

ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE
ENGINEERING AND TECHNOLOGY

**DEEP SEA MINING IN THE PACIFIC ISLAND COUNTRIES, MINING
POTENTIAL OF VANUATU AND POSSIBLE COLLABORATION WITH ITU**

M.Sc. THESIS

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Department of Mining Engineering

Mining Engineering Programme

MAY, 2015

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ FEN BİLİMLERİ ENSTİTÜSÜ

**PASİFİK ADA ÜLKELERİNDE DERİN DENİZ MADENCİLİĞİ,
VANUATU’NUN MADENCİLİK POTANSİYELİ VE İTÜ İŞBİRLİĞİ**

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To my spouse and child,

FOREWORD

This thesis would not have been realized without the support of many people in Turkey, Australia and Vanuatu. The author wishes to express his sincere gratitude to his supervisor Prof. Dr. Nuh Bilgin who offered great support and guidance.

Vanuatu Ministry of Lands and Mineral Resources, Nautilus Company in Australia provided very valuable information during the preparation of the thesis. So many thanks for their valuable contribution.

As it is well known, the mining exploration in the Pacific region have revealed that all the Pacific Island Countries need the mining and geological experts to be able to follow mining operations in their Exclusive Economic Zone. Their co-operation for this study may enable us the establishment of Mining Engineering Department at the Emalus Campus of the South Pacific University in Vanuatu.

The author also would like to thank to all his family members for their support during the preparation of this study.

May 2015

Mehmet ATAR
Mining Engineer

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ABBREVIATIONS

CRC	: Cobalt Rich Crusts
DSM	: Deep Sea Minerals
EEZ	: Exclusive Economic Zone
EIA	: Environmental Impact Assessment
ESIA	: Environmental and Social Impact Assessment
EU	: European Union
MN	: Manganese Nodules
MSR	: Marine Scientific Research
NOMC	: National Offshore Minerals Committee
ROVs	: Remotely Operated Vehicles
SEA	: Strategic Environment Assessment
SMS	: Seafloor Massive Sulphides
SPREP	: The Secretariat of the Pacific Regional Environment Programme
SPC	: Secretariat of the Pacific Community
UNCLOS	: United Nations Convention on the Law of the Sea
USP	: University of the South Pacific

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DEEP SEA MINING IN THE PACIFIC ISLAND COUNTRIES , MINING POTENTIAL OF VANUATU AND POSSIBLE COLLABORATION WITH ITU

SUMMARY

Deep Sea Mining Applications are investigated in this study. After the introduction and the objective of the research, in the second section of the thesis, deep sea mining is defined and reasons behind developments of deep sea mining are explained. The process of mineral occurrence at the seafloor is explained and the three different types of seafloor mineralization are defined. Terrestrial mining and deep-sea mining is also compared.

The deep sea mining applications are the exploration and exploitation of three main groups of mineral deposits namely seafloor massive sulphides, manganese nodules and cobalt rich crusts. The target minerals in the deep-sea mining in generally are the manganese, cobalt, copper, silver and gold. These are main metals used in mobile phones, tablet computers, PCs and electric cars

With the development of technology, demand for the metal in the world is increasing, grade values of precious metals are dramatically decreasing in terrestrial mining, metal prices are also increasing. These facts has been leading to deep sea mining exploration in the recent years. Seabed minerals could therefore attract lucrative values in the world market. Typical value of a tone of land based ore is between 50-180 USD. Typical value of a tone of SMS ore: 800 – 1500 USD.

The limiting factors dealing with deep-sea mining are the political and legal aspects. Legal and political issues related to exploration, exploitation, and marketing of sea floor minerals must be resolved. One of the biggest issues for deep-sea mining is the environment at seafloor. So, negative effects of the deep sea mining to the ecology must be considered and balanced with the benefits of mining exploitation methods. The ecosystem at seafloor is also briefly determined.

In the third part of the thesis deep sea mining exploration in the Pacific Island Countries is introduced. This is based on the collaboration between the Secretariat of the Pacific Community (SPC) and the European Union (EU). All Pacific Island Countries have low economic profiles because of their large distance to the global big markets. So realization of the deep sea mining activities in the Exclusive Economic Zones of these countries will provide great support to their economies. The mining activities will create lots of different sectors such as machinery, ore dressing, housing and needs for educated young people in the mining sectors. The sharing of the tenements among the mining companies is also given to be able to establish the link between the Turkish Mining sector especially based in Australia. The current tenement holder companies will need partners.

In all Pacific Island Countries stated above, deep sea mining activities are at the first stage. DSM training workshops have been held. Representatives of relevant government agencies, civil society organizations, and DSM experts have been

invited and supported to attend. Private sector representatives have also been invited to attend at their own cost. Workshops specifically focused on “Deep Sea Minerals Law”, “Government-Company Contract Negotiations”, “Environment” and “Social Impacts of Deep Sea Mining”.

In the fourth part, mining potential of Vanuatu is analyzed. Although there is no current exploitation for terrestrial mining in Vanuatu, this country has also rich gold, copper, silver and manganese deposits. Similarly Vanuatu has rich seafloor Massive Sulphides in the Exclusive Economic Zone.

Surveys carried out within Vanuatu waters show deposits of polymetallic seafloor massive sulphides (SMS), found at sub-sea hydrothermal vent sites. The first ever sample recovered in one of the research cruise had a sample assayed at 40% zinc. Vanuatu deep sea mineral exploration is in its early stages and a lot of work is yet needed to understand the geology and the environment at which these deposits exist.

In the fifth part, Deep Sea Mineral Policy subjects in Vanuatu is investigated in detail. Establishment of the mining engineering department at the South Pacific University in Vanuatu and possible collaboration with ITU are on the agenda. In this part preparation processes for the deep sea mining in Vanuatu are explained in detail.

In order to realize the mining activities in the Exclusive Economic Zone of Vanuatu, Vanuatu government started a national consultation on a draft Deep Sea Minerals Policy in 2014. The author also involved in this consultation meetings as member of Vanuatu National Offshore Committee.

PASİFİK ADA ÜLLKELERİNDE DERİN DENİZ MADENCİLİĞİ, VANUATU'NUN MADENCİLİK POTANSİYELİ VE İTÜ İŞBİRLİĞİ

ÖZET

Bu çalışmada, derin deniz madencilik uygulamaları konu edinildi. Pasifik Ada Ülkelerindeki derin deniz madenciligi ve özellikle Vanuatu'nun madencilik potansiyeli ele alındı. Dünyanın gittikçe artan metal talebi, metal fiyatlarındaki yükselmeler, karasal madencilikteki metalik maden yataklarında gittikçe düşen tenör değerleri, derin deniz madenciligine konu olacak metalik madenlerin yüksek tenörlere sahip oluşları ve nadir toprak elementlerine olan ihtiyaç artışları derin deniz madenciligine yönelinmesine neden oldu.

Derin deniz madencilik arama, araştırma ve işletilmesi üç farklı türde mineral gruplarının üretilmelerini sağlayacaktır. Bunlar sırasıyla, deniz dibi masif sülfidler, manganez yumruları ve kobalt içeriği zengin kabuklar olarak sayılabilir. Derin deniz madenciliginden elde edilecek hedef metaller modern teknolojinin vazgeçilmezi olan; taşınabilir telefonlar, tabletler, bilgisayarlar ve elektrikli arabaların yapımlarında kullanılan bileşenlerdir.

Derin deniz madenciligi karasal madencilige göre pek çok avantajlara sahiptir. Tenör değerleri açısından ele alındığında deniz madenciliginden elde edilen cevherlerin tenör değerleri, karasal madencilikle karşılaştırıldığında 2 ile 10 kat daha yüksek değerlere sahiptir. Karasal madencilikten elde edilen tipik bir cevherin satış fiyatı bir ton için 50 ile 180 Amerikan Doları arasında olurken, deniz dibi madenciliginden elde edilen cevherlerin satış fiyatının tonu 800 ile 1500 Amerikan dolar olarak hesaplanmıştır. Derin deniz madenciliginde sınırlayıcı faktörler yasal ve politik sınırlamalar ve ekolojik faktörler olarak sıralanabilir.

Deniz dibindeki 160 bar'a yaklaşan (1,6x10 Pascal) yüksek basınç, düşük sıcaklık ve ışısız ortam koşullarında üretim yapabilecek makinelerinin tasarlanması da derin deniz madenciligi konusundaki gelişmelerin başlamasına yol açtı.

Küçük adalardan oluşan Güney Pasifik ada ülkelerinin (Kiribati, Cook Adaları, Tuvalu, Samoa, Tonga, Papua Yeni Gine, Solomon Adaları, Vanuatu, Fji, Marshall Adaları, Mikronezya, Palau ve Niue) maden kanunlarının derin deniz madenciligine cevap verecek şekilde uyarlanması, deniz ekolojisi ile ilgili konuların tamamen tanımlanması ardından yakın bir gelecekte bu bölgede derin deniz madencilik üretimleri başlayacaktır. Bu aşamada tüm bu ülkelerde proje paydaşları ile çok sayıda çalıştay ve toplantılar yapılmaktadır.

Giriş ve amaç kısımlarından sonra, tezin ikinci bölümünde derin deniz madenciligi ve gelişmesine neden olan faktörler ele alınmıştır. Karasal madencilik ile derin deniz madenciligi karşılaştırılmıştır. Deniz dibindeki üç tür mineral oluşumu anlatılmıştır. Maden üretiminde çok önemli bir konu olacak o bölgedeki okyanus dibindeki flora ve faunaya kısaca değinilmiştir. Üretim faaliyetleri için ekoloji ve fayda dengesi konu edinilmiştir.

Üçüncü bölümde, Avrupa Birliği'nin uluslararası anlaşmalar temelinde başlattığı “Derin Deniz Madencilik” projesi ve gelişimi anlatılmış, ülkelere göre maden yatakları ve arama izinlerinin dağılımları sunulmuştur. “Nautilus” firmasının başlattığı üretim hazırlıkları bir örnek olarak anlatılmıştır. Uluslararası pazarlara uzak olmaları, zaman zaman doğal felaketler nedeniyle kırılgan ekonomik yapıları nedeniyle derin deniz madenciliğinin Pasifik Ada Ülkelerine faydaları belirtilmiştir.

Dördüncü bölümde, ülkemiz ile daha güçlü ilişkiler geliştirmek isteyen Vanuatu'nun madencilik potansiyeli madencilik firmalarının ilgisini bu yöne de çekmek amacıyla anlatılmıştır. Başlayacak olan derin deniz madenciliği nedeniyle Vanuatu'da Türk firmaları açısından önemli fırsatlar ortaya çıkacaktır.

Vanuatu'da da maden kanunu derin deniz madenciliğinin yapılabilmesine imkan sağlayacak şekilde geliştirilmektedir. Derin deniz madenciliği projeleri paydaşları ile toplantılar, çalıştaylar yapılmaktadır. Bu amaçla oluşturulan bir komitenin (National Offshore Mineral Committee) üyesi olarak Vanuatu'nun derin deniz madenciliğinde öne çıkan bir ülke olması için sunulan tavsiyeler beşinci bölümde ele alınmıştır. Tavsiyelerden en önemlisi, Vanuatu'da kampüsü bulunan Güney Pasifik Üniversitesi'nde Maden Mühendisliği Bölümünün açılması olmuştur.

1. INTRODUCTION

Deep sea mining is the new frontiers in the mining technologies and related subjects such as mineralization at the sea floor and international sea law. Although the marine mining especially aggregates and nodules extraction and dredging from the sea have been in applications since 1960s, the deep sea mining is totally different from the marine mining and has been developing drastically since 2010s.

The deep sea mining includes exploration and exploitation of three main groups of mineral deposits namely Seafloor Massive Sulphides, Manganese Nodules and Cobalt rich crusts. The mining areas are between the depth of 1,400 and 3,700 meters from the sea level. The target minerals in the deep-sea mining in generally are the manganese, cobalt, copper, silver and gold.

While technology is advancing and the demand of metal of the world is increasing, grade values of precious metals are dramatically decreasing in terrestrial mining, metal prices are also increasing. These facts has been leading to deep sea mining exploration in the recent years.

On the other hand, as it is in terrestrial mining, the ecology is also the main concern for the deep sea mining. The brief outline of the environmental aspects of deep mining have also been discussed in this study.

Deep sea mining productions will be realized in the Pacific Region soon. As it is well known, all Pacific Island Countries, The Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor Leste, Tonga, Tuvalu and Vanuatu are away far from the global the markets and have vulnerable economies because of the frequent natural disasters. Deep sea mining will boost their economic developments. They are all making arrangements and meetings with stakeholders and enacting regulation in the context of their mining laws [1, 2].

1.1 Purpose of The Study

One of the aims of this master thesis is to introduce the deep sea mining applications in the Pacific Island Countries to all relevant associations and companies. Deep sea mining projects in the Pacific Island Countries will bring lots of opportunities for relevant sectors such as ore dressing, machinery, education and housing. It will also play important role for the future developments in the mining sector.

This master thesis also aims at creating interest in the mining sector. This will enable the sector to understand the current market dynamics, hear the latest plans access different ideas and perspectives. In order to follow and take part in the current developments in the deep sea mining, sector representatives and scientist should also follow the deep sea mining summits that have been organized regularly in the recent years.

The thesis is also aiming to make the contribution to the deep sea mineral policies in Vanuatu. As it is known, Vanuatu will be the host country for the application of deep sea mining in the near future and deep sea mining policies consultation is still continuing. The cooperation with this country will add values for the developments deep sea mining around the world.

As it is mentioned above, all the Pacific Island Countries are the stages of the adaptation their mining regulations and laws to be able to create competitive environment for the companies that have tenements. In order to enforce the relations between Vanuatu and Turkey, any suggestions are provided in this study.

