NI 43-101 Technical Report 2011 PNG, Tonga, Fiji, Solomon Islands, New Zealand, Vanuatu and the ISA

Report Prepared for

Nautilus Minerals Incorporated

Report Prepared by

srk consulting

SRK Consulting (Australasia) Pty Ltd

NAT008

March 2012

NI 43-101 Technical Report 2011 PNG, Tonga, Fiji, Solomon Islands, New Zealand, Vanuatu and the ISA

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Summary

Nautilus Minerals Incorporated (”Nautilus Minerals”) is exploring mineral exploration tenements located in the Exclusive Economic Zones of Papua New Guinea (PNG), Tonga, Fiji, Solomon Islands, Vanuatu and New Zealand. These tenements are either known to host, or are considered prospective for, Cu-Zn-Ag-Au seafloor massive sulfide (SMS) mineralisation. SMS deposits are formed where hot hydrothermal fluids transporting metals mix with cold sea water on the seafloor. At present, more than 300 sites of hydrothermal activity and seafloor mineralisation are known globally.

On-land, volcanic-hosted massive sulfide (VHMS) deposits form a major part of the world’s reserves of copper, lead and zinc, as well as being significant producers of gold and silver. Notable examples include the deposits of the Iberian Pyrite Belt in Spain and Portugal, Kidd Creek and Noranda in Canada and Kuroko in Japan. The similarities between SMS deposits and many ancient VHMS deposits have led to the conclusion by geologists that VHMS deposits originally formed as SMS deposits.

In the Solomon Sea and New Ireland Arc areas of Papua New Guinea, as of 31 December 2011, Nautilus Minerals has 13 granted Exploration Licences and nine Exploration Licence applications.

As of 31 December 2011, Nautilus Minerals has the following tenements in other SW Pacific countries: 16 granted Prospecting Licenses and a further 30 Prospecting License applications in the Kingdom of Tonga; 3 Special Prospecting Licence applications and 14 granted Special Prospecting Licences and three Special Prospecting Licence applications in Fiji; 92 granted Prospecting Licences in the Solomon Islands (refer to the notes accompanying the Solomon Islands tenement table); 41 granted prospecting licences and a further 14 prospecting licence applications in Vanuatu; and two Prospecting Permit applications in New Zealand.

On 11 January 2012, the International Seabed Authority (ISA) approved an application lodged by Tonga Offshore Mining Limited (TOML), a subsidiary of Nautilus Minerals, in The Area (Clarion-Clipperton Zone). A formal Contract of Work was entered into by both parties on the 11 January 2012 (subsequent to the closure date of this technical report). The Clarion-Clipperton Zone contains significant accumulations of polymetallic nodules, which may become an important source of copper, nickel and cobalt in the future. TOML’s application to explore in the Clarion- Clipperton Zone has been sponsored by the Kingdom of Tonga.

These represent a total granted exploration area, excluding tenement in the Bismarck Sea Property, of approximately 203,147 km^2 and a further 291,982 km^2 under application.

During the 2008 NorSky and 2009 Southern Surveyor cruises, a total of 18 SMS systems were identified in Tonga. In 2009, Nautilus Minerals completed a target generation program in Tonga that generated 32 new exploration targets. These were largely plume targets, similar to those previously generated in PNG that have been demonstrated to host SMS mineralisation. Dredge sampling of some of these targets resulted in the discovery of SMS mineralisation; and a camera tow over another target recovered a high grade copper sample. Tonga has strong potential for further SMS discoveries in the future.

In November and December 2011, the cruise of the *RV Kilo Moana* in Tonga was conducted, primarily to use an AUV to map out the source of plume targets generated during the Southern Surveyor (SS09) cruise in 2009, ultimately leading to the discovery of seafloor massive sulfides (SMS). Six new SMS targets were generated during 16 AUV missions from 10 surveyed sites. These sites are now ready for ROV follow up to confirm the occurrence of sulfides and to sample them. One site, Fonualei Central 1, was upgraded to a prospect after successful camera tow and dredging operations confirmed chimneys in the area. This prospect will now be known as Tahi

Moana 8. Data processing of high resolution multi-beam AUV and sea surface multi-beam bathymetry and backscatter is still in progress.

Rock samples were recovered from all 28 dredging operations and a selection of these were chosen for whole rock analysis. 105 samples were selected from 28 dredge operations; however sulfides of significance were only recovered from one dredge (DR19) at Fonualei Central.

In 2009, Nautilus Minerals also acquired water column geochemical data in the Woodlark Basin and Solomon Islands in order to define prospective areas. Nautilus Minerals has continued to improve its technology for measuring water column geochemistry in order to identify anomalous plumes that may be related to active hydrothermal systems. In collaboration with academic research institutes, Nautilus Minerals has been able to participate in the deployment of autonomous underwater vehicles (AUVs) and is able to efficiently identify prospective areas in its large tenement holdings.

Nautilus Minerals has proposed additional exploration programs in the future to further assess their tenement holdings. In addition to the ongoing drilling program, Nautilus Minerals is planning several target generation cruises during2012, focusing on PNG and Tonga. The target generation work is planned to involve shipboard multi-beam in prospective areas currently lacking sufficient bathymetry; autonomous underwater vehicle (AUV) surveys over key targets identified previously; camera tows and seafloor sampling.

SRK Consulting (Australasia) Pty Ltd (SRK) is of the view that the tenements are sufficiently prospective to warrant exploration at the budgetary levels indicated, with the techniques and programs presented to SRK during the assessment. In SRK's opinion, the directors and staff of Nautilus Minerals have the appropriate technical and management expertise to manage the proposed exploration program.

For this independent geological assessment, SRK has:

- reviewed previous exploration works and technical literature;
- conducted six site visits to some of the granted tenements in PNG and Tonga;
- independently verified sampling procedures, sample integrity and sample security;
- reviewed various Company reports as appropriate; and
- reviewed the proposed exploration program for 2012.

This Report conforms to the reporting requirements of National Instrument 43-101 (Standards of Disclosure for Mineral Deposits) and 43-101F1 guidelines provided by the Canadian Securities Administrators.

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List of Abbreviations

Abbreviation	Meaning
°C	degrees Celsius
ANZECC/ARMCANZ	Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand
AUV	Autonomous Underwater Vehicle
bcm	bank cubic metre
BD	bulk density
BSL	below sea level
C	cohesion
CAPEX	capital expenditure
Coffey	Coffey Natural Systems (Australia)(now Coffey Environments)
CCZ	Clarion-Clipperton Zone
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTD	conventional tailings disposal
dB	decibels
DEC	Department of Environment and Conservation
DPS	dynamic positioning system
DTM	digital terrain model
E	East
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIR	Environmental Inception Report
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management System
E–W	east-west
FoS	Factor of Safety
GBI	geotechnical blockiness index
GDM	geotechnical domain model
GIS	geographic information system
GSBW	geotechnical safety berm width
Hr	hydraulic radius
IFC	International Finance Corporation
IMO	International Maritime Organisation
IRA	inter ramp angle
k	thousand
kL	kilolitre
km	kilometre
km^2	square kilometre
KORDI	Korea Ocean Research & Development Institute
kt	kilotonne
LOSA	limiting overall slope angle
m	metre

Abbreviation	Meaning
M	million
m RL	metres reduced level
m/s	metre per second
m^3	cubic metre
MARPOL	International Convention for the Prevention of Pollution from Ships
mE	metres east
mN	metres north
MRMR	Mining Rock Mass Rating
mS	metres south
N	North
Nautilus Minerals	Nautilus Minerals Incorporated
NE	northeast
NGO	Non Government Organizations
NPV	net present value
NW	Northwest
OPEX	operating expenditure
OS	oversize
PGE	platinum group element
PMF	probable maximum flood
PNG	Papua New Guinea
Q	Barton Q value
Q’	modified Q value
RMR	rock mass rating
ROM	run of mine
RQD	rock quality designation
S	South
SE	Southeast
SI	International System of Units
SMS	Seafloor Massive Sulfide
SPREP	Convention for the Protection of the Natural Resources and Environment of the South Pacific Region
SRK	SRK Consulting (Australasia) Pty Ltd
S-SE	South-Southeast
SW	southwest
t	tonne
tpa	tonnes per annum
UNCLOS	United Nations Convention on the Law of the Sea
VHMS	Volcanic-hosted massive sulfide
W	West
WBS	Work Breakdown Structure
WHO	World Health Organisation
W-NW	West-Northwest
XRF	X-Ray Fluorescence

1 Introduction and Scope of Report

SRK Consulting Australasia Pty Ltd ("SRK") has been commissioned by Nautilus Minerals Incorporated ("Nautilus Minerals") to provide an independent technical assessment of mineral exploration tenements located in the maritime Exclusive Economic Zone (EEZ) of Papua New Guinea, Fiji, Tonga, Solomon Islands, New Zealand and Vanuatu. These tenements are either known to host, or are considered prospective for, Cu-Zn-Pb-Ag-Au SMS mineralisation.

1.1 Scope of Work

This Report covers the exploration potential, exploration targeting, completed exploration works and exploration program for the tenements held or applied for by Nautilus Minerals up to 31 December 2011.

These tenements are located in the following regions:

- the Solomon Sea and New Ireland Arc areas of Papua New Guinea;
- the Lau Basin of Tonga;
- the North Fiji Basin of Fiji;
- areas to the southwest and south of New Georgia Islands and east of the Malaita, San Crisotobal and Santa Cruz Islands in the Solomon Islands;
- the Havre Trough of New Zealand;
- Vanuatu; and
- The Clarion-Clipperton Zone in the East Pacific.

Nautilus Minerals requested that this Report conform to the reporting requirements of National Instrument 43-101 (Standards of Disclosure for Mineral Deposits) and 43-101F1 guidelines provided by the Canadian Securities Administrators. This present Report is an update of a previous SRK Report entitled "Nautilus Minerals Inc. NI43-101 Technical Report 2010 PNG, Tonga, Fiji, Solomon Islands and New Zealand" (Jankowski, 2011), and includes information on exploration reconnaissance in Tonga; and exploration in the Solomon Islands.

For this Report, SRK has:

- reviewed previous exploration works and technical literature;
- conducted six site visits to some of the granted tenements in PNG and Tonga;
- independently verified sampling procedures, sample integrity and sample security;
- reviewed various company reports as appropriate; and
- reviewed the proposed exploration budget and program for 2012 to 2013.

1.2 Sources of Information

SRK has derived the technical information that forms the basis of this Report from Nautilus Minerals. SRK has supplemented this information where necessary with information from its own extensive regional geological database. However, if discrepancies arise and no alternative comments are provided, the discrepancy is noted and the data and interpretations provided by Nautilus Minerals prevail in this report. The exploration history for these tenements has been derived from previous explorers' reports, as provided by Nautilus Minerals. SRK has not conducted its own independent data searches.

1.3 Site Visits

The following professionals, associated with SRK at the time, have made the following site visits to Nautilus Mineral's exploration programs. The Phil Jankowski site visit to Tonga pertains to the Property defined for this Technical Report; whilst the other site visits pertain to a neighboring Nautilus Minerals Property (the Bismarck Sea) where the SMS exploration methods and techniques have been observed.

SRK completed an initial site visit of some of the tenements from 24 February to 9 March 2005, on the geophysical survey vessel *MV Genesis*. On this visit, exploration targeting, remote-data gathering and sampling methods were reviewed.

Paul Hodkiewicz visited Solwara 1 in PNG between 31 January and 4 February 2006 on the *DP Hunter*, and witnessed Remotely Operated Vehicle (ROV) sampling and core drilling from the surface.

Phil Jankowski visited Solwara 2 between 24 July and 30 July 2006 on the research vessel *RV Melville*, and witnessed ROV grab sampling, bathymetry measurements, Autonomous Underwater Vehicle (AUV) operations, sub-sampling and sample dispatch.

Phil Jankowski also visited the Valu Fa 1 prospect in Tonga on the *MV NorSky* between 20 September and 3 October 2008, and witnessed ROV traversing, grab sampling, sample retrieval and processing, and geophysical data gathering;

Phil Jankowski also visited the Solwara 12 prospect in PNG between 25 and 30 January 2011 and witnessed core retrieval, geological logging, sampling and ROV-mounted core drilling on the *REM Etive*.

Bruce Sommerville visited Solwara 1 on the *MV Wave Mercury* between 15 August 2007 and 16 August 2007 and witnessed core retrieval, geological logging, sampling and ROV-mounted core drilling associated with the metallurgical drilling campaign. SRK has not visited any of the tenements in Fiji, the Solomon Islands, New Zealand, Vanuatu or the Clarrion-Cliperton Zone.

1.4 Qualifications of SRK and authors

SRK is an international mining industry consulting company that has been providing services and high-level technical and financial advice to the mining industry since 1975. SRK has fully staffed independent offices in all major mining centres of the world. This Report was authored by Phil Jankowski, *MSc MAusIMM(CP)*, Associate Consultant of SRK.

Mr Jankowski has 23 years' experience in open pit and underground mine geology and grade control, exploration and resource development. He has experience in a wide variety of deposit types including Archaean lode-gold deposits, tantalum-tin deposits, base metal, copper, epithermal porphyry Cu-Au, nickel and bauxite. Mr Jankowski is a Member and Chartered Professional of the AusIMM.

1.5 Statement of SRK independence

Neither SRK nor any of the authors of this Report have any material, present or contingent, interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of SRK. SRK has no beneficial interest in the outcome of the Report being capable of affecting its independence. SRK's fee for completing this Report is based on its normal professional daily rates plus reimbursement of incidental expenses. The payment of SRK's professional fee is not contingent upon the outcome of this Report.

SRK has completed seven previous reports on Nautilus Minerals' tenements:

- Independent Technical Assessment of Exploration Tenements in the Bismarck Sea and the Solomon Sea, Papua New Guinea (Clark, Hodkiewicz and Williams, 2005). This report covered the PNG tenements that are also reported on in this Report;
- Independent Technical Assessment of Sea Floor Massive Sulfide Exploration Tenements in Papua New Guinea, Fiji and Tonga (Jankowski and Hodkiewicz, 2006). This report covered the PNG, Fiji and Tonga tenements that are also reported on in this Report;
- Independent Technical Assessment of Sea Floor Massive Sulfide Exploration Tenements in Papua New Guinea, Fiji, Tonga, Solomon Islands and New Zealand (Bucci and Hodkiewicz, 2008). This report covered the PNG, Fiji, Tonga, Solomon Islands and New Zealand tenements that are also reported on in this Report;
- Independent Technical Assessment of Sea Floor Massive Sulfide Exploration Tenements in Papua New Guinea, Fiji, Tonga, Solomon Islands and New Zealand (Jankowski *et al.*, 2009). This report covered the PNG, Fiji, Tonga, Solomon Islands and New Zealand tenements that are also reported on in this Report;
- Nautilus Minerals Inc. NI 43-101 Technical Report 2009 PNG, Tonga, Fiji, Solomon Islands and New Zealand (Jankowski, 2010). This report covered the PNG, Fiji, Tonga, Solomon Islands and New Zealand tenements that are also reported on in this Report;
- Nautilus Minerals Inc. NI 43-101 Technical Report June 2010 PNG, Offshore Production System Definition and Cost Study (Blackburn *et al*., 2010); and
- Nautilus Minerals Inc. NI 43-101 Technical Report 2010 PNG, Tonga, Fiji, Solomon Islands and New Zealand (Jankowski, 2011). This report covered the PNG, Fiji, Tonga, Solomon Islands and New Zealand tenements that are also reported on in this Report.

1.6 Warranties

Nautilus Minerals has represented in writing to SRK that full disclosure has been made of all material information and that, to the best of its knowledge and understanding, such information is complete, accurate and true.

1.7 Consents

Phil Jankowski is the Qualified Persons for this Report and consents to the filing of this Report with the relevant securities commission, stock exchange and other regulatory authorities as may be determined by Nautilus including general publication in hardcopy and electronic formats to shareholders and to the public.

This consent is provided on the basis that the technical assessments expressed in the Summary and in the individual sections of this Report are considered with, and not independently of, the information set out in the complete Report.

1.8 Units

Distances, lengths, weights and areas are expressed in SI units (otherwise known as metric units). Distances are approximate and if less than 1000m quoted to the nearest 10m. Grades or concentrations are stated in percent (%) or parts per million (ppm) or as appropriate (1% = 10,000 ppm).

Unless otherwise noted, monetary amounts stated as dollars refer to United States Dollars (USD). The national currency of Papua New Guinea is the Kina (PGK). The February 2012 exchange rate was approximately USD0.47 per PGK1. The national currency of Fiji is the Fiji Dollar (FJD). The February 2012 exchange rate was approximately USD0.57 per FJD1. The national currency of Tonga is the Tongan Pa'anga (TOP). The February 2012 exchange rate was approximately USD0.60 per TOP1. The national currency of Solomon Islands is the Solomon Dollar (SBD). The February 2012 exchange rate was approximately USD0.14 per SBD1. The national currency of New Zealand is the New Zealand Dollar (NZD). The February 2012 exchange rate was approximately USD0.83 per NZD1. The national currency of Vanuatu is the Vatu (VUV). The February 2012 exchange rate was approximately USD0.01 per VUV1.

2 Reliance on Other Experts

The opinions expressed in this Report have been based on the information supplied to SRK by Nautilus Minerals. The opinions in this Report are provided in response to a specific request from Nautilus Minerals. SRK has exercised all due care in reviewing the supplied information.

Unless otherwise noted, all illustrations in this Report were supplied by Nautilus Minerals.

3 Property Description and Location

The A summary of Nautilus Minerals' total tenement position as at 31 December 2011, in the South West Pacific and East Pacific regions, but excluding their other Bismarck Sea Property, is presented in Table 3-1 (the Property).

Table 3-1: Nautilus Minerals' South West Pacific & East Pacific tenements and tenement applications

Location	No.	Total area	Granted	Granted area (km^2)	Applications	Application area (km^2)
PNG - Woodlark Area	16	21,281	13	13,609	3	7,672
PNG - New Ireland Arc	6	15,345	0	0	6	15,345
Solomon Islands	92	50,102	92	50,102	0	0
Tonga	46	209,441	16	77,563	30	131,878
Fiji	17	63,087	14	58,243	3	4,844
New Zealand	2	56,283	0	0	2	56,283
Vanuatu	55	4,877	41	3,630	14	1,247
ISA - CCZ nodules	1	74,713	0	0	1	74,713
Total	**235**	**495,129**	**176**	**203,147**	**59**	**291,982**

3.1 Papua New Guinea (PNG)

3.1.1 Tenement details

The Papua New Guinea *Mining Act 1992* is the principal policy and regulatory document governing the exploration, development, processing and transport of minerals in PNG. It vests ownership of all minerals in or below the surface of land with the State, and governs exploration and mining activities. The *Mining Act* allows exploration activities and mining of minerals to be undertaken on the seafloor within PNG territorial waters.

As of 31 December 2011, Nautilus Minerals' New Ireland Arc project area comprised 6 exploration licence applications covering approximately 15,345 km^2 (Figure 3-1).

As of 31 December 2011, Nautilus Minerals' Woodlark Basin Project Area comprised 13 granted Exploration Licences and 3 Exploration Licence applications (Figure 3-2). The granted Woodlark Basin ELs cover approximately 13,609km2 and the EL application areas cover approximately 7,672 km^2.

Figure 3-1: Nautilus Minerals' tenements and tenement applications in the New Ireland arc area of PNG

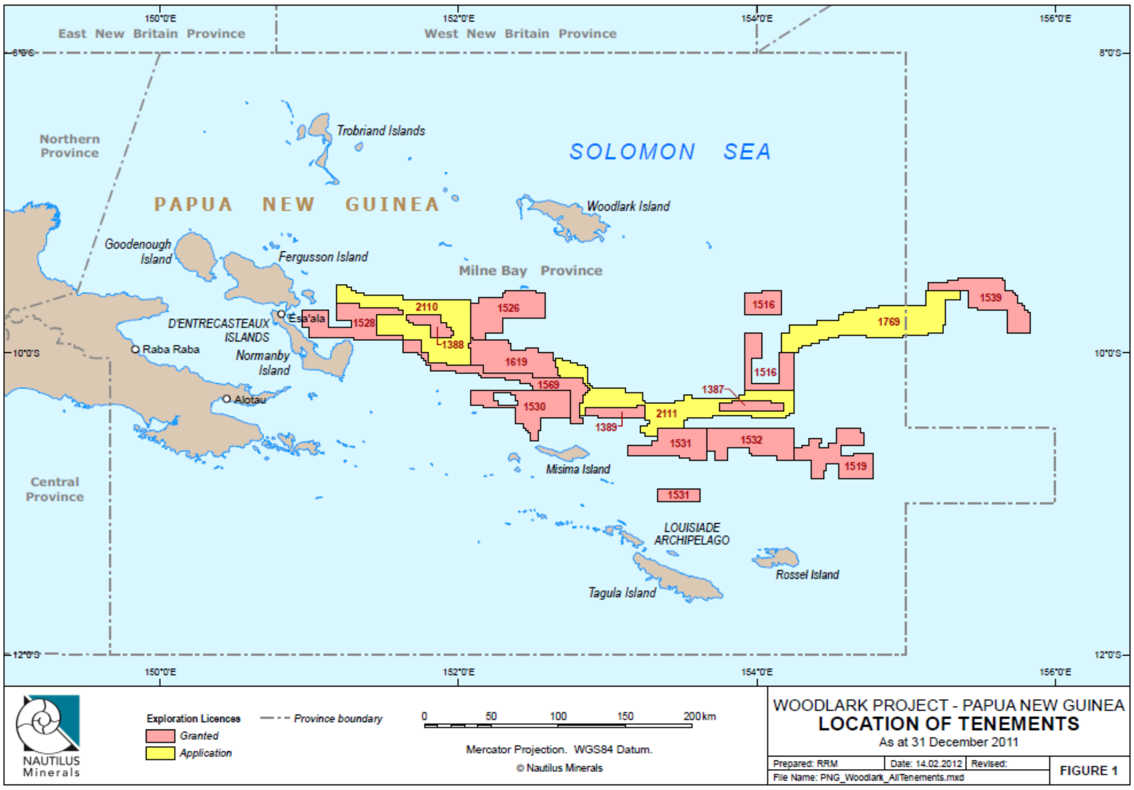


Figure 3-2: Nautilus Minerals' tenements and tenement applications in the Woodlark Basin, PNG

Table 3-2: Nautilus Minerals' PNG tenements and tenement applications

EL	Name	Area km^2	Grant date	Expiry date	Application fee (PGK)	Expenditure commitment (PGK)		Annual rent (PGK)	
						2012	2013	2012	2013
EL 1387	Woodlark Basin East	320.54	14/09/2005	13/09/2013	5,000	188,000	188,000	44,180	44,180
EL 1388	Woodlark Basin West	320.54	14/09/2005	13/09/2013	5,000	188,000	188,000	44,180	44,180
EL 1389	Woodlark Basin Central	320.54	14/09/2005	13/09/2013	5,000	188,000	188,000	44,180	44,180
EL 1516	Pocklington 1	1278.75	3/11/2008	2/11/2012	5,000	375,000	376,000	67,500	88,360
EL 1519	Pocklington 4	1278.75	3/11/2008	2/11/2012	5,000	375,000	376,000	67,500	88,360
EL 1526	Woodlark 8	1278.75	3/11/2008	2/11/2012	5,000	375,000	376,000	67,500	88,360
EL 1528	Woodlark 10	1278.75	3/11/2008	2/11/2012	5,000	375,000	376,000	67,500	88,360
EL 1530	Woodlark 12	1278.75	3/11/2008	2/11/2012	5,000	375,000	376,000	67,500	88,360
EL 1531	Woodlark 13	1278.75	3/11/2008	2/11/2012	5,000	375,000	376,000	67,500	88,360
EL 1532	Woodlark 14	1278.75	3/11/2008	2/11/2012	5,000	375,000	376,000	67,500	88,360
EL 1539	Woodlark 21	1278.75	3/11/2008	2/11/2012	5,000	375,000	376,000	67,500	88,360
EL 1569	Woodlark 23	1138.94	29/05/2008	28/05/2012	5,000	334,000	334,000	60,120	78,490
EL 1619	Woodlark 24	1278.75	29/05/2008	28/05/2012	5,000	375,000	376,000	67,500	88,360
EL 1769	Woodlark 25	2557.5	Application		5,000	300,000	300,000	67,500	67,500
EL 1921	Mahur Island	2557.5	Application		5,000	300,000	300,000	67,500	67,500
EL 1922	Boang Island	2557.5	Application		5,000	300,000	300,000	67,500	67,500
EL 1923	Ambitle Island	2557.5	Application		5,000	300,000	300,000	67,500	67,500
EL 1924	Tabar Island	2557.5	Application		5,000	300,000	300,000	67,500	67,500
EL 1925	Nissan Island	2557.5	Application		5,000	300,000	300,000	67,500	67,500
EL 1926	Simberi Island	2557.5	Application		5,000	300,000	300,000	67,500	67,500
EL 2110	Woodlark 26	2557.5	Application		5,000	300,000	300,000	67,500	67,500
EL 2111	Woodlark 27	2557.5	Application		5,000	300,000	300,000	67,500	67,500
Total Granted Area (km^2)		**13,609**							
Total Application Area (km^2)		**23,018**							

3.1.2 Exploration Licences

An Exploration Licence (EL) is granted for a period of two years and is renewable for a further period of two years, with a 50% reduction in area at the end of the initial period. The base unit of area for a PNG EL is the sub-block (~3.41 km^2). The maximum size over which an EL can be granted is 750 sub-blocks; approximately 2,555 km^2. If successive reductions reduce an EL to 30 sub-blocks or fewer, no further reductions are required. If successive reductions reduce an EL to between 30 and 75 sub-blocks, the holder may apply to the Mineral Resources Authority (MRA) to waive or vary the requirement to make further reductions. If the MRA is satisfied that special circumstances justify retention of more than 30 sub-blocks, the MRA may waive or vary the requirement to reduce area, but the total area after the waiver or variation shall not exceed 75 sub-blocks. Successful renewal is dependent upon the holder having complied with the provisions of the Papua New Guinea *Mining Act 1992*. Under the *Mining Act 1992*, an EL grants the right to exclusive occupancy for exploration purposes over the area identified in the EL to the holder. This includes the surface and any ground beneath the surface of the land and any offshore areas identified in the EL, being the seabed underlying the territorial sea from the mean low water spring level of the sea to such depth as required for the exploration or mining of minerals.

An EL permits the holder to extract, remove and dispose of such quantity of rock, earth, soil or minerals as may be permitted by the approved program subject to the requirements that all cores and drilling samples shall be preserved. The EL authorises the holder to do all other things necessary or expedient for the undertaking of exploration and confers to the holder priority over other parties when applying for mining rights.

3.1.3 Mining Leases

A Mining Lease (ML) is granted for an initial term not exceeding 20 years under the PNG *Mining Act 1992*. The Minister may, after considering a recommendation from the MRA Board, extend the term of the ML for a period or periods not exceeding 10 years, as the Minister determines.

Holders of MLs are authorised, in accordance with the *Mining Act 1992* and *Mining (Safety) Act 1977* and any other conditions attached thereto, to:

- enter and occupy the Mining Lease for the purpose of mining the minerals on that land and carry on such operations and undertake such works as may be necessary or expedient for that purpose;
- construct a treatment plant on that land and treat any mineral derived from mining operations, whether on that land or elsewhere, and construct any other facilities required for treatment including waste dumps and tailings dams;
- take and remove rock, earth, soil and minerals from the land, with or without treatment;
- take and divert water situated on or flowing through such land and use it for any purpose necessary for mining or treatment operations subject to and in accordance with the *Water Resources Act 1982*; and
- do all other things necessary or expedient for the undertaking of mining or treatment operations on that land.

The holder of an ML is entitled to the exclusive occupancy for mining and mining purposes of the land in respect of which the ML was granted; and owns all minerals lawfully mined from that land.

3.1.4 Tenement survey

Under the *Mining Act 1992*, an applicant for an ML is to mark out each corner of the land over which the ML is sought by erecting a distinctively coloured post standing at least 1.2 m above the surface. In the case of ML154, four metal posts that conform to the Mining Act, labelled with coordinates marking the four corners of the ML, were deployed on the seafloor.

ELs are not required to be surveyed under the *Mining Act 1992*. The area of an EL comprises blocks and sub-blocks, measuring five minutes of latitude by five minutes of longitude and one minute of longitude by one minute of latitude, respectively. The surface area of a sub-block is variable depending on its latitude. At PNG latitudes of a sub-block are generally around 3.41 km^2.

3.1.5 Royalty

The royalty payable to the State of PNG under the Papua New Guinea *Mining (Royalties) Act 1992* is 2% of the net smelter return on all minerals produced, and 0.25% for the Mineral Resources Authority (MRA).

3.1.6 Environmental deposits

A security deposit of PGK6,000 is lodged upon grant for each Exploration Licence in PNG. When a Mining Lease is granted, a security deposit of PGK48,000 applies.

3.1.7 Legal requirements

Prior to commencing either onshore construction activities or seafloor mining operations, Mining Lease and an Environmental Permit must be granted in accordance with the *Mining Act 1992* and the *Environment Act 2000*, respectively. The application process requires, inter alia, the submission of a Mining Feasibility Plan and approval of an Environmental Permit.

Nautilus Minerals has, in the first instance, used local PNG legislation and requirements as reference standards. However, where local requirements were inadequate or non-existent, requirements laid down in the Equator Principles and other internationally recognised standards and guidelines were used. Nautilus Minerals also took cognisance of international conventions and maritime law requirements.

3.2 Tonga

3.2.1 Tenement details

The Royal Proclamation of 1887 declared Tonga's jurisdiction over approximately 394,000 km^2 of ocean area, defined as being between latitude 15°S and 23°30'S and longitude 173°W and 177°W. Under current international legal arrangements, Tonga is entitled to a much larger EEZ of approximately 700,000 km^2, and although Tonga has not formally declared such a zone, most international arrangements to which it is a party function as if it had.

Nautilus Minerals has 16 granted Prospecting Licences (PL) (Figure 3-3) within the 1887 Proclamation Area of the Kingdom of Tonga. In addition, Nautilus Minerals has 30 applications for PLs which are located both within and outside the 1887 Proclamation Area (Table 3-3).

3.2.2 Rights of a Holder of a PL

Under the *Minerals Act 1988*, a PL authorises the holder to exclusive occupancy of the area of the PL for the purposes of exploration, provided the prospecting licence is held by either a Tongan citizen or company, or a citizen of a company registered in the British Commonwealth. Nautilus Minerals has made its applications through Nautilus Minerals Offshore, which is registered in

Vanuatu and 100% owned by Nautilus Minerals Inc. Both Vanuatu and Canada are members of the British Commonwealth.

In addition to the *Minerals Act 1988*, relevant sections of the *Petroleum Mining Act* are also used to administer offshore Prospecting Licences.

PLs are issued for a period of two years and can be renewed, provided the holder has complied with its work program as specified under the *Minerals Act 1988*. The conditions attaching to Nautilus Minerals' granted PLs do not include a requirement to reduce the area upon renewal. Renewal applications were lodged in 2009 and were subsequently renewed for a further period of four years.

The PL grants priority to the holder for the issuance of a Mining Lease, on either expiry of the PL or application for a Mining Lease, subject to meeting the conditions of the PL, and any conditions considered applicable by the Minister of Lands, Survey and Natural Resources.

The *Minerals Act 1988* does not specify any annual rental fees for PLs, the only fee being a TOP500 application fee for each PL. Nautilus Minerals' original proposed work program covered all 18 of the original PL applications, with a total two year expenditure commitment of TOP6.2M. The program for 2010 and 2011 covered all 16 granted PLs with proposed expenditure of USD2M in each year (i.e. two applications were not granted).

3.2.3 Royalty

Mining royalties are payable to the Kingdom of Tonga under the *Minerals Act 1988* based on the value of production net of all mining, processing, transportation, marketing and related costs. The rates are set at 5% net value for gold, and 1% net value for other minerals.

3.2.4 Environmental Liabilities and Permits

The Tongan tenements are not subject to any environmental liabilities or rehabilitation performance bonds.

Table 3-3: Nautilus Minerals' offshore tenements and applications in the Kingdom of Tonga

Lease	Area km^2	Granted	Expiry	Application fee (TOP)	Expenditure commitment (TOP)	
					2012	2013
East Late No 1	4872	2/11/2007	2/11/2013	500	236,000	236,000
East Late No 2	4854	2/11/2007	2/11/2013	500	236,000	236,000
Late No 1	4893	2/11/2007	2/11/2013	500	236,000	236,000
Late No 2	4869	2/11/2007	2/11/2013	500	236,000	236,000
Late No 3	4834	2/11/2007	2/11/2013	500	236,000	236,000
Niuafo ou No 1	4955	2/11/2007	2/11/2013	500	236,000	236,000
Niuafo ou No 2	4944	2/11/2007	2/11/2013	500	236,000	236,000
Niuafo ou No 3	4919	2/11/2007	2/11/2013	500	236,000	236,000
Niuafo ou No 4	4959	2/11/2007	2/11/2013	500	236,000	236,000
Valu Fa No 1	4798	2/11/2007	2/11/2013	500	236,000	236,000
Valu Fa No 2	4772	2/11/2007	2/11/2013	500	236,000	236,000
Valu Fa No 3	4742	2/11/2007	2/11/2013	500	236,000	236,000
West Late No 1	4578	2/11/2007	2/11/2013	500	236,000	236,000
West Late No 2	4903	2/11/2007	2/11/2013	500	236,000	236,000
West Late No 3	4886	2/11/2007	2/11/2013	500	236,000	236,000
WVFa1	4785	2/11/2007	2/11/2013	500	236,000	236,000

Lease	Area km²	Granted	Expiry	Application fee (TOP)	Expenditure commitment (TOP)	
					2012	2013
East Late No 3	4886	Application		500	122,039	122,039
East Late No 4	4879	Application		500	122,039	122,039
East Late No 5	4861	Application		500	122,039	122,390
East Late No 6	4838	Application		500	122,039	122,039
East Late No 7	4811	Application		500	122,039	122,039
East Late No 8	1591	Application		500	122,039	122,039
Late No 4	4827	Application		500	192,000	192,000
Late No 5	4824	Application		500	122,039	122,039
NE Lau No 2	4969	Application		500	122,039	122,039
NE Lau No 1	4641	Application		500	192,000	192,000
Niuafo ou No 5	3932	Application		500	192,000	192,000
Niuafo ou No 6	4951	Application		500	192,000	192,000
Niuafo ou No 7	4954	Application		500	122,039	122,039
Niuafo ou No 8	4903	Application		500	122,039	122,039
NW Lau No 5	4963	Application		500	122,039	122,039
NW Lau No 6	1322	Application		500	130,000	130,000
NW Lau No 7	2639	Application		500	130,000	130,000
NW Lau No 1	2962	Application		500	192,000	192,000
NW Lau No 2	4945	Application		500	192,000	192,000
NW Lau No 3	4288	Application		500	192,000	192,000
NW Lau No 4	4962	Application		500	192,000	192,000
SW Lau No 1	4712	Application		500	122,039	122,039
SW Lau No 2	4699	Application		500	122,039	122,039
SW Lau No 3	4684	Application		500	122,039	122,039
SW Lau No 4	4669	Application		500	122,039	122,039
SW Lau No 5	4652	Application		500	122,039	122,039
West Late No 4	4873	Application		500	192,000	192,000
WV Fa No 2	4124	Application		500	192,000	192,000
WV Fa No 3	4782	Application		500	192,000	192,000
WV Fa No 4	4735	Application		500	122,039	122,039
Total Granted Area (km²)	**77,563**					
Total Application Area (km²)	**131,878**					

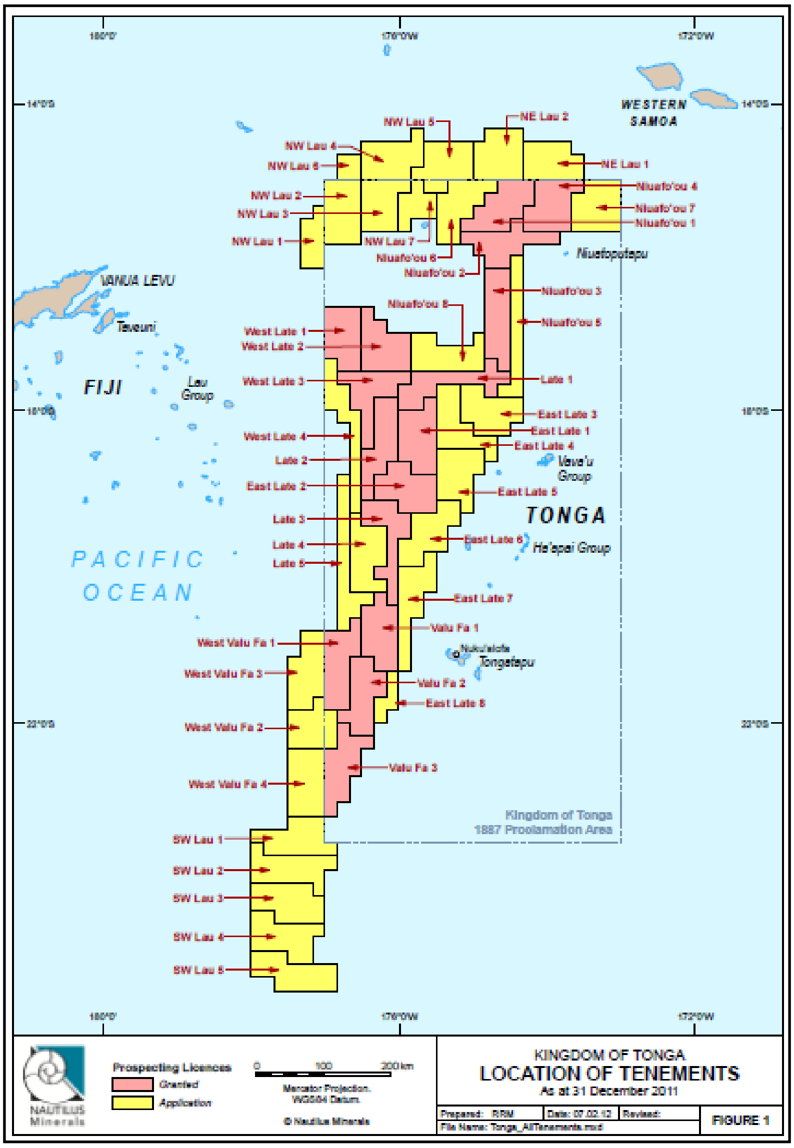


Figure 3-3: Nautilus Minerals' Prospecting Licences in Tonga

3.3 Fiji

3.3.1 Tenement details

Nautilus Minerals originally applied for 14 Special Prospecting Licences (SPLs) in the North Fiji Basin in the Exclusive Economic Zone of Fiji, but a change in legislation in 2010 necessitated the splitting and/ or re-lodgement of all applications. Consequently, the Company lodged 17 SPL applications. SPLs in Fiji are granted for a period of up to two years and are renewable for periods of two years. There is no automatic requirement to relinquish ground on renewal, provided that the tenement conditions have been met in full, and annual expenditure commitments have exceeded requirements. Terms and conditions attached to the SPLs are determined by the Minister of Mines. Tenements do not necessarily have to be surveyed prior to grant, which is dependent upon whether the Minister of Mines is satisfied that there are no land use conflicts.

In August 2011, 14 of the 17 SPLs were granted to Nautilus Minerals for an initial period of two years. The area of granted SPLs is approximately 58,243 km^2, while those still under application cover an area of approximately 4,844 km^2 (Table 3-4; Figure 3-4).

3.3.2 Rights of a Holder of an SPL

The *Continental Shelf Act 1987* and the *Fiji Constitution 1997* enables the *Mining Act 1978* to control the exploration and exploitation of minerals within Fiji's Exclusive Economic Zone. Under the *Mining Act*, an SPL authorises the holder to have exclusive occupancy for exploration purposes of the area identified in the SPL licence, provided that the work is completed under the direction or supervision of the holder of a current Fiji Prospector's Right. The SPL grants priority to the holder for the issuance of a Mining Lease, subject to submission of a comprehensive Feasibility Study that demonstrates the commercial and technical viability of the project. Submission of a Development Agreement is also required. Mining Leases can be granted for periods of between 5 and 21 years, and SPLs can be granted for a period of up to two years, at the discretion of the Minister. There is a right to renew for both.

3.3.3 Royalty

The royalty payable to the State under the *Fiji Mining Act 1978* comprises a royalty and Export Tax; the combined total of which will not exceed 5% free on board (FOB) for all minerals other than iron and bauxite, for which the maximum is 3%. Gold and silver have a 3% FOB Export Tax payable on export, but this is included as part of the overall 5% royalty rate.

3.3.4 Environmental Liabilities and Permits

Environmental requirements are yet to be confirmed by the Mineral Resources Department (MRD). A performance bond equivalent to 10% of the proposed exploration expenditure has been lodged with the MRD.

Table 3-4: Nautilus Minerals' Fiji tenement applications

Name	Area (km^2)	Grant Date	Expiry Date	Appl. fee (FJD)	Expenditure Commitment (FJD)		Annual Rental (FJD)	
					2012	2013	2012	2013
Fiji Fracture Zone 1	3307.92	4/08/2011	3/08/2013	947	100,000	200,000	63,924	63,924
Fiji Fracture Zone 2	1890.24	4/08/2011	3/08/2013	947	100,000	200,000	36,528	36,528
Fiji Fracture Zone 3	5907	4/08/2011	3/08/2013	947	100,000	200,000	114,150	114,150
Fiji Fracture Zone 4	5670.72	4/08/2011	3/08/2013	947	100,000	200,000	109,584	109,584
Fiji Fracture Zone 5	4725.6	4/08/2011	3/08/2013	947	100,000	200,000	91,320	91,320
Futuna SC 1	2480.94	4/08/2011	3/08/2013	947	100,000	200,000	47,943	47,943
Hunter Ridge 1	3544.2	4/08/2011	3/08/2013	947	100,000	200,000	68,490	68,490
North Cikobia SC	4489.32	4/08/2011	3/08/2013	947	100,000	200,000	86,754	86,754
North Fiji Basin 3	236.28	4/08/2011	3/08/2013	947	100,000	200,000	4,566	4,566
Peggy Ridge 1	5907	4/08/2011	3/08/2013	947	100,000	200,000	114,150	114,150
Peggy Ridge 2	5316.3	4/08/2011	3/08/2013	947	100,000	200,000	102,735	102,735
Peggy Ridge 3	4725.6	4/08/2011	3/08/2013	947	100,000	200,000	91,320	91,320
Peggy Ridge 4	4725.6	4/08/2011	3/08/2013	947	100,000	200,000	91,320	91,320
Peggy Ridge 5	5316.3	4/08/2011	3/08/2013	947	100,000	200,000	102,735	102,735
North Fiji Basin 1	472.56	Application		947	100,000	200,000	9,132	9,132
North Fiji Basin 2	3544.2	Application		947	100,000	200,000	68,490	68,490
North Fiji Basin 4	826.98	Application		947	100,000	200,000	15,981	15,981
Total Granted Area (km^2)	**58,243**							
Total Application Area (km^2)	**4,844**							

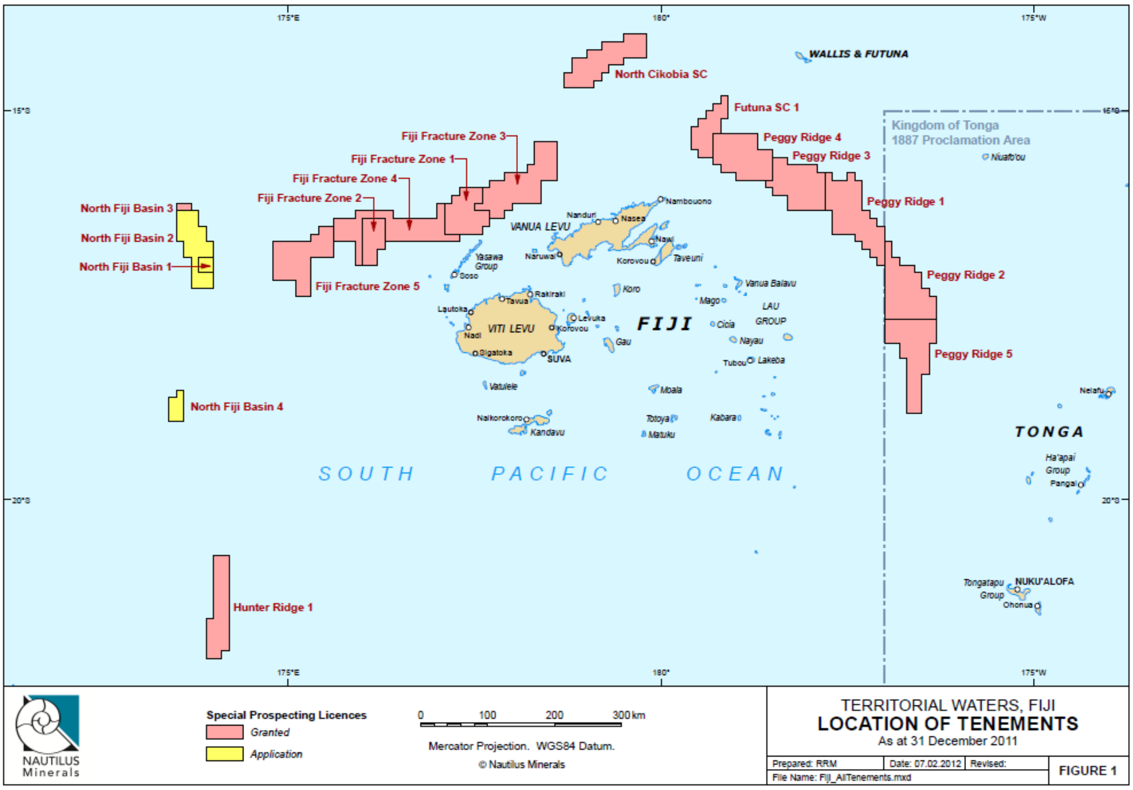


Figure 3-4: Nautilus Minerals' Special Prospecting Licences in Fiji

3.4 Solomon Islands

3.4.1 Tenement details

Nautilus Minerals holds 92 granted Prospecting Licences (PLs) covering an area of 50,102 km^2 in the Solomon Islands, to the west and south of the New Georgia group of islands. In addition, 67 PL applications were granted in the east Solomon Islands in July 2011 (Figure 3-5; Figure 3-6). Tenement details are shown in Table 3-5.

Under the Solomon Islands *Mines and Minerals Act 1990* and the *Mines and Minerals Regulations 1996*, every holder of a PL is required to report on prospecting activities quarterly and annually. A PL is granted for an initial period of three years; however at expiration, a PL holder may apply for a renewal of up to half of the initial area of the PL for a further two years. The Minerals Board may authorise renewal over a larger area if, in its opinion such authorisation would be in the national interest.

A Mining Lease is required for production, and may be granted for a maximum of 25 years and may be renewed for a further period not exceeding 10 years. Only the holder of a PL who has made a commercial discovery may apply for a Mining Lease over the area covered by their PL and in respect of a mineral allowed to be exploited under the PL. The grant of the mining lease is dependent on the Minister being satisfied that the proposed mining plan ensures the efficient and beneficial use of the mineral resources and adequate protection of the environment. The holder of a mining lease may be required to pay royalties, surface rental and compensation for damage, and a share of production, revenues, profits or equity capital to the Government of Solomon Islands. It may also be required to maintain an office in Solomon Islands with complete technical and financial records.

3.4.2 Environmental liabilities

The Mines and Minerals Board may require the holder of a Prospecting Licence to lodge a bond or guarantee with the Director for due performance; and on due performance of obligations under the *Mines and Minerals Act* the deposit will be refunded.

Table 3-5: Nautilus Minerals' offshore Prospecting Licenses in the Solomon Islands

PL	Name	Area km^2	Grant date	Expiry date	Appl. fee (SBD)	Expenditure commitment (SBD)		Annual rent (SBD)	
						2012	2013	2012	2013
PL 01/09	New Georgia 32	590	21/10/2009	20/10/2012	2,250	200,000	0	44,900	28,900
PL 02/09	New Georgia 33	590	21/10/2009	20/10/2012	2,250	200,000	0	44,900	28,900
PL 03/09	New Georgia 34	590	21/10/2009	20/10/2012	2,250	200,000	0	44,900	28,900
PL 04/09	New Georgia 35	590	21/10/2009	20/10/2012	2,250	200,000	0	44,900	28,900
PL 05/09	New Georgia 36	590	21/10/2009	20/10/2012	2,250	200,000	0	44,900	28,900
PL 06/09	New Georgia 37	590	21/10/2009	20/10/2012	2,250	200,000	0	44,900	28,900
PL 06/11*	East Solomons 1	538	19/07/2011	18/07/2014	2,250	30,000	200,000	22,720	29,400
PL 07/09	New Georgia 38	590	21/10/2009	20/10/2012	2,250	200,000	0	44,900	28,900
PL 07/11*	East Solomons 2	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 08/09	New Georgia 39	590	21/10/2009	20/10/2012	2,250	200,000	0	44,900	28,900
PL 08/11*	East Solomons 3	501	19/07/2011	18/07/2014	2,250	30,000	200,000	21,240	27,550
PL 09/09	New Georgia 40	590	21/10/2009	20/10/2012	2,250	200,000	0	44,900	28,900
PL 09/11*	East Solomons 4	591	19/07/2011	18/07/2014	2,250	30,000	200,000	24,840	32,050
PL 10/09	New Georgia 41	590	21/10/2009	20/10/2012	2,250	0	0	44,900	28,900
PL 10/11*	East Solomons 5	588	19/07/2011	18/07/2014	2,250	30,000	200,000	24,720	31,900
PL 11/09	New Georgia 42	590	21/10/2009	20/10/2012	2,250	200,000	0	44,900	28,900
PL 11/11*	East Solomons 6	596	19/07/2011	18/07/2014	2,250	30,000	200,000	25,040	25,040
PL 12/11	East Solomons 7	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 13/11	East Solomons 8	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 14/11	East Solomons 9	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 15/11	East Solomons 10	594	19/07/2011	18/07/2014	2,250	30,000	200,000	24,960	32,200
PL 16/11	East Solomons 11	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 17/11	East Solomons 12	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 18/11	East Solomons 13	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 19/11	East Solomons 14	594	19/07/2011	18/07/2014	2,250	30,000	200,000	24,960	32,200
PL 20/11	East Solomons 15	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 21/11	East Solomons 16	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 22/11	East Solomons 17	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 23/07	New Georgia 1	296	21/05/2007	20/07/2012	3,000	705,000	0	46,765	30,636
PL 23/11	East Solomons 18	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 24/07	New Georgia 2	296	21/05/2007	20/07/2012	3,000	705,000	0	46,765	30,636
PL 24/11	East Solomons 19	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 25/11	East Solomons 20	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 26/07^	New Georgia 9	296	21/05/2007	20/07/2012	3,000	0	0	0	0
PL 26/11	East Solomons 21	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 27/07^	New Georgia 10	296	21/05/2007	20/07/2012	3,000	0	0	0	0
PL 27/11	East Solomons 22	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100

PL	Name	Area km^2	Grant date	Expiry date	Appl. fee (SBD)	Expenditure commitment (SBD)		Annual rent (SBD)	
						2012	2013	2012	2013
PL 28/07^	New Georgia 11	296	21/05/2007	20/07/2012	3,000	0	0	0	0
PL 28/11	East Solomons 23	591	19/07/2011	18/07/2014	2,250	30,000	200,000	24,840	32,050
PL 29/11	East Solomons 24	591	19/07/2011	18/07/2014	2,250	30,000	200,000	24,840	32,050
PL 30/11	East Solomons 25	591	19/07/2011	18/07/2014	2,250	30,000	200,000	24,840	32,050
PL 31/11	East Solomons 26	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 32/11	East Solomons 27	591	19/07/2011	18/07/2014	2,250	30,000	200,000	24,840	32,050
PL 33/11	East Solomons 28	590	19/07/2011	18/07/2014	2,250	30,000	200,000	24,800	32,000
PL 34/07	New Georgia 17	296	21/05/2007	20/07/2012	3,000	705,000	0	46,765	30,636
PL 34/11	East Solomons 29	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	24,920
PL 35/07^	New Georgia 18	296	21/05/2007	20/07/2012	3,000	0	0	0	0
PL 35/11	East Solomons 30	590	19/07/2011	18/07/2014	2,250	30,000	200,000	24,800	32,000
PL 36/11	East Solomons 31	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 37/07	New Georgia 20	295	21/05/2007	20/07/2012	3,000	705,000	0	46,625	30,636
PL 37/11	East Solomons 32	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 38/11	East Solomons 33	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 39/07^	New Georgia 22	295	21/05/2007	20/07/2012	3,000	0	0	0	0
PL 39/11	East Solomons 34	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 40/07^	New Georgia 23	254	21/05/2007	20/07/2012	3,000	0	0	0	0
PL 40/11	East Solomons 35	590	19/07/2011	18/07/2014	2,250	30,000	200,000	24,800	32,000
PL 41/11	East Solomons 36	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 42/11	East Solomons 37	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 43/07	New Georgia 26	296	21/05/2007	20/07/2012	3,000	705,000	0	46,765	30,636
PL 43/11	East Solomons 38	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 44/07	New Georgia 27	296	21/05/2007	20/07/2012	3,000	705,000	0	46,765	30,636
PL 44/11	East Solomons 39	598	19/07/2011	18/07/2014	2,250	30,000	200,000	25,120	32,400
PL 45/11	East Solomons 40	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 46/11	East Solomons 41	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 47/11	East Solomons 42	589	19/07/2011	18/07/2014	2,250	30,000	200,000	24,760	31,950
PL 48/11	East Solomons 43	591	19/07/2011	18/07/2014	2,250	30,000	200,000	24,840	32,050
PL 49/11	East Solomons 44	578	19/07/2011	18/07/2014	2,250	30,000	200,000	24,320	31,400
PL 50/11	East Solomons 45	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 51/11	East Solomons 46	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 52/11	East Solomons 47	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 53/11	East Solomons 48	588	19/07/2011	18/07/2014	2,250	30,000	200,000	24,720	24,720
PL 54/11	East Solomons 49	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 55/07	New Georgia 30	286	27/08/2007	26/08/2012	2,250	166,666	166,666	30,440	45,365
PL 55/11	East Solomons 50	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 56/07	New Georgia 31	296	27/08/2007	26/08/2012	2,250	166,666	166,666	31,340	46,765
PL 56/11	East Solomons 51	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 57/11	East Solomons 52	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 58/11	East Solomons 53	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 59/11	East Solomons 54	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100

PL	Name	Area km^2	Grant date	Expiry date	Appl. fee (SBD)	Expenditure commitment (SBD)		Annual rent (SBD)	
						2012	2013	2012	2013
PL 60/11	East Solomons 55	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 61/11	East Solomons 56	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 62/11	East Solomons 57	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 63/11	East Solomons 58	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 64/11	East Solomons 59	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 65/11	East Solomons 60	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 66/11	East Solomons 61	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 67/11	East Solomons 62	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 68/11	East Solomons 63	591	19/07/2011	18/07/2014	2,250	30,000	200,000	24,840	32,050
PL 69/11	East Solomons 64	592	19/07/2011	18/07/2014	2,250	30,000	200,000	24,880	32,100
PL 70/11	East Solomons 65	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 71/11	East Solomons 66	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
PL 72/11	East Solomons 67	593	19/07/2011	18/07/2014	2,250	30,000	200,000	24,920	32,150
Total Granted Area (km^2)		**50,102**							

*PLs granted in error due to conflict, but withdrawal by Department had not been confirmed as at 31 December 2011

^PLs subject to surrender, but formal confirmation of surrender had not been received as at 31 December 2011

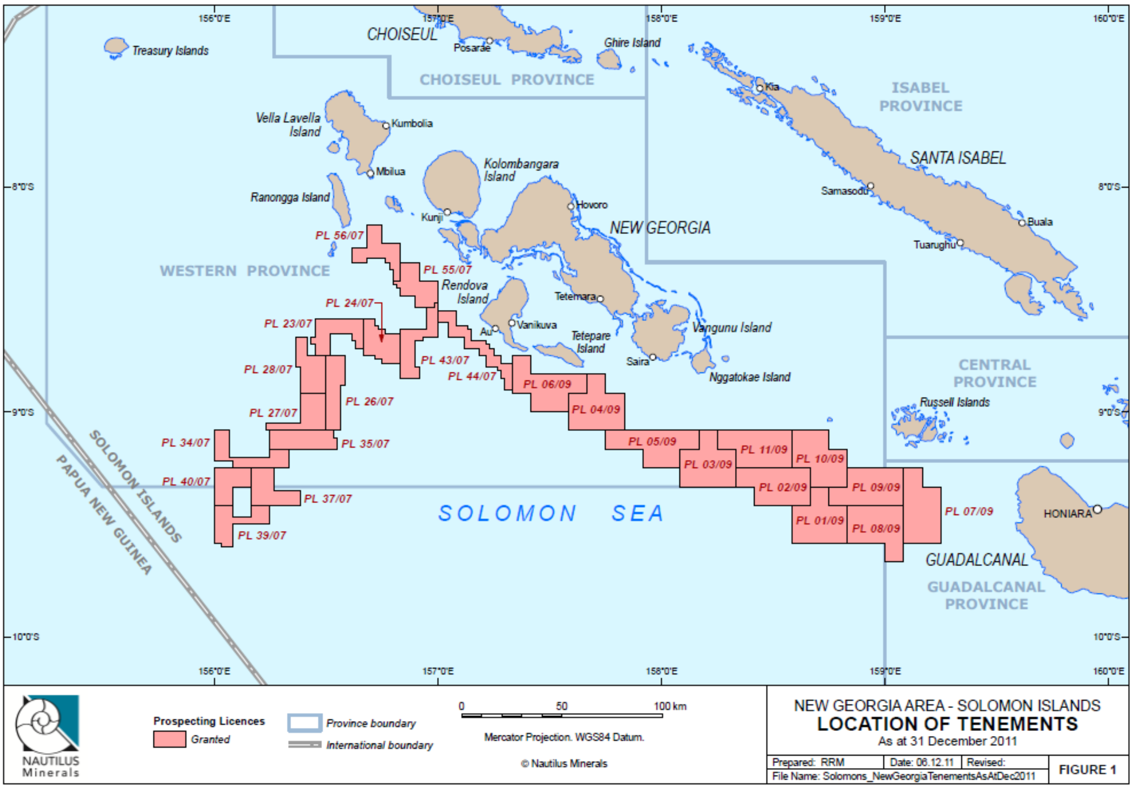


Figure 3-5: Location of Nautilus Minerals' tenements in the west Solomon Islands

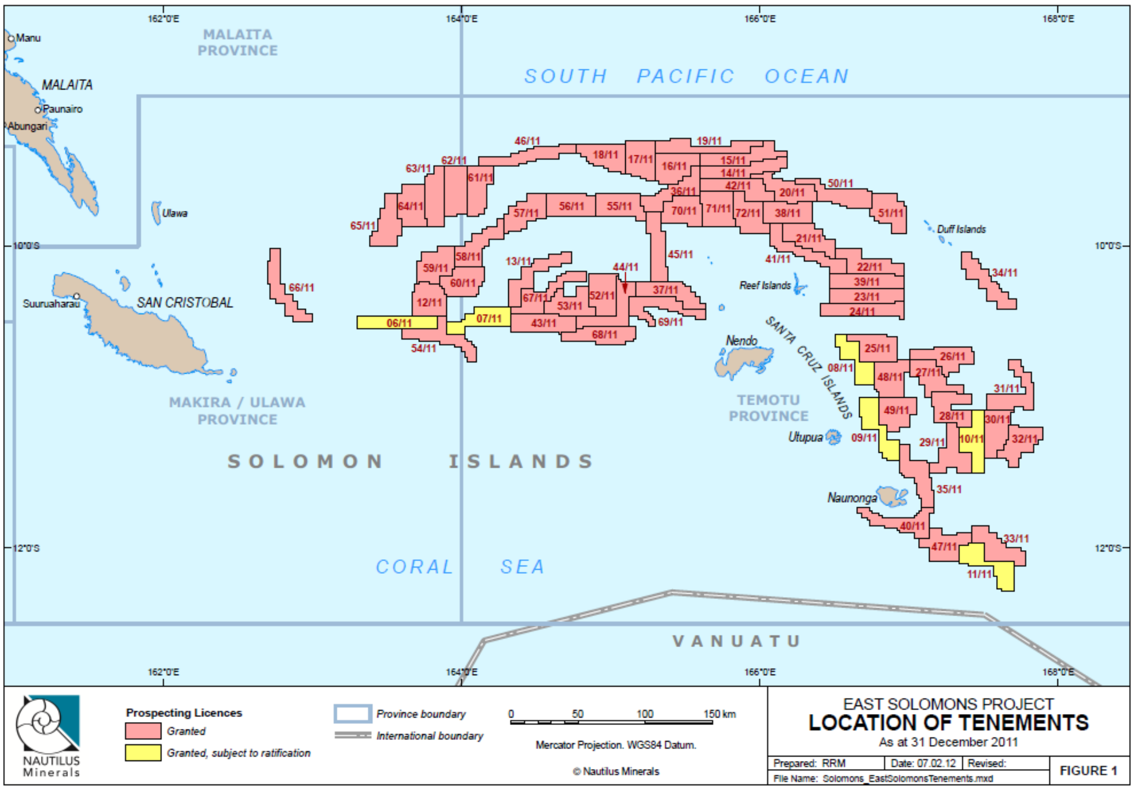


Figure 3-6: Location of Nautilus Minerals' tenements in the east Solomon Islands

3.5 New Zealand

3.5.1 Tenement details

Nautilus Minerals has applied for two Prospecting Permits (PP) in the Havre Trough-Kermadec Ridge region of New Zealand (Table 3-6; Figure 3-7). In New Zealand, the *Crown Minerals Act 1991* provides for three types of permit: Prospecting, Exploration and Mining. Provisions in the *Continental Shelf Act 1964* are also used to administer PPs by the New Zealand authorities. Under draft Standard Terms and Conditions prepared by the authorities in 2010, an offshore PP is granted for an initial period of four years under the *Continental Shelf Act*. A PP allows geological, geochemical, and geophysical surveys; sampling by hand or handheld methods; and serial surveys. An Exploration Permit is initially granted for a period up to five years and is for the purpose of identifying mineral deposits and evaluating the feasibility of mining.

The annual rent on a PP is NZD5.00 per km^2. Holders of PPs are required to file annual technical and financial summaries to the Ministry of Economic Development.

Mining requires a Mining Permit (MP), where the nature and extent of a mineral deposit needs to be clearly defined during exploration. A Mining Permit can be granted for a period of up to forty years depending on the size of the resource. It is more common for MPs to be granted for periods of less than twenty years.

3.5.2 Royalty

In New Zealand, a royalty is payable on all coal or minerals produced from the permit that are sold, disposed of or used in production (if the minerals are not sold, disposed of or used a royalty is no payable). The amount of royalty payable is based on the net sales revenues (the value of production sold, disposed of or used) from the permit.

The royalty regime provides for two rates of royalty; the ad valorem royalty (AVR) which is 1% of the net sales revenues and the Accounting Profits Royalty (APR) which is 5% of the accounting profits from the permit.

If annual net sales revenues are less than $100,000 or average monthly net sales revenues are less than $8,333 royalty is not payable.

If annual net sales revenues are $100,000 or more and not greater than $1 million or average monthly net sales revenues are $8,333 or more but not greater than $83,333 1% AVR only is payable.

If annual net sales revenues are greater than $1 million or average monthly net sales revenues are greater than $83,333, 1% AVR or 5% APR, whichever is greater, is payable.

3.5.3 Environmental Liabilities and Permits

The New Zealand tenements are currently in the application stage. No environmental requirements or performance bonds have yet been fixed.

Table 3-6: Nautilus Minerals' offshore tenement applications in New Zealand

Tenement	Name	Area km^2	Grant date	Expiry date	Appl. fee (NZD)	Expenditure commitment (NZD)		Annual rental (NZD)	
						2012	2013	2012	2013
39348	Havre Trough	52,818	Application		10,000	500,000	500,000	264,090	264,090
53998	Kermadec Ridge	3,465	Application		10,000	500,000	500,000	17,325	17,325
Total Application Area (km^2)		**56,283**							

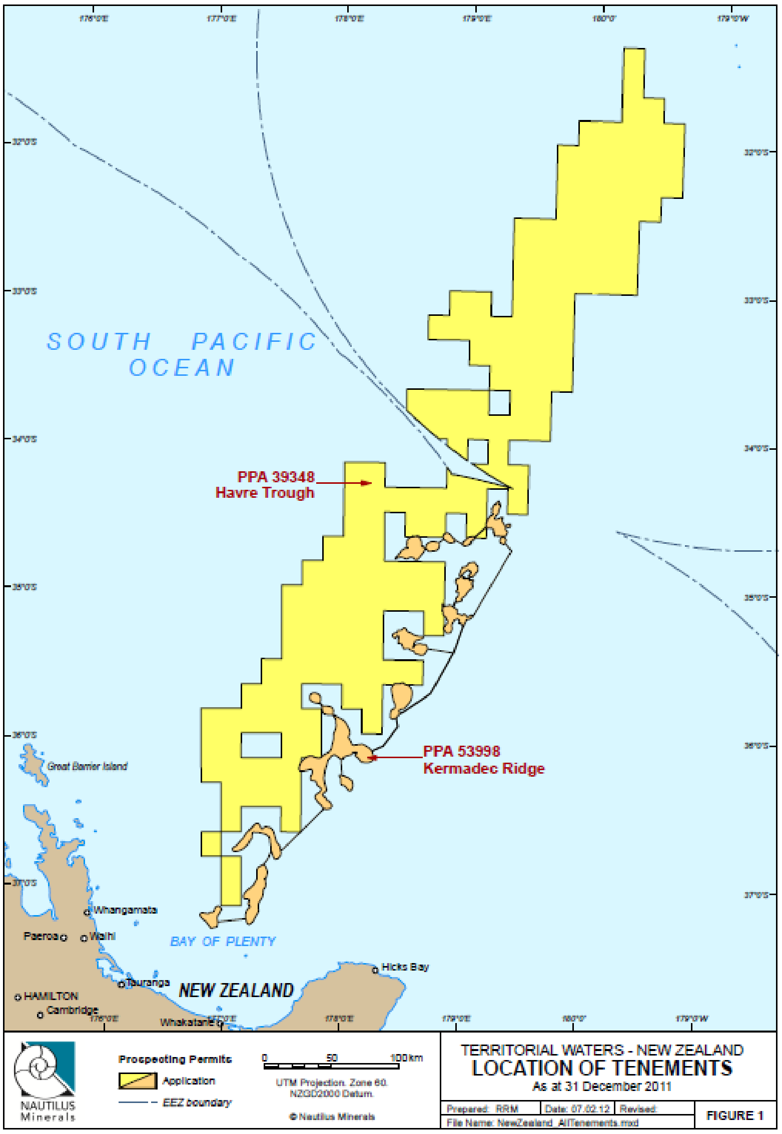


Figure 3-7: Location of Nautilus Minerals' New Zealand tenements

3.6 Vanuatu

3.6.1 Tenement details

Nautilus Minerals holds 41 granted Prospecting Licences (PLs) covering an area of 3,630 km^2 in Vanuatu on the eastern side of the main islands. In addition, 14 PL applications have been lodged (Figure 3-8). The total area covered by the PL applications is 1,247 km^2. Tenement details are shown in Table 3-7.

Under the Vanuatu *Mines and Minerals Act*, every holder of a PL is required to report on prospecting activities quarterly. A PL is granted for an initial period of three years, however at expiration a PL holder may apply for a renewal of up to half of the initial area of the PL for a further two years.

A Mining Licence is required for production and may be granted for a maximum of 25 years. It may be renewed for a further period, not exceeding 25 years. Only the holder of a PL who has made a commercial discovery may apply for a Mining Licence over the area covered by their PL, and only in respect of a mineral permitted to be explored for under the PL. The grant of the Mining Licence is dependent on the Minister for Lands and Natural Resources being satisfied that the proposals of the applicant ensure the most efficient, beneficial and timely use of the mineral resources concerned.

3.6.2 Rights of a holder of a PL

A PL gives the holder, subject to the Act and the conditions specified in the licence, the exclusive right to carry out prospecting operations in or in relation to the prospecting area for any mineral to which the licence relates, and to undertake in the prospecting area such works as are necessary for that purpose.

3.6.3 Royalties

Subject to the *Mines and Minerals Act*, the holder of a Mining Licence must pay a royalty in respect of minerals recovered from the mining area.

The royalty is at the rate fixed in, or calculated in accordance with the provisions of the Mining Licence concerned, or if no rate is fixed or provision so made in the Mining Licence concerned; pursuant to the rate prescribed.

3.6.4 Environmental liabilities

The Minister may require arrangements to be made which he deems sufficient to secure the performance of the holder of a Mining Right under the Act.

Table 3-7: Nautilus Minerals' Offshore tenements in Vanuatu

Lease	Name	Area km^2	Grant date	Expiry date	Appl. fee (VuV)	Expenditure commitment (VuV)		Annual rent (VuV)	
						2012	2013	2012	2013
PL 1652	Temakons 2	99.33	1/08/2010	31/07/2013	0	3,212,286	6,433,570	496,650	496,650
PL 1653	Temakons 3	99.28	1/08/2010	31/07/2013	0	3,212,286	6,433,570	496,400	496,400
PL 1654	Temakons 4	50.29	1/08/2010	31/07/2013	0	3,212,286	6,433,570	251,450	251,450
PL 1655	Temakons 5	56.58	1/08/2010	31/07/2013	0	3,212,286	6,433,570	282,900	282,900
PL 1656	Temakons 6	51.12	1/08/2010	31/07/2013	0	3,212,286	6,433,570	255,600	255,600
PL 1657	Temakons 7	53.00	1/08/2010	31/07/2013	0	3,212,286	6,433,570	265,000	265,000
PL 1658	Coriolis 1	99.76	1/08/2010	31/07/2013	0	3,212,286	6,433,570	498,800	498,800
PL 1659	Coriolis 2	99.76	1/08/2010	31/07/2013	0	3,212,286	6,433,570	498,800	498,800
PL 1660	Coriolis 3	99.76	1/08/2010	31/07/2013	0	3,212,286	6,433,570	498,800	498,800

Lease	Name	Area km^2	Grant date	Expiry date	Appl. fee (VuV)	Expenditure commitment (VuV)		Annual rent (VuV)	
						2012	2013	2012	2013
PL 1661	Coriolis 4	99.76	1/08/2010	31/07/2013	0	3,212,286	6,433,570	498,800	498,800
PL 1662	Coriolis 5	99.76	1/08/2010	31/07/2013	0	3,212,286	6,433,570	498,800	498,800
PL 1663	Coriolis 6	99.76	1/08/2010	31/07/2013	0	3,212,286	6,433,570	498,800	498,800
PL 1664	Coriolis 7	98.40	1/08/2010	31/07/2013	0	3,212,286	6,433,570	492,000	492,000
PL 1665	Coriolis 8	95.00	1/08/2010	31/07/2013	0	3,212,286	6,433,570	475,000	475,000
PL 1666	Coriolis 9	96.25	1/08/2010	31/07/2013	0	3,212,286	6,433,570	481,250	481,250
PL 1667	Nifonea Ridge 4	98.01	1/08/2010	31/07/2013	0	3,212,286	6,433,570	490,050	490,050
PL 1668	Nifonea Ridge 5	98.01	1/08/2010	31/07/2013	0	3,212,286	6,433,570	490,050	490,050
PL 1669	Futuna 2	93.10	1/08/2010	31/07/2013	0	3,212,286	6,433,570	465,500	465,500
PL 1670	Futuna 3	98.01	1/08/2010	31/07/2013	0	3,212,286	6,433,570	490,050	490,050
PL 1696	Oscostar 1	95.90	15/06/2011	14/06/2014	0	465,000	3,255,000	479,500	479,500
PL 1697	Oscostar 2	95.90	15/06/2011	14/06/2014	0	465,000	3,255,000	479,500	479,500
PL 1698	Oscostar 3	95.90	15/06/2011	14/06/2014	0	465,000	3,255,000	479,500	479,500
PL 1699	Oscostar 4	95.90	15/06/2011	14/06/2014	0	465,000	3,255,000	479,500	479,500
PL 1700	Oscostar 5	95.90	15/06/2011	14/06/2014	0	465,000	3,255,000	479,500	479,500
PL 1701	Oscostar 6	89.50	15/06/2011	14/06/2014	0	465,000	3,255,000	447,500	447,500
PL 1702	Nifonea Ridge 6	91.00	15/06/2011	14/06/2014	0	465,000	3,255,000	455,000	455,000
PL 1703	Nifonea Ridge 7	98.00	15/06/2011	14/06/2014	0	465,000	3,255,000	490,000	490,000
PL 1704	Nifonea Ridge 8	91.00	15/06/2011	14/06/2014	0	465,000	3,255,000	455,000	455,000
PL 1705	Nifonea Ridge 9	98.00	15/06/2011	14/06/2014	0	465,000	3,255,000	490,000	490,000
PL 1706	Nifonea Ridge 10	98.00	15/06/2011	14/06/2014	0	465,000	3,255,000	490,000	490,000
PL 1707	Futuna 6	97.00	15/06/2011	14/06/2014	0	465,000	3,255,000	485,000	485,000
PL 1708	Futuna 7	99.00	15/06/2011	14/06/2014	0	465,000	3,255,000	495,000	495,000
PL 1709	Futuna 8	96.00	15/06/2011	14/06/2014	0	465,000	3,255,000	480,000	480,000
PL 1710	Futuna 9	97.00	15/06/2011	14/06/2014	0	465,000	3,255,000	485,000	485,000
PL 1711	Futuna 4	85.14	15/06/2011	14/06/2014	0	465,000	3,255,000	425,700	425,700
PL 1712	Futuna 5	99.36	15/06/2011	14/06/2014	0	465,000	3,255,000	496,800	496,800
PL 1713	Futuna 1	83.70	15/06/2011	14/06/2014	0	465,000	3,255,000	418,500	418,500
PL 1714	Nifonea Ridge 3	99.00	15/06/2011	14/06/2014	0	465,000	3,255,000	495,000	495,000
PL 1715	Temakons 1	55.18	15/06/2011	14/06/2014	0	465,000	3,255,000	275,900	275,900
PL 1716	Temakons 9	31.00	15/06/2011	14/06/2014	0	465,000	3,255,000	155,000	155,000
PL 1717	Temakons 8	57.72	15/06/2011	14/06/2014	0	465,000	3,255,000	288,600	288,600
JEAC 1	Jean Charcott 1	99.00	Application		0	347,400	3,445,050	495,000	495,000
JEAC 2	Jean Charcott 2	99.00	Application		0	347,000	3,445,050	495,000	495,000
JEAC 3	Jean Charcott 3	100.00	Application		0	465,000	2,170,000	500,000	500,000
JEAC 4	Jean Charcott 4	100.00	Application		0	465,000	2,170,000	500,000	500,000
MAD 1	Madwo 1	93.00	Application		0	465,000	2,170,000	465,000	465,000
MAD 2	Madwo 2	93.00	Application		0	465,000	2,170,000	465,000	465,000
MAD 3	Madwo 3	99.00	Application		0	465,000	2,170,000	495,000	495,000
MAD 4	Madwo 4	93.00	Application		0	465,000	2,170,000	465,000	465,000
NIFR 1	Nifonea Ridge 1	99.00	Application		0	347,400	3,445,050	495,000	495,000
NIFR 2	Nifonea Ridge 2	99.00	Application		0	347,400	3,445,050	495,000	495,000
VOL1	Volsmar 1	78.10	Application		0	465,000	3,255,000	390,500	390,500

Lease	Name	Area km²	Grant date	Expiry date	Appl. fee (VuV)	Expenditure commitment (VuV)		Annual rent (VuV)	
						2012	2013	2012	2013
VOL2	Volsmar 2	81.20	Application		0	465,000	3,255,000	406,000	406,000
VOL3	Volsmar 3	63.20	Application		0	465,000	3,255,000	316,000	316,000
VOL4	Volsmar 4	50.50	Application		0	465,000	3,255,000	252,500	252,500
Total Granted Area (km²)		**3,630**							
Total Applications Area (km²)		**1,247**							

Figure 3-8: Location of Nautilus Minerals' tenements in Vanuatu

3.7 Clarion-Clipperton Zone (CCZ)

3.7.1 Tenement application details

Tongan Offshore Mining Ltd (TOML), a subsidiary of Nautilus Minerals, has been sponsored by the Government of Tonga in its application for approval by the International Seabed Authority (ISA) of a Contract of Work for polymetallic nodule exploration under the terms of the United Nations

Convention on the Law of the Sea 1982 (UNCLOS). The ISA approved the Contract of Work in July 2011. Subsequent to the period of this Technical Report, on 11 January 2012, a Contract of Work was signed by the ISA and TOML.

The Contract of Work within the Clarion-Clipperton Zone (CCZ) is located in the Eastern Pacific Ocean, between Longitude 110°W and 160°W and Latitude 5°N and 20°N. The Contract of Work covers a total combined surface area of 74,713 km^2. The Contract of Work is divided into six regions (Table 3-8), with each region covering a section from ISA Reserved Blocks (Figure 3-9).

Table 3-8: Contract of Work Regions and Block Numbers in the CCZ

Contract of Work Region	Reserved Block	Area (km^2)
Area A	Block 2	10,281
Area B	Block 15	9,966
Area C	Block 16	15,763
Area D	Block 20	15,881
Area E	Block 21	7,002
Area F	Block 25	15,820
Total		**74,713**

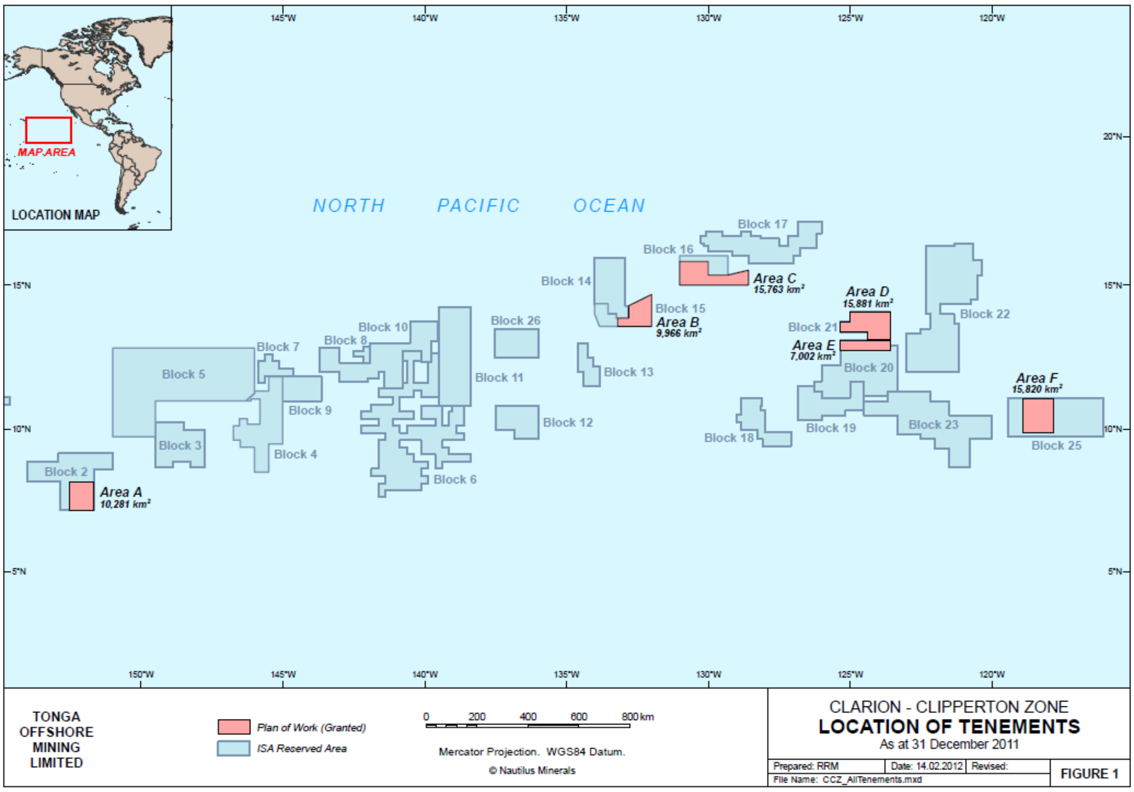


Figure 3-9: Location of Tongan Offshore Mining Limited's Contract of Work regions

Note: Six separate areas comprise the single Contract of Work.

Area Regions A, B, C, D, E and F shown in pink.

3.7.2 International Seabed Authority (ISA)

The International Seabed Authority is an autonomous international organization established under the 1982 United Nations Convention on the Law of the Sea and the 1994 Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea. The Authority is the organization through which State Parties to the Convention shall, in accordance with the regime for the seabed and ocean floor and subsoil thereof beyond the limits of national jurisdiction (the Area) established in Part XI and the Agreement, organise and control activities in the Area, particularly with a view to administering the resources of the Area.

The Authority, which has its headquarters in Kingston, Jamaica, came into existence on 16 November 1994, upon the entry into force of the 1982 Convention. The Authority became operational as an autonomous international organization in June 1996. Currently, the Authority has 161 members, although the United States of America has still not formally ratified the treaty, and is the only notable absentee.

3.7.3 United Nations Convention of the Law of the Sea (UNCLOS)

UNCLOS deals with navigational rights, territorial sea limits, economic jurisdiction, legal status of resources on the seabed beyond the limits of national jurisdiction, passage of ships through narrow straits, conservation and management of living marine resources, protection of the marine environment, and marine research.

Part XI of UNCLOS, and its subsequent Implementation Agreement of 1994, deals with mining of minerals from the seafloor outside of nationally regulated areas. The agreements provide a framework for countries and companies (with country sponsorship) to obtain legal title to areas of the seafloor from the International Seabed Authority for the purpose of exploration and eventually exploitation of resources. The agreements also recognise the rights of “Pioneer Investors”, those companies and countries that had invested significantly in deep ocean mining prior to the adoption of UNCLOS and the Implementation Agreement.

3.7.4 Permitting Regime

The ISA has issued draft regulations on Prospecting and Exploration for Polymetallic Nodules (adopted 13 July 2000), and Prospecting and Exploration for Polymetallic Sulfides (adopted 7 May 2010). To date, eight countries or consortiums have been granted Contracts of Work for polymetallic nodules within the area, through governmental bodies.

These are:

- Yuzhmorgeologiya (the Russian Federation);
- Interoceanmetal Joint Organization (consortium comprising Bulgaria, Cuba, Slovakia, Czech Republic, Poland and the Russian Federation);
- The Government of the Republic of Korea;
- China Ocean Minerals Research and Development Association (COMRA);
- Deep Ocean Resources Development Company (Japan);
- Institut français de rechèrche pour l’exploitation de la mer (France);
- The Government of India; and
- The Federal Institute for Geosciences and Natural Resources (Germany).

Of the eight contractors, seven hold their Contracts of Work in the Clarion-Clipperton Zone, while the Government of India holds its Contract of Work in the central Indian Ocean.

Contracts of Work for prospecting and exploration for nodules are granted for 15 years, and provide the Contractor with exclusive title. Contract areas initially comprise 150,000 km^2, although half (based on "value" and area) must be returned to the ISA by year eight, to be administered by the "Enterprise" as part of the "Reserved Areas". The Enterprise is a body within the ISA tasked with holding and managing the landholdings held by the "Pioneer Investors" as well as those areas relinquished by Contractors during the term of their initial exploration work. The Enterprise acts as a sort of "land bank" for developing nations to benefit directly from deep ocean mining, whereby developing nations (or their sponsored companies) may apply for ground.

The Contract of Work conditions cover such areas as obligations of the sponsoring state, environmental obligations, marine scientific research, fees, and work programs.

The application for a Contract of Work made by Tonga Offshore Mining (sponsored by the Kingdom of Tonga) comprises 74,713 km^2, and covers reserved blocks (i.e. areas "controlled" by the Enterprise) within the Clarion-Clipperton Zone of the Eastern Pacific. The application was first heard by the ISA Legal and Technical Commission (LTC) in mid-2008, although the LTC was unable to reach a decision on the application at that time. The LTC and ISA Tribunal approved a Contract of Work for TOML in July 2011.

4 Accessibility, Climate, Local Resources, Infrastructure, Physiography and Environment

4.1 Papua New Guinea

4.1.1 Accessibility and infrastructure

Papua New Guinea (PNG) occupies the eastern half the island of New Guinea. PNG lies between 2°S and 11°S, with an estimated population of 7,000,000, comprising many offshore islands, the largest of which are New Britain and New Ireland to the east. The total land surface is 462,840 km^2. The capital, Port Moresby (2009 census population 307,643) is located on the shores of the Gulf of Papua on the south eastern coast of New Guinea. The nation's main international airport (IATA: POM), situated at Port Moresby, can handle aircraft up to Boeing 747 size, and is served by scheduled commercial flights to destinations in the South Pacific, Australasia and Asia. There are significant port, logistics and services available in Port Moresby, Lae, Madang and Rabaul which is served by regular shipping to Australasia, Asia, North America and the South Pacific.

Regular domestic flights service the major Highlands, coastal and island centres of PNG. Transport and other infrastructure outside of these centres is limited.

4.1.2 Physiography

The area of interest in the New Ireland 'back-arc' basin is named the Tabar-Lihir-Tanga-Feni arc. This island chain of young volcanoes lies in the New Ireland basin to the NE of New Ireland and SW of the inactive Manus-Kilinailau Trench. The seafloor between the islands averages between 1,500 and 2,000 m in depth with sporadic seamounts rising up several hundred metres from this base. The seafloor drops below 3,000 m closer to the inactive trench.

The Woodlark Basin is a small, rifted basin located between the easternmost Papuan Peninsula and the Solomon Islands in the southwest Pacific. It is bordered to the north and south by the Woodlark and Pocklington Rises. Maximum depths of the basin are around 4,000 mbsl. Trenches and submarine volcanoes reach up to 1,000 mbsl with seamount summits reaching up to 500 mbsl.

4.1.3 Climate

The climate in PNG is tropical with the coastal plains averaging 28°C, mountain ranges and inland averaging 26°C and higher areas averaging 23°C. There is a distinct wet season (December to March) and a dry season (June to September). Rainfall is linked with monsoon and is highly variable across the country due to topography.

Mean wind speeds (10 minute means) are typically lightest in and around the transition months (April to May and October to December) between the two monsoons, with mean speeds ranging from only about 4.7 to 5.6 m/s. Mean wind speeds are typically strongest during the winter SE monsoon months of July and August with 10 minute mean speeds ranging from about 6.8 to 7.4 m/s. Maximum wind speeds are typically strongest during the summer NW monsoon months of March and April with 10 minute mean speeds ranging from about 18.2 to 20.3 m/s.

Due to its proximity to the equator and the considerable protection of the surrounding islands, tropical cyclones (tropical storms or depressions) historically have not occurred within the Bismarck Sea. However, within the months of November to June, distant tropical cyclones do occasionally occur in the Solomon Sea, Coral Sea and SW Pacific Ocean to the SSE of the Bismarck Sea. These distant storms can still act to enhance the normal monsoon winds over the Bismarck Sea.

For example, tropical cyclone Justin (920 km at its closest point of approach) which occurred in March 1997 in the Coral Sea strongly enhanced the NW monsoon over the Bismarck Sea.

Within a 1,000 km radius of Rabaul, historically only 36 tropical cyclones occurred during the months of November to May (predominantly summer) and only one storm passed within 400 km over the approximately 42 year period (1961–2002). April is the most active month for cyclone activity and most storms are of Category 3 strength or less.

4.1.4 Wind

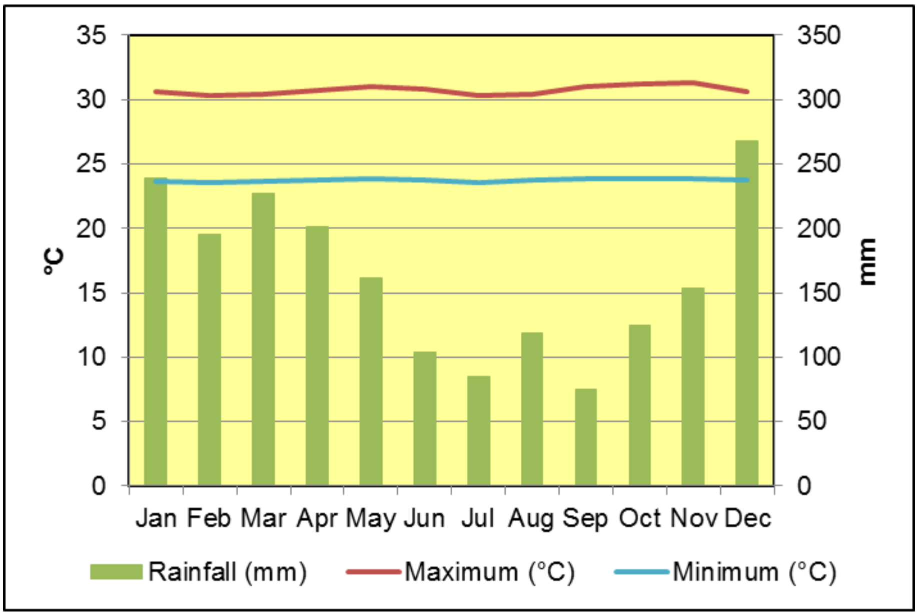


Figure 4-1: Average climate conditions for Rabaul, 1974-1994

4.1.5 Tectonics and seismicity

PNG straddles several major tectonic plate boundaries and is part of the Pacific ‘Ring of Fire’. Modelling indicates that the India–Australia and Pacific plates are moving towards each other at a rate between 3 and 10 cm/yr. The movement of the plates has resulted in significant faulting and seismic activity, creating the potential for both shallow and large-magnitude earthquakes on land and under the sea. The PNG earthquake loadings code indicates that the Solwara 1 deposit is located within Zone 2 (where Zone 1 is most unstable) and the Port of Rabaul component of the Project is located within Zone 1. The Global Seismic Hazard Assessment Program has assessed the Rabaul area as having a peak ground acceleration range of 4.0 g to 4.8 g (a very high hazard) for a return period of 475 years.

4.2 Tonga

4.2.1 Accessibility and infrastructure

The Kingdom of Tonga is an island nation in the South Pacific lying between 15°S and 23°30’S. There are 169 islands in three groups, of which 39 are inhabited; the total land surface area is 747 km^2. The 2006 census population of Tonga was 101,991, of whom 70% live on the main island of Tongatapu, about 15,500 on the Vava'u group of islands and 7,500 on the Ha'apai group.

The only deepwater port in Tonga is located in the capital, Nuku’alofa (population approximately 40,000). It is served by scheduled cargo ships sailing to and from New Zealand, Fiji and Samoa. Tonga’s international airport (Fua’amotu International Airport, IATA code TBU) is located 24 km by road from Nuku’alofa at Latitude 21°14’S Longitude 175°08’W. The main runway is 2,691 m by 45 m

and is asphalt sealed, capable of handling aircraft as large as a Boeing 767. There are regular commercial flights from Sydney, Australia; Auckland, New Zealand; Nadi and Suva, Fiji; and Apia, Samoa. The airport also serves as the hub for internal flights to Ha'apai (HPA), 'Eua (EUA) and Vava'u (VAV).

Nautilus Minerals' tenements are located in the open ocean to the west of the three island groups. The sea floor of prospective parts of the Tonga tenements comprises volcanic rift and ridges, at depths between 1,770 to 2,100 mbsl. These tenements do not include any habitable land or coastal waters; there is no requirement to negotiate access rights with local landowners.

4.2.2 Climate

Tonga has a subtropical climate, with a wet season from November to April and a dry season from May to October. In general, the climate becomes warmer and wetter moving from the south to the north of the archipelago. Average temperatures and rainfall are presented for southern Tonga (Nuku'alofa) in Figure 4-2 and for northern Tonga (Niuafo'ou) in Figure 4-3. Temperature variability is moderate, with a maximum recorded temperature for the nation of 35.0°C and a minimum recorded temperature of 8.7°C. Average relative humidity is around 75%. The predominant wind is the southeast trade wind, which is generally light to moderate year-round, averaging 12-15 knots. Tropical cyclones, which may bring heavy rainfall and destructive winds, occur between November and April, usually one or two per year; although in the 2002-2003 seasons, there were five that affected at least part of Tonga. There is a 10% chance that any part of the country or its territorial water will be affected by an intensity 4 cyclone (winds in excess of 210 km/h) or higher every ten years.

The Tonga region is seismically highly active; there is a 20% chance that any part may be affected by a Modified Mercalli Intensity VIII earthquake (destructive) every 50 years.

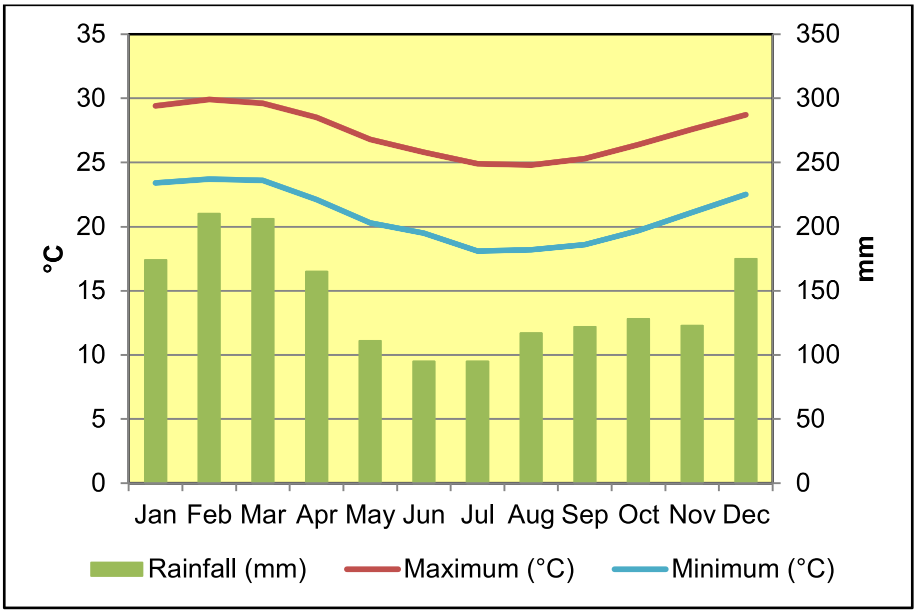


Figure 4-2: Average climate conditions for Nuku'alofa (southern Tonga), 1971-2000

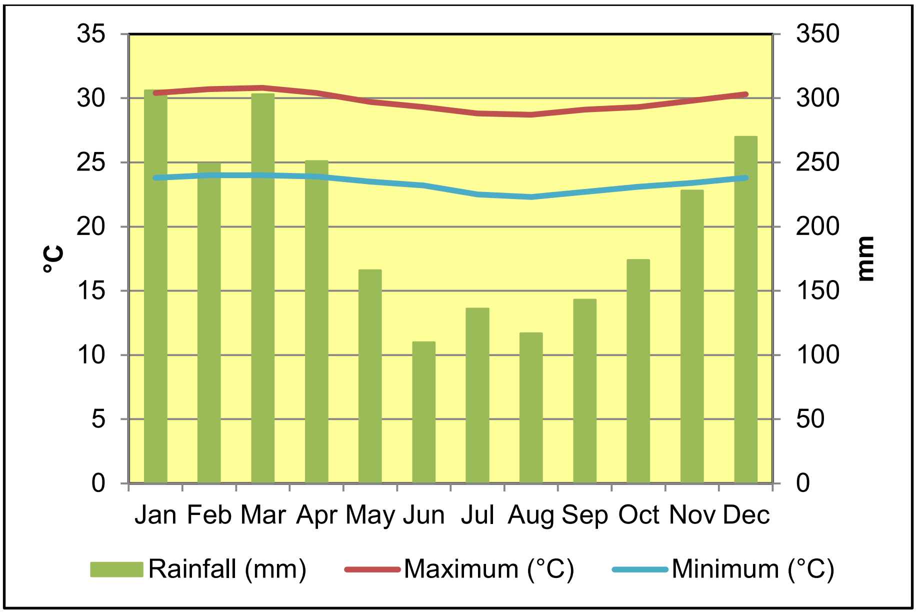


Figure 4-3: Average climate conditions for Niuafo'ou (northern Tonga), 1971-2000

4.3 Fiji

4.3.1 Accessibility and infrastructure

Fiji is an island nation in the South Pacific lying between 9°S and 25°S, with a population of 850,000 (estimated), comprising 322 islands of which 106 are inhabited. The total land surface is 18,274 km^2; the two largest islands of Viti Levu (10,388 km^2) and Vanua Levu (5,587 km^2) also account for most of the population. The capital, Suva (1996 census population 167,975) is in the southeast part of Viti Levu. The nation's main international airport (IATA: NAN), situated at Nadi (1996 census population 30,791) in the west of Viti Levu, can handle aircraft up to Boeing 747 size, and is served by scheduled commercial flights to destinations in the South Pacific, Australasia, North America and Asia. There are port, logistics and services available in Suva, which is served by regular shipping to Australasia, Asia, North America and the South Pacific; port facilities are also available at Lautoka on the west coast of Viti Levu.

4.3.2 Climate

The climate in Fiji is tropical with a distinct wet season (November to April) and a dry season. Local rainfall is highly variable on the larger islands of Fiji due to topography, but much more evenly distributed on low-lying islands and in ocean areas. The predominant winds year-round are trade winds from the east to south-east; in general light or moderate. Fiji is affected by tropical cyclones, mostly confined to the period November to April, with greatest frequency around January and February. On average, some ten to twelve cyclones per decade affect some part of Fiji, with two or three causing severe damage. The climatic averages for Nadi are presented in Figure 4-4.

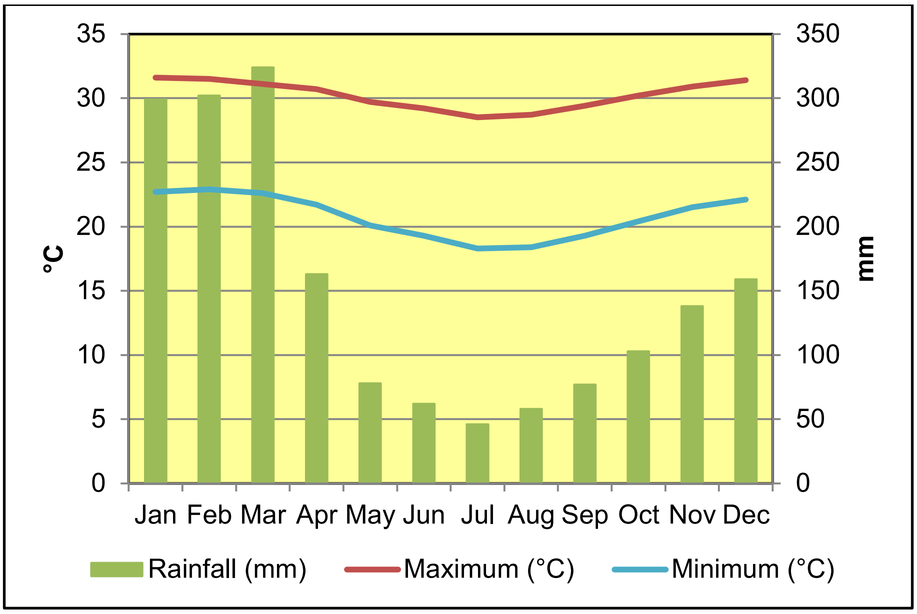


Figure 4-4: Average climate conditions for Nadi, 1974-1994

4.4 Solomon Islands

4.4.1 Accessibility and infrastructure

The Solomon Islands is a nation in the South Pacific, east of Papua New Guinea, consisting of six major islands, about thirty smaller ones and hundreds of minor islets stretching over a distance of approximately 1,500km. Collectively, the islands cover a land mass of 27,540 km^2, the six largest representing about 75% of this area. The total population is 506,967 (2008), of which about 250,000 live on the two most populous islands, Guadalcanal and Malaita. The capital and largest population centre is Honiara (pop 54,600, 2003 estimate), located on the island of Guadalcanal. Honiara is served by scheduled shipping services, and hosts the Solomon Islands' international airport (IATA: HIR). This has a main runway of 2,200 m by 45 m and is asphalt sealed. There are regular commercial flights from Brisbane, Australia; Port Moresby, PNG; and Nadi and Suva, Fiji. The airport also serves as the hub for internal flights to numerous destinations within the Solomon Islands.

4.4.2 Climate

The Solomon Islands have a humid tropical climate, with very little climatic variation throughout the year. Temperature, humidity and air pressure normally follow a regular diurnal cycle. Rainfall is abundant, with a wetter period from November to April. Thunderstorms are common throughout the year, but are more abundant during the wetter period. Light to moderate east to southeast trade winds are usual from May to October, with lighter west to northwest winds from about November to April; although this latter period is also the season when cyclones may occur; the Solomon Islands are usually affected by one or two per year. These may bring heavy rain and destructive winds, and would disrupt Nautilus Minerals' activities. The Solomon Islands are also highly active seismically. The climatic averages for Auki in the northern Solomon Islands are presented in Figure 4-5.

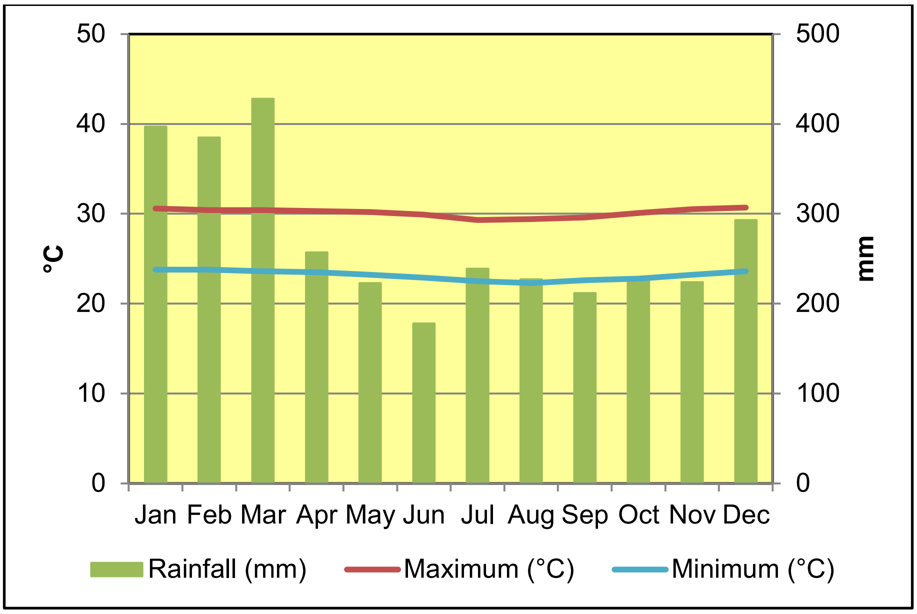


Figure 4-5: Average climate conditions for Auki, 1962-2000

4.5 New Zealand

4.5.1 Accessibility and infrastructure

New Zealand is a country in the south-western Pacific Ocean comprising two large islands (the North Island and the South Island) and numerous smaller islands, most notably Stewart Island and the Chatham Islands. The North and South Islands are separated by the Cook Strait, which is 20 km wide at its narrowest point; the total land area, 268,680 km^2. New Zealand is notable for its geographic isolation, being separated from Australia to the northwest by the Tasman Sea, approximately 2,000 km across. Its closest neighbours to the north are New Caledonia, Fiji and Tonga.

New Zealand has a modern developed economy with an estimated Gross Domestic Product of USD119 billion (as of 2008). Logistically the country has international airports with scheduled commercial flights to many other countries.

4.5.2 Climate

The climate throughout the country is mild and temperate, mainly maritime, with temperatures rarely falling below 0°C or rising above 30°C in populated areas. Conditions vary sharply across regions from extremely wet on the West Coast of the South Island to semi-arid in the Mackenzie Basin of inland Canterbury and subtropical in Northland. Of the main cities, Christchurch is the driest, receiving only some 640 mm of rain per year. Auckland, the wettest, receives almost twice that amount. Climatic averages for Tauranga in the north of the North Island are presented in Figure 4-6.

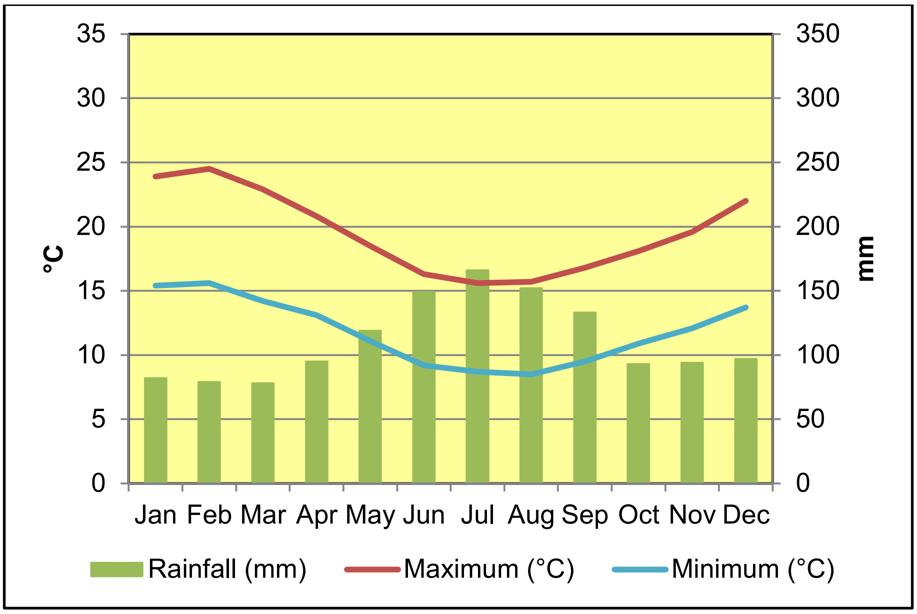


Figure 4-6: Average climate conditions for Tauranga (northern NZ), 1971-2000

4.6 Vanuatu

4.6.1 Accessibility and infrastructure

Vanuatu is an island nation located in the South Pacific Ocean. The archipelago, which is of volcanic origin, is some 1,750 km east of northern Australia, consisting of approximately 82 relatively small, geologically newer islands of volcanic origin (65 of them inhabited), with about 1,300 km north to south distance between the outermost islands. Collectively, the islands cover an area of 12,274 km^2.

The total population is 221,506 (1999), and is predominantly rural, although Port Vila and Luganville have populations in the tens of thousands. The capital and largest population centre is Port Vila (population 29,356, 1999), located on the island of Efate. Port Vila is served by scheduled shipping services, and has Vanuatu's international airport (IATA: VLI). This has a main runway of 2,600 m and is asphalt sealed. There are regular commercial flights from Brisbane, Melbourne and Sydney, Australia; Noumea, New Caledonia; Auckland, New Zealand; Nadi, Fiji; and Honiara, Solomon Islands. The airport also serves as the hub for internal flights in Vanuatu.

4.6.2 Climate

Vanuatu has a sub-tropical climate with approximately nine months of warm to hot rainy weather and the possibility of cyclones and three to four months of cooler drier weather characterised by winds from the southeast. Cool between April and September, the days become hotter and more humid starting in October. The daily temperature ranges from 20°C to 32°C. Southeasterly trade winds occur from May to October. Vanuatu has a long rainy session, with significant rainfall usually occurring almost every month. The wettest and hottest months are December through April, which also constitute the cyclone season; Vanuatu is usually affected by two or three per year. These may bring heavy rain and destructive winds, and would disrupt Nautilus Minerals' activities. The climatic averages for Port Vila are presented in Figure 4-7.

Vanuatu is also highly active seismically.

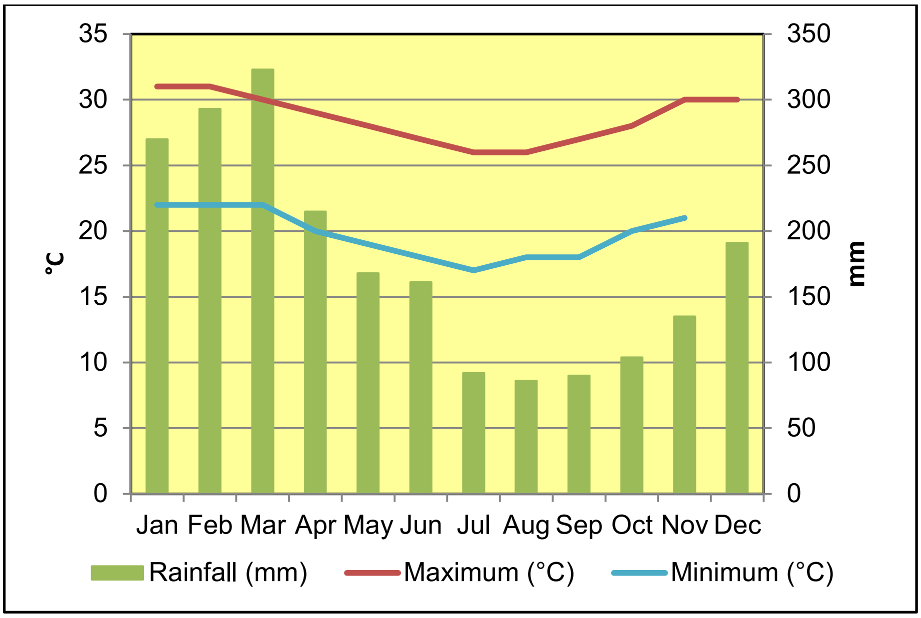


Figure 4-7: Average climate conditions for Port Vila, Vanuatu

4.7 Clarion-Clipperton Zone (CCZ)

4.7.1 Accessibility and infrastructure

Access to the CCZ is essentially only achieved by ocean going vessels. There is no infrastructure in the region of the CCZ. The nearest land is Mexico, some 2,00 km to the east, and Hawaii some 3,000 to 4,000 km to the northwest.

4.7.2 Climate

Climate in the region of the CCZ is largely warm equatorial, moving northwards into lower temperate zones. Being in the middle of the Pacific Ocean, and thousands of kilometres from land, there is limited climatic data available.

5 History

5.1 Papua New Guinea

The first discovery of submarine hydrothermal sulfides and black smokers in Papua New Guinea was at what was to become the Solwara 2 project, when in 1985 the US research vessel RV Moana Wave photographed seafloor sulfides there. Since then, occurrences of submarine sulfides in the Bismarck Sea, where some of Nautilus Minerals' PNG tenements are located, have been studied by research groups from many countries, including France, Germany, Canada, USA, Japan, Korea, UK and Australia (Table 5-1).

As a result of detailed geological, geophysical and geochemical surveys by these research groups, extensive hydrothermal fields and SMS mineralisation have been identified. Results of these studies are documented in several reports that are listed in the reference section of this report and the Mineral Resource Estimate Solwara Project, 23 December 2011 (Lipton, 2011). A brief and general summary of the research history of the property is provided here, mainly from Adamson (2003).

Research cruises have supplied detailed bathymetry of the Solwara 1, 2, 3 and 4 areas; these have also been observed during manned submersible dives and numerous deep-tow video traverses. Dredging traverses were extensively employed during the various "PACMANUS" and "Binatang" research cruises, and it is estimated that, since 1991, Australia's Commonwealth Scientific and Industrial Research Organisation ("CSIRO") has acquired several tonnes of sulfide samples from the Solwara 4 and Solwara 1 hydrothermal fields. Basic descriptions of dredge contents are recorded in the various cruise reports, which were compiled on board, prior to chemical analyses. Submersible and deep-tow video observations supplemented by the dredge reports have enabled researchers to compile and publish basic geological reconnaissance reports and maps of several of the hydrothermal fields.

Analytical data were generally reported several years after the research cruises. The largest research database is contained in Yeats, Parr and Binns (1998), which presents data from about 100 of the almost 500 samples collected between 1991 and 1997 at the Solwara 4 and Solwara 1 hydrothermal fields.

Detailed logs, core photos and some descriptive data are reported from Leg 193 of the Ocean Drilling Program, which was completed in December 2000 (ODP 193, 2000). A series of partially cored holes was drilled to investigate geological and geophysical conditions to depths of up to 370 m below the seafloor in three of the active Solwara 4 fields.

During the German/ UK Research Cruise "Condrill" (SO166) in late 2002, an initial phase of drilling to 5m depth into the surface of the Solwara 4 hydrothermal fields was conducted using the drilling services of the British Geological Survey. Of the ten holes drilled, three recovered massive chalcopyrite mineralisation, and six recovered sphalerite-rich chimney material (Petersen *et al.*, 2003).

Dredge samples were recovered during several research cruises (e.g. Yeats, Parr and Binns, 1998; Binns, Parr and Waters et al, 1996), and included grades of approximately 8% Cu, 18% Zn, 200ppm Ag and 11 ppm Au, based on analyses of 17 samples. Note that these grades are from scientific reports and may be based on sulfide samples that were specifically selected for detailed analysis and scientific research on the formation and genesis of sea-floor massive sulfide systems. Therefore, the grades only reflect the average of the samples selected and may not reflect the average value of the SMS deposit.

Table 5-1: Summary of selected research cruises in and around Nautilus Minerals' tenements

Research Cruises	Ship/ Cruise	Dates	Area
CSIRO-led Cruises			
PACLARK I	RV Franklin	April 1986	Western Woodlark Sea
PACLARK II	RV Franklin: FR01/88	January 1988	Western Woodlark Sea and Goodenough Bay
PACLARK III	HMAS Cook	February 1988	Western Woodlark Sea
PACLARK IV/SUPACLARK	RV Akademik Mstislav Keldysh: Leg 1	April 1990	Western Woodlark Sea
SHAARC	RV Franklin: FR04/00	May 2000	Tabar-Lihir-Tangi-Feni Chain
BISMARCK-SOLAVENTS 2002	RV Franklin: FR03/2002	Mar-Apr 2002	Bougainville-Solomons
Cruises with CSIRO participation			
Edison '94	*RV Sonne*: SO 94	Mar-Apr 1994	Lihir-Feni Chain and Eastern Manus Basin
Dae Yang 2002 Leg 1	*RV Onnuri*	Aug-Sep 2002	Lihir Island and Eastern/Western Bismarck Sea
Other cruises			
Moana Wave (USA)	*RV Moana Wave*: MW8517-18	1985-86	Bismarck Sea, Woodlark Sea and Islands
ODP Leg 180	*JOIDES Resolution*	Jun-Aug 1998	Western Woodlark Sea
Edison II	*RV Sonne*: SO 133	Jul 1998	Lihir-Feni Chain
Condrill	*RV Sonne*: SO 166	Sep-Oct 2002	Solwara 4 and Conical Seamount
Woodlark Basin	*RV Sonne:* SO 203	Oct-Dec 2009	Solomon Sea

5.2 Fiji

The North Fiji Basin has been the subject of a number of scientific research cruises over the past 20 years (Table 5-3), although no mineral exploration activity has been carried out to date. These cruises have broadly defined the geology and mineralisation of an active spreading centre, and the active and fossil hydrothermal systems have been investigated by ROV dives, dredging and limited drilling. Analyses of sulfide samples has not been systematic, with many researchers not assaying for gold, and much of the focus in the later cruises shifting towards biological rather than mineral sampling.

The 2001 Triple Junction cruise undertaken by Japanese researchers drilled 22 shallow holes in the vicinity of the SO99 field using the BMS (Boring Machine System) rig built by Williamson and Associates of Seattle, Washington, USA. Eight of the holes intersected massive sulfides, with thicknesses up to 7 m reported.

Table 5-2: Summary of selected research cruises to the North Fiji Basin

Research Cruises	Ship	Dates
SEAPSO III Avant Cruise	*RV Jean Charcot*	1985
STARMER Kaiyo 88	*RV Kaiyo*	Nov-Dec 1987
STARMER I	*RV Nadir /Nautile*	June 1989
STARMER Kaiyo 89	*RV Kaiyo*	1989
NEW STARMER NOFI 94	*RV L'Atalante*	Sep1994
STARMER	*Yokosuka*	Jan-Feb 1990

Research Cruises	Ship	Dates
STARMER	*Yokosuka*with *Shinkai*	Aug-Sep 1991
NEW STARMER	*RV L'Atalante*	Sep 1994
Hyfiflux SO 99	*RV Sonne*	Jan 1995
Hyfiflux II SO 134	*RV Sonne*	Aug 1998
SOPAC-Japan Project	*Yokosuka*	1999
TRIPLE JUNCTION	*Yokosuka* with BMS rig	2001
Ridge 2000 Expedition 4 of 5	*RV Melville*	May-June 2005
North of Hunter Ridge 03-2009	*RV Southern Surveyor*	July 2009

5.3 Tonga

There have been a number of marine science research cruises in the Lau Basin over the past 20 years (Table 5-3). The research cruises have broadly defined the geology and mineralisation of the spreading ridges identified to date within the Lau Basin. Investigations of spreading rates, structural geology, biology and geochemistry, have been supported by numerous sampling runs using both dredging, ROVs and submersibles. The majority of this work has focused on the Eastern Lau Spreading Centre (ELSC), a 400 km-long segment of active spreading and hydrothermal activity that includes the Valu Fa Ridge.

Since late 2003, the Ridge 2000 Program (funded by the US National Science Foundation) has conducted five cruises to the Lau Basin. These cruises brought together multidisciplinary teams of research scientists to study various aspects of the Lau Basin such as the geology, structure, geophysics, geochemistry, fluid genesis, and biology. The Ridge 2000 Program has made major contributions to the understanding of this complex plate tectonic junction.

Table 5-3: Summary of selected marine science research cruises to the Lau Basin

Research Cruises	Ship/Cruise	Dates
SO 35 Leg 2	*RV Sonne*	Dec 1984 – Jan 1985
SO 48	*RV Sonne*	Feb-Apr 1987
Nautilau	*RV Le Nadir*/Nautile	Apr-May 1989
SO 67	RV Sonne	Mar-Apr 1990
21st Cruise, leg 2	*RV Akademik Mstislav Keldysh*, MIR submersible	Mar-Jun 1990
SOPAC/MMAJ Leg 1	*Hakurei Maru No. 2*	July- Aug 1995
MW9603	*RV Moana Wave*	Feb-Mar1996
Lauhavre 97 (New STARMER Program)	*RV Yokosuka*	Jan-Feb 1997
SO 167	*RV Sonne*	Oct-Nov 2002
TELVE (SSO2/2003)	*RV Southern Surveyor*	Mar-Apr 2003
Ridge 2000 expedition 1 of 5 (KM0410)	*RV Kilo Moana*	Apr-May 2004
Ridge 2000 expedition 2 of 5 (KM0417)	*RV Kilo Moana*	Sept-Oct 2004
NoToVe (SS11/2004)	*RV Southern Surveyor*	Oct-Nov 2004
YK04-09 Leg 1	*RV Yokosuka*/Shinkai 6500	Sep-Oct 2004
YK04-09 Leg 2	*RV Yokosuka*/Shinkai 6500	Oct-Nov 2004
KORDI	*RV Onnuri*	Dec 2004 -Jan 2005
Ridge 2000 expedition 3 of 5 (TUIM05MV)	*RV Melville*	Apr-May 2005
Ridge 2000 expedition 4 of 5 (TUIM06MV)	*RV Melville*	May-June 2005
Ridge 2000 expedition 5 of 5 (TUIM07MV)	*RV Melville*	June 2005
MGLN07MV	*RV Melville*	Sept-Oct 2006

Research Cruises	Ship/Cruise	Dates
MANGO SO 192 Leg 2	*RV Sonne*	Apr-May 2007
KM0804	*RV Kilo Moana*	Apr-May 2008
SS07/2008	*RV Southern Surveyor*	May-Jun 2008
NE Lau Basin	*RV Thomas G. Thompson*	Nov 2008
NE Lau Basin	*RV Thomas G. Thompson*	Apr 2009
KM1129A	*RV Kilo Moana*	Nov-Dec 2011

5.4 Solomon Islands

Since 1960, over 70 cruises have been carried out by various Marine Scientific Researchers (MSRs) in the EEZ of Solomon Islands. Six of the known areas of hydrothermal venting and plumes occur outside Nautilus Minerals' tenement areas. However, one significant plume found in the licence area (SHAARC cruise) is a positive indicator for hydrothermal activity, and demonstrates the prospectivity of the Nautilus Minerals tenements.

5.5 New Zealand

In 1999 the New Zealand American Plume Mapping Expedition (NZAPLUME) surveyed 13 volcanoes in the southern 260km of the Kermadec Arc for their hydrothermal plumes with seven of them discharging vent fluids into the surrounding ocean. Three of those seven volcanoes have had mineralisation recovered from them during dredging and submersible operations: Brothers, Rumble II and Clark.

5.6 Vanuatu

There have been a number of marine science research cruises in Vanuatu over the past 40 years (Table 5-4). Early research cruises, including an Ocean Drilling Program (ODP Leg 134) mainly investigated the hydrocarbon potential of shallower areas near the island chain. However, more recently research has focused on the seafloor geology and mineralisation in the spreading troughs to the east of the New Hebrides Arc. Seafloor mineralisation research has been supported by dredging, plume mapping (hydrocasts) and sampling, water chemistry analysis, seafloor towed camera and submersible observation, sediment coring, as well as multi-beam bathymetric and sidescan sonar surveys.

Hydrothermal indicators of interest include recovery of hydrothermal precipitates, visual observation of vent related biological communities and possible chimneys, as well as hydrothermal plume indicators from hydrocasting and water sampling.

Table 5-4: Summary of selected marine science research cruises to Vanuatu

Cruise Name	Vessel name	Dates
Monster Cruise Mahi 2-70	*RV Mahi*	22 Apr 1970 to 20 Jun 1970
DME06	*RV Dmitry Mendeleev*	18 Jun 1971 to 13 Oct 1971
KK71-04-26-05	*RV Kana Keoki*	4 Oct 1971 to 2 Nov 1971
GEORSTOM II	*RV Coriolis*	20 Aug 1974 to 18 Sep 1974
EVA 77/4	*RV Coriolis*	5 Aug 1977 to 5 Sep 1977
EVA 77/5	*RV Le Noroit*	10 Sep 1977 to 14 Oct 1977
VA80-1	*RV Vauban*	25 Jul 1980 to 26 Aug 1980
VA80-2	*RV Machias*	22 Nov 1980 to 1 Dec 1980
VA80-3	*RV Machias*	4 Dec 1980 to 21 Dec 1980

EVA 81/8	*RV Coriolis*	13 Oct 1981 to 31 Oct 1981
EVA 81/9	*RV Coriolis*	1 Nov 1981 to 12 Nov 1981
EVA 82/10 (GEOVAN II)	*RV Coriolis*	10 Oct 1982 to 4 Nov 1982
EVA 82/11	*RV Coriolis*	10 Nov 1982 to 4 Dec 1982
CH100L09	*RV Chain*	4 Aug 1971 to 26 Aug 1971
L6-82-SP / SOPAC 1	*RV Samuel Peter Lee*	27 Apr 1982 to 16 May 1982
L5-84-SP / SOPAC 2	*RV Samuel Peter Lee*	4 May 1984 to 5 Jun 1984
SEAPSO Leg 1	*RV Jean Charcot*	14 Oct 1985 to 6 Nov 1985
SEAPSO Leg 2	*RV Jean Charcot*	9 Nov 1985 to 29 Nov 1985
EVA 86/13	*RV Coriolis*	21 Aug 1986 to 25 Sep 1986
MULTIPSO	*RV Jean Charcot*	12 Apr 1987 to 29 Apr 1987
EVA 87/14	*RV Coriolis*	3 Aug 1987 to 4 Sep 1987
Kaiyo 87/1, STARMER	*RV Kaiyo*	28 Nov 1987 to 14 Dec 1987
SUBPSO	*RV Nadir*	27 Feb 1989 to 13 Mar 1989
SOPAC GLORIA	*HMAS Cook*	Aug-89
ODP Leg 134	*RV Joides Resolution*	16 Oct 1990 to 16 Dec 1990
SOPAC Maps Leg 1	*RV L'Atlante*	17 July 1993 to 15 Aug 1993
JAPAN/SOPAC DeepSea Mineral Resources Program - Phase I	*RV Hakurei Maru No 2*	22 Aug 1994 to 25 Oct 1994
CALVA	*RV L'Atlante*	12 Jul 1996 to 17 Jul 1996
	DGWR Boat	29 May 1999 to 8 June 1999
ALAUFI transit	*RV L'Atlante*	29 Feb 2000 to 17 Mar 2000
VAVE FR08/2001	*RV Franklin*	5 Sep 2001 to 25 Sep 2001
TERRALIS	*RV Alis*	10 Dec 2003 to 20 Dec 2003
High Resolution Bathymetric Survey of Efate	*RV Turagalevu*	2 Aug 2003 to 27 Aug 2003
CoTroVE SS06/2004	*RV Southern Surveyor*	2 Jun 2004 to 27 Jun 2004

5.7 Clarion-Clipperton Zone (CCZ)

Since 1868, when polymetallic nodules were first discovered, scientific expeditions have demonstrated that there is a widespread occurrence in the world's oceans. Relatively dense zones are found in the north central Pacific Ocean, the Peru Basin in the southeast Pacific, and the centre of the north Indian Ocean. The highest nodule abundance and metal contents are found in the CCZ of the eastern equatorial Pacific, between Hawaii and Central America.

From the 1960s onwards, interest in the potential exploitation of nodules included the United States led International Decade of Ocean Exploration (IDOE) from 1972 to 1982. During this period some 30-40 US, 26 German, and 42 French cruises as well as Soviet and Japanese programs were completed. Seven mining consortia were formed at various times. This activity culminated in the trial mining or bulk sampling of nodules by two of these consortia in the mid to late 1970s. One consortium, led by the Canadian mining company INCO, collected polymetallic nodules from the abyssal plains of the CCZ, at a depth of approximately 5,500 mbsl (Figure 5-1). Nickel (the primary target at the time) as well as copper and cobalt were extracted from the recovered nodules using both pyrometallurgical and hydrometallurgical methods.

Activities stopped due to a combination of low metal prices, critical gaps in technology, and the lack of a secure mining tenure system.

Figure 5-1: Trial mining of nodules by the INCO consortium

6 Geological Setting

6.1 Woodlark Basin

The three main Woodlark Basin tenements follow the axis of the Woodlark Spreading Centre in the Woodlark Basin and cover an area of 633 km^2 (EL1387), 633 km^2 (EL1388), and 633 km^2 (EL1389). These three tenements underwent a further 50% relinquishment in 2009. Prospective areas relinquished as a result of compulsory 50% relinquishment were re-applied for, after the moratorium on applying for relinquished areas had ended. A series of other tenements held by Nautilus Minerals surround these tenements, and cover the adjacent parts of the Spreading Centre.

The Woodlark Spreading Centre (Figure 6-1) is an active spreading centre southeast of mainland PNG, where the continental crust of PNG has been rifting rapidly (~25 mm/yr) along an east-west axis for at least 6 million years (Martinez *et al.*, 2001).

Marine science research cruises discovered active hydrothermal venting at the Franklin Seamount, a 250 m high basalt-basaltic andesite volcano (crest at 2,138 mbsl) lying at the western propagating end of the Woodlark Spreading Centre, with a breached collapse crater (~300 to 400 m across) at its summit (Binns *et al.*, 1993). Two sites on the seamount have been investigated: Beaujolais, which consists of extensive deposits of Fe-Mn-Si oxide with some active venting of a clear, low-temperature fluid; Chablis is a group of barite-silica chimneys with disseminated sulfides on the crater floor. Six grab samples from Chablis, acquired by manned submersible dives, contained anomalous gold assays of 21.0, 21.1, 8.1, 11.0, 13.7, and 3.8 ppm Au (Binns *et al.*, 1993). Zn, Cu and Pb were present only at trace levels. The chimneys' mineralogy consisted of fine-grained barite aggregates, botryoidal silica, pyrite, sphalerite, galena, chalcopyrite and cerussite.

Note that the assay grades reported are from a scientific report and may be based on samples that were specifically selected for detailed analysis and scientific research on the formation and genesis of sea-floor massive sulfide systems. Therefore, the grades stated only reflect the grades of the samples selected and may not reflect the average value of any SMS deposit. No SMS deposits were discovered, however Binns *et al.* (1993) postulated that they may be present in the subsurface of the volcano.

The Woodlark Basin tenements are prospective for SMS deposits due to the combination of active spreading, active hydrothermal activity and known base-precious metal mineralisation.

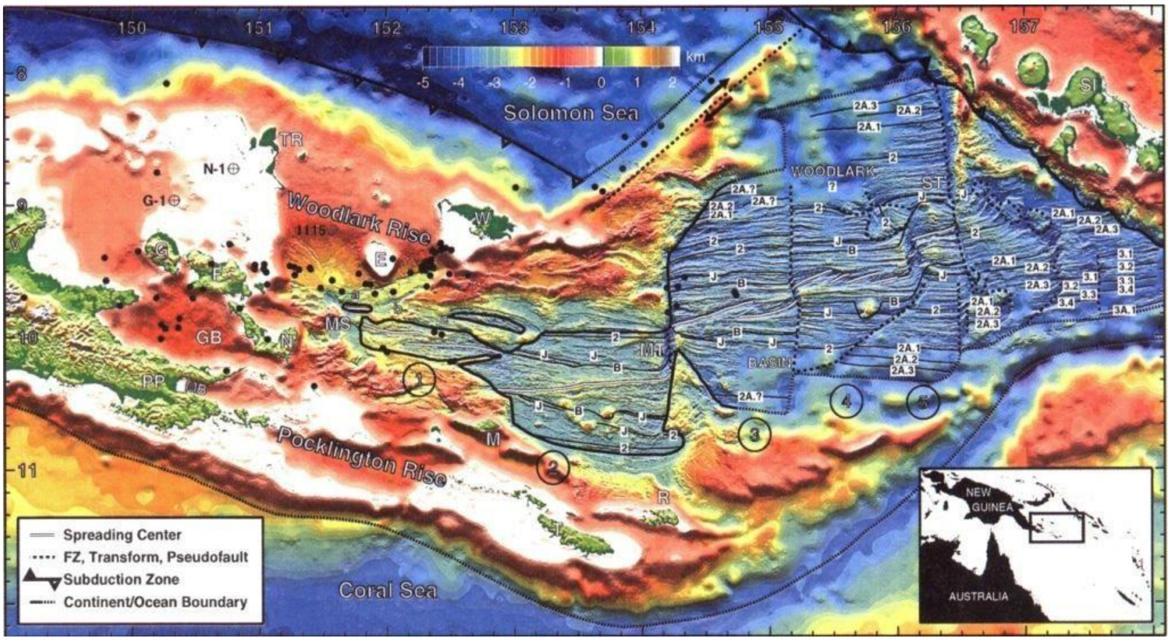


Figure 6-1: Bathymetry of the Woodlark Basin, showing the location of the active spreading centre

Source: Taylor *et al.*, (1999)

6.2 New Ireland Arc

This island chain lies to the east of New Ireland and north of Bougainville Island (refer Figure 3-1). Nautilus Minerals has applied for six exploration licences running roughly parallel to New Ireland from just north of Buka, Bougainville to just north of the Tabar Islands.

This volcanic arc includes several significant mineral deposits that make this region very attractive for metal fertility. The largest is the Ladolam Au deposit on Lihir Island with ~40 Moz. The Panguna Cu-Au porphyry system has Cu reserves of 3 Mt and 40,000 oz Au/annum. Simberi Au mine has over 2 Moz Au reserves with total inferred out to 6 Moz at ~1.1 g/t oxide. There are several other Au occurrences in the region, one in particular is Ambitle Island, which has incredible pan concentrate Au values and a few shallow DDH revealed ~10 m at up to 10 g/t Au. High hydrothermal pressures limited drilling further. Off shore in ~30 m water a strong hydrothermal spring is driving ~1.5 kg of As into the ocean very day. This is a very active metal-rich zone.

Just south of Lihir is Conical Seamount, which is a submarine alkali basalt volcano with the summit at a water depth of ~1,050 m and slope angle of ~15°. It has been surveyed several times during MSR cruises with ~1.2 tonnes of material dredged and/ or TV grab extracted from the summit plateau (~100 x 200 m diameter). It can be categorised as a submarine epithermal system containing poly-metallic (Au-Zn-Pb-Ag) veins and pyritic stockwork in altered volcanic host rocks. There are several unexplored seamounts along this arc corridor that may be prospective. The areas of interest lie in variable water depths from 100 to 2,400 m as a series of seamounts and ridges.

With regard to tectonic setting, the island arc lies to the SW of the Ontong Java Plateau, which blocked a major Pacific Plate subduction zone below PNG ~15 Ma. The recent volcanism is suggested to be related to the subduction occurring under New Britain producing high K, alkaline, SiO_2 under-saturated magma, which are highly oxidized and sulphur-rich. They are thought to be generated by partial melting of older metasomatised mantle wedge and extracted to surface through the old fore arc along reactivated transfer faults (Figure 2). A major driver for these systems is a hot mantle mix penetrating through a major slab tear from the northward subducting Solomon Sea Plate.

6.3 North Fiji Basin

This description of the North Fiji Basin (NFB) is compiled from Halbach *et al.* (1999) and Danyushevsky *et al.* (2006). The North Fiji Basin is a back-arc basin that began opening ~12 Ma. The triangular shape of the basin reflects southward propagation of the spreading centre since ~5 Ma. During this time (5-3 Ma), a short-lived intra-oceanic arc, the Hunter Ridge, formed along the southeast margin of the NFB. This arc magmatism occurred in response to a short period of NNW-directed subduction of the South Fiji basin crust under the NFB. The southern tip of the North Fiji Basin is a volcanically active submarine triple junction between the back-arc basin spreading centre, the Vanuatu Trench and the Hunter Fracture zone.

The spreading centre is moderately fast-spreading, with a spreading rate of about 6 cm/yr. In Nautilus Minerals' main tenement area in the western part of the basin, intense tectonism and recent hydrothermal activity have been observed. The sea floor topography is a 2 km wide axial valley, ranging from 1,980 mbsl in the north deepening to 2,200 mbsl in the south. It is bordered by two volcanic ridges rising 100 m above the adjacent sea floor. SMS systems have been found within this axial valley.

6.4 Lau Basin

The Lau Basin (Figure 6-2) is an active back-arc basin bounded to the east by the Tonga Ridge, and to the west by the Lau Ridge. The basin has a triangular shape, formed by differential spreading rates on the Eastern Lau Spreading Centre, ranging from 39 mm/yr in the south to more than 97 mm/yr in the north. The basin is over 1,500 km in length from south to north, and contains ridges and spreading centres that are prospective for SMS systems.

The oceanic crust is thinner in the north, where spreading is fastest (around 5.5 km thick) and thickest in the south (more than 9 km thick). The volcanic rocks also show variation along the length of the spreading ridge, with mainly basalt in the north, and mainly dacites and andesites in the south.

The main spreading ridges have been mapped by numerous marine science research cruises, and are known to host a number of active and waning hydrothermal vent sites and SMS systems. A seismic line completed along the length of the spreading centre in 2003 showed the presence of a magma chamber at depth in the southern portion of the main spreading ridge.

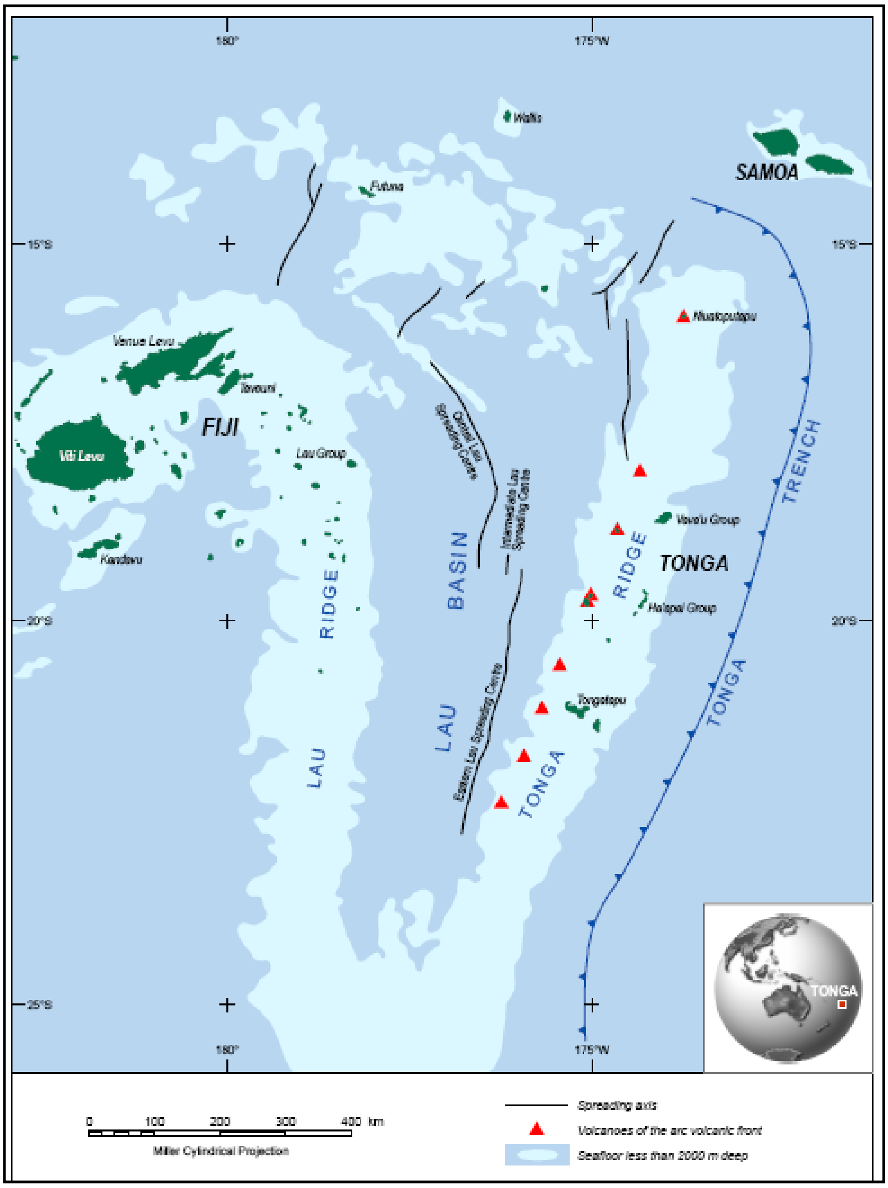


Figure 6-2: Tectonic setting of the Lau Basin

6.4.1 Tahi Moana 1 (CELSC Plume 12)

Tahi Moana 1 is located in a graben with steeply dipping axial faults and terraces, coincident with a large plume anomaly (CELSC Plume 12) found by previous marine scientific research cruises. The terraces are generally composed of pillow volcanics, with volcanic talus at the bottom of the rift. The seafloor adjacent to the rift is mostly covered by sediment. Anomalous biomarkers and bacterial mats are common throughout the target area and visibility.

There are three main chimney fields: Tahi Moana 1a, 1b and 1c. Tahi Moana 1a is a largely inactive chimney field about 480 by 90 m located at the intersection of the rift and major cross structures and the axial rift, on a plateau or terrace between two large axial faults. Massive chimneys and sulfide mound development have been observed with one chimney measuring 30 m high. Some active chimneys have also been observed. The chimneys were usually covered with a white bacterial mat. Minor volcanics were observed within the chimney field.

Tahi Moana 1b is about 1 km north of Tahi Moana 1a on a terrace on the western side of the graben in a similar setting to Tahi Moana 1a. It measures about 130 by 100 m.

Tahi Moana 1c is about 200 m to the south of Tahi Moana 1a, and comprises poorly developed chimney clusters in a field about 400 m long but only 10 to 20 m wide.

There are another five small chimney occurrences in the target area, all along the same structure as the three main fields. The eastern side of the graben is much steeper than the western side with smaller terraces, and is probably too steep for chimney development.

6.4.2 Tahi Moana 2 (NVFR 3 Plume Target)

Tahi Moana 2a is an inactive chimney field approximately 200 m long and up to 100 m wide; in places the chimneys are densely concentrated and show some mound development. The maximum chimney height is 13 m but generally the chimneys range from 3 m to 5 m tall. The chimneys are strongly degraded with a firm outside crust and soft, friable internal structure. Numerous attempts to sample the chimneys have failed. Extending to the west of the chimney field (and probably connected to the field) is a north-west trending structure 100 m long and at least 10 m wide filled with wall to wall chimneys with a distinctive flower structure.

The northern section of the original target area consists of two parallel north-east trending ridges. The eastern ridge is covered by thick volcaniclastic sediment and has generally poor outcrop with the exception of ridge parallel fault lines. The western ridge consists of fresh volcanic with little or no sediment cover. The volcanics appear to have flowed down both sides of the ridge forming long lava tubes and lobate flows. In places the ridge crest consists of sheet flows. The thick sediments on the eastern ridge generally have a scalloped appearance. Between the ridge crests the volcanics are generally auto breccias with minor lobate and sheet flows.

Further areas of chimneys have been discovered in the south of this target area close to the marked location of NVFR Site 3. Three areas were delimited and named NVFR Site 3a, 3b and 3c.

Approximately 200 m north of Tahi Moana 2a is Tahi Moana 2b; the two areas are separated by a younger lava-flow unit indicating very recent eruptive activity. The Tahi Moana 2b area is approximately 370 by 90 m in size with rare active (black smoke) chimneys and common degraded chimneys. Chimneys are generally less than 1 m tall with rare taller spires to 10 m. The chimneys occur between unsedimented lobate and autoclastic volcanic flows to their west and mainly sediment-covered flows to the east.

6.4.3 Tahi Moana 3 (Misiteli #2/VFR Plume 042)

Tahi Moana 3a is a small occurrence of highly altered volcanics (soft, Fe-oxide) with numerous small (<1 m) inactive chimney-like structures associated with a major structure.

Very soft chimney structures were found with Fe-oxide chimlets (small chimneys < 1 m) on the edges of the field. The area between the chimneys is composed of chimney talus and mat covered sediments. No volcanic rocks were observed within the chimneys. Active venting has been noted in the area.

6.4.4 Tahi Moana 4 (Telve Plume Target)

Tahi Moana 4 is an occurrence of single chimneys and clusters up to 3 m high with associated diffuse clear-water venting in an area of approximately 120 by 40 m. The chimneys are anhydrite rich and poorly cemented, making sampling difficult. The chimneys have wide bases with numerous flanges and appear to grow from relatively unaltered volcanics. Outcrop around the chimney field is 40-50% volcanics flows and volcanic talus masked by sediment. There is evidence of volcanics overlying sediments and debris flows overlying volcanics indicating recent volcanic and tectonic activity.

6.4.5 Tahi Moana 5 (Misiteli Plume Target Area)

Multiple small chimney fields related to ridge-parallel structures have been named Tahi Moana 5a through to Tahi Moana 5g.

Extensive yellow and grey mats with associated diffuse venting occur in the north-western part of the area. The underlying volcanics (generally talus) are altered over extensive areas and throughout thick vertical sequences as observed on steep slopes. Extensive chimney development exists, with columns up to 15 m high (Tahi Moana 5a, 5b, 5c and 5d) and is associated with a north-south fault and bathymetric low. Many of the chimneys are active.

A further chimney field was located 120 m southeast (Tahi Moana 5e); here the chimneys are up to 15 m high, many with white mushroom-shaped tops showing diffuse venting. Numerous small (<1 m) chimney-like structures made of iron oxides grow from areas of venting in volcanic outcrop; these structures are extremely soft and collapse on sampling. An extensive area of altered volcanics surrounds the chimney fields. The volcanics (generally talus) are altered to iron oxide and clay and have extensive yellow staining between the clasts.

At Tahi Moana 5f and Tahi Moana 5g, chimneys are mainly made up of active, between 5 and 15 m high, mostly active and hosted fauna including mussels and squat lobsters. The presence of yellow and black mat/ precipitates was also noted, containing iron oxide mounds and small chimlets on a substrate of altered volcanic.

6.4.6 Tahi Moana 6 (Si'i Si'i Plume Target)

Tahi Moana 6 is an occurrence of three chimney clusters over an area of 175 by up to 75 m. The chimneys are up to 6 m high, have a mushroom shape and are covered with a white bacterial mat. Active chimneys (grey smoke) were noted along with numerous passive vent sites of shimmering water. Distinctive, possibly sulfide, mounds of 5 to 10 m diameter with white anhydrite veining occur. Tahi Moana 6 occurs on a ridge of brecciated flows and volcanic talus with minor areas of sediment cover.

6.4.7 White Church

White Church was initially discovered by a marine science research cruise. Minor small inactive chimneys were confirmed by Nautilus Minerals. An area containing chimneys approximately 470 m by 80 m was discovered, although significant areas of volcanic outcrop are contained within this. Chimneys are inactive, weathered and of variable size. Some mound development was observed, which suggests sub-seafloor mineralisation.

The surrounding rocks are dominantly volcanic breccia (flow breccia and some talus) with minor pillow basalt.

6.4.8 NVFR Site 2

NVFR Site 2a consists of inactive chimneys located on three ROV traverses in a zone approximately 220 m by less than 25m wide. NVFR Site 2b is a small site with two chimneys, one very soft and the other inactive and degraded. Areas about 1 m in diameter of clear water venting surrounded by snails and mats were found adjacent to the chimneys.

6.4.9 NVFR Site 3

NVFR Site 3a covers approximately 430 by 140 m, but has some significant areas of volcanic outcrop between chimney clusters. The central area of the chimney field consists of large flanged chimneys with rare towers. The flanges seem to be growing together, in some cases resulting in a sulfide floor. The central chimneys are generally less than 5 m high. Chimneys in the southern part

of the field are active grey smokers and have abundant bio-markers: these chimneys were generally much higher than the central chimney area, had less flanges, and more biota. Chimneys ranged up to 13 m in height.

NVFR Site 3b covers approximately 150 by 100 m and is located at the base of a ridge-parallel fault on the eastern margin of the area. The field included active clear water vents and extensive bio-markers. Chimney clusters are up to 5 m high with a volcanic substrate.

NVFR Site 3c covers approximately 70 by 50 m. Clusters of inactive chimneys occur with rare bio-markers. The chimneys are surrounded by pillow lava units with some mound development. The chimneys occur in a rift, bounded on both sides by steep slopes.

6.4.10 Mariner (Mariner/FVR Plume 12-2)

At the Mariner site, numerous tall (10-15 m high) chimneys occur both singly and in clusters with wide bases and occasional white/ yellow matting on the tops. On sampling, many of these structures were found to be extremely soft and disintegrated to a yellow powder; these are probably Fe-Mn oxide accumulations. Hydrothermal activity includes clear water venting, white smokers and black smokers. Many of the active chimneys have a white or yellow mat on the top. The chimneys appear to be barite and anhydrite rather than massive sulfide.

6.4.11 Hine Hina 1

Hine Hina 1a consists of inactive chimneys up to 3 m tall adjacent to a steep cliff with some smaller chimneys noted on sediment covered slopes in the area. An area of diffuse water venting also occurs with associated iron-manganese-oxide precipitates and possible flange growths.

Hine Hina 1b is an area of bulbous inactive chimneys in an area of sediment draped volcanic flows. An irregular ridge of 100 m length by just 1 m width of slightly domal shaped features with irregular cracks and fissures with protruding growth structures also occurs in this area. In most cases, the growth structures are less than 50 cm high and formed of soft, black manganiferous material.

6.4.12 Tui Malila 1

Tui Malila 1a consists of numerous clusters of active chimneys up to 13 m high on a volcanic substrate. Large areas of clear water venting without chimney development, but with vent bio-markers were also noted. The area of chimneys and venting covers approximately 225 by 80 m.

Tui Malila 1b is 170 m to the north of Tui Malial 1a and consists of chimneys over an area of 140 by 90 m. No venting was directly observed but turbidity is relatively high in this area. Chimneys were up to 10 m tall.

6.4.13 Maka

The Maka system is located at approximately 1660 mbsl and on the crest of the North East Lau Spreading Centre. S ulfide outcrops up to 4 m high protruding from the base of predominantly pillow basalts over an area of approximately 130 m by 100 m.

6.4.14 Tunu-Sosisi

The Tunu-Sosisi system comprises three subsystems (Tunu, Sosisi 1 and Sosisi 2) at approximately 1635 mbsl. The three subsystems are 150 m by 100 m, 150 m by 60 m and 105 m by 70 m respectively. The system lies along a roughly linear zone over a 1.7 km length on a major structural zone cross cutting the southern rim of the North East Lau Caldera. All three subsystems have sulfide outcrops protruding from a soft sedimentary base.

6.4.15 Pia

The Pia SMS system is located at approximately 1470 mbsl and is close to a major structural zone that cross-cuts the northern rim of the North East Lau Caldera. The system is 200 m by 80 m. All sulfide outcrops protrude from a soft sedimentary base.

6.4.16 Niua

The Niua SMS system comprises two subsystems that lie approximately 1,300 m apart within individual crater-like depressions in a rifted part of the old Tongan arc. The first system, Niua-2 is at 900 mbsl with a strike length of approximately 230 m and width of 170 m. The second system, Niua-3 is at 1,180 mbsl with a strike length of approximately 270 m and width of 250 m.

6.4.17 Tahi Moana 7 (North East Lau 5 Target)

Tahi Moana 7 lies on the North East Lau Spreading Centre. Previous research cruises detected water column anomalies suggesting strong hydrothermal source on the axis of the ridge. High resolution bathymetry and seven CTD tow-lines were completed by Nautilus Minerals, which identified a water column anomaly with strong nephelometer and Eh response. A total of 47 water samples were taken within the NEL5 area with most around the Tahi Moana 7 site.

One camera tow was conducted over Tahi Moana 7 which delineated a several hundred metre extent of chimney field. Biota, alteration indicators and pillow basalts were also reviewed. A dredge of the seafloor recovered basalts and massive sulfides.

An AUV multi-beam survey conducted from the Kilo Moana in 2011 mapped part of Tahi Moana 7 outside the expected chimney area before the multi-beam sensor failed. CTD turbidity data from the AUV revealed hydrothermal venting from several sources, while magnetic data showed structures capable of hosting sulfides, although it also suggested that volcanic flows overlie much of the area.

6.4.18 Tahi Moana 8

Tahi Moana 8 lies within the Central Fonualei Rift system. A Kilo Moana 2011 AUV dive was conducted at this location as a follow up on previous targeting work conducted from the Southern Surveyor in 2009. The Southern Surveyor CTD tow was targeted on the location where sulfide samples were recovered during a KORDI survey. The Southern Surveyor detected a water column anomaly within 2 km of the FRSC02 site from which KORDI reported to have dredged sulfides. A follow-up camera tow (on the same Southern Surveyor cruise), failed to gain any footage due to a technical failure, but fortuitously recovered one piece of massive sulfide, probably knocked off a sulfide chimney in the area.

The Kilo Moana 2011 AUV dive collected multi-beam bathymetry allowing confident interpretation of chimney features. There were a multitude of clusters (~20) interpreted along a ~3.5 km corridor which is semi-parallel to the main N-S trending ridges and spreading centre. The corridor is only a few hundred metres wide and the interpreted chimney clusters are varied in size and shape, but the bigger clusters appear to lie in the north of the block and actually continue up to the boundary of the survey and hence there may be more to be found further to the north. A follow-up camera tow (TC12) was placed over targets identified in the AUV bathymetry. The camera tow was dominated by volcanic debris, pillows and some sediment. There were at least three separate, small stands of chimneys and alteration spread out along the 2 km track. A dredge (DR19) recovered sulfides and glass rimmed, vesicular mafic volcanic rocks. Sulfides composed of ~5 kg of chimney fragments coated in manganese, which appear to be inactive remnants with some weathered features such as interior soft, grey-green massive sulfides. Sphalerite, pyrite, galena and barite can be identified.

6.5 Solomon Islands

The structural-tectonic setting within the Woodlark Sea license area has the potential for the polymetallic SMS mineralisation. The area includes a series of submerged structural ridges and fault zones adjacent to active spreading centres, which occur to the west of an active subducting slab and trench. Hot magmas below the active spreading centres are interpreted to induce hydrothermal activity in the overlying volcanic rocks and adjacent structures. The Eastern Solomons terrane includes an active arc and back-arc system on a large bend in the plate boundary that is likely to contain slab tears. Recent studies also confirmed the presence of fertile volcanic rocks.

6.6 New Zealand

New Zealand is situated astride a convergent plate boundary that extends offshore from the North Island towards Tonga and into the southern part of Samoa. A prominent feature on this plate boundary is the Kermadec Arc, which hosts numerous volcanic complexes and seamounts, occurring both on the arc and in a zone immediately west of the arc (de Ronde, 2006). The arc marks the boundary between the westward subducting Pacific Plate. Active volcanoes occur within a 40 km-wide, NNE-trending zone that extends for ~2,500 km.

The Havre Trough region lies to the west of the Kermadec Arc and is interpreted as a back-arc rift system. Nautilus Minerals' New Zealand application lies within the Havre Trough area (Figure 6-3).

Flanking the Havre Trough, the remnant Colville Ridge to the west (~5Ma) and the active Kermadec Arc to the east, form a series of longitudinally semi-continuous ridges. Studies of hydrothermal plumes along the southern part of the Kermadec Arc during the 1999 New Zealand American Plume Mapping Expeditions (NZAPLUME) showed that 7 of the 13 volcanoes surveyed were discharging metal-rich fluids into the surrounding ocean. Similarly, later studies verified both the frequency and heterogeneous nature of venting further north along the Kermadec Arc (de Ronde, 2006).

6.7 Vanuatu

Vanuatu forms part of the New Hebrides Island Arc. This is currently the active island arc forming at the western boundary of the North Fiji Basin where the Australian Plate is being subducted beneath the Pacific Plate at the New Hebrides Trench (Figure 6-4). The Coriolis Troughs are a series of very young back-arc basins forming behind the active arc, south of 17°S. The centre of this subduction zone, between 13.5°S and 17°S is affected by the subduction of the D'Entrecasteaux Ridge, and forms a back-arc thrust belt, which is a compressional terrain, rather than extensional, and the hydrothermal prospectivity here is lower. North of 13.5°S, the Jean Charcot Troughs are also thought to be back-arc basins. Hydrothermal indicators have been located throughout the Coriolis Troughs, at several arc volcanoes, and in the Jean Charcot Troughs.

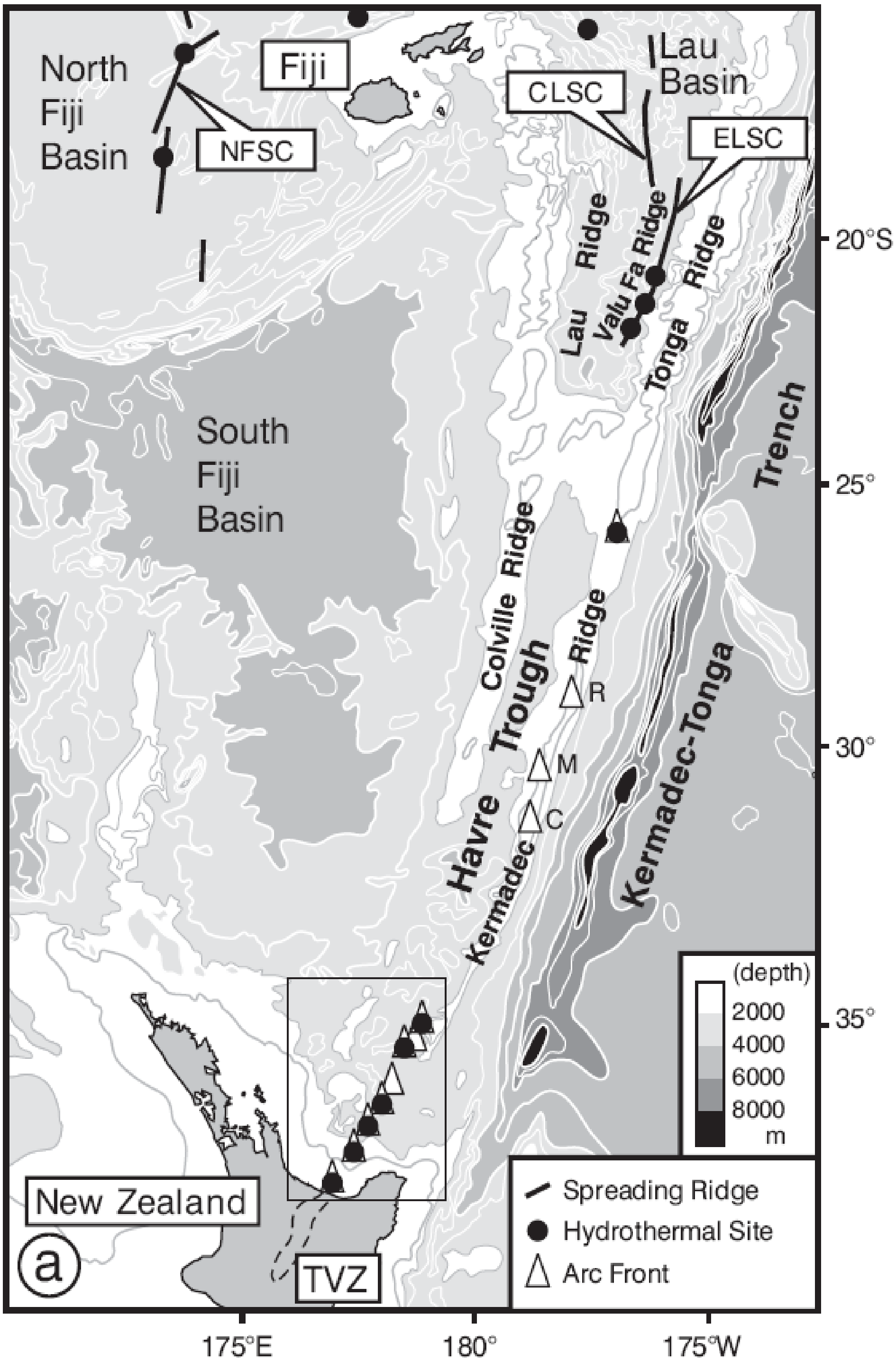


Figure 6-3: Tectonic setting of the Tonga-Kermadec Arc

The Australian and Pacific plates occur W and E of the Tonga-Kermadec Trench, respectively (de Ronde, 2006).

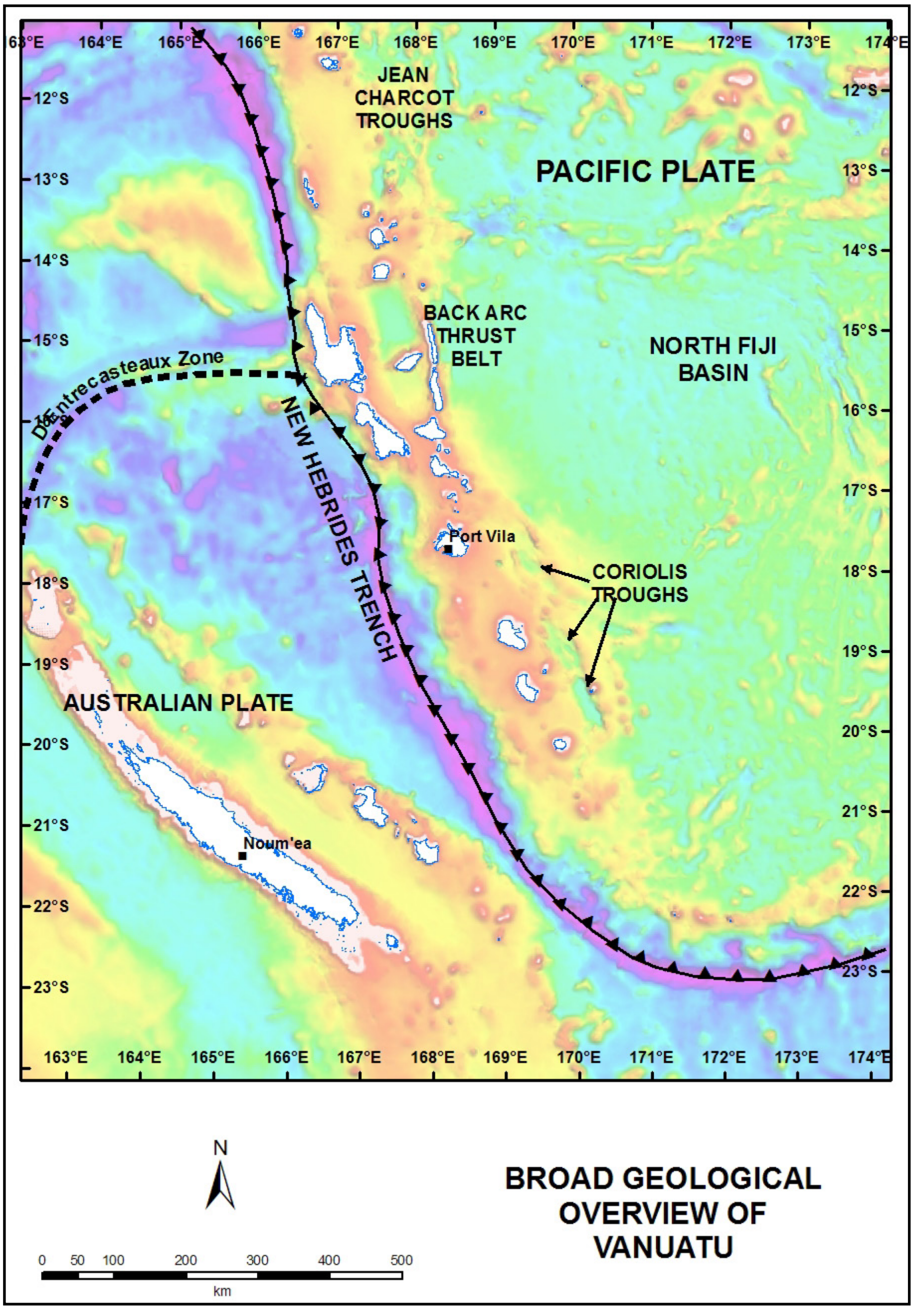


Figure 6-4: Geological setting of Vanuatu

6.8 Clarion-Clipperton Zone

The seafloor in the CCZ is between 4,000 mbsl and 5,000 mbsl; characterised by NW-SE to NNW-SSE trending elongated horsts and grabens, largely of Oligocene to Miocene age. They are overlain by a variable-thickness drape of largely Miocene to Holocene aged sediment of varying composition. The sediments are predominately carbonate mud in the south, and siliceous clays in the north. This pattern largely reflects the current location of the Carbonate Compensation Depth (CCD).

The position of the CCD has not remained constant over time. The seafloor has migrated relative to the Equator, and the balance between tectonic displacement, biological activity, and clastic sedimentation has been dynamic over geological time. As a result, three dimensionally and temporally the sedimentary pattern is locally quite complex with interfingering layers in both north-south and east-west orientations.

The pattern is complicated further by a basin wide mid Miocene unconformity. Nodule development is most favoured by lower sedimentations rates, and high biological activity, conditions occurring most readily below the CCD.

Major east-northeast structures (the Clarion and Clipperton Fracture Zones) dissect the northern and southern margins of the CCZ. Both fracture zones have been volcanically active in the past, and are a likely source for some the of the nodule metal, along with the relatively much more active East Pacific Rise to the east of the nodule area.

7 Deposit Types

7.1 SMS discovery and global distribution

More than 300 sites of hydrothermal activity and seafloor massive sulfide mineralisation are known (Hannington *et al.* 2004) (Figure 7-1), of which about 100 have high-temperature venting or polymetallic sulfide deposits. The existence of more can be inferred on the basis of hydrothermal plume studies (Baker *et al.*, 2003). These hydrothermal sites have been discovered principally by cooperative research and government institutions conducting basic research on Earth processes. Deposits of metalliferous mud and sulfides are formed at, or adjacent to, the vent site when the rising hot hydrothermal fluids mix with the cold ambient seawater on the sea floor.

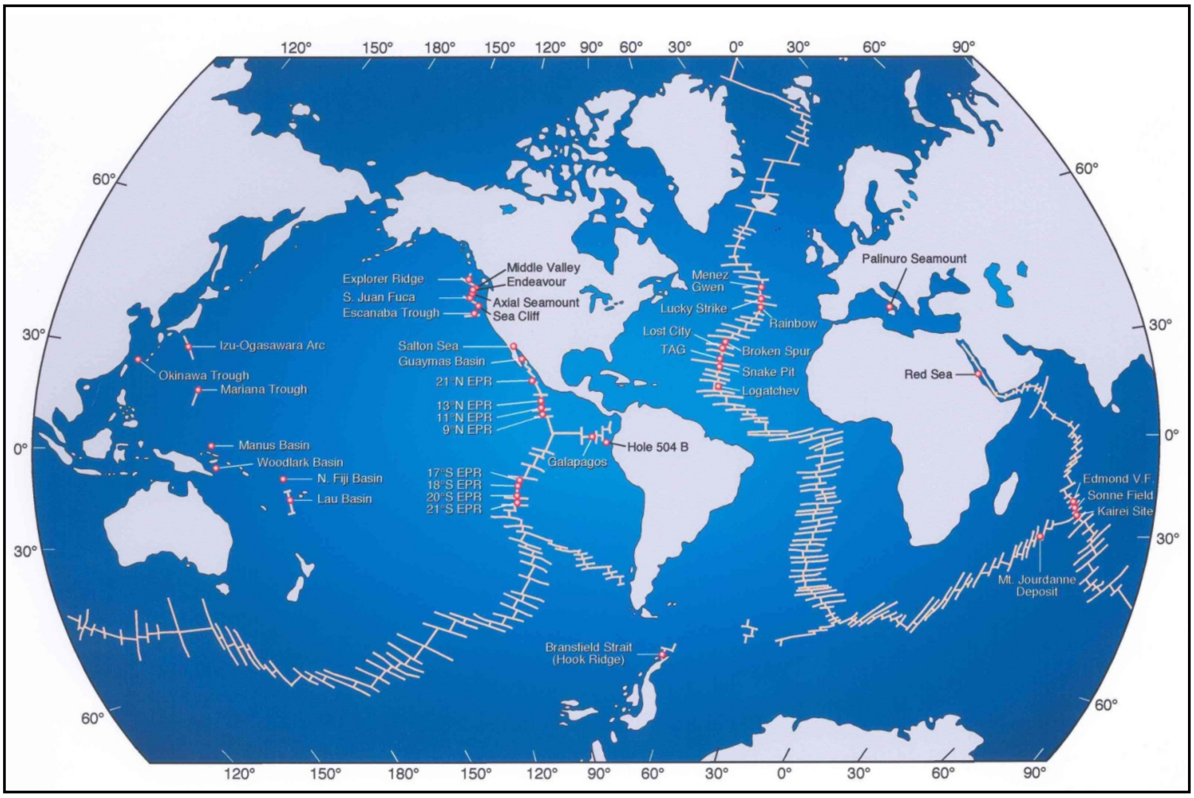


Figure 7-1: Known hydrothermal systems and polymetallic massive sulfide deposits

The Atlantis II Deep deposit is located in the Red Sea and is the largest known seafloor sulfide deposit. During the 1970s, the Sudanese and Saudi Arabian governments contracted the German company, Preussag, to bulk sample and review the economics of mining the Atlantis II Deep deposit (Guney *et al.*, 1984). Although there were some higher grade parts of the deposit, the overall grades of 0.45% Cu, 2.07% Zn, 39 g/t Ag and 0.5 g/t Au were considered to be uneconomic.

The first active 'black smoker' chimneys (and associated SMS deposits) were discovered in 1977 around the Galápagos Islands by the National Oceanic and Atmospheric Administration. They were observed using the submersible *Alvin*. Subsequently, numerous marine scientific research projects have discovered SMS systems throughout the oceans of the world. This period of rapid discovery was followed by exploration in western Pacific back-arc basins. One of the first discoveries of modern massive sulfide chimneys was in the Manus Back-arc Basin in PNG (Both *et al.*, 1986). Although not unlike their mid-ocean equivalents, subsequent research on back-arc SMS systems has shown them to be higher grade (Herzig, 1999). By drawing an analogy with ancient felsic-hosted VHMS deposits, further expeditions discovered SMS deposits in volcanically active back-arc

rifts (Halbach *et al.*, 1999; Binns and Scott, 1993) and within the calderas of submarine arc volcanoes (Iizasa *et al.*, 1999; de Ronde *et al.*, 2001).

The 1991 discovery of actively forming massive sulfide chimneys with high base- and precious metal contents in felsic volcanics at Pual Ridge (Solwara 4) demonstrated the potential of PNG to host high grade SMS deposits (Binns and Scott, 1993; Binns *et al.*, 1993). In 1997, the PNG Government granted Nautilus Minerals the first two exploration licences for SMS deposits, covering the Solwara 1, 2, 3 and 4 areas, in the Bismarck Sea.

Only about 13% of the known 82,000 km of prospective sea floor environments worldwide have been carefully surveyed, with another ~6% in less detail (Baker *et al.*, 2003). To date, academic research efforts have only focussed on the active hydrothermal fields and little is known about extinct or mature fields. The older fields are the priority target for Nautilus Minerals' exploration programmes as these areas contain deposits that are mature, and therefore more likely to be of a sufficient size for exploitation. The extinct fields are also less likely to support colonies of hydrothermal-specific marine life. There are likely to be many more extinct fields deposited over time (~100,000 years) on the sea floor than currently active fields, which are the main focus of researchers.

7.2 Characteristics of terrestrial VHMS deposits

Volcanic-hosted massive sulfide (VHMS) deposits form a major part of the world's reserves of copper, lead and zinc, as well as being producers of gold and silver. Over 800 terrestrial (land based) VHMS deposits have already been identified around the world (Franklin *et al.*, 2005). These deposits occur in rocks that range in age from the Archaean through to the Cainozoic, with notable examples being the deposits of the Iberian Pyrite Belt in Spain and Portugal, Kidd Creek and the Noranda Camp in Canada, and Kuroko in Japan.

VHMS are commonly found in clusters, consisting of dozens of individual deposits, around 1 to 10 Mt within a larger mining camp. A selection of VHMS deposits is tabulated in Table 7-1; a comparison of the Solwara 1 resource, located in the Bismarck Sea, to some other VHMS deposits is shown in Figure 7-2.

Large *et al.* (2005) listed the features common to VHMS deposits:

- They are hosted in volcanic or volcano-sedimentary successions originally deposited under water;
- They are the same age as the host succession;
- The host rocks vary from coherent volcanic to volcaniclastic or sedimentary facies, and range in composition from basalt through andesite and dacite to rhyolite;
- Most deposits are hosted in thin volcaniclastic units (less than 100 m thick) between major volcanic formations;
- The economic parts of the deposits typically comprise >80% sulfide minerals by volume, principally pyrite, sphalerite, chalcopyrite and galena;
- Massive sulfide lenses are commonly aligned parallel to volcanic strata;
- Stringer (or stockwork) sulfide zones commonly underlie the massive sulfides and may contain economic Cu grades;
- Metal contents and metal ratios vary considerably - deposits may be Cu-rich, Au-rich, Cu-Zn-rich or polymetallic (Cu-Zn-Pb-Ag-Au) types; and
- Ore metals within sulfide deposits are typically vertically zoned, from Cu at the stratigraphic base to Zn, Pb, Ag, Au and Ba towards the top. However, there are many exceptions to this zonation pattern.

The widely accepted genetic model for VHMS deposits is that they are formed at, or just below, the seafloor, in volcanically-active extensional settings, where convected seawater is drawn into the seafloor down extensional faults. Vent fluids are heated (>200°C) by underlying magmas, and leach metals from the underlying volcanic rock; this metal-rich fluid may also mix with magmatic fluids sourced from sub-volcanic intrusions. The reduced hydrothermal fluid is then driven upwards towards the seafloor via fault pathways, and expelled at or immediately below the seafloor surface. When in contact with cold seawater, the hydrothermal fluid cools rapidly and precipitates sulfides, sulphates and Fe-oxide minerals. Long lived precipitation eventually builds up a mound of metal-rich sulfide on or immediately beneath the seafloor.

Within a mining camp, VHMS deposits tend to be spatially clustered with multiple deposits, commonly forming at a single stratigraphic level. Deposits are localised at the prospect scale by the distribution of synvolcanic extension faults. These extension faults are active during the formation of the deposits and create the permeability required to allow transport of the upward-migrating metal-laden fluids to reach either the sea floor or the immediate sub-sea floor porous environments.

Table 7-1: Average grade and tonnage data* for selected VHMS groups

Area	Dominant metals	Number of deposits	Average grade and tonnage					
			Cu (%)	Zn (%)	Pb (%)	Ag (ppm)	Au (ppm)	Mt
Abitibi Belt, Canada	Cu-Zn	52	1.47	3.43	0.07	3.19	0.8	9.2
Norwegian Caledonides	Cu-Zn	38	1.41	1.53	0.05			3.5
Bathurst, N.B., Canada	Zn-Pb-Cu	29	0.56	5.43	2.17	62.0	0.50	8.7
Green Tuff Belt, Japan	Zn-Pb-Cu	25	1.63	3.86	0.92	95.1	0.90	5.8
Iberian Pyrite belt	Cu-Zn	85	0.80	2.00	0.70	26.0	0.50	20.8
Australian Palaeozoic	Cu-Zn	24	1.13	4.10	1.62	42.95	1.78	10.7

Modified after Lydon (1993) and Large (1992).* This information does <u>not</u> relate to mineralisation on the properties that are the subject of this technical report.

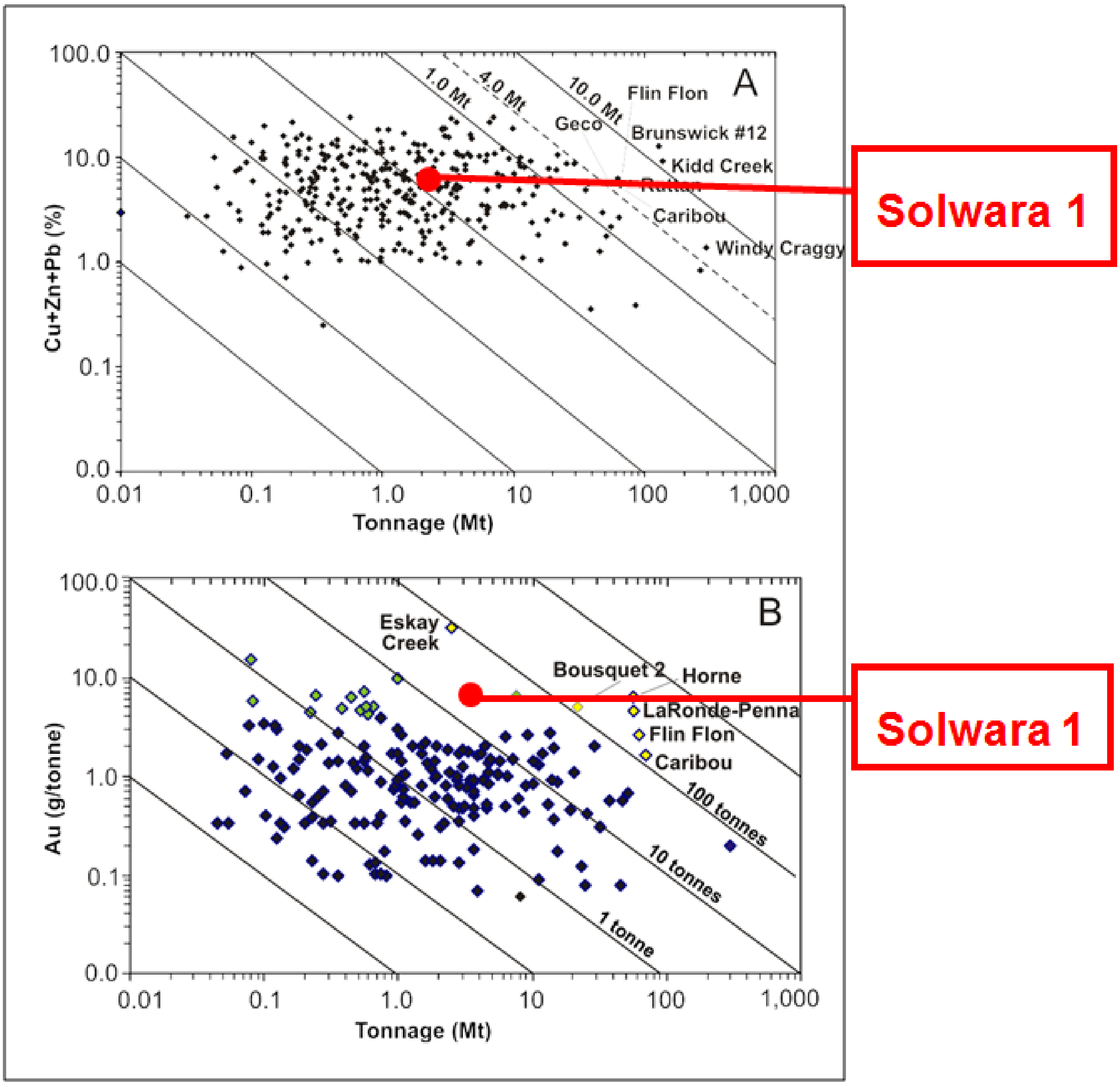


Figure 7-2: Comparison of Solwara 1 resource to Canadian VHMS deposits

Source: Galley *et al.* (2008)

7.3 Formation and morphology of SMS deposits

SMS deposits can be subdivided into three end member deposit styles, based on morphology (Large, 1992):

1 lens and blanket deposits have a low aspect ratio with a dominant zinc-rich massive sulfide lens and subordinate stringer zone;

2 mound deposits have a high aspect ratio, narrow and elongate massive sulfide with a well-developed stringer zone; and

3 pipe and stringer deposits have cross-cutting massive sulfide pyrite-chalcopyrite pipe or stringer zones with little or no stratiform Zn-rich sulfide lenses.

SMS deposits are commonly formed on the sea floor near plate margins in either:

- divergent plate margins such as mid-ocean ridge spreading centres or spreading back arc basins;
- convergent plate margins such as island arcs or continental margins; or
- intra-plate oceanic islands.

SMS deposits are formed in geological settings where extensional fault systems facilitate the deep circulation of sea water in convection cells, formed by heat flow from submarine volcanic activity. Active sulfide deposition on the ocean floor (Figure 7-3) is confined to sites where hot (>200°C) rising hydrothermal vent fluids mix with cool (2°C) ambient ocean water. Through the accumulated precipitation of the sulfides at the vent site, chimney-like structures form.

These chimneys consist of anhydrite and polymetallic sulfides resulting from the combined process of:

- episodic flux of the hydrothermal vent fluid;
- sea floor oxidation; and
- seismic events which contribute to the collapse of the old chimney structures and the initiation of new chimney structures.

This cyclical process results in the formation of a sulfide mound on the sea floor. As the size of the mound increases, through prolonged hydrothermal activity, the mound permeability decreases to a point where precipitation, replacement and remobilisation of sulfides inside the mound can occur resulting in a concentration of minerals.

The obvious similarities (tectonic setting, mineralogy, metal zonation and alteration zonation) between SMS deposits and mound style VHMS deposits have led the research community to conclude the systems are analogous.

To date research programs have mostly identified SMS deposits that appear to be analogues with the mound style of VHMS deposit, as these are forming on the sea floor surface and are readily detectable by bathymetry, camera tows, dredge sampling or ROV mapping and sampling. Any SMS analogues of the other two styles of VHMS deposits (pipe and stringer deposits and lens and blanket deposits) would be forming beneath the sea floor, and require geophysical, geochemical and drilling techniques to detect them rather than by direct seafloor observations.

VHMS deposits on land commonly form in clusters. This is likely to be similar for SMS deposits; however, many small (<0.5 Mt) SMS deposits could be mined by moving floating infrastructure, whereas on land VHMS deposits of this size may individually be too small to justify development.

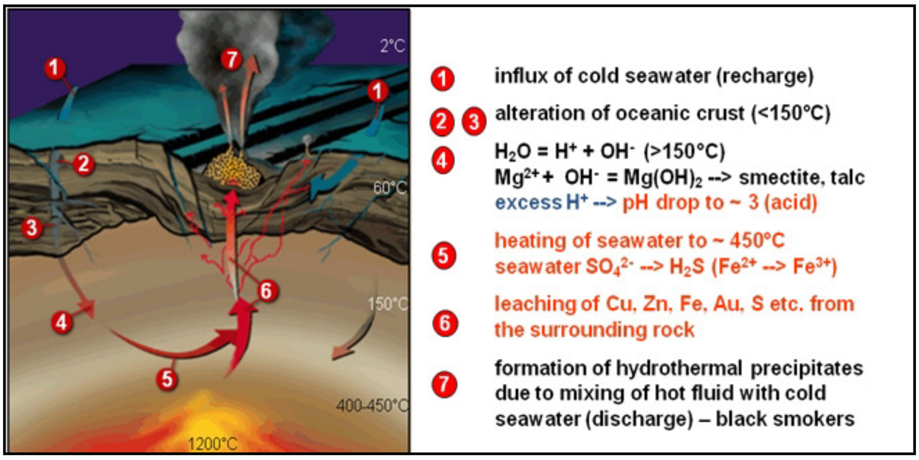


Figure 7-3: Schematics of development of modern mound-chimney SMS deposit

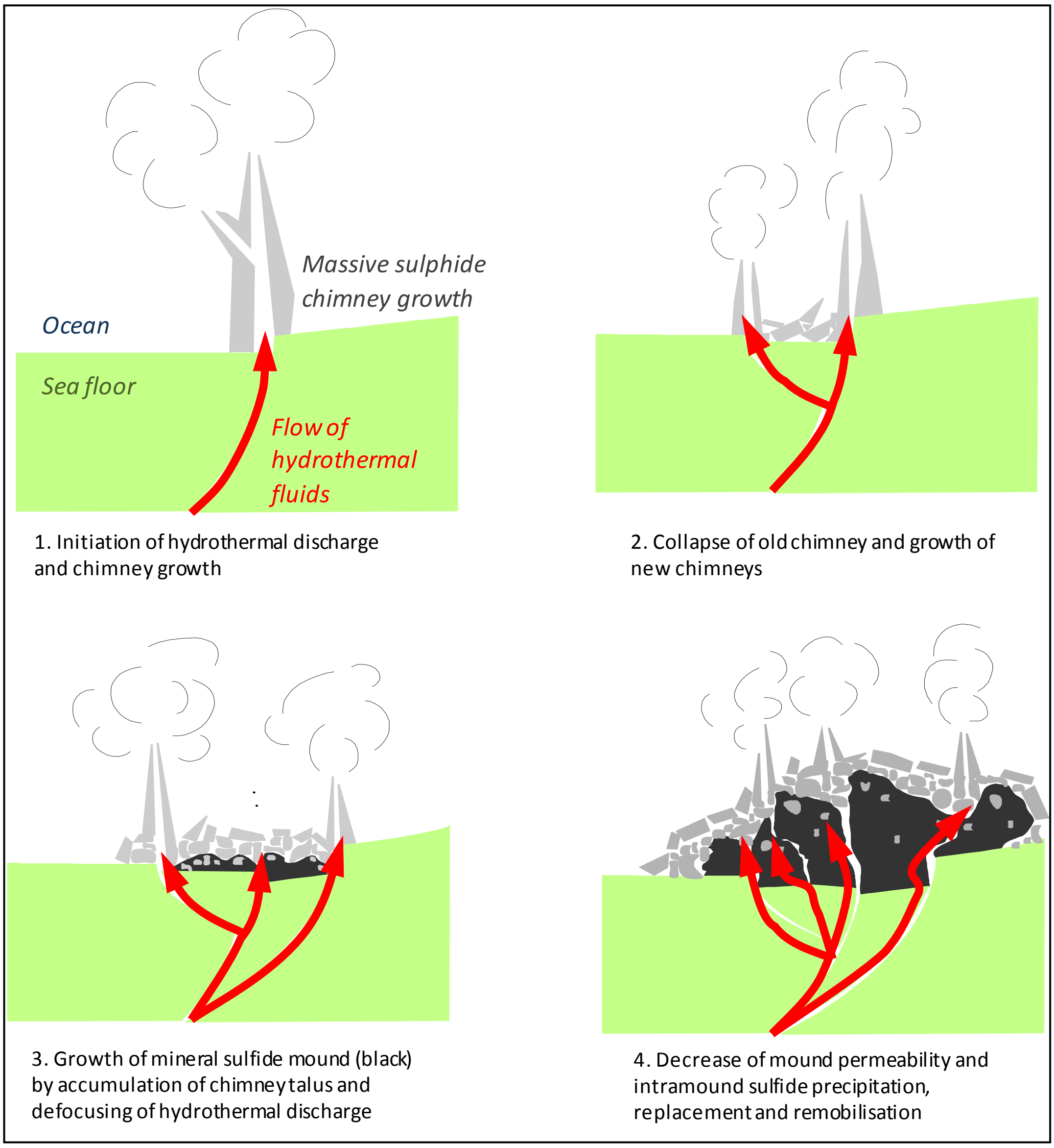


Figure 7-4: Schematic diagram showing hypothesis for the development of SMS mounds on the seafloor

7.4 Polymetallic nodule deposits

7.4.1 Discovery and global distribution

Submarine ferromanganese concretions were first discovered in the Kara Sea off Siberia in 1868 (Earney, 1990). In the course of its round-the-world expedition from 1873 to 1876, *HMS Challenger* collected many small dark-brown balls, rich in manganese and iron (Murray and Reynard, 1891; Manheim, 1978; Earney, 1990).

Polymetallic nodules are found on the seabed in many areas, and have been comparatively well studied because of their potential economic importance (Mero, 1965). The CCZ has been the focus of much international attention for many years (Mero, 1965; McKelvey *et al.*, 1979; Bernhard and Blissenbach, 1988). Nodules of economic interest have been found in three areas: the north central Pacific Ocean, the Peru Basin in the southeast Pacific, and the centre of the north Indian Ocean. The most promising of these deposits in terms of nodule abundance and metal concentration occur in the CCZ of the eastern equatorial Pacific between Hawaii and Central America.

7.4.2 Formation and morphology of polymetallic nodule deposits

Nodules lie on the seabed sediment, often partly or completely buried (Figure 7-5). They vary greatly in abundance, in some cases touching one another and covering more than 70% of the sea floor. They can occur at any depth, but the highest concentrations have been found on abyssal plains between 4,000 and 6,000 mbsl.

Nodule growth is one of the slowest of all geological phenomena, at rates of 1 to10 mm per million years. Several processes are involved in the formation of nodules, including the precipitation of metals from seawater, the remobilization of manganese in the water column, the derivation of metals from hot springs associated with volcanic activity, the decomposition of basaltic debris by seawater and the precipitation of metal hydroxides through the activity of microorganisms. Several of these processes may operate concurrently or they may follow one another during the formation of a nodule (**Error! Reference source not found.**; Figure 7-7).

Polymetallic nodules are classified into three types, according to their morphology, size and texture;

1 S-type (smooth type);

2 R-type (rough type); and

3 S-R-type (smooth-rough mixed type).

The chemical composition of nodules varies according to manganese mineralogy. Those of greatest economic interest contain manganese (27-30 %), nickel (1.25-1.5 %), copper (1-1.4 %) and cobalt (0.2-0.25 %). Other constituents include iron (6 %), silicon (5%) and aluminium (3%), with lesser amounts of calcium, sodium, magnesium, potassium, titanium and barium, along with hydrogen and oxygen.

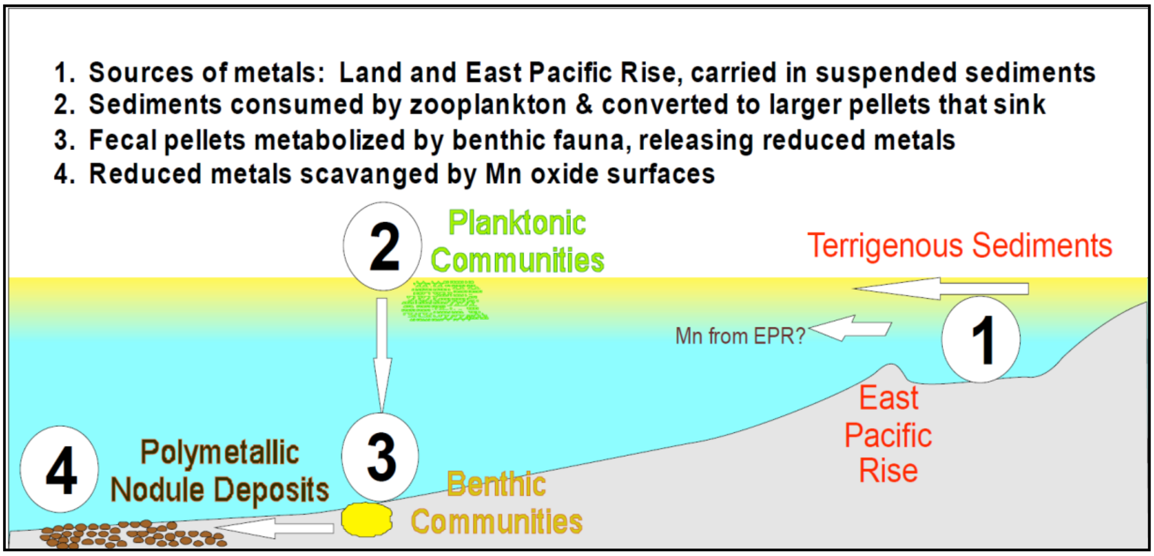


Figure 7-5: Formation model for CCZ polymetallic nodules

Source: ISA Technical Study No. 6

Figure 7-6: Nodule pavement at depth within the CCZ

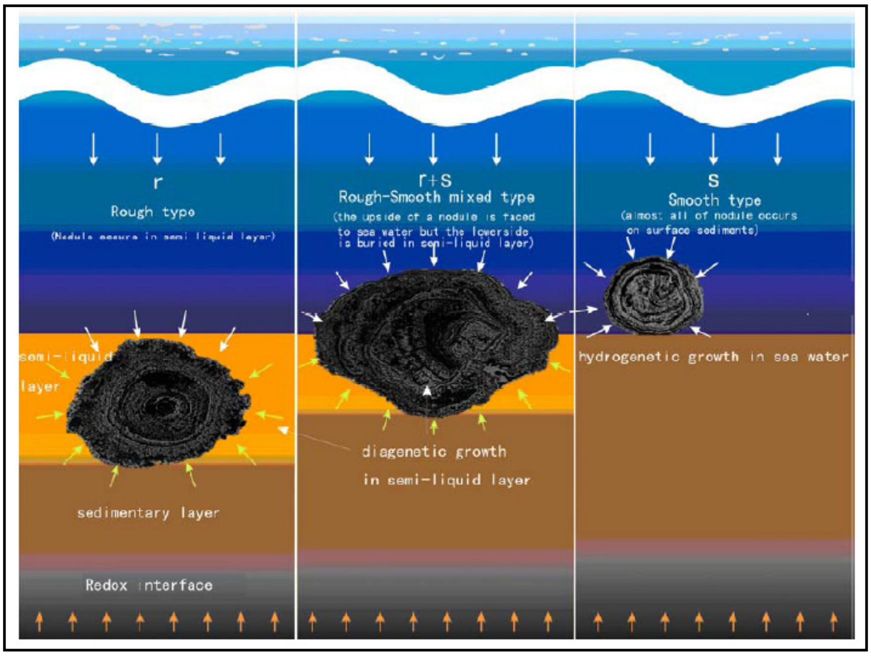


Figure 7-7: Polymetallic nodule growth process

8 Mineralisation

This section includes results from previous studies and investigations, along with descriptions of mineralised zones, surrounding rock types and geological controls.

Nautilus Minerals has collected grab samples from 17 SMS systems located within tenements pertaining to this technical report. All these SMS systems are located in the Kingdom of Tonga. The mineralised samples from these 17 SMS systems are tabulated in Table 8-1.

In the discussion that follows, reference is also made to additional marine scientific research samples that have been published.

Table 8-1: Average compositions of Nautilus Minerals grab subsamples from the Tongan SMS Systems

Prospects	Cu %	Zn %	Au g/t	Ag g/t	Grab sample count	Exploration stage
Tahi Moana 1	1.6	31.2	4.2	180	9 chimney samples	Target Testing
Tahi Moana 2	0.3	7.6	3.1	129	5 chimney samples	Target Testing
Tahi Moana 4	0.0	1.7	12.3	533	1 chimney samples	Target Testing
Tahi Moana 5	1.5	12.8	19.9	696	7 chimney samples	Target Testing
Tahi Moana 6	0.4	27.0	7.8	230	3 chimney samples	Target Testing
Tahi Moana 7	2.5	27.8	10.2	81	19 chimney samples*	Target Testing
Tahi Moana 8	0.4	26.0	17.5	488	3 chimney samples*	Target Testing
Hine Hina 1	5.7	18.6	5.6	150	9 chimney samples and 2 rock samples	Target Testing
Maka	5.4	6.0	4.6	62	3 chimney samples	Target Testing
Mariner	3.8	24.2	3.6	80	3 chimney samples	Target Testing
Niua	8.1	15.3	13.7	313	3 chimney samples	Target Testing
NVFR Site 2	0.7	23.7	5.7	128	4 chimney samples	Target Testing
NVFR Site 3	1.8	22.5	3.3	115	12 chimney samples	Target Testing
Pia	4.6	17.6	20.6	191	6 chimney samples	Target Testing
Tui Malila 1	0.9	21.8	4.0	84	5 chimney samples	Target Testing
Tunu-Sosisi	14.3	8.2	20.3	173	5 chimney samples	Target Testing
White Church	0.6	19.3	3.0	87	6 chimney samples	Target Testing

Note: Cut-off grade based on mineralised samples where Au > 0.97 g/t or Ag > 29 g/t or Cu > 1.87% or Zn >2.21%
* Dredge samples

8.1 North Fiji Basin

Three areas of hydrothermal venting and/or black smoker chimneys have been identified: SO99 (comprising the Corner Mound and Yogi Mound prospects), Père Lachaise and White Lady (comprising the White Lady and Mussel Hill prospects). Hydrothermal venting is active at the White Lady site, where low-salinity fluid at a temperature of up to 290°C has been observed. By contrast, only low-temperature fluids are being vented at Mussel Hill and SO99.

The SO99 hydrothermal field is reported as being about 500 m wide and 800 m long. It contains numerous black smoker chimneys, some of which are on hydrothermal mounds up to 10 m thick. More than 2,000 kg of chimney fragments were recovered from SO99 by using the TV grab aboard the *RV Sonne* in 1999. The principal sulfide minerals observed were chalcopyrite, cubanite, bornite,

covellite, pyrite, marcasite, sphalerite, wurtzite, greenockite and fahlore. Gangue minerals were anhydrite, barite and quartz.

In 2001, the Japanese Jamstec marine science research cruise drilled 22 holes in the vicinity of the SO99 Field. Of the 22 holes drilled, massive sulfides were reported from eight of them, with thicknesses up to 7 m.

Note that the assay grades reported are from scientific reports and may be based on samples that were specifically selected for detailed analysis and scientific research on the formation and genesis of sea-floor massive sulfide systems. In addition, many samples were not assayed for Au, and the grades stated only reflect the grades of those samples selected for analyses, and may not reflect the average value of any SMS deposit. A summary of grab and dredge samples from various mounds and prospects are presented in Table 8-1.

Table 8-2: Summary of grab and dredge samples from the North Fiji tenements

Location	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)	Pb (%)	Number of samples
Père Lachaise	4.05	216	17.85	5.85	0.03	30
SO99 Field	3.59	306	0.58	12.83	0.15	28
White Lady	Not assayed	Not assayed	7.99	4.69	0.04	16
Yogi Mound*	1.14	68.4	0.60	15.13	Not assayed	27

* samples collected by scientific research groups and assayed by Placer Dome in 2005. Data from Hannington *et al.*, (2004)

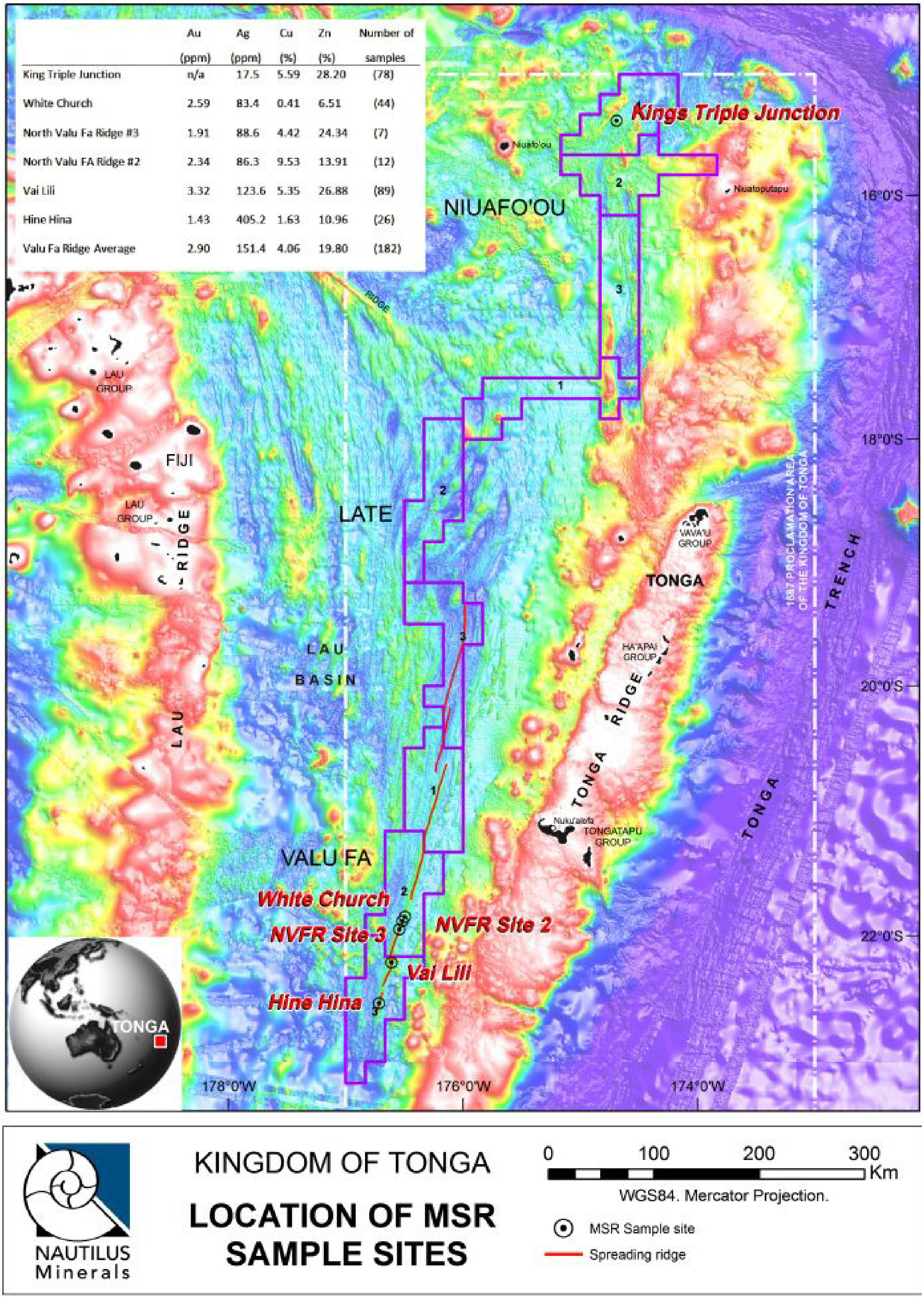
8.2 Valu Fa Ridge (Southern Lau Basin, Tonga)

Numerous areas of hydrothermal venting and activity have been noted in the Lau Basin and grab sampling has returned samples with metal grades similar to that of sites in PNG and Fiji (Table 8-2). The samples reported are from scientific reports and may be based on samples that were specifically selected for analysis and scientific research on the formation and genesis of sea-floor massive sulfide systems. The samples may not therefore reflect the average of any SMS deposit.

Table 8-3: Summary of grab and dredge samples from the Valu Fa tenements

Location	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)	Number of samples
White Church	2.59	83.4	0.41	6.51	44
Northern Valu Fa Ridge Site 2	2.34	86.3	9.53	13.91	12
Northern Valu Fa Ridge Site 3	1.91	88.6	4.42	24.34	7
Vai Lili	3.32	123.6	5.35	26.88	89
Hine Hina	1.43	405.2	1.63	10.96	26

* samples collected by scientific research groups. Data from Hannington *et al.*, (2004)



	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)	Number of samples
King Triple Junction	n/a	17.5	5.59	28.20	(78)
White Church	2.59	83.4	0.41	6.51	(44)
North Valu Fa Ridge #3	1.91	88.6	4.42	24.34	(7)
North Valu FA Ridge #2	2.34	86.3	9.53	13.91	(12)
Vai Lili	3.32	123.6	5.35	26.88	(89)
Hine Hina	1.43	405.2	1.63	10.96	(26)
Valu Fa Ridge Average	2.90	151.4	4.06	19.80	(182)

Figure 8-1a: Location of sampling sites from historical marine science research cruises in the Lau Basin (Tonga)

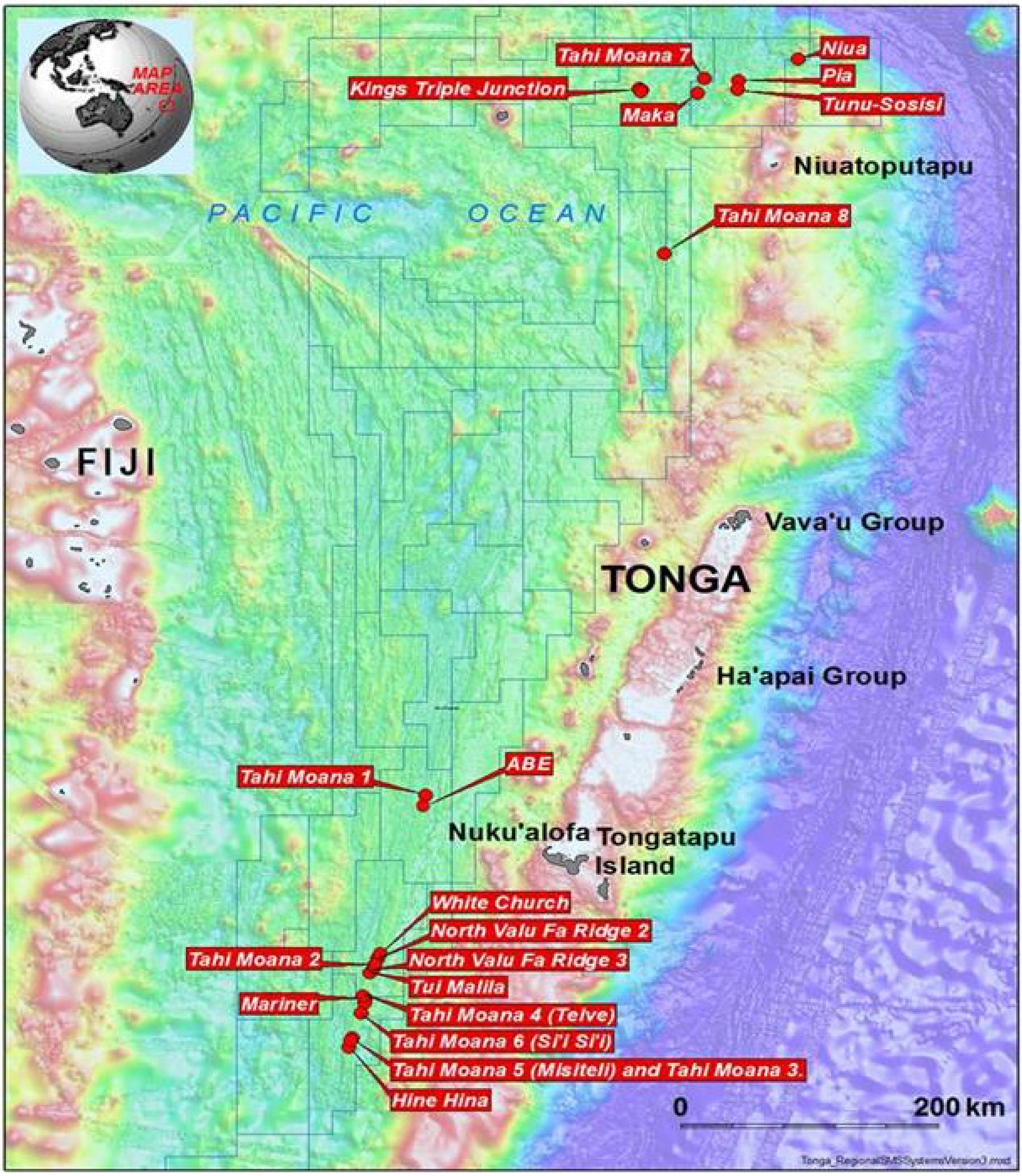


Figure 8-2b: Location of SMS prospects in the Lau Basin (Tonga)

8.2.1 Tahi Moana 1

The mineralisation at the two Tahi Moana 1 sub-areas is zinc-rich with significant gold and silver content. The average grade of sulfide samples returned from samples is 26% Zn, 1.3% Cu, 3.4 g/t Au and 147 g/t Ag.

8.2.2 Tahi Moana 2

The mineralisation at Tahi Moana 2 is sulfide-poor compared to Tahi Moana 1, but some samples returned significant gold and silver content. The average grade of sulfide samples returned from chimneys of the two Tahi Moana 2 sub-areas are 5.4% Zn, 0.2% Cu, 2.0 g/t Au and 95 g/t Ag.

8.2.3 Tahi Moana 3

No chimney samples were collected due to the softness of the material.

8.2.4 Tahi Moana 4

The returned chimney sample showed low base-metal grades but relatively high Au and Ag content.

8.2.5 Tahi Moana 5

Assays of material collected from the Tahi Moana 5 sub-areas were highly variable, but averaged 10.0% Zn, 1.2% Cu, 15.8 g/t Au and 546 g/t Ag. Pb was also anomalously high in the Tahi Moana 5 areas compared to the other SMS prospects visited during the cruise with an average Pb content of 2.1%.

8.2.6 Tahi Moana 6

Assays of material collected from the Tahi Moana 6 area averaged 27% Zn, 0.4% Cu, 7.8 g/t Au and 230 g/t Ag.

8.2.7 White Church

The mineralisation at White Church is Zn-rich with significant Au and Ag content. The average grade of sulfide samples returned from chimneys is 19% Zn, 0.6% Cu, 3.0 g/t Au and 87 g/t Ag.

8.2.8 NVFR Site 2

The mineralisation at NVFR 2 is Zn-rich with significant Au and Ag content. The average grade of sulfide samples returned from chimneys is 24% Zn, 0.7% Cu, 5.7g/t Au and 128 g/t Ag.

8.2.9 NVFR Site 3

The mineralisation at NVFR 3 is generally sphalerite-rich with significant Au and Ag content. The average grade of sulfide samples returned from chimneys of the three NVFR 3 sub-areas are 23% Zn, 1.8% Cu, 3.3 g/t Au and 115 g/t Ag.

8.2.10 Mariner

Assays of material collected from the Mariner site averaged 24% Zn, 3.8% Cu (strongly influenced by one outlier sample of 10.45% Cu), 3.6g/t Au and 80g/t Ag.

8.2.11 Hine Hina 1

Assays indicate differences in mineralogy between the Hine Hina 1a and 1b sites with the 1a site reporting a higher Cu content and the 1b site reporting a higher Zn content. Chimney material collected from Hine Hina 1a averaged 16.9% Zn, 5.2% Cu, 4.8 g/t Au and 209 g/t Ag, and from Hine Hina 1b 38% Zn, 4.1 % Cu, 4.6 g/t Au and 139 g/t Ag.

8.2.12 Tui Malila 1

Assays of material collected from the Tui Malila sub-areas averaged 22% Zn, 0.9% Cu, 4.1 g/t Au and 84 g/t Ag.

8.3 NE Lau Basin, Tonga

Hydrothermal venting and activity has also been noted in the NE Lau Basin in Tonga. Grab sampling has returned assays with metal grades similar to sites in southern Tonga, PNG and Fiji (Table 8-2 and Figure 8-1). The samples reported below are from scientific reports and may be

based on samples that were specifically selected for analysis and scientific research on the formation and genesis of sea-floor massive sulfide systems. The samples may not therefore reflect the average of any SMS deposit.

8.3.1 Maka

The mineralisation at Maka is generally chalcopyrite-rich but with significant Au and Ag content. Three chimney samples were collected from the Maka site. Material collected from the Maka site averaged 6.0% Zn, 5.4% Cu, 4.6 g/t Au and 62 g/t Ag.

8.3.2 Tunu-Sosisi

The mineralisation at Tunu-Sosisi is sulfide-rich (abundant in chalcopyrite and sphalerite) with samples returning significant Au and Ag results. Three chimney samples from Sosisi and two samples from Tunu were collected. Material collected from the Sosisi site averaged 12.4% Zn, 17.0% Cu, 19.2 g/t Au and 208 g/t Ag. Final assays of material collected from the Tunu site averaged 1.8% Zn, 10.3% Cu, 22.0 g/t Au and 121 g/t Ag.

8.3.3 Pia

The mineralisation at Pia is sulfide-rich, but generally more sphalerite-rich. Samples returned significant Au and Ag content. Six chimney samples were collected from Pia averaged 17.6% Zn, 4.6% Cu, 20.6 g/t Au and 191 g/t Ag.

8.3.4 Niua

The Niua SMS system (Volcano P area), comprises two sub-areas approximately 1.3 km apart in crater-like depressions. Niua 2 is at a water depth of 900 mbsl with a strike length of 230 m and width of 170 m. Niua 3 is at a water depth of 1,180 mbsl with a strike length of 270 m and width of 250 m.

The mineralisation at Niua is sulfide-rich (abundant in chalcopyrite and sphalerite) with samples returning significant Au and Ag assays. Results show Niua 3 to be more sphalerite-rich than Niua 2. Three chimney samples were collected from Niua 2 and Niua 3. Material collected from the Niua site averaged 15.3% Zn, 8.1% Cu, 13.7g/t Au and 313 g/t Ag.

8.3.5 Tahi Moana 7

One dredge operation was completed over Tahi Moana 7 with basalts and sulfides recovered. Results for 19 samples collected from the prospect averaged 27.8% Zn, 10.2g/t Au, 2.5% Cu and 81g/t Ag.

8.3.6 Tahi Moana 8

One camera tow operation was conducted at Central Fonualei. It was designed to cover the FRSC02 site and the main plume anomaly detected on the Southern Surveyor 2008 cruise. This camera tow failed to gain any footage due to a technical failure, but it recovered one piece of sulfide, probably knocked off a sulfide chimney in the area. A 600 g sample of massive sulfide was recovered from the camera frame. Two subsequent short small dredge sampling lines did not return any further samples. The assay results from the single sample returned 12.6% Cu and 10.8 g/t Au.

A dredge conducted from the *RV Kilo Moana* as a follow-up to AUV and camera tow chimney observation, recovered sulfides and glass rimmed, vesicular mafic volcanic rocks. Samples of chimney fragments coated in manganese were collected.

The chimneys appear to be inactive remnants with weathered features such as soft interior, grey-green massive sulfides. Three samples were assayed (Table 8-3); these may represent a single chimney.

Table 8-4: Summary of dredge samples from Central Fonualei

	Ag (ppm)	Au (ppm)	Cu (%)	Pb (%)	Zn (%)
25073	294	12.85	0.386	0.444	37.5
25074	504	23.40	0.395	4.280	24.1
25075	666	16.25	0.353	1.845	16.5

8.3.7 Kings Triple Junction

Previous MSR cruises to the Kings Triple Junction site recovered dredge samples rich in Zn, Cu and Ag (Table 8-4). Note that the assay grades reported are from scientific reports and may be based on samples that were specifically selected for detailed analysis and scientific research on the formation and genesis of sea-floor massive sulfide systems. In addition, samples were not assayed for Au, and the grades stated only reflect the grades of those samples selected for analyses, and may not reflect the average value of any SMS deposit.

Table 8-5: Summary of grab samples from the NE Lau basin tenements

Location	Au (ppm)	Ag (ppm)	Cu (%)	Zn (%)	Number of samples
King's Triple Junction	Not reported	17.5	5.59	28.20	78

Compiled from various marine science research cruises; data from Hannington *et al.*,(2004)

8.4 Solomon Islands

Three areas of hydrothermal venting and precipitates, including minor sulfides, have been identified in the East Solomon Islands: the Grover, Stanton and Starfish seamounts. All three sites fall under competitor's tenements, however, they suggest the SMS prospectivity of the adjacent areas of the seafloor over which Nautilus Minerals has applied for tenements.

8.5 Vanuatu

Five areas of hydrothermal activity have been identified within Vanuatu's EEZ by marine scientific research organizations, at a seamount in the Tikopia area, Temakons, Nifonea Ridge, 94SO2, and Oscostar. Currently, Nautilus Minerals holds tenements over areas in the vicinity of Temakons, Nifonea Ridge and 94SO2, although none of these mineralised systems actually occur within Nautilus Minerals' tenement holdings.

Temakons, which was formerly known as 94SO1, is a seamount at the northern end of the Vate Trough, which is the northernmost of the Coriolis Troughs. Seafloor sampling here has recovered hydrothermal sediments, several chimneys, and iron rich hydrothermal rocks, while deep towed camera footage also identified fauna common at hydrothermal vents.

Nifonea Ridge, found on a ridge across the Vate Trough, consists of at least three separate zones of hydrothermal activity within an area measuring 2400m x 600m, with the largest field at around 600m by 400m. Extensive hydrothermal fauna, spire-like structures (some of which may be sulfide chimneys) and yellow-brown oxide crusts were photographed but dredging recovered only fauna and iron oxyhydroxides.

94SO2 is located at the western end of a ridge separating the Erromango and Futuna troughs, which are the two southernmost of the Coriolis Troughs. Seafloor sampling and camera footage at this site revealed reddish-brown sediments, presumed to be of hydrothermal origin, as well as corals and fish.

Oscostar is an active submarine volcano, located approximately 100 km south of the southernmost of the Coriolis Troughs. Seafloor sampling here recovered sulfidic scoria breccia and agglomerate, and quenched native sulphur.

8.6 Clarion-Clipperton Zone (CCZ)

The block areas covered by the Tonga Offshore Mining Limited (TOML) application are held by “The Enterprise”, and as such were available to developing nations to apply for. Sampling programs undertaken by previous explorers in the area of the application include German, French, American and Korean teams, and provide the basis of a database held by the ISA, and were used to define the application areas in the TOML application.

The sites shown have been sampled by a combination of grab samplers, box corers, gravity cores and multi-corers. As a result, sample quality, spacing and assay reliability vary greatly from sample to sample, and block to block.

A plan of the sample locations is presented in Figure 8-3; the statistics for the samples inside the Nautilus Minerals Contract of Work (TOML Tenement) are tabulated in Table 8-5 to Table 8-13. Samples in the CCZ but outside the Nautilus Minerals areas are presented in Table 8-11. .

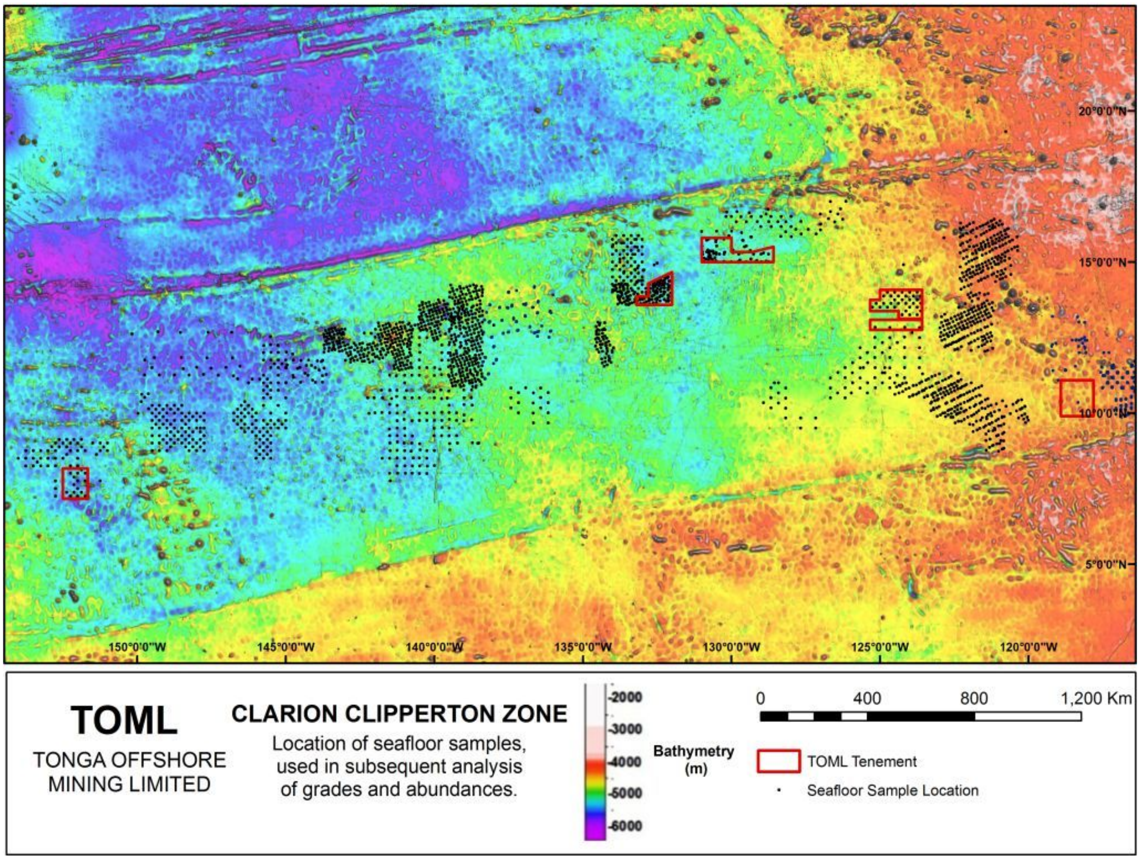


Figure 8-3: Location of sampling sites in the CCZ

Table 8-6: Summary of historic grab samples Zone A

	Mn (%)	Co (%)	Ni (%)t	Cu (%)	Abundance (kg/m^2)
Count	18	18	18	18	18
Minimum	21.46	0.15	0.71	0.46	2.68
Maximum	30.05	0.30	1.47	1.51	17.93
Mean	25.40	0.22	1.14	1.00	10.12
Median	25.50	0.21	1.15	1.02	9.19
Standard Deviation	2.44	0.04	0.24	0.35	5.08
CV	0.10	0.18	0.21	0.35	0.50

Table 8-7: Summary of historic grab samples Zone B

	Mn (%)	Co (%)	Ni (%)t	Cu (%)	Abundance (kg/m^2)
Count	88	88	88	88	88
Minimum	10.30	0.02	0.53	0.40	0.03
Maximum	31.20	0.35	1.51	1.40	26.00
Mean	25.40	0.25	1.16	0.94	8.82
Median	26.55	0.25	1.23	1.02	8.09
Standard Deviation	4.19	0.06	0.23	0.26	5.87
CV	0.16	0.22	0.20	0.27	0.67

Table 8-8: Summary of historic grab samples Zone C

	Mn (%)	Co (%)	Ni (%)t	Cu (%)	Abundance (kg/m^2)
Count	78	78	78	78	78
Minimum	22.01	0.14	0.93	0.71	1.35
Maximum	30.90	0.32	1.42	1.44	21.25
Mean	27.91	0.25	1.27	1.15	9.98
Median	28.55	0.25	1.29	1.19	9.17
Standard Deviation	2.13	0.03	0.10	0.15	4.20
CV	0.08	0.13	0.08	0.13	0.42

Table 8-9: Summary of historic grab samples Zone D

	Mn (%)	Co (%)	Ni (%)t	Cu (%)	Abundance (kg/m^2)
Count	42	42	42	42	42
Minimum	22.79	0.19	1.09	0.79	0.12
Maximum	30.45	0.30	1.44	1.36	16.37
Mean	28.52	0.22	1.31	1.16	7.68
Median	28.76	0.22	1.32	1.17	7.78
Standard Deviation	1.47	0.02	0.08	0.10	4.09
CV	0.05	0.10	0.06	0.08	0.53

Table 8-10: Historic grab samples Zone E

Longitude	Latitude	Water depth (m)	Mn (%)	Co (%)	Ni (%)t	Cu (%)	Abundance (kg/m^2)
-124.162	12.8331	4542	26.83	0.16	1.11	1.14	18.18
-123.669	12.8293	4497	24.04	0.21	1.01	0.88	6.73
-124.667	12.8284	4851	25.64	0.18	1.21	1.04	9.24

Table 8-11: Historic grab samples Zone F

Longitude	Latitude	Water depth (m)	Mn (%)	Co (%)	Ni (%)t	Cu (%)	Abundance (kg/m^2)
-118.33	10.35	4073	32.4	0.17	1.33	1.31	9.3
-118.33	10.35	4073	32.4	0.16	1.27	1.29	13.7

Table 8-12: Summary of historic CCZ grab samples outside Nautilus Minerals' Contract of Work (TOML Tenement)

	Mn (%)	Co (%)	Ni (%)t	Cu (%)	Abundance (kg/m^2)
Count	2188	2188	2188	2188	2188
Minimum	4.14	0.05	0.15	0.12	0.01
Maximum	35.62	3.23	1.75	1.62	52.20
Mean	27.47	0.21	1.25	1.04	8.21
Median	28.47	0.21	1.30	1.09	7.10
Standard Deviation	4.06	0.08	0.20	0.24	6.06
CV	0.15	0.40	0.16	0.24	0.74

9 Exploration

9.1 Exploration strategy

SMS deposits are formed where rising hot hydrothermal fluids mix with cold sea water at seafloor spreading centres, back-arc basins and along submarine volcanic arcs. Nautilus Minerals applies the understanding of the formation of VHMS deposits to locate and map outcropping SMS systems.

Nautilus Minerals has the following five-step exploration strategy prior to development::

1 Project Generation – Identify and secure title over the most prospective areas for SMS mineralisation;

2 Target Generation – Identify and rank sufficient high quality targets to ensure new SMS systems can be discovered at a sufficient rate to provide continual growth options to Nautilus Minerals;

3 Target Testing – Discover new SMS systems at a sufficient rate to provide continual growth options to Nautilus Minerals;

4 Prospect Delineation – Focus resource evaluation work with mapping, sampling and geophysics and

5 Resource Evaluation – Drilling, resource estimation, metallurgical test work and environmental impact statement.

At each stage of the above five-step process, Nautilus Minerals assigns a prospectivity rank to each area to prioritise expenditure.

9.2 Project generation

Nautilus Minerals identifies terranes prospective for SMS mineralisation using regional datasets and interpreted tectonic models.

After identifying a prospective terrane, Nautilus Minerals conducts extensive literature and data searches of public-domain scientific reports and databases, to identify historical research cruises that have occurred over the prospective areas. These MSR cruises have largely been funded by international, governmental or scientific bodies, and many have investigated areas prospective for SMS deposits over the last three decades. Many features that are associated with the formation of SMS deposits have been identified on historical MSR cruises, including iron-oxide crusts, metalliferous sediments, active hydrothermal vents, vent dispersion plumes in the water column, active volcanic complexes, altered and mineralised rocks, as well as maps of the geology and structure of the seafloor. As part of these studies, samples of mineralised material have been recovered from the seafloor ;(although they are sampled for scientific research purposes, and may not be in themselves representative of the grades of any mineralisation). Notwithstanding this, Nautilus Minerals has found these results to be useful indicators of mineralisation, and follow-up dredging, grab sampling and scout drilling by Nautilus Minerals generally returns grades that are broadly similar in metal tenor to the grades from the previous scientific programs. Based on the results of this type of research compilation work, Nautilus Minerals applies for exploration tenements covering the most prospective areas identified.

9.3 Target generation

Having secured tenure over prospective areas, Nautilus Minerals generates larger project areas and smaller target areas for further consideration and investigation. SMS deposits are commonly present as raised sulfide mounds on the seafloor, with either fossil or active black smoker chimneys,

which may be up to 20 m in height. Targets are identified by regional geophysical and geochemical methods such as:

- Sidescan sonar;
- Multi-beam bathymetry;
- Magnetics;
- 3D plume mapping (Eh, temperature, conductivity, turbidity); and
- Water chemistry testing.

9.4 Target testing

Possible SMS targets are confirmed or tested by direct inspection using a remote operated vehicle (ROV), and physical sampling of seafloor rocks, which may use:

- ROV mapping using video cameras on a systematic grid or traverse through the target area;
- Grab sampling from the ROV to select samples from the target area; or
- Camera tows.

9.5 Prospect delineation

Nautilus Minerals uses detailed grid based mapping, sample collection, and ROV-based geophysical surveys such as electromagnetics and magnetics to define the approximate resource boundaries on the seafloor. These are used along with high-resolution bathymetry surveys.

9.6 Resource Evaluation

Nautilus Minerals progresses the best prospects to resource status by undertaking systematic resource drilling and sampling, followed by resource estimation. Detailed bathymetry and grid-based geophysics are used to define the resource boundaries, prior to drilling.

9.7 Exploration potential

Approximately 5,500 line km of EM302 multi-beam mapping is planned over ELAs in the New Ireland Arc area of Papua New Guinea. This is be followed by a plume hunting tow-yo program over the best targets defined from the multi-beam program. Nautilus is searching for similar targets to the Au-bearing Conical Seamount lying just south of the giant Ladolam Au mine on Lihir island.

After an extensive tow-yo program in 2009 in the Woodlark Basin, no live plumes were confirmed, nonetheless there were several subtle helium anomalies indicating historical activity. One such anomaly can be traced back to the Franklin Seamount where previous MSR cruises had identified very small occurrence of Au-bearing sulphate chimneys. In late 2009, a German research cruise detected a strong plume in the deep (>3,000 m) part of the rift which is potentially a target.

Nautilus Minerals has located SMS deposits on various ELs it holds within the Territorial Waters of Tonga. The deposits occur at or near seafloor, and have various unique associated geomorphic seafloor features. These can manifest themselves as chimney-structures on the seafloor, from decimetre to a few metres diameter and up to 10-20 m high. These chimneys often occur as clustered “fields” and can be associated with an underlying sulphide mound, which can be hundreds of meters in lateral extent.

To date, exploration efforts within the Tonga region (also known as the Lau Basin) have focused on active/ waning SMS systems. Many of these were discovered during MSR (Marine Scientific Research) cruises where plume hunting was followed up by ROV investigation to confirm the

occurrence of SMS systems. A Nautilus ROV survey in 2008 confirmed most of these sites in the Valu Fa region with new discoveries also made. Also in 2008, a Teck Cominco sponsored survey to the North East Lau region also discovered new SMS systems by following up plume targets. With such significant success using plume hunting techniques a major 60-day program was conducted in 2009 using the RV Southern Surveyor. At least 32 plume targets were generated with only a few were suitably tested to confirm the presence of SMS systems. The 2011 AUV program aims to test the remaining active centres with an additional objective of delineating any closely associated inactive systems.

- Areas of interest in Fiji lie within the tectonically complex North Fiji Basin, which covers an area greater than 1,000,000 km. The main areas of interest are typically along active spreading centres and extensional sub-basins with transtensional structural corridors. Approximately 35% of Nautilus' Fiji tenements have been mapped at a sufficient resolution for target testing level therefore a further 40,000 km^2 requires coverage by a new survey. This work would take ~40 days. The tenements are to be ranked by priority for relative prospectivity and therefore the length of program would dictate which areas are mapped first. It is envisaged that a 30-day program could be completed in 2012, which includes a suitable combination of MBES bathymetry mapping and Tow Yo or Hydrocasting over the main prospective ridges and spreading centres.
- Proposed areas for survey within the EEZ of Solomon Islands constitute a section of oceanic crust Nautilus has named the San Cristobal Back Arc in the East Solomon Islands region bordering the EEZ of Vanuatu. Tectonically, this area is bound to the south by the San Cristobal and South Solomon trench, which is part of the SW Pacific boundary between the Australian and Pacific tectonic plates. Nautilus' tenements basically follow the seafloor ridges that are potential sites for SMS formation. This represents an approximate area of 38,400 km^2. Most of the area has been mapped by the French marine research agency using an earlier version of the EM120 MBES system. These data are useful for planning plume hunting surveys. Approximately 20-30% of the tenement package is not covered by the French survey. It is estimated that 6,300 line km of EM302 MBES mapping would cover the gaps in the French data. Taking into account a survey speed of 10 knots a 3 km swath width and a 20% contingency, mapping would take ~20 days to complete. However, part of this time could be allocated to plume hunting activities.

The area of interest to survey in Vanuatu constitutes a series of small, linked back-arc basins with associated volcanic features. The exposed island chain that constitutes Vanuatu represents the main volcanic arc which is formed during subduction of oceanic crust from the west. The purple area to the west of the islands represents the trench of the New Hebrides subduction zone. Most of Nautilus' tenements lie in the back-arc zone behind the island arc where SMS prospectivity is highest. The majority of a proposed survey area lies between 1,000 and 3,000 m water depth. The total area of bathymetry mapping required on Nautilus' tenements is ~600 km^2 because the rest of the areas have been covered by MSR cruises. The ~600 km^2 would take around two days to complete at 10 knots, assuming a 3 km swath width. These areas all lie north of Port Vila. The greater part of the campaign would focus on tow-yo operations over prospective bathymetry features. It is worth noting that during tow-yo operations bathymetry data can also be collected and processed on board to produce higher resolution bathymetry and backscatter maps to aid in targeted seafloor sampling. A total of 31 tow-yo lines have been selected for a total distance of 460 km. The tow-yo lines will be ranked and would be completed in order depending on the length of the campaign.

9.8 Seafloor mapping

Seafloor geological mapping is completed with the ROV in low-fly mode, with the aim to map out areas of mineralisation. Traverses of the seabed are completed with the ROV in visual contact with the seafloor, generally at an altitude of 1-5 m. Live video feed from two forward-looking cameras, a forward-looking sonar, and other geophysical sensors are monitored by geologists to aid in event logging. On previous mapping campaigns visibility has generally been sufficient to easily identify hydrothermal chimneys and outcrop of volcanic rocks. The location of the ROVs was continuously recorded through an on-board ultra-short baseline (USBL) acoustic beacon location system referenced to the global positioning system aboard the vessels. All geological, biological and geophysical sensor observations observed in the water column and on the seafloor are captured using the NautiCal Event Logging system developed by Nautilus Minerals and displayed in real-time in ArcGIS via a live ODBC link to the SQL database onboard the vessel.

9.9 NOAA Tonga target generation cruise (*RV Kilo Moana*)

This Marine Science Research cruise KM1008 was organised by the NOAA PMEL Vents Group, aboard the *RV Kilo Moana* from 28 April to 11 May 2010. The purpose of this research cruise was to complete CTD and camera tow operations over previously known and new areas of interest in the NE Lau Basin for venting and volcanic eruptions. A Nautilus Minerals geologist attended this cruise as an observer as many of the sites of interest lay on Nautilus Minerals' tenements.

The main operations undertaken during this cruise included:

- Bathymetric seafloor mapping using EM122 multi-beam system;
- Plume hunting – including tow-yo operations and vertical CTD casts; and
- Camera tows.

The bathymetric seafloor mapping undertaken during this cruise is shown in Figure 9-1.

Vertical casts and tow-yo plume hunting surveys were completed over several targets including West Mata to check on the eruption activity. At West Mata, a multi-layered plume was located, with the highest point exceeding a 2009 survey by a further 100 m, whilst at Mata Ua, a strong plume was also located. Tows over Mata Ono and Mata Fitu at the far northern edge of the survey area both identified plumes. