maximize benefits to Pacific Island countries, safeguard the environment, allow public participation in licensing and policy decisions, and provide a conducive environment for foreign investment.

Box 5. Key Principles of the Madang Guidelines

The Madang Guidelines were developed by SOPAC as a blueprint for offshore mineral policy in the Pacific. Key principles include the following:

- Coastal States should move rapidly to stake claims for extending their continental margins.
- Nations should minimize the potential adverse impacts of offshore mining on marine environment and on other users of the sea.
- All exploration licenses should be conditional upon the collection of baseline environmental data.
- Coastal states should develop offshore mining policies and legislation that are separate from those of inland mining.
- Nations should ensure that Marine Scientific Research can produce research data while protecting the confidentiality of investors.
- Coastal states representatives should participate in all at-sea research and exploration to ensure effective monitoring.
- Marine Scientific Research and the industry should ensure adequate understanding of the life forms associated with actively venting chimneys.
- Coastal states should consider the risks involved in seabed mining in the development of licensing and fiscal regimes.
- All commercial offshore operators must carry appropriate insurance.

Source: Adapted from SOPAC (1999).

Maximizing Benefits to Pacific Island Countries. An overriding objective of national policies is maximization of economic benefits. The following general principles are recommended to achieve this objective:⁹

- *Rely on license revenue.* License fees will be the major source of seabed mining revenues for Pacific Island countries in the foreseeable future. The experience of offshore fishing suggests that Pacific Island countries should avoid any direct public involvement in mining or processing.

⁹ These recommendations are based on a review of the Madang Guidelines (SOPAC 1999) and the draft Fiji offshore policy (MRD 1999).

- *Split licenses whenever feasible.* If mining areas remain profitable, issuing several licenses for a given area is likely to increase competition and maximize benefits to Pacific Island countries (Clark 1999b).
- *Avoid linking licensing to aid.* Offshore mining licenses should not be tied to aid funds, promises of local employment, or investments in processing facilities. The same principle should apply to tax holidays or reduced license fees in exchange for local investment. Such provisions create inconsistencies that could undermine the credibility of the licensing system, and are likely to result in lower benefits than originally expected.
- *Protect genetic property rights.* Given the potential biomedical and industrial value of organisms associated with actively venting chimneys—where polymetallic sulphide deposits are also found—Pacific Island countries need to adopt regulations that protect their genetic property rights in the event of future discoveries.

Imposing Strict Environmental Safeguards.

International concern about the potential environmental impact of seabed mining is growing. The magnitude of the operations will almost certainly guarantee high public visibility. Only by adopting strict environmental standards and communicating openly with the public will the industry and Pacific Island decisionmakers avoid strong negative lobbying by environmental groups (Morgan 1999). The following environmental safeguard principles are recommended:

- *Assess environmental impacts in actual field conditions.* Pacific Island countries should withhold exploitation licenses until the environmental impact of seabed mining has been assessed under actual field conditions. Only then can long-term licensing arrangements be correctly formulated.
- *Adopt a regional code of environmental practice.* Pacific Island countries should develop a regional code of environmental

practice.¹⁰ The code should be developed in close consultation with environmental and industry experts.

- *Perform independent monitoring.* Draft mining policies currently give investors the main responsibility for monitoring environmental impacts. The burden of proof falls on external stakeholders to prove that impacts have occurred. This is a key weakness that undermines many environmental regulations around the world. Pacific Island countries should consider setting up an independent monitoring system for seabed mining. The system could rely upon on-site observers or periodic ground and air surveillance. To help defray its costs, the system could operate at the regional level, with support from a share of the mining royalties.
- *Impose strict penalties for polluting.* Once an independent monitoring system is put in place, Pacific Island countries should impose stiff penalties for violators based on a polluter-pay principle. Disincentives for repeat violators—such as withdrawal of licenses to operate in any of the Pacific Island countries' waters—could also be adopted. In addition, Pacific Island countries should require mining operators to develop and exercise comprehensive contingency plans for offshore incidents. Asking investors to post environmental bonds as a condition for licensing could be a way to ensure payment for any major damages that may occur. However, for this to be effective, Pacific Island countries would need to adopt legislation that is consistent at the regional level.
- *Require rehabilitation deposits.* Pacific Island countries should require all mining operators to provide a rehabilitation security deposit, to be refunded upon verification that all structures have been removed satisfactorily at the end of the licensing period (MRD 1999).

¹⁰ Fiji has proposed such a code in its draft mining policy (MRD 1999).

- *Ban seabed mining in areas of high biological value.* With the help of regional organizations, Pacific Island countries could assess which areas should be zoned as off-limits to seabed mining. Off-limits zones could include areas of other important commercial uses, such as established shipping lanes and known areas of high tuna abundance. They could also include areas set aside to protect threatened or endangered species (Wanjik 1999). To comply with the Law of the Sea and the Biodiversity Convention, Pacific Island countries may need to develop regulations that minimize impacts on organisms associated with active hydrothermal vents, and consider designating areas for their protection (Glowka 1999).

Providing for Public Participation. Given the potential magnitude of seabed mining operations, it is important for Pacific Island countries to hold public consultations when developing their national offshore mineral policies, as well as to conduct public hearings on all license applications. Key stakeholders could be invited to participate in decisionmaking, dispute resolution, and benefit sharing. To ensure effective public involvement, policymakers should:

- *Identify conflicting and traditional claims.* Most seabed mining areas will be located outside the territorial sea and therefore beyond community waters. Notwithstanding, potential conflicts between traditional fishing rights and rights of passage and an application for offshore mining may arise. These should be investigated, and stakeholders consulted to obtain their consent or determine appropriate compensation.
- *Hold public hearings.* Public hearings should be advertised for all license applications, and stakeholders allowed a reasonable period of time to voice and discuss their objections. Results of independent monitoring should also be made public.
- *Establish an independent dispute resolution mechanism.* Once licenses are issued, Pacific

Island countries should consider an independent forum for dispute resolution—such as the Mining Tribunal in Fiji (MRD 1999)—to enable the hearing of any valid claims from stakeholders.

- *Share benefits and invest in the future.* Seabed minerals are also the patrimony of future generations of Pacific Islanders. To every extent possible, Pacific Island governments should invest a share of mining royalties in trust accounts and ensure that stakeholders with valid user rights receive a fair share of the benefits (MRD 1999).

Creating a Conducive Environment for Foreign Investment. National seabed mineral policies need to recognize that potential investors face severe constraints: a high-risk, high-cost industry with uncertain future viability and unstable markets (Clark 1999b). These constraints should not be addressed by relaxing environmental safeguards but rather by offering a stable and conducive investment environment to attract foreign investor interest. To create such an environment, Pacific Island countries could take the following steps:

- *Simplify the fiscal regime.* The draft seabed mineral policy for Fiji includes 13 different fiscal instruments, including mineral royalties, corporate income tax, dividend withholding tax, carry forwards, and a duty free area (MRD 1999). The fiscal regime should be made as simple and transparent as possible, avoiding exemptions and conditional concessions. Of particular importance to investors will be the elimination of double taxation of profits already taxed by their country of origin (Clark 1999b).
- *Streamline reporting requirements.* Reporting and data requirements before and during the licensing period should be streamlined and clarified. Some of the monitoring requirements now imposed on investors would be better carried out by an independent monitoring system.

- *Provide incentives for long-term investment.* One of the most contentious issues raised by the mining industry is how to deal with uncertainty. Because environmental impacts are not yet fully understood, coastal states might need to supplement mining contracts with additional regulations that may not be known at the time the contract is signed. This is strongly opposed by the industry (Lodge 1999). One possible solution might be to phase the licenses, with the first phase including those activities that are clearly

known up front. Renewal of the contract would then be conditional upon acceptance of the safeguards adopted during the first phase (Morgan 1999).

The implications of an independent monitoring system for seabed mining in the Pacific need to be further assessed, as such a system would have to be established at the regional level to be cost-effective. An appropriate forum for such discussions could be facilitated by SOPAC, or by the Marine Sector Working Group of the Council of Regional Organizations in the Pacific.