The deep sea mining consultations in Vanuatu is an excellent example for the preparation process of a country where deep sea mining applications will be realized. So with this study, it is also aimed to create a competitive environment for near future development of the deep sea mining applications in Vanuatu. The involvement of the deep sea mining consultation in Vanuatu will probably lead to cooperation between Turkey and Vanuatu in the field of education regarding to mining engineering specifically in the deep sea mining in Vanuatu. The signing of the MOU between University of the South Pacific (USP) and Istanbul Technical University can be first step for this co-operation. As in the other Pacific Island Countries, deep-sea mining consultations have been realizing with the involvement of citizens in Vanuatu so it is necessary to increase the public awareness very quickly and effectively.

At the preparation of the Deep Sea Mining policy, the author has involved in the consultation as the member of National Offshore Mining Committee in Vanuatu. The contributions of author to the deep sea mining policies of Vanuatu has been summarized.

2. DEEP SEA MINING

2.1 The Definition and Importance of Deep Sea Mining

Deep-sea mining is a new mineral exploitation method that takes place on the ocean floor. Deep sea mining sites are usually around large areas of polymetallic nodules or active and no longer active hydrothermal vents at about the depth 1,400 – 3,700 m below the ocean's surface. The vents create seafloor massive sulphides (SMS) which contain valuable metals such as silver, gold, copper, manganese, cobalt, and zinc. These are all indispensable metals for the high and green technologies. With the realization of deep sea mining application in the Pacific Island Countries two third of the world will start open to the mining activities.

Pacific Island governments have approached the new offshore sector enthusiastically. Support is evidenced by media reports and participants' and official responses at events such as the 2012 SPC-EU Deep Sea Mineral Project meetings. Communities appear less convinced, but, with little independent research into the views of Pacific Islanders on deep-sea mining, this perspective is difficult to assess. Important questions about the impacts and perceived risks of deep-sea mining remain, and appear to shape community concerns. Recent examples from the Cook Islands and Papua New Guinea indicate the same tensions identified with onshore mining – between potential environmental degradation and likely economic gain, and between social harm and economic development – also shape the current deep sea mining debate.

Rapid expansion of marine technology in the 1990s was driven by military and marine research; gas and oil production; relatively shallow marine mining (i.e. diamond mining) Extensive use of Remotely Operated Vehicles (ROVs) in offshore diamond mining in Africa and existing mining technologies are transferable to deep sea mining including the use of ROVs.

Increasing demand in metal resulted in shortages and a rise in metal prices in the world. Also, metal concentration is decreasing in terrestrial mineral deposits. These reasons have led to deep-sea mining. Target metals from the deep sea mining will be

used in mobile phones, tablet computers, PCs, electric cars, more and many devices powered by batteries, and these batteries contain metals. As an example World, copper demand is presented in Figure 2.1. This increasing trend in global demand and consumption is applicable to any commodity.

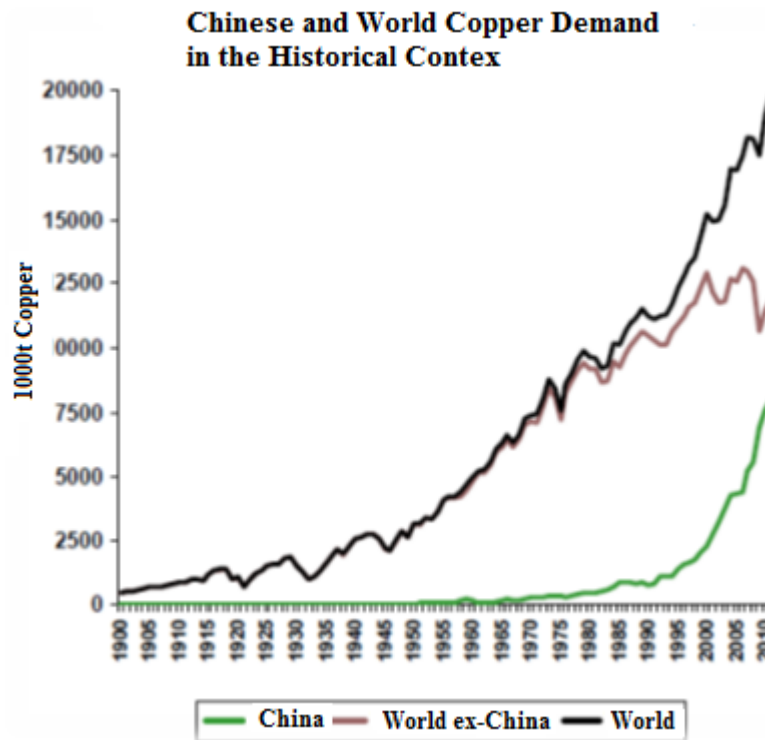


Figure 2.1 : 1910 – 2010 World copper demand [3].

Deep Sea Mining is realized using either hydraulic pumps or bucket systems that take ore to the surface to be processed. Like in the terrestrial mining, deep-sea mining raises questions about potential ecological impact on surrounding environment.

The limiting factors dealing with deep-sea mining are the political and legal aspects. Legal and political issues related to exploration, exploitation, and marketing of sea floor minerals must be resolved.

Even waters within the sovereign rights of territorial seas present difficulties because of inequalities of operational laws, royalties, lease agreements, and political stability. Conflicts between user groups, especially near shore, and concerns about pollution need to be resolved with a set of regulations controlling and defining activities.

Vanuatu is still organizing meetings with the stakeholders to determine and overcome all these difficulties.

Deep-sea mining productions will be realized in the Pacific Region soon. As it is well known, all Pacific Island Countries, The Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor Lester, Tonga, Tuvalu and Vanuatu have very common problems such as needs for energy supplies, good quality potable water, the effects of global warming and difficult governance because of partly human settlement in many different islands. Therefore, the economy of these countries must be more powerful to combat all these threads. For instance, in March 2015 Cyclone Pam affected all Vanuatu very deeply leaving behind thousands of homeless people. Deep-sea mining productions can provide very valuable contribution to the economies of these countries [3].

2.2 Mineralization In Deep Sea Floor

Deep-sea minerals are deposited on the surface or sub-surface of the deep seafloor by natural processes. There are different types of deep-sea mineral deposits that occur on the seafloor such as iron and manganese in nodular and encrustation forms, massive sulphides, phosphates and metalliferous sediments. The three major deposits that can potentially be commercially developed in the future explained below.

2.2.1 Seafloor massive sulphides (SMS)

Sea-floor massive sulphides (SMS) are deposits of metal-bearing minerals that are formed by hydrothermal vents on and below the seabed at mid-ocean ridges, and back-arc basins. At these locations, cold seawater can penetrate through cracks in the sea floor, reaching depths of several kilometers below the seafloor surface. At these depths, the seawater is heated by magma to temperatures above 400°C and leaches out metals from the surrounding rock mass. The heated seawater rises to the sea floor where upon mixing with the cold seawater the metals precipitate. Much of the metal is transported in the hydrothermal plume and deposited as fallout of particular debris producing black and white smoker chimneys and mound deposits. In some instances, the vents are no longer active leaving cold, dormant SMS deposits on the seafloor [4].

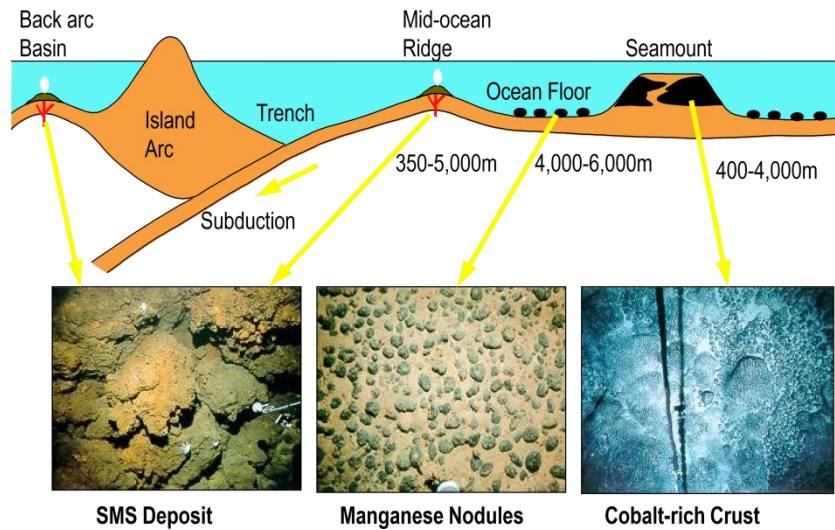


Figure 2.2 : Deep sea mineral occurrence [3].

Many deposits in deep sea floor have a tonnage and mineral grade comparable to land deposits and are attractive to mining companies. Economically viable deposits can be either active or inactive, with different biological communities existing at each. These benthic communities may include specially adapted and endemic fauna that could be severely impacted by mining activity. Although there is currently, no active SMS mining, recent research from Industry and scientific investigations are able to help decisions on the management of SMS deposits, including appropriate mitigation strategies to minimize the impact of mining activities. Mitigation strategies will likely focus on facilitating decolonization of areas impacted by mining, spatial management with open and closed areas and reducing the effects of sediment plumes from mining activity. Regulation of mining activity at SMS deposits can be complex, falling under national and international legislation alongside codes of practice issued by industry and other stakeholders. Despite decades of research effort, there are still many unknowns about the ecology of SMS deposits, in particular for inactive SMS sites and the genetic and demographic connectivity of populations among deposits. With considerable industry interest in the exploitation of SMS deposits in the Western South Pacific Ocean. Vanuatu has also great SMS potential [5, 3].

2.2.2 Manganese nodules (MN)

Manganese nodules (MN) occur predominantly in spherical nodular form. Occasionally they are also found in encrustation forms encasing hill slopes and rocky

surfaces. Circular layers of minerals (concentric bands) around a core characterize them. The core can be a rock fragment, a shell or a shark tooth. Local factors play important role in nodule formation.

The longest side (diameter) of nodules is usually measured between 1 to 5 centimeters. They have a wide distribution on the seafloor, and whilst their composition is dominated by manganese and iron oxides, they have minor amounts of other minerals. Manganese nodules occur in all of the oceans [6].

2.2.3 Cobalt-rich crusts (CRC)

Due to the elevated concentration of cobalt in crusts, they are commonly called Cobalt-rich Crusts (CRC). Although they also contain other metals CRC are formed when minerals have precipitated out of the cold surrounding seawater (hydrogen tic) and attached onto the clean rock surface of seamounts CRC do not form in areas where sediment covers the rock surface. CRC are found on the flanks of volcanic islands, ridges, and the flanks and summits of seamounts throughout the oceans. CRC bearing seamounts can be huge, some as large as mountain ranges on continents. Only a few of the estimated 30,000 seamounts that occur in the Pacific, where the richest deposits are found, have been mapped and sampled in detail. Crusts generally form at the rate of 1-6 millimeters per million years and can vary in thickness. Cobalt is the most important of the elements in nodules and crusts in price and as a strategic metal. It is indispensable for "super alloys" used in jet aircraft engines. Deep Sea mining can provide a new source of Cobalt. Cobalt-rich manganese crusts occur on the shallower flanks of volcanic islands and seamounts. Thus, these deposits may be easily recovered compared to the deposits found in deeper areas [3].

The CRC potential of the Pacific has been of interest for three decades. During the 20-year period from 1980 to 2000, more than 40 research cruises investigated aspects of the formation and character of ferromanganese crusts.

Ferromanganese crusts are partially made up of valuable cobalt, nickel, and manganese. Additionally, crusts are seen as a potential source of the rare-earth elements and other in-demand metals that are increasingly used in high technology and green technology industries. However, mining the crusts has been considered more technically challenging than mining other deep sea deposits, such as

manganese nodules or sea-floor massive sulphides, and this has slowed development. The crusts can be firmly attached to the underlying rock, and technological solutions are required to design a process to retrieve them while minimizing the collection of non-mineralized waste rock.

Table 2.1. Occurrence of manganese nodules and cobalt rich crusts [3].

	Manganese Nodules	Cobalt-rich Crust
Occurrence	All oceans	Flanks of volcanic islands and seamounts
Place		
Mode of Occurrence	Nodular and encrustations	Widespread but thin encrustation on the rock surface
Depth (m)	4,000 – 6,000	400 – 4,000
Major Minerals	Manganese (20 %), Iron (14 %),	Manganese, Iron
Minor Minerals	Nickel (0.55%), Copper (0.35%), Cobalt (0.25%)	Nickel, Cobalt (0.5 – 2.5%), Platinum

2.3 Comparison of Terrestrial Mining and Deep Sea Mining

When terrestrial mining and deep sea mining are compared there are many advantages for the deep-sea mining. Huge amount of overburden has to be excavated in the open pit mining or that needs to be deal with in the underground mining but in the deep-sea mining operation huge water body (ocean) will be subject. While terrestrial mining is creating big footprints, exploitation of seafloor massive sulfides production will be generating small footprints. All issues regarding to terrestrial and deep-sea mining summarized in Table 2.2.

Table: 2.2. Comparison of terrestrial mining and deep sea mining [3].

Criteria	Terrestrial Mining	Deep Sea Mining
Overburden	Significant overburden	Huge water body (ocean) that needs to be deal with
Tailings and waste material	Generate significant amount of waste (overburden, tailings, leachates	Reasonably less amount of waste generated
Ecology	Huge footprints	Small footprints (SMS) Reasonable footprint (MN&CRC)
Access	Often isolated and difficult to access	Located with national EEZ
Needs for Infrastructure	Huge infrastructure development	Farr less infrastructure to be built
Acids	Acid rock drainage	Sulphuric acid cannot form in ocean (seawater being alkaline)
Ownership	Complex resource ownership system	Common heritage of the nation
Environment	Reasonable knowledge of environment	Limited knowledge of environment

There are also some rumors that deep-sea mining will change the behavior of ocean currents by altering the seabed's topography. Deep-sea mining will cause direct physical changes in the structure of the seabed, as well as in the quality of the physical environment and the nature of environmental processes. Mining of sea-floor massive sulphides and cobalt-rich ferromanganese crusts might require strip-mining techniques that use remotely operated underwater miners to remove the ore. Manganese nodule mining might use a vacuum system. Strip mining and sea floor vacuuming could affect the physical habitat of deep sea-floor areas and associated biota.

Without careful controls, deep-sea mining could release particulate matter into the water column, both from the cutting process and seawater from the shipboard dewatering process this release could be detrimental to organisms living close to the mine site.

Seabed minerals contains target metals with higher grade per tonnage than is derived currently from land-based ore, including strategic elements ('rare earth elements') required for in-demand high- tech applications and 'green technology'.

Seabed minerals could therefore attract lucrative values in the world market. Typical value of a tone of land based ore is between 50-180 USD. Typical value of a tone of SMS ore: 800 – 1500 USD.

Table 2.3 Grade values of terrestrial and Seafloor Massive Sulphides for some metallic mines [3].

Metal	On-land	SMS
Copper	0.5-2%	5-15%
Gold	0.6-8g/t	2-20g/t
Zinc	5-20%	5-50%
Lead	5-20%	3-23%

2.4 Benefits of Deep Sea Mining For Host Country And The Region

Probable deep-sea mining productions will bring millions of dollars to the national economies of Pacific Island Countries. Significant share of the wealth will be returned to government and the people through tax revenues, royalty and employment.

Deep-sea mining requires large expenditures on vessels and equipment, processing, and transportation. Some of the expenses dealing with deep-sea mining operations can be spent in the host country. This can create new jobs and revenues in the host country.

Revenue generated from deep sea mining could lead national governments to provide services such as new hospitals, schools, or roads. Local engineering firms, contracted to do the work, might be expected to employ new staff. These workers would then have money to buy food and pay for housing in the community. With increased sales revenue and housing costs, local businesses might experience a small boom, and they in turn might take on additional staff who would buy more products. In this way, the market benefits of deep sea mining (earnings and investment) can spread throughout the national economy.

2.5 Environmental Aspects of Deep Sea Mining

There are two very different categories of habitat types to consider on the ocean and seas. Animals associated with active hydrothermal flow “Vent endemic fauna” and Animals associated with inactive structures, either at otherwise active sites or sites with no current hydrothermal activity.

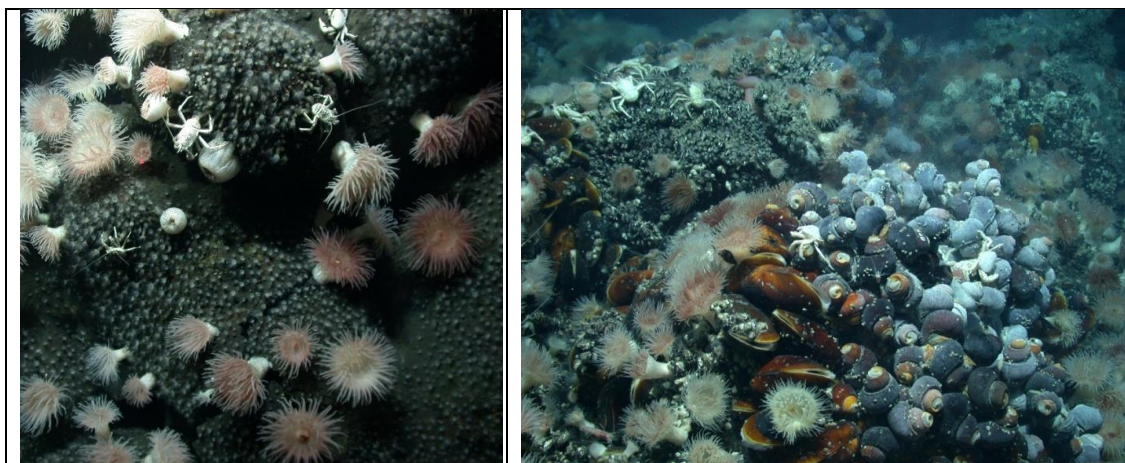


Figure 2.3 : Fauna with seafloor massive sulphides [11].

The International Seabed Authority regulates deep-sea mining activity in international waters, and has developed guidelines for an Environmental Impact Assessment (EIA) process which will be used to assess applications for exploitation rights of SMS deposits and other deep-sea mineral resources, such as manganese nodules and cobalt crusts. These guidelines are informed by and inform working groups of scientists, industry and stakeholders. The EIA process is part of a precautionary approach to management and may consist of three basic stages:

- (1) A scoping study to assess the area to be mined, an evaluation of possible environmental impacts from mining, and proposals to address these impacts.
- (2) An environmental survey composed of a number of separate assessments, including: an identification of habitats; an assessment of currents in the mining area and surveys of the seabed and the physical, chemical and biological properties of the water column. The baseline ecological survey includes attractive large animals, such as whales, that capture public attention as well as commercial fish stocks that might be affected by noise or the disturbance. Of concern are the endemic organisms to the vents that live on or in the seabed sediment adjacent to vents, which may be destroyed by the mining process.
- (3) An ecological risk assessment, based on the scoping study and environmental survey and is used to evaluate risk and develop effective mitigation strategies, such as set-aside areas. Set-asides should have similar physical, chemical and biological characteristics as the extraction site and should act as a source of recruits for recolonisation of the mining area.

Together with an environmental management plan, which describes monitoring plans for the mining areas before and after mining operations, and other aspects, such as the legal and policy framework, the EIA forms the basis for the Environmental Impact Statement, which provides an overview of the whole mining project.

2.6 Benefit-Cost Analysis

Deep sea mining applications involves calculating the gains and losses (benefits and costs for ecology) from an activity to the country, using money as a measure; and aggregating values of gains and losses and expressing them as net economic value.

Including opportunity costs provides a more complete accounting of the combined direct and indirect (external) costs and benefits of Benefit-cost analysis can also be used to show how the costs and benefits of a project are distributed across different businesses, organizations, individuals, or communities.

A distributional analysis is likely to be especially useful when designing programs to reinvest mining taxes/fees/royalties in social capital or when trying to identify stakeholder groups that are likely to support or challenge deep sea mining plans.

3. DEEP SEA MINING APPLICATIONS IN PACIFIC ISLAND COUNTRIES

3.1 Deep Sea Mineral Projects in the Pacific Island Countries

In the Pacific region, including Vanuatu, there is a project entitled The Deep Sea Minerals Project (DSM) to realise deep sea mining application. It is a collaboration between the Secretariat of the Pacific Community (SPC) and the European Union (EU). It started in 2011 and the €4.4 million is allocated to Pacific Island countries to improve the governance and management of their deep-sea minerals resources in accordance with international law. Particular care to the protection of the marine environment and equitable financial arrangements has been taken into consideration for Pacific Island countries and their people.

The DSM Project has 15 member Pacific Island Countries: the Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor Leste, Tonga, Tuvalu and Vanuatu. In Figure 3.1, all these countries can be seen with their EEZ (Exclusive Economic Zone).

The Project has four main aims. The First objective of the project is to support informed and careful governance of any deep sea mining activities in accordance with international law. Protection of the marine environment and equitable financial arrangements for Pacific Island countries and their people will have the highest priorities. The Project tries to encourage and support participatory decision-making in the governance and management of national deep sea minerals resources.

The DSM project aims to develop a Regional Legislative and Regulatory Framework (RLRF) that can be used by individual countries to develop their national frameworks for the sustainable management of their marine mineral resources. The work is of critical importance to have effective environmental, fiscal and social management instruments in place for the exploration and exploitation of deep sea minerals that can support economic growth.

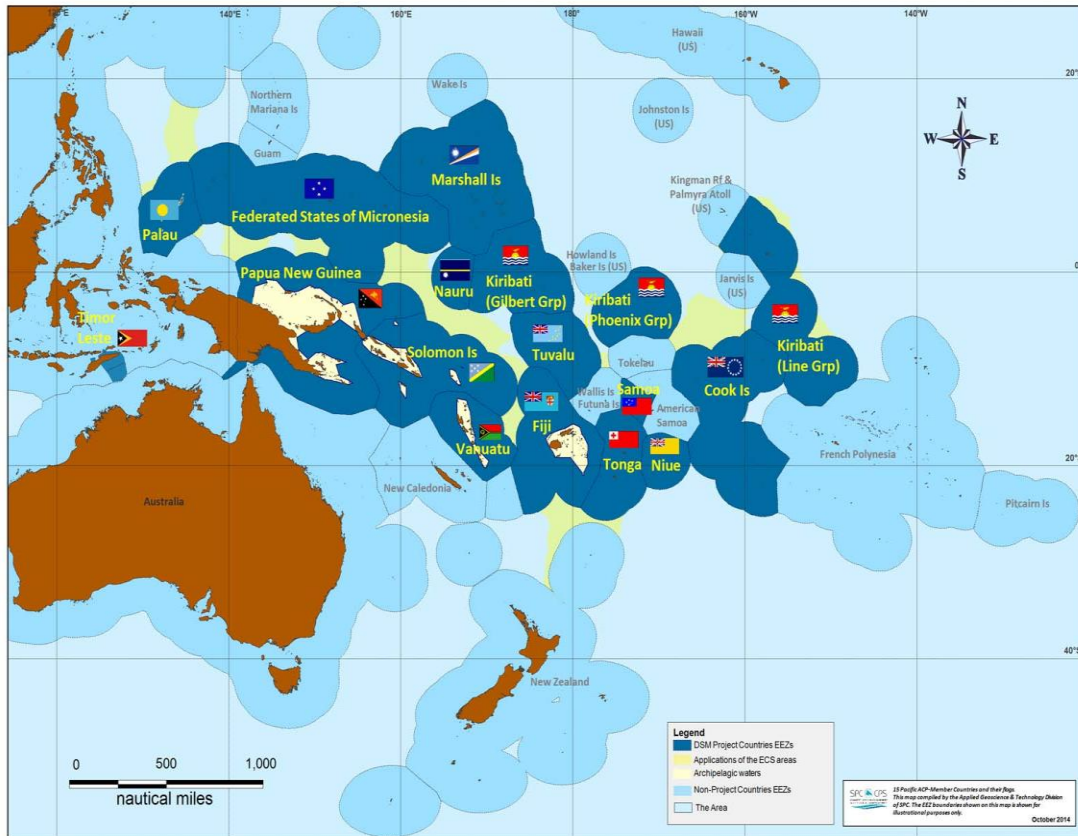


Figure 3.1 : Probable deep see mining application area in the Pacific region [3].

With the guidance of the project, Fiji promulgated “Fiji International Seabed Mineral Management Decree” in July 2013. So, this country became the first Pacific country to pass DSM legislation with the DSM Project’s support. Additionally, the Project has developed a ‘guide to developing a National Deep Sea Minerals Policy’, and also Seabed Minerals Legislation template to promote harmonisation across the region, conformity to international law, and capture of the necessary technical provisions related to mineral development. These templates, together with the Project’s 2012 Regional Legislative and Regulatory Framework, can be used by any Pacific ACP State to develop their own policy and law, and the DSM Project offers additional support in adapting the templates to fit the country’s requirements.

From the beginning of the project many DSM training workshops have been held. Representatives of relevant government agencies, civil society organizations, and DSM experts have been invited and supported to attend. Private sector representatives have also been invited to attend at their own cost. Workshops specifically focused on “Deep

Sea Minerals Law”, “Government-Company Contract Negotiations”, “Environment” and “Social Impacts of Deep Sea Mining”.

DSM Project team members and selected stakeholders in Fiji, Cook Islands and Vanuatu. According to the monitoring report for the progress of project implementation in very good with an overall score of “B”. A number of recommendations are given in the report for the improvement.

Although there is rapidly growing commercial interest in deep sea minerals many Pacific nations do not have the necessary legal or management systems. In response to this urgent need Pacific Island countries requested the development of a regional project to help governments develop the national frameworks and technical capacity needed to strengthen the management of their national deep sea mineral resources. Vanuatu also commenced a national consultation on a draft Deep Sea Minerals Policy in October 2014. Workshops and meetings have been organized to discuss all the relevant subjects with the stakeholders in the country.

As it is summarized on the International Conference on Small Island Developing States in Samoa in September 2014 all the Pacific Islands have common issue. All Pacific Island Countries must have more strong economies to overcome their problems on the basis of their situation. Deep sea mining applications in that countries will support their economies.

3.2 Recent Offshore Exploration in the Region

There are three major companies and an Institute of Technology holding tenements having total area of 1067062 km² in the Pacific Island Countries. The Nautilus is Canadian but Australian based company and has already started to explore the ocean floor for polymetallic seafloor massive sulphide deposits. The company is aiming to produce copper, gold and silver in the territorial waters of Papua New Guinea. Deep Sea mineral potential of the Pacific Island Countries can be seen in the Table 3.1 [3].

The tenements of Neptune Minerals Company cover approximately 450,000 square kilometers of prospecting license applications and granted prospecting licenses. Their aim is to explore their licensed tenement areas, discover prospective deposits, define

corresponding resources and generate revenue from their deposits by either selling all, or a portion of, their deposits. Alternatively Neptune Minerals is planning to extract from their deposits in approved mining license areas.

Table 3.1 : Deep sea mineral potential in the Pacific region countries [3].

Country	MN	CRC	SMS
Kiribati	+	+	
Cook Islands	+		
Tuvalu	+	+	
Samoa		+	
Tonga			+
Papua New Guinea			+
Solomon Islands			+
Vanuatu			+
Fiji			+
Marshall Islands		+	
Federated States of Micronesia		+	
Palau		+	
Niue	+	+	

Bluewater Metals is a subsidiary of Neptune Minerals. It is an American but Australian based company. It has been making exploration in Papua New Guinea, Solomon Islands, Vanuatu, and Tonga.

Korean Ocean Research and Development Institute (KORDI) is exploring in Tonga and Fiji. The tenements area of the companies. In table 3.2 Tenements of the Companies and corresponding areas can be seen from the table.

Table 3.2 : Tenement holdings of companies [3].

Company	Granted (km²)	Application (km²)
Nautilus Minerals	450462	276980
Neptune Minerals (NZ)	450600	200000
KORDI	20000	-
Bluewater Metals	146000	-
Total	1067062	476980

3.3 Recent Technological Developments in Deep Sea Mining

Nautilus Minerals Inc. is the first company to explore the ocean floor for polymetallic seafloor massive sulphide (MS) deposits. The company has already designed mining Support Vessel (MSV) - Riser and Lifting Systems (RALS), Seafloor Mining Tools (SMT). Commencing of deep sea mining in the region will lead to improved deep sea mining technology in the future. The development of new seabed mining technologies will increase the economic viability of Manganese Nodules and Cobalt-rich Crust deposits. The Seafloor Production suggested by Nautilus is illustrated in Figure 3.2.

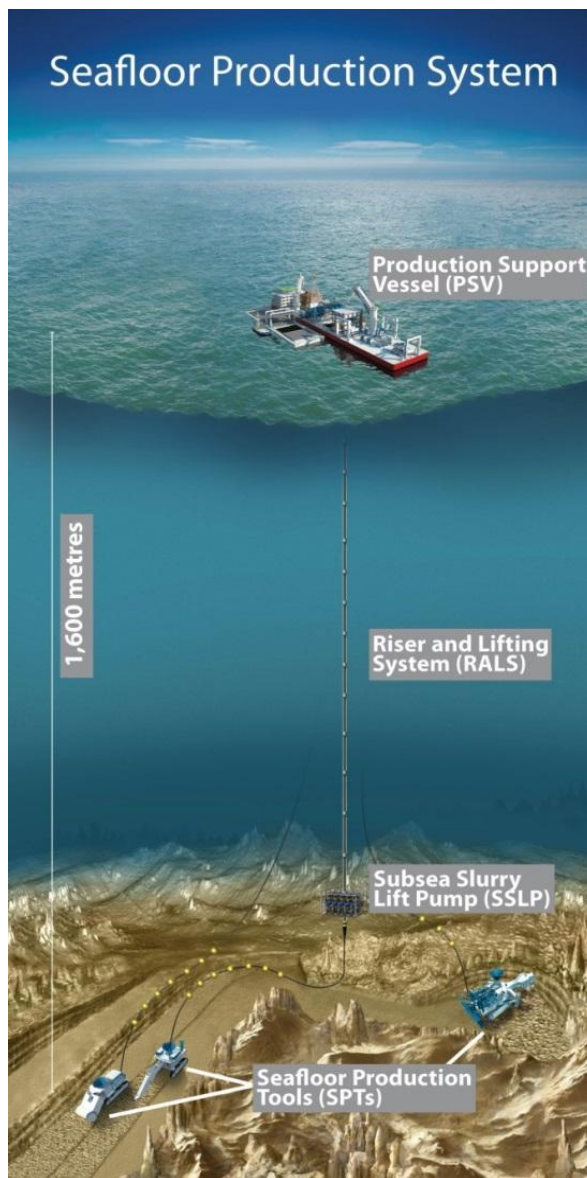


Figure 3.2 : Seafloor production system [7].

4. MINERAL POTENTIAL OF VANUATU

4.1 Terrestrial Mining in Vanuatu

Vanuatu is an archipelago of over 80 islands located in the southwest Pacific that stretches 1,300 kilometers from north to south. Vanuatu is highly rich for porphyry copper and epithermal gold and silver deposits. There is also manganese deposits in the country. [8]

In Vanuatu The minister of Lands and Natural Resources has the power to grant licenses according to the Mines and Minerals Act Cap 190. However the government has not given any production licenses yet. The Mines and Minerals Act [Cap 190] interprets Land as including;

- the land beneath the sea surface
- the seabed and subsurface beneath the ocean
- the sea bed on the continental shelf within the country's Exclusive economic zone. The Mines and Minerals Act [Cap 190] states that all minerals in their natural state belong to the state for Republic of Vanuatu [9].

The elevated copper levels confirm copper-porphyry systems on the island of Santo and possibly mineralized zones have also been subject to high-sulphidation epithermal system. The sulphur levels are also very high (S~ 26%) [9].

The presence of 0.93g/t gold is also a good indicator that small scale alluvial mines are possible as generally 0.3g/t is required in alluvial gold mining to be sustainable. Figure 4.1 shows gold exploration results for terrestrial mining in Vanuatu.

The volcanism at Santo has produced a hybrid porphyry-high sulphidation epithermal system where precious/base metals are mineralized in the country rocks. However, it

will require ground surveys and general mapping to further understand possible alteration patterns and mineralizing systems.

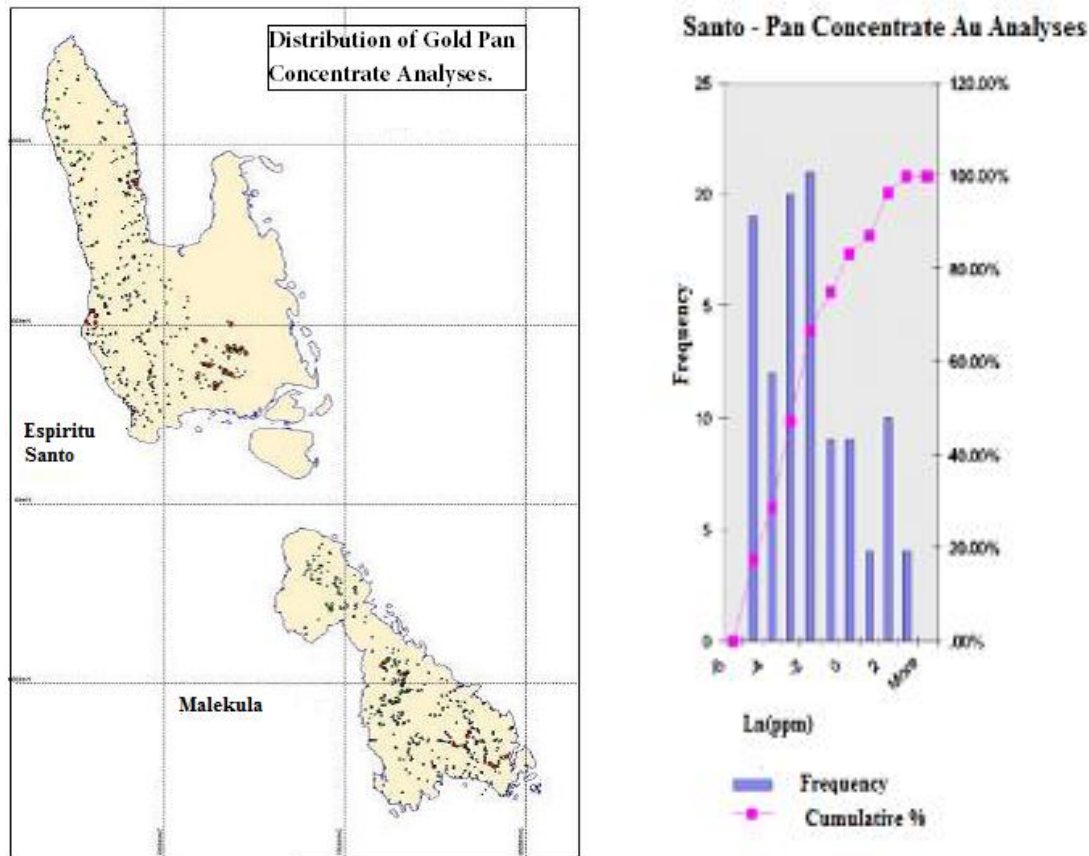


Figure 4.1 : Distribution of occurrence of gold for the terrestrial mining in Vanuatu [8].

The geo-chemical searches also suggest of a possible porphyry-copper deposit. The porphyry system has high Copper and Silver values with lower gold credits. However, at this point it is possible to say that the composite sample suggests of 0.93 g/t gold, 41.75g/t silver and almost 10% copper.

Since companies have shown interest, the minister of Lands and Natural Resources has issued around 165 mineral prospecting licenses to two mining companies, the Neptune Minerals, which is registered in Vanuatu as the Bismarck Mining Company, and the Nautilus Minerals Inc [10]. In Figure 4.2 Copper occurrence for the terrestrial mining of Vanuatu is given.

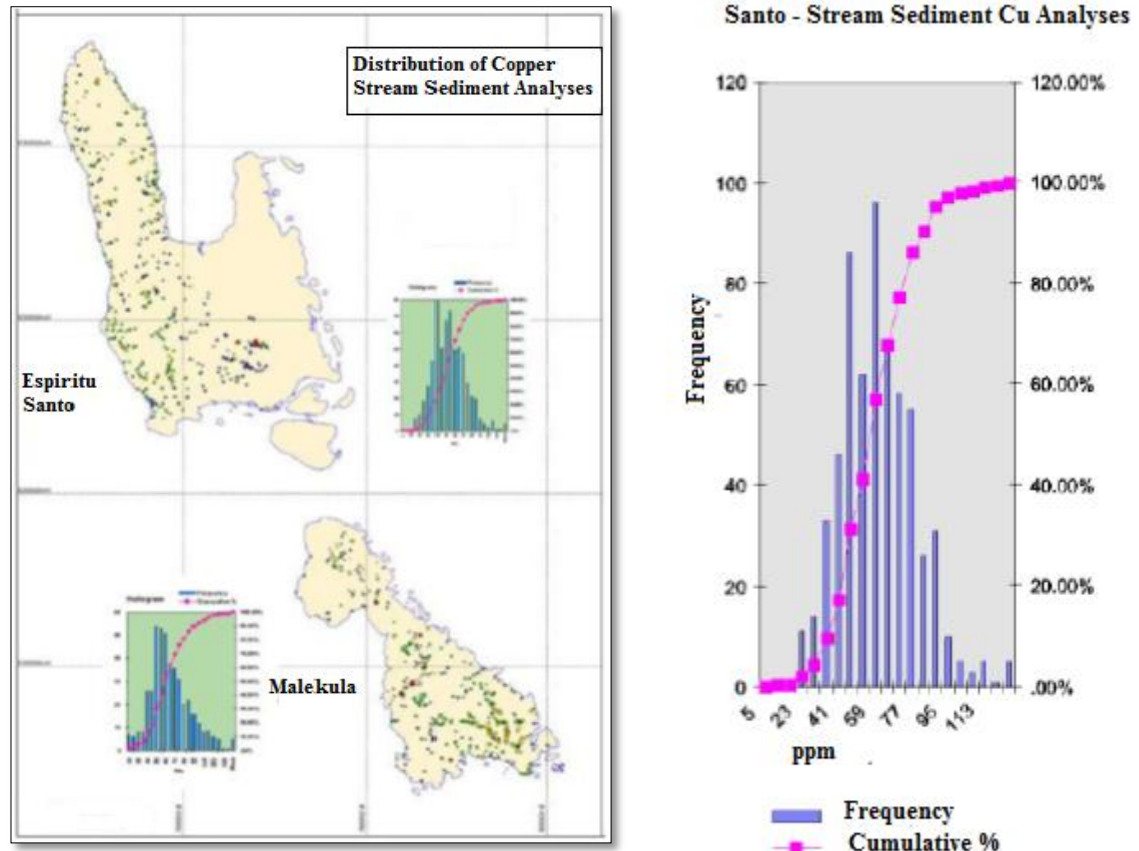


Figure 4.2 : Copper occurrence for the terrestrial mining of Vanuatu [8].

4.2 Deep Sea Mining Potential of Vanuatu

Recent explorations in Vanuatu's waters have proved the presence of massive seafloor sulfide deposits within its exclusive economic zone (EEZ), which could contain significant quantities of copper, gold, zinc, silver and other commercially viable minerals. The presence of such minerals could present a potential economic opportunity for Vanuatu if deep sea mining activity is carried out with appropriate environmental, legal and financial management. The occurrence of seafloor massive sulphides can be seen Figure 4.3.

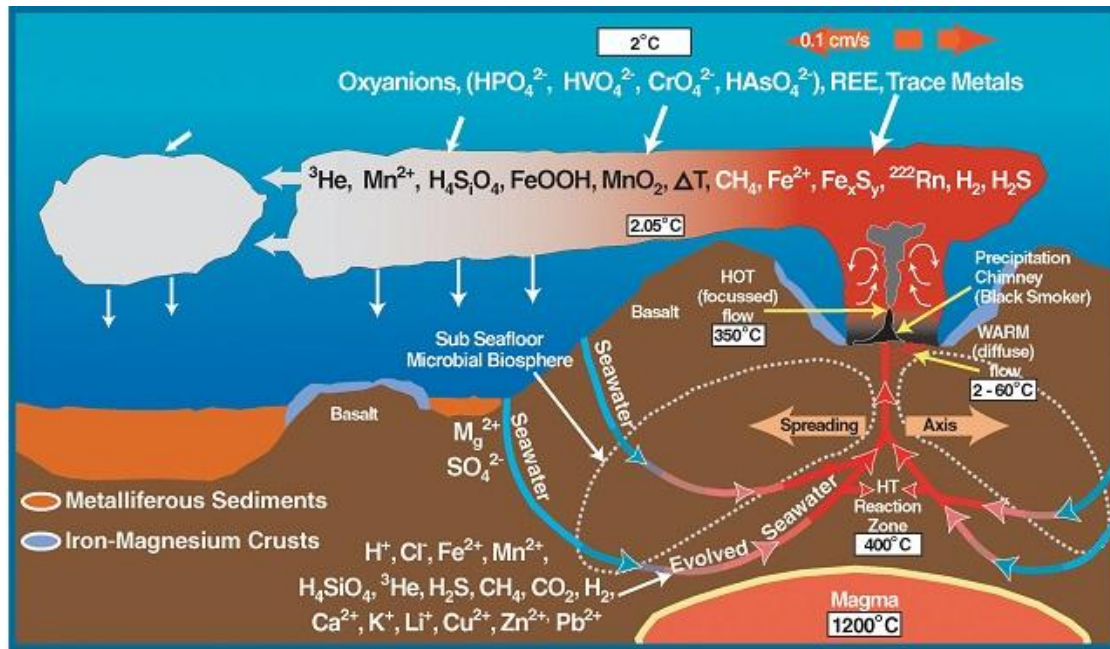


Figure 4.3 : Occurrence of seafloor massive sulphides in Vanuatu's EEZ [12].

In 2013, German vessel, RV Sonne collected samples from the Exclusive Economic Zone of Vanuatu. It must be noted that to conduct research in deep oceans is very expensive (approximately 50000 USD per day and one cruise usually takes 4 weeks or one month). This cost cannot be afforded by the Vanuatu government. Therefore it seems to be advantageous to prospect the mine in the ocean floor with the co-operations of EU or other country institutions.

Surveys carried out within Vanuatu waters show deposits of polymetallic seafloor massive sulphides (SMS), found at sub-sea hydrothermal vent sites. The first ever sample recovered in one of the research cruise had a sample assayed at 40% zinc. Vanuatu deep sea mineral exploration is in its early stages and a lot of work is yet needed to understand the geology and the environment at which these deposits exist [11].

5. DEEP SEA MINING POLICY IN VANUATU

In order to realize the mining activities in the Exclusive Economic Zone of Vanuatu, Vanuatu government started a national consultation on a draft Deep Sea Minerals Policy in 2014. The author also involved in this consultation meetings as member of Vanuatu National Offshore Committee. As it can be seen from Figure 5.1 below, deep sea mining process will start and continue with the interaction of among the government, company and Vanuatu citizens [10].

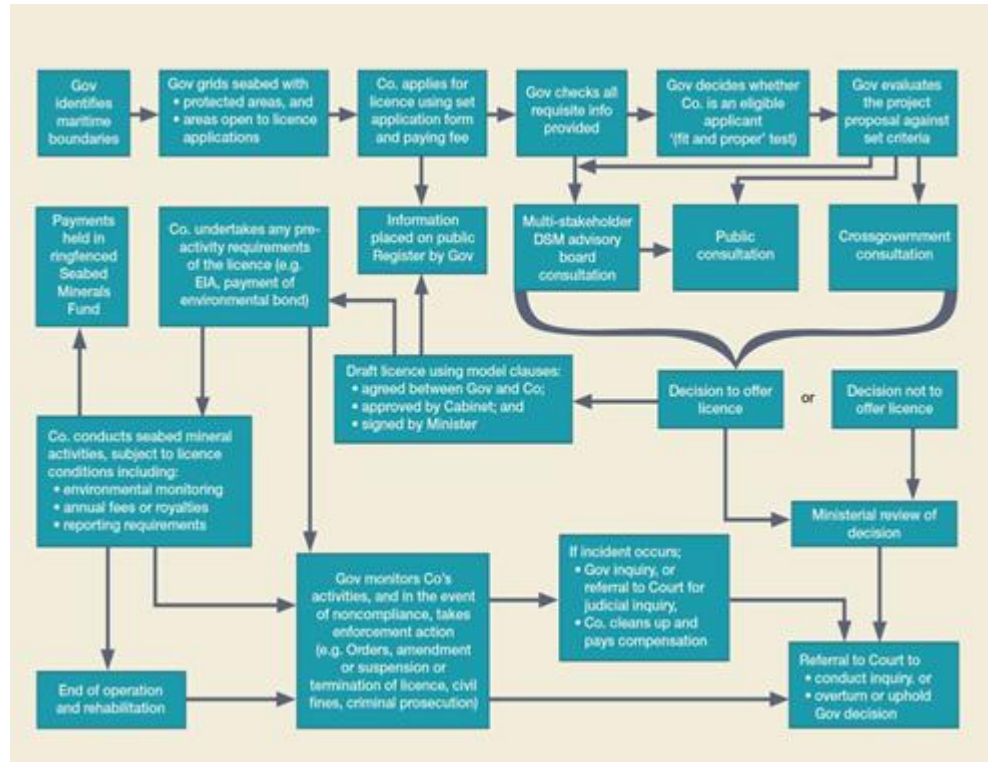


Figure 5.1: Starting and carrying out DMS process in Vanuatu [12].

The draft policy determines Vanuatu's vision and strategic aims in relation to its deep sea minerals, and will form the basis for future drafting of laws in line with the policy. The draft policy has been prepared by the Ministry of Lands with advice from the Deep

Sea Minerals (DSM) Project. This project is on basis of a partnership between the Secretariat of the Pacific Community (SPC) and the European Union (EU).

The DSM Project works to assist 15 Pacific Island countries to improve governance and management of their deep-sea mineral resources, including through the development of national policies and laws.

The DSM project places great emphasis on the importance of a consultative approach, and encourages all governments to involve concerned citizens in decisions that may affect natural resources and the environment. The DSM project is providing technical and financial support to the Government of Vanuatu to conduct this important consultation exercise and will continue to work with Vanuatu's multi-stakeholder National Offshore Minerals Committee, which includes the Vanuatu Association of Non-Governmental Organizations, as they progress this work.

The government must be particularly commended for initiating an open and inclusive process whereby Vanuatu citizens can engage in and influence the country's deep sea mining policy via the newly established committee. This process is very important and something that the EU encourages, particularly on such a sensitive issue like deep sea mining. Deep sea mining policy draft involves citizens, civil societies, the media and indigenous communities of Vanuatu.

The involvement of Vanuatu people to the deep sea mining policy has been realizing with workshop. In 2013 The largest meeting was organized by Vanuatu's Minister for Lands and Natural Resources, where 75 participants, representing Government, civil society and private sector from 18 countries met to discuss concerns about the potential social impacts of deep sea mining, and the importance of public participation in policy development and decision-making about the sector.

Despite the rapidly growing commercial interest in deep sea minerals many Pacific nations do not have the necessary legal or management systems needed to ensure the responsible management of these important natural resources. In response to this urgent need Pacific Island countries requested the development of a regional project to help governments develop the national frameworks and technical capacity needed to strengthen the management of their national deep sea mineral resources.

5.1 Country Context

The Vanuatu political framework is a constitutional democracy. The Constitution of the Republic makes provision for a representative parliamentary system. The figure head of the Republic is an elected President, however the Prime Minister holds the executive power, and the legislative power is vested in both the government and parliament. The judiciary is independent of the executive and the legislature.

Vanuatu Legal system is a mixed legal system of English and common law, French law and customary law. The highest court in Vanuatu is the Supreme Court. Any aggrieved parties including members of the public can settle their disputes in the Courts. Vanuatu is a member of ICJ/ITLOS (UNCLOS). Any deep sea minerals (DSM) issues pertaining to the area shall be dealt with, by these institutions

Like other Pacific Island Countries, deep sea mining is a new industry for Vanuatu that is expected to give rise to significant opportunities but also an array of challenges. A seabed minerals sector can bring significant income to Vanuatu, if responsibly managed and run in adherence to international law standards, with stringent laws and regulations of Vanuatu to manage health, social or environmental risks, prioritizing the protection of the marine environment and equal rights of other sea users [12].

The vestment of the properties of minerals in their natural condition in land is to the Republic of Vanuatu. The government views Vanuatu's mineral endowment as part of the inheritance of every citizen of the country. The Government, as a steward of this inheritance, aims to implement regulatory mechanisms for the development of seabed resources in an environmentally and socially responsible manner in order to safeguard the nation's environment and citizens. No seabed mineral activities will be permitted if it is identified that these will cause unacceptable harm to the nation's society or environment, and the people of Vanuatu will be given the opportunity to participate in these decisions. This Policy also supports the development of mechanisms that will facilitate long term investment, and equitable sharing of the financial and developmental benefits of seabed mining across all of the country: now and for future generation.

5.2 Scientific Capacity of the Pacific Region

There is a main university in the region named South Pacific University. The University is the premier institution of higher learning for the Pacific region. Established in 1968, USP is one of only two universities of its type in the world. It is jointly owned by the governments of 12 member countries; Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu and Samoa. The University has campuses in all member countries. The main campus, Laucala, is in Fiji. The Alafua Campus in Samoa is where the School of Agriculture and Food Technology is situated, and the Emalus Campus in Vanuatu is the location for the School of Law.

The academic Schools, Institutes and Centers at the University of the South Pacific are organized into three faculties and led by Deans. These are: the Faculty of Arts, Law and Education; the Faculty of Business and Economics; and the Faculty of Science, Technology and Environment. Each faculty comprises of a number of schools which offer a wide range of academic programs and courses at the undergraduate and postgraduate levels. Advanced communication technologies through *USPNet* are used to reach distance and flexible learning students across the vast expanses of the Pacific Ocean.

The multi-cultural nature of the staff and student body give USP an exceptional character. It is a quality institution producing degrees comparable to those awarded by universities in Australia, New Zealand and the United Kingdom. Graduates from USP are found in important executive positions throughout the public and private sectors in all member countries and in numerous countries around the world.

The University has set a high standard for quality in its research. Major research commitments include business management, teacher education, Pacific studies, marine studies, agriculture, science and technology.

USP is governed by its own Council, which includes representatives of the member country governments, academic staff, students, community and business leaders, the Pacific Islands Forum Secretariat, Secretariat of the Pacific Community, the American Council of Education, the Privy Council, Australia and New Zealand. The Senate is the academic authority of the University, responsible for matters such as teaching and research.

The Council and the Senate are served by committees working in such areas as Finance, Human Resource Management and Academic Planning. Other committees deal with special projects and the day-to-day work of the University.

The ceremonial head of the University is the Chancellor. USP's Chancellors have been drawn from the leaders of the University's member governments and include Prime Ministers, Presidents and Heads of State. The Pro Chancellor is Chair of Council and the executive head of the University is the Vice-Chancellor. The Vice-Chancellor is assisted by two Deputy Vice-Chancellors and two Pro Vice-Chancellors.

The Senior Management Team is responsible for the welfare of the University community. The Executive Director of Finance is concerned with control of University finances. The Executive Director Human Resources manages the University's human resources. In total, USP employs more than 1,500 staff.

5.3 Purpose of The Policy For Deep Sea Mining

The principles for the development of National deep sea mining were determined at the meetings in Madang City in Papua New Guinea in 1999. The Madang Guidelines advise that it is necessary in developing a national DSM Policy to address the characteristics of the DSM industry, which include that: DSM exploration is high risk and costly; DSM work is capital intensive and will require advanced technology; and DSM project economics are subject to market and price instability [13].

The aim of this policy is to promote and guide the development of deep sea mining in Vanuatu, in a strategic and sustainable manner that will help to ensure Vanuatu's long-term national economic growth and overall improved socio-economic conditions for its people.

The policy is also developed within the framework of the national policies and development plans. National strategic priority emphasizes private sector development and employment creation. The other priority objective emphasizes for an equitable and sustainable development of land while ensuring the heritage of future generations.

Government of Vanuatu accepts that mining is a high risk industry. Legitimate private investment is attracted to countries having good geological potential, stable governance, and clear and transparent fiscal policies. In order for Vanuatu to attract the highest quality DSM investors and operators, its policies must be internationally competitive. At the same time, it is imperative that this new industry is managed to prioritize the best interests of the people and overall environment of Vanuatu.

- To provide a policy and regulatory framework for offshore mineral development activities in Vanuatu that is consistent and compliant with relevant international conventions and standards, including the United Nations Convention on the Law of the Sea, while reflecting circumstances and needs in Vanuatu and the development goals and aspirations of the people of Vanuatu.
- To provide an investment climate, fiscal regime and regulatory framework that encourages responsible investment in the country for the development of offshore mineral activities in Vanuatu.
- To ensure the equitable sharing of benefits from offshore mineral activities, including fair, equitable and effective distribution of fiscal benefits from royalties and taxes, employment, training and skills development benefits, maximum local content and technology and knowledge transfer benefits.
- To protect the coastal and marine environment, (biodiversity, ecology and living marine resources) and other legitimate sea users (including customary and subsistence use, commercial fisheries, coastal and marine tourism and maritime transport and communications from the potential impacts of offshore mineral development activities).
- To utilize certain portion of the revenue generated from DSM activities to finance sound social policies to improve human welfare throughout the country
- To ensure that revenue generated from DSM activities does not crowd out other forms of capital and that DSM activities will support economic diversification.

5.4 Legal Framework for Deep Sea Mining in Vanuatu

International laws give countries rights over seabed minerals, and also set obligations for ensuring the protection of the marine environment, including duties to:

1. Protect and preserve the marine environment and rare or fragile ecosystems and habitats;
2. Prevent, reduce and control pollution from seabed activities, or caused by ships, or by dumping of waste and other matter at sea;
3. Prevent trans-boundary harm;
4. Conserve biodiversity;
5. Apply the precautionary approach;
6. Employ the best environmental practice;
7. Conduct prior environmental impact assessment of activities likely to cause significant harm;
8. Take measures for ensuring safety at sea;
9. Not interfere with rights and freedoms of other States, such as the installation of submarine pipelines and cables, and marine scientific research.

For all seabed mineral operations conducted within Vanuatu's waters, Vanuatu's governmental agencies will be expected to regulate, monitor and oversee operations. If Vanuatu decides to be a sponsoring state, any activities conducted under Vanuatu's sponsorship in international waters must comply with rules of the International Seabed Authority. To be a sponsoring State, Vanuatu will have an obligation under UNCLOS to ensure that its sponsored contractor complies with the International Seabed Authority's rules and regulations, and international law. If Vanuatu fails to do so, it could be liable for any pollution or damages caused by its contractor as a result of that non-compliance.

It is therefore essential that Government has effective control over its seabed mineral operators, and this requires the implementation of national laws dedicated to seabed mineral regulation. It is also vital that the government ensures institutional strengthening either on a national or regional level to conduct standard monitoring and oversight.

5.5 Management of Deep Sea Mining Operations in Vanuatu

The Department of Geology and Mines leads the DSM work in Vanuatu. The established National Offshore Minerals Committee by the Council of Minister is the appropriate and adequately resourced technical oversight body who will advice the office of the Commissioner of Mines and Minister responsible for mines on DSM matters, and the development of technical, financial, health and safety, environmental, and social standards, guidelines and procedures, in support of the legal and regulatory framework for the Vanuatu's DSM sector, will continue to be developed by the National Offshore Minerals Committee (NOMC) in coordination with relevant Government authorities. Every effort will be made to ensure the regulatory regime is appropriately harmonized with Vanuatu's other laws [10].

The National Offshore Minerals Committee is composed of representatives from:

- 1) Department of Geology, Mines and Water Resources,
- 2) Department of the Environment,
- 3) Department of Fisheries,
- 4) Ministry of Foreign Affairs and External Trade,
- 5) The State Law Office,
- 6) Ministry of Finance and Economic Management,
- 7) Civil society (non-governmental organizations) and Malvatumauri (Council of Chiefs).

5.6 Responsibilities of National Offshore Minerals Committee

The activities and responsibility of the National Offshore Minerals Committee includes;

- Convene quarterly meetings per year, and develop and maintain relevant committee rules procedures, and an annual plan of work.
- Develop a Vanuatu national DSM policy.
- Advise upon national DSM legislation or regulations.
- Make recommendations for other State decisions regarding DSM exploration and

exploitation.

- Identify opportunities and suitable candidates for capacity building opportunities; and assess the effectiveness of capacity-building initiatives.
- Work with the SPC-EU DSM Project, identifying particular activities useful in the local context, or particular national support needs with which the Project can assist.
- Facilitate and mediate discussion and consultation between key stakeholders, affected communities and the general public, and mining companies and/or relevant Government agencies.
- Raise awareness and disseminate accurate information about DSM exploration and mining issues.
- Prepare regular (e.g. quarterly) progress reports/updates and submit them to the SPC-EU DSM Project.
- Represent the country, and provide updates of NOMC activities, at national, regional and international meetings/workshops.

It is envisioned that the new DSM statute and associated subsidiary legislation will include;

- The powers and functions of relevant administrative agencies (including monitoring and enforcement authority and responsibilities)
- A standardized system for issuing and registering licences and permits through transparent and public processes;
- The necessary eligibility requirements and qualifications of DSM operators;
- Rights and obligations of permit, license and title holder (including consequences for breaches of the law and regulations);
- Timing and requirements of environmental impact assessments (including public participation);
- Public annual reporting requirements for DSM operators;
- Security arrangements (including the deposit of bonds and proof of insurance);
- Opportunities for public participation, provisions for freedom of information, and open standing provision for access to justice (in order to

- restrain breaches and challenge administrative decisions);
- The establishment of detailed regulations as subordinate legislation under the statutory framework.

5.7 State Regulation of DSM

Government recognizes the potential economic contribution of DSM developments to national growth, but also accepts that socio- environmental impacts of these developments are likely. By establishing a clear regulatory regime, government will ensure that only those developments which have a net benefit to Vanuatu and its citizens, in terms of total economic, social and environmental costs and benefits, will be licensed. As a matter of policy all seabed mineral licences will be awarded by public tender when the government of Vanuatu has the capacity and the data to advertise Vanuatu's DSM potential on the web. For the time being, DSM applications will be in accordance with the current legislative provisions. A transitional time frame of three years from the date of the DSM legislation published in the gazette is set for the shift from the current practice to the public tender approach.

Government acknowledges that, financially and technically, private sector investment is critical to the development of Vanuatu's DSM resources. In order for investors to have confidence in Vanuatu as a mining destination, predictable license rights and security of tenure are essential. Government is committed to establishing a published DSM licensing system and to coordinating sector development with Vanuatu's environmental, financial and social law structures. Government will require that mineral developers take a comprehensive approach, taking account of all the social, environmental, and economic costs and benefits of the development at the project planning stage, and throughout the life of the project. Responsibility rests with the government to oversee and regulate these projects and not to permit activities to take place outside of these parameters.

5.7.1 Role of the state of Vanuatu

The role of the State in DSM operations in Vanuatu will be the facilitation and regulation of investment in the sector, to support exploration, mining, sale and processing of seabed minerals in and out of Vanuatu. The State will also play an important role to protect the environment and other legitimate sea users from potential impacts of deep sea mining activities.

The Ministry of Lands and Mineral Resources is the primary government agency responsible for the administration, oversight and regulation of the country's seabed minerals sector, and the office of the Commissioner of Mines regulation role as the responsible national DSM authority will be formalized in legislation. As a matter of policy, Government is also committed to establishing in law a clear regime for Vanuatu's involvement as a 'sponsoring State' in the development of seabed minerals outside of Vanuatu's national jurisdiction: 'the Area'. Vanuatu is currently a non sponsoring State, however Vanuatu has been observing with interest other Pacific Island Countries like Nauru, Tonga, Kiribati and the Cook Islands partner with commercial DSM operators and obtain contracts in the Area, and has taken a policy decision to include relevant provisions in the new DSM laws to be drafted, to enable Vanuatu similarly to get involved in the Area in the future, should the opportunity arise.

The Ministry of Lands will work with other relevant government agencies to establish a clear fiscal and operating regime for the sector including the Ministry of Finance, in relation to revenue collection.

The Ministry of Lands on behalf of the State and its related departments will be the Ministry responsible for developing and implementing the sector policy and relevant legal and regulatory framework, and will be responsible for the due diligence, licensing, registration and inspection of seabed exploration and mining operations, and the gathering and retention of geo-science data: The Ministry of Land includes Cadastre, Inspectorate and Geology and Mines sections, which will play an important role in seabed mineral activities Where there is suspected non-compliance by a contractor, or the risks or impacts of the seabed mineral activities and environmental impact appear too great, the Ministry of Lands will have enforcement powers, including (after

reasonable notice) the imposition of sanctions against the contractor, such as: an order requiring certain action, amendment or suspension to the work program, fines, or referral for prosecution for offences.

5.7.2 Maritime boundaries, cadastral and bathymetry mapping

With the recognition of the economic potential of DSM within Vanuatu's national jurisdiction, the importance of identifying the extent of that jurisdiction becomes a priority. The State and investors need to know which parts of the seabed fall within the country's control, and which fall within a neighboring State's, or international, jurisdiction. Because Vanuatu's maritime boundaries are not yet formally declared in accordance with international law, the extent of Vanuatu's maritime zones remains subject to negotiation with neighboring countries. Clarity about the exact extent of Vanuatu's sovereign rights over marine resources is essential to ensure that licenses are not issued. To avoid disputes over resource ownership. Government will therefore prioritize the formalization of Vanuatu's maritime boundaries.

UNCLOS gives coastal countries, like Vanuatu, exclusive and sovereign rights to mine and manage the seabed minerals contained within their national jurisdiction, pursuant to their environmental policies and in accordance with the duty to protect and preserve the marine environment. Vanuatu's national jurisdiction over its seabed and water column extends through its EEZ, which is the marine area measured with a 200 nautical mile radius from a coastal baseline drawn around all the islands of Vanuatu (but subject to negotiation, where that area overlaps with the EEZ of a neighbouring country, such as Fiji, the Solomon Islands and New Caledonia.

The Constitution of Vanuatu proclaims that all land in the Republic belongs to the indigenous custom owners and their descendants. Only indigenous citizens of the Republic who have acquired their land in accordance with a recognized system of land tenure can have perpetual ownership of land. Land transactions between an indigenous citizen and either a non-indigenous citizen or a non-citizen may be permitted only with the consent of the Government. The Constitution formally recognizes the role of custom chiefs in deliberating on land matters.

The Constitution is silent on the question of the ownership of minerals, but the Mines and Minerals Act [CAP 190] vests “the property in minerals in their natural condition, in land, in the Republic of Vanuatu” [9].

The Mines and Minerals Act [CAP 190] defines land to include

- a) Land beneath water;
- b) The seabed and subsoil beneath the territorial sea; and
- c) the seabed and subsoil of the continental shelf or beneath the waters of EEZ.

Government maps/grids Vanuatu’s seabed into sections, blocks, and cells. As a matter of policy, Government may designate certain blocks as protected areas, where DSM activities are not permitted. Government may choose to protect areas of particular biological significance, or areas ecologically similar to mining sites for comparative and ‘control’ purposes, or ‘buffer zones’ around licensed sites. Other blocks may be declared by Government to be open for tender for licenses for DSM activities, and shapes and sizes of those blocks may be specified for exploration and mining sites. As part of Vanuatu’s emerging DSM legal framework, clear processes and required approvals will be included to ensure that mapping is consistently and transparently conducted.

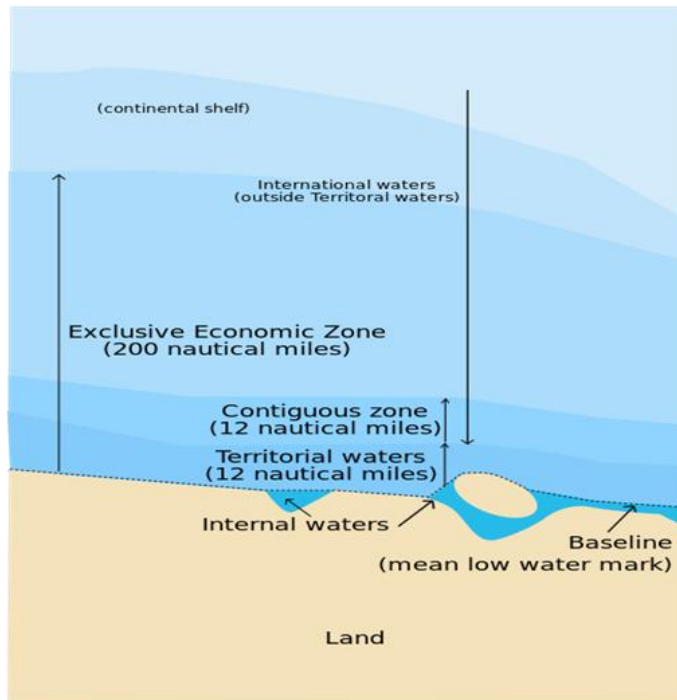


Figure 5.2 Exclusive economic zone, internal waters and territorial waters of a country [3].

5.7.3 Licensing of DSM activities

Mineral rights are given with the National Offshore Minerals Committee's (NOMC) consent to applicants who by merit can demonstrate that they have the technical and financial capability to carry out an agreed work program. The Minister shall act in accordance with the advice of the NOMC to inform the council of Ministers accordingly. There will be published eligibility criteria for who can apply for DSM licenses (e.g. a presence in Vanuatu is required and published evaluation criteria for DSM project proposals, against which the office of the Commissioner of Mines and the National Offshore Minerals Committee (NOMC) shall assess all applications received, in consultation with other Ministries and the wider public where relevant. Applications for different activities are separated into three different phases, each having different rights and responsibilities attached: Exploration, prospecting and mining, will have different application requirements and processes. If an application is successful, a license will be issued setting out what commodities are sought, which specific activities are permitted, and the parameters within which they must be conducted. National laws and the license will require the licensee to uphold certain standards,

such as best environmental practices and the application of the precautionary principle, throughout its operations.

The office of the Commissioner of Mines will receive quarterly and annual activity reports from DSM licensees, and will also conduct site visits and operational inspections to verify that the DSM activities are taking place within the specified rules and the agreed work program.

Operators who exercise due diligence in performing their work in compliance with the country's laws and terms of the license (including maintaining a vigorous environmental management program, and timely and comprehensive reporting) will enjoy continuity of title and eligibility for a mining license after the expiry of a prospecting project.

While Government is keen to encourage legitimate seabed mineral explorers in Vanuatu, it does not want to see prospective seabed tied up by companies only interested in speculative ventures. To discourage this, exploration licensees are required to achieve an annual minimum expenditure, and over time, to relinquish portions of their exploration area, and licenses will be revoked if there are unjustified and lengthy periods of inaction.

5.7.4 Sustainable environmental management

Presently, there is a lack of complete scientific knowledge about the deep sea environment and the potential scope, magnitude or duration of the impact of seabed mineral activities. Government is committed to applying the precautionary principle. The Precautionary Principle is a strategy to cope with possible risks where scientific understanding is yet incomplete, such as the risks of Nano technology, genetically modified organisms and systemic insecticides.

The Precautionary Principle is defined as follows: When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm. Morally unacceptable harm refers to harm to humans or the environment that is threatening to human life or health, or serious and

effectively irreversible, or inequitable to present or future generations, or imposed without adequate consideration of the human rights of those affected.

The judgment of plausibility should be grounded in scientific analysis. Analysis should be ongoing so that chosen actions are subject to review. Uncertainty may apply to, but need not be limited to, causality or the bounds of the possible harm. Actions are interventions that are undertaken before harm occurs that seek to avoid or diminish the harm.

Government aims to ensure responsible and sustainable management of the deep sea, by enforcing a stringent environmental management regime for all offshore activities. Government requires use of best available technology and best environmental practices from any DSM licensees, and intends to take necessary steps to prevent, reduce and control pollution, waste material and other hazards to the marine environment arising from DSM activities.

Prior environmental and social impact assessment (often called 'EIA' or 'ESIA'), building on Vanuatu's existing environmental laws, is one key mechanism within the DSM regulatory regime. Before any DSM mining or advanced prospecting occurs, the potential impacts on the marine environment (and other sea users) must be assessed, and measures designed to ensure such impacts are avoided, mitigated or managed to a degree considered acceptable. To develop a better understanding on the marine environment, it will be legislated and provisions will be made for an Authorized officer to be part of scientific cruises in Vanuatu waters. The proponent company will be responsible for performing an environmental and social impact assessment for activities that constitute a DSM Development under Vanuatu's environmental protection and conservation act (cap 283 of 2002), and cannot proceed with advanced prospecting or mining production until and unless consent is obtained under that legislation from the Director of Environment and Conservation. This process will include public consultation and the assessment of wider social impacts, evaluating the potential effects that a project may have on all natural, physical, and social resources including the people and culture of Vanuatu.

It will be legislated that the development of a DSM EIS for advanced prospecting or for a mining production application shall be complemented with a more proactive Strategic Environment Assessment (SEA). This is a systematic process for evaluating the environmental consequences of proposed policy, plan or program initiatives in order to ensure they are fully included and appropriately addressed at the earliest appropriate stage of decision making on par with economic and social consideration. Government will also review the existing environmental laws that it provides adequate protection for the marine environment from the likely impacts of DSM activities.

Also critical will be Government's monitoring of the performance and impact of DSM activities. The Commissioner of Mines, the Minister responsible for mines and the Department of Environment can take emergency action to prevent anticipated risks, and will enforce remedial measures or penalties for any non-compliance by DSM operators with relevant environmental obligations, for example by: issuing mandatory Orders or fines, or in extreme cases, suspending the license government recognizes and enforces the 'polluter-pays' principle. Any person or community whose lifestyle or income is adversely affected by seabed mining will be eligible for compensation from the DSM Company. In addition, the company is responsible for all costs associated with mitigation and rehabilitation activities, from initial exploration to post-closure of mining activity.

The Commissioner of Mines or the Minister responsible for Mines may require a licensee to pay an upfront environmental bond as surety of best practices that the International Organization for standardization (ISO) recognizes as industry standards. The bond may be used to remedy unacceptable environmental impacts of the mining project.

As part of the environmental monitoring requirements, the licensee will have an obligation to put in place real-time monitoring instruments for the deep sea environment of the mining site and its surrounding areas. These monitoring data shall be made available to the public in its raw form upon request without delay.

In the event any incident from activities which may cause, are causing, or pose a threat of serious harm to the marine environment must be reported by the licensee.

Government will take particular care to research and monitor whether any DSM development has an impact on fisheries in the area of activity, or beyond; and will take measures and decisions designed to protect the current fishery populations and the income generated from that industry. The government is also engaging with other Pacific Island countries throughout the region to consider an inclusive regional approach for monitoring and assessing DSM activities.

5.7.5 Attracting investment

Government believes that a thriving DSM sector will contribute positively to national growth and social welfare improvements for all of Vanuatu's citizens. Government therefore wishes to provide an internationally competitive operating environment to encourage investors and companies to invest in Vanuatu's DSM sector.

This will include providing review mechanisms against Government decision-making, and making it an element of an offence under the laws of Vanuatu for any person to willfully obstruct seabed mineral operations or State regulation of those operations. The regulatory regime will also allow licence-holders who comply with legal requirements and perform efficiently to enjoy security of tenure, and continuation or extension of their mineral rights. Predictability, transparency and accountability must be underpinning principles to the law and implementation of Vanuatu's regulatory and fiscal regime for seabed minerals.

Other aspects of Government policy in relation to the national investment environment include:

- **Insurance:** Investors in all seabed mineral sector operations and related activities will be required to insure any and all assets and risks including its labor force with national and/or international insurance companies.
- **Expropriation:** In accordance with the investment laws of Vanuatu, the State can expropriate an investment or the assets of a registered company only for the purpose of public interest, based on a law permitting such expropriation, and on a non-discriminatory basis. The State shall provide prompt, adequate and effective

compensation in conformity with principles of international law, equivalent to fair market value of the expropriated investment or assets immediately before the expropriating action was taken.

- **Right to be Free from Discriminatory Governmental Actions:**

This Policy shall be applied equally and fairly to all similarly - situated registered companies whether they have foreign equity ownership or not.

- **Right to Transfer Funds:** Domestic and foreign investors shall be permitted freely to transfer funds out of Vanuatu without unreasonable delay at the prevailing exchange rate for the currency.

5.7.6 Transparency

Government supports the transparent operation of seabed mining companies through a regularized system of reporting and audit controls implemented by the Minister responsible for mines on the advice of the Mining Advisory Board. As part of its support of transparent operations, Government will publish the relevant legislation, regulations and licence terms to which all seabed mineral projects must adhere, will hold a publicly-accessible register of information about any exploration or granted, and will hold public consultations before any decision to grant a mining license. The National Offshore Minerals Committee established, will include non- governmental members when and where appropriate, selected to represent particular communities or sections of society. This advisory body will be consulted by the Minister responsible for mines and their views taken into account before any licensing decision is taken. The National Offshore Minerals Committee (NOMC) can hold consultations with wider sections of the public before providing their views. Government is also committed to implementing the principles of the Extractive Industry Transparency Initiative (EITI) in the management and monitoring of seabed mineral revenues.

5.7.7 Equitable fiscal regime

DSM are a non-renewable resource, forming part of Vanuatu's capital stock. It is important that they are economically and efficiently managed in the country's best

interests in the short- and long-term. The commercial viability of mining Vanuatu's DSM depends on a multitude of factors, including: further resource assessment of the quantity and quality of the deposits, the practicality and costs of accessing and processing those resources, the market value of the target minerals, and the regime of fees, royalties and tax duties that Vanuatu imposes on the companies undertaking this work. If the 'take' for the State is set too low, Vanuatu will be selling valuable resources without making optimum return. If set too high, the companies will move elsewhere and Vanuatu will not generate income from its resources. As a matter of policy, Government will therefore support a fiscal regime that will facilitate the sharing of wealth derived from the extraction of the country's DSM mineral equitably between the developer and the State.

Through the DSM fiscal policy, Government seeks to achieve the goals of investment promotion, equitable return to the people of Vanuatu, and protection of investments. Government will support the development of a regime that is stable, competitive, transparent, and equitable.

Seabed mineral tax policy does not presently exist independently from the general tax system that is applied to other sectors of the Vanuatu's economy. Nevertheless, there are particular features of DSM development which must be specifically addressed, namely: the capital (and debt) intensiveness of offshore mining ventures; depreciation of assets; the cyclical nature of metal markets; and the long and costly period of pre-operational expenditure on exploration, environmental and feasibility studies. These issues are considered in framing the tax package.

Although some other States have chosen to do so, as a matter of policy, the Government of Vanuatu does not intend to take an equity stake in any mineral project, nor to require direct payments from mining companies to communities. The Government believes that a clear and equitable centrally collected and managed royalties system (combined with other relevant national taxes) is the best mechanism for obtaining domestic income from DSM development, and can be calculated and collected within Vanuatu's existing tax administration structures.

5.8 Long-Term Revenue Management

Government wishes to ensure that income obtained from DSM activities are managed sustainably and in the long-term interests of the country. Government is therefore establishing a Seabed Minerals Fund, a protected savings fund set-up by law, under the control and management of the Treasury. Any funds received by Vanuatu from DSM activities will be paid into the Seabed Minerals Fund, except for any proportion of those funds allocated by the Treasury to be used directly for the purposes of covering Government's costs of regulating the industry in the country. There will be set rules for the use or investment of that income.

Key principles will be to set aside revenue for future generations, while not precluding immediate investment in infrastructure and socio-economic projects. By depositing money when prices are high and withdrawing when prices are low, use of the Fund can protect against mineral resource price fluctuations. It also keeps the majority of this new revenue out of the local economy, thus avoiding excessive inflationary pressure, and safeguarding funds for future generations.

5.8.1 Optimizing social benefits from DSM

Although the likely direct socio-economic impacts of DSM on the country, save for new revenue, should not be over-estimated, where possible, the construction of large-scale DSM operations should be linked with conditions for national development (including local employment, personnel up skilling, and water resources, transport and electric power to enhance local industrial and economic development). Government will support a series of policies and regulations that not only promote the development of Vanuatu's DSM resources but that integrates this development with broader development goals of the country e.g. improved shipping routes, inter-country cooperation, mid-stream and downstream mining linkages, educational and skills-training program without discrimination based on gender, revenue management measures that ensure long-term economic development for Vanuatu, and other opportunities that may emerge as the sector evolves.

The government recognizes the rights of indigenous peoples and local custom and traditions, including subsistence fishing activities. As a matter of priority, no seabed mineral activities will be permitted if it is identified that it will cause unacceptable harm to the nation's society or environment, and the people of Vanuatu will be given the opportunity to participate in these decisions. The government and licensees shall commit to and implement internationally recognized standards, such as the OECD Guidelines for multinational Enterprises, the United Nations Declaration on the rights of indigenous Peoples, UN Voluntary Principles on security and Human Rights, and the IFC Performance Standards.

5.8.2 Employment and local procurement

Due to the extent to which equipment and modern technology will be used to conduct DSM operations, the number of potential jobs created by the sector is likely to be modest. Employment policies in the sector are nonetheless important. Government will encourage mining companies to pursue local recruitment, by law requiring 100% of the unskilled labour force used for Vanuatu's DSM projects to be recruited from the country, and will require a program of capacity- building and skills-training, designed to maximize the opportunity for participation of Vanuatu's citizens in this new industry.

If DSM mining operations in the future involve vessels docking in Vanuatu, it maybe anticipated that demand for onshore services including fuel supply, catering services, interim housing and other goods and services will arise. Government will support policies that safeguard these business opportunities for Vanuatu's nationals.

5.8.3 Capacity-Building towards Vanuatu's DSM sector

Government believes that a skilled and able population fosters better national resource management. Vanuatu has the opportunity via the DSM sector to train and up-skill local personnel. As a matter of policy (which will be supported by laws to be introduced), applications for DSM licenses must include a proposal for a capacity-building program for personnel of Vanuatu – including through offering berths to the country nationals on any cruises conducted under the license. Licensees are expected to implement those

programs, and to cooperate in capacity - building of personnel of Vanuatu in connection with marine scientific research or DSM activities, and related transfer of technology and intellectual property. This may be by providing opportunities - including through financial support - for the participation of representatives of the country in the company's seabed mineral activities, or through study scholarships and training in related and relevant fields that may include but not be limited to geological processes, environmental protection and management, commercial support (legal, financial, accounting), revenue management.

Government will commence an active program of Government-staff capacity building that will include in-ministry and related training, exchange programs and review of staff positions to ensure that requisite technical, financial and legal capacity is available throughout the relevant Government agencies. There will be a review of Government staff compensation and benefit arrangements toward promoting market-competitiveness. Government will also facilitate access by Vanuatuans to other educational or career-enhancing opportunities arising from the deep sea minerals sector offered by agencies such as the International Seabed Authority and the Secretariat of the Pacific Community.

Government will encourage public and educational authorities to provide fiscal and other resources for the development of academic and training services that target the technical, fiscal, legal, environmental and other aspects of seabed mineral sector development. Where possible, Government shall develop initial and mid-career training programmer for technicians, commercial staff, government officials and other essential professional and technical positions, exploring possibilities of international partnerships that support mid- career internships, training and other professional development opportunities both in Vanuatu and abroad.

Scientific data about Vanuatu's DSM resources (and the associated environment) is currently limited. Government Policy is to support measures, in addition to the capacity-building initiatives cited above, that will enable the Government of Vanuatu and potential investors to gain further understanding of the DSM resources within the country's jurisdiction as well as the various options for developing them. As a matter of

Policy, Government supports the systematic collection and analysis of geological data relevant to seabed minerals of Vanuatu. The law will require all data gathered within a DSM license area to be deposited with the office of the Commissioner of Mines, and will work with DSM companies operating in Vanuatu's waters, to ensure collection and safeguarding of geosciences data. Government will look for opportunities for related research and development activities (which may be facilitated by the regional agencies, educational institutions, or the private sector). Government will endeavor, through the Ministry of Lands, and any other available public or private academic structures, to undertake basic and applied research aimed at discovering technical solutions to seabed mining problems and/or creating new goods and knowledge specific to these developments in the country – ultimately with the aim to export these services to other countries in the future.

5.8.4 Public participation and social impacts

Vanuatu's DSM resources are considered to be publicly-owned assets to be managed for, and on behalf of, the country's people by the State. Government believes that regular consultation and meaningful participation from relevant stakeholders is fundamental in managing Vanuatu's engagement in DSM activities. Through an inclusive and participatory approach Government seeks to generate an operational regime that will maximize both the understanding of the people of Vanuatu, and the benefits that may be derived from this new industry. The Government will utilize the established Provincial network to disseminate information on DSM Development in Vanuatu. The Government will ensure that the information delivered whether in media, publications, newsletter, or brochure is understandable to every citizens of Vanuatu.

As detailed above, Government's goal for the DSM sector is to ensure that developments proceed in a responsible and net-beneficial manner. Successful operations will be those that effectively incorporate community participation during the administrative and corporate decision-making process, that ensure an equitable distribution of the benefits arising from mineral extraction, and that carefully assess and minimize socio-environmental impacts.

Because DSM operations will occur far-offshore, they will not be focused on one or more particular local community or communities. Therefore Government intends to consider the entire island nation of Vanuatu and its people potentially to constitute “community” with regard to consultation and participatory decision- making processes. Accordingly Vanuatu’s DSM regulatory regime will provide opportunities for the general public to obtain information about DSM activities and to influence decisions, and Government will also work at the outset of any DSM project to identify the number and special interests of any stakeholders who may be directly or indirectly impacted by that project.

DSM license-holders in Vanuatu are also encouraged to develop a participatory and collaborative approach with the country’s citizens, as they embark on DSM project planning and development. Applicants for DSM exploration or mining licenses are required to provide a public engagement and information plan, and its implementation will be a condition of any resulting license. Interested parties may also participate in a project’s environmental and social impact assessment procedures and consultations, and any person materially affected by a decision taken by the Government in relation to DSM issues can apply to the Minister for an administrative review of that decision, or to the Courts for judicial review.

Government anticipates that the on land and social impacts of DSM mining in Vanuatu will be minimal (and even more negligible in the case of the country’s sponsorship of seabed mineral activities in the Area, thousands of kilometers away from Vanuatu. Operations will be located far off-shore, and may occur wholly at sea, with the ore most likely being shipped directly from the at-sea mining site to another country for processing, with the mining vessel and barges potentially never docking in Vanuatu.

Customary landowner rights in the country do not include the seabed far offshore where DSM operations will occur. Nevertheless, concerns must be heard and addressed, and Government views the direct participation of the Vanuatu’s people in decision-making about DSM projects as an integral part of a successful long term relationship between Vanuatu and this new industry. Other stakeholders e.g. fishery, tourism or shipping operators must also be taken into account. If marine or coastal users likely to

be adversely affected by the proposed projects are identified at any time, including through the environmental and social impact assessment process, the mining company will be required to obtain consent from those persons, including by way of compensation, prior to commencing those activities. This policy position will be underpinned by legal mechanisms and public consultation requirements, for Government and for industry.

Also, DSM projects are prohibited from interfering with other legitimate sea uses, such as navigation or fishing. Where an environmental and social impact assessment shows likely adverse commercial or social impacts from a seabed minerals project, Government can reject the project or can require amendments to avoid or minimize those impacts.

5.8.5 Occupational health and safety

Safeguarding health and safety for DSM workers is of paramount importance, as a matter of Government Policy. Vanuatu's laws require safety at sea in accordance with international standards. DSM developers will be required to exercise proactive due diligence in safeguarding the health, safety and welfare of persons employed by them. DSM companies operating under Vanuatu's licence or sponsorship must carefully recruit and train their staff, and properly equip them. If any incident occurs involving the loss of life or injury, or the loss or damage of any equipment or vessel at sea, this must be reported immediately, and Government may take appropriate remedial or preventative actions as required. The matter may also be referred to an inquiry or the Courts.

5.8.6 Regional co-operation

Government recognizes the Pacific Islands Regional Ocean Policy, which promotes regional co-operation as one of its key principles. This is complemented by the multi-national ocean governance framework adopted by Vanuatu, and other Pacific Islands 'the Pacific Oceans cape', which emphasizes the importance of a regional approach to the sustainable development, management and conservation of the ocean. International law also requires States to work to harmonies policies relating to seabed activities at the

appropriate regional level. Information-sharing with neighboring States will minimize the potential for unanticipated trans-boundary pollution or impacts, and/or promote the possibility of cross-border joint developments. Vanuatu wishes to encourage the use of the Regional Legislative and regulatory Framework that should aim to promote a regionally integrated approach to DSM regulation. The Government realizes that The 1986 Convention for the protection of Natural Resources and the Environment of the South Pacific Region has a significant role to play in protecting the marine environment from DSM activities. Vanuatu is therefore committed to a collaborative approach. Government will participate in bilateral, regional and international information-sharing and capacity-building initiatives to address DSM issues, including through active engagement with relevant regional agencies, such as the EU-funded Deep Sea Minerals Project, hosted by the Secretariat of the Pacific Community.

Government will also explore future joint working arrangements with other Pacific Islands that may strengthen the country's negotiation position in setting financial terms for DSM extraction, and/or assist Vanuatu meet its DSM monitoring and regulation duties.

Government acknowledges The Secretariat of the Pacific Regional Environment Programme (SPREP) as a regional hub for the protection of natural resources and the environment of the South Pacific region.

5.8.7 Marine scientific research

Countries are obliged under international law to promote and facilitate development and conduct of marine scientific research ('MSR') by other Governments and international organisations. Vanuatu's law and policy takes this into account, by ensuring that the rules applicable to DSM activities are designed not to obstruct current or planned MSR initiatives, and to promote industry-research cooperation where possible.

Equally MSR operators should not be treated differently from commercial DSM operators in relation to environmental management requirements. Persons conducting MSR must also comply with national environmental laws, and every proposed activity – whether DSM or MSR – shall be considered according to its anticipated impacts on the environment. Government will also develop

guidelines specifically to address MSR initiatives within Vanuatu's waters. Any DSM company operating, or person conducting MSR, within the country's waters, will be required by law to share scientific data including row data gathered and report of the cruise to the office of the Commissioner for Mine.

6. CONSLUSION AND RECOMMENDATION

The thesis is also results of deep sea Mineral consultation through the Vanuatu National Mineral Committee. This involvement enabled to be a part of prospecting and mining of phase in the EEC Zones of Vanuatu in the near future. It will also be possible to add new dimension for the mining education in Vanuatu with the universities in Turkey. During the preparations of this thesis, the co-operation procedure has been started by the Istanbul Technical University and the South Pacific University (USP). The establishment of Mining Engineering department at the USP in Vanuatu is on the agenda.

Deep Sea Mining Applications and related subjects are the new concepts for Turkish Miners, with this thesis is also aimed to introduce deep sea mining applications. With the introduction of Deep Sea Mining opportunities in the Pacific Island Countries, Australian based Turkish mining companies will be able to move their operations to the Pacific Island Countries.

In the Pacific Island Countries, Deep Sea Mining exploration projects have been carried out on the basis of the collaboration between the Secretariat of the Pacific Community (SPC) and the European Union. The co-operations in this fields have led us to communicate with the universities in European Union Countries. The thesis will also be an important tool for development of Vanuatu and Turkey bilateral and multilateral relations.

The Pacific Island Countries -The Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor Leste, Tonga, Tuvalu and Vanuatu- spread across hundreds of islands over an area equivalent to 15 percent of the globe's surface. So this study, will enable us to know much more about this large area of the World.

As it is summarized on the International Conference on Small Island Developing States in Samoa in September 2014 all the Pacific Island Countries have common issue such as the result of climate change, sustainable energy, disaster risk reduction, food security and nutrition, water and sanitation and social development. In order to

combat all these global and regional subjects, Pacific Island countries have to reach good economic conditions. In the period of this time deep sea mining application can be seen as the most powerful source to enforce their economies. The economic and social development in those countries will also create opportunities for Turkish tourism industry.

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APPENDICES

APPENDIX A: GENERAL PROTOCOL OF EDUCATIONAL AND SCIENTIFIC COOPERATION BETWEEN THE UNIVERSITY OF THE SOUTH PACIFIC AND ISTANBUL TECHNICAL UNIVERSITY

APPENDIX A



GENERAL PROTOCOL OF EDUCATIONAL AND SCIENTIFIC COOPERATION

between the

THE UNIVERSITY OF THE SOUTH PACIFIC
(Suva, Fiji)

And

ISTANBUL TECHNICAL UNIVERSITY
(Istanbul, Turkey)

Preamble

THE UNIVERSITY OF THE SOUTH PACIFIC, herein referred as “USP”, founded in 1968, with its headquarters in Laucala Bay Road, Suva, Fiji, represented herein by its Vice-Chancellor and President, Professor Rajesh Chandra. The University of the South Pacific, a body incorporated by the Royal Charter of Her Majesty Queen Elizabeth II, is a key contributor to the development of Pacific Island Countries and region’s premier University providing a primary source of high quality graduates in the region. USP serves the regional needs of its 12 member Countries¹. USP strives towards excellence in the provision of tertiary education and aims to build on and preserve the Pacific Heritage. It proactively engages with the region, its communities, and with international partners on major development issues relevant to the region. The University has positioned itself as a leader in research and education that is original, modern, and readily applicable in addressing the problems and challenges faced by its member countries. USP is one of the two regional Universities in the world and is not only a higher education institute, but also an active regional integration organisation. The steady supply of graduates has contributed to meeting the growing development needs of the region for almost 47 years. The University, through its Office of the Deputy Vice-Chancellor (Learning, Teaching & Student Services) will be responsible for implementing this protocol.

ISTANBUL TECHNICAL UNIVERSITY, herein referred as “ITU”, is a state university which has more than 240 year prominent history defines the professions of engineering and architecture in Turkey that provides a modern education environment to the students while possessing its

¹ Cook Islands, Kiribati, Nauru, Samoa, Tokelau, Tuvalu, Fiji, Marshall Islands, Niue, Solomon Islands, Tonga, Vanuatu

Initialed by Prof. Rajesh Chandra for USP:

Initialed by Prof. Dr. Mehmet Karaca for ITU:

conventional structure. ITU educates its students as the future pioneers in engineering and architecture not only in national but also in international environments by establishing strong relations with international institutions. ITU maintains International Accreditation in all of its undergraduate degree programs (ABET, EUA, NAA, IMO).

Purpose

Istanbul Technical University and The University of the South Pacific join in the following protocol in order to further promote mutual cooperation in education and scientific research.

1. Within fields that are mutually acceptable, the following general forms of co-operation will be pursued:

- a. Exchange of undergraduate and/or graduate students;
- b. Exchange of faculty members and/or research scholars;
- c. Participation in seminars and academic meetings;
- d. Joint organisation of conferences and meetings;
- e. Joint research activities in areas of common interest; and/or
- f. Exchange of scientific materials and information.

2. Themes of joint activities and conditions for utilising the results achieved as well as arrangements for scientific visits, exchanges, and other forms of international cooperation will be developed mutually for each specific case, along with any other necessary terms and conditions. Specific formal protocols signed by authorised representatives of both institutions/parties shall be required for anything pertaining to and/or covered by a-f under paragraph 1 hereof.

3. All financial and other arrangements, terms and conditions will be negotiated for each specific case/programme as appropriate. Each institution will designate a primary coordinator to develop and implement specific programmes.

Amendment

No amendment, consent, or waiver of terms of this protocol shall bind either party unless in writing and signed by all parties. Any such amendment, consent, or waiver shall be effective only in the specific instance and for the specified purpose given. The parties to this protocol, by the signatures below of their authorised representatives, acknowledge having read and understood this protocol and agree to be bound by its terms and conditions.

Term of Protocol

This protocol shall remain in effect for five (5) years from the date it is signed, and may be renewed or amended at any time before the expiration date, by a written protocol signed by authorised representatives of both parties. This protocol may be terminated by either party in writing, upon ninety (90) days advance written notice to the other party.

Initialled by Prof. Rajesh Chandra for USP:

Initialled by Prof. Dr. Mehmet Karaca for ITU:

This Protocol is written in English and will be effective after the approval of authorised institutions.

THE UNIVERSITY OF THE SOUTH PACIFIC **ISTANBUL TECHNICAL UNIVERSITY**
Suva, Fiji Istanbul, Turkey

Professor Rajesh CHANDRA,
Vice-Chancellor & President

Date: _____

Witnessed by:

Jaindra Karan
Director, Development, Marketing and
Communications

Signed: _____

Date: _____

Prof. Dr. Mehmet KARACA,
Rector

Date: 17.04.2015

Witnessed by:

Prof. Dr. Mehmet Sabri ÇELİK
Vice-Rector

Signed: _____

Date: 17.04.2015

GOVERNEMENT DE LA
RÉPUBLIQUE DE VANUATU

MINISTÈRE DES
AFFAIRES ÉTRANGÈRES,
DE LA COOPÉRATION
INTERNATIONALE ET DU
COMMERCE EXTÉRIEUR



GOVERNMENT OF THE
REPUBLIC OF VANUATU

MINISTRY OF
FOREIGN AFFAIRS,
INTERNATIONAL
COOPERATION AND
EXTERNAL TRADE

15th April 2015

Mehmet ATAR
Honorary Consul of the Republic of Vanuatu in Istanbul
ITU Faculty of Mines, Entrance B
Mining Engineering Department
Maslak - Istanbul - TURKEY

Dear Sir,

**RE : GENERAL PROTOCOL OF EDUCATIONAL AND SCIENTIFIC COOPERATION
BETWEEN THE UNIVERSITY OF THE SOUTH PACIFIC AND ISTANBUL TECHNICAL
UNIVERSITY**

The Ministry of Foreign Affairs, International Cooperation and External Trade would like to thank the Government of Turkey and the University of the South Pacific in Fiji on the negotiations of a *General Protocol of Education and Scientific Cooperation between the University of the South Pacific (Suva, Fiji) and Istanbul Technical University (Istanbul, Turkey) Joint Communiqué on the Establishment of Diplomatic Relations between the Republic Istanbul and the Republic of Vanuatu.*

We are pleased to inform you that the Protocol has been cleared and is in order and wish both institutions all the best in facilitating this through the Universities as indicated and to assist the students in both Mining Engineering at Laucala in Suva Fiji and Meteorological Engineering Departments at the Emalus Campus here in Vanuatu..

Yours Sincerely,

Yvon Basil
Director



PMB 9051, Port Vila, Republic of Vanuatu, Tel: (678) 5333870 / 5333860, Fax: (678) 26547/23142, e-mail: mofa@vanuatu.gov.vu

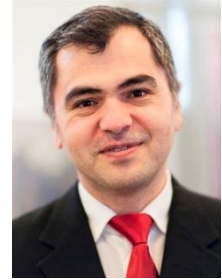
CURRICULUM VITAE

Name Surname: Mehmet ATAR

Place and Date of Birth: 01.06.1969

E-mail: atar@vanuatufk.com;

mehmetatar@hotmail.com



EDUCATION:

B.Sc.: Istanbul Technical University, Mining Engineering Department

PROFESSIONAL EXPERIENCE AND REWARDS:

Mehmet ATAR has been serving for Vanuatu as the Honorary Consul of Republic of Vanuatu in Istanbul since 2013. He is also the active member of Vanuatu National Offshore Mineral Committee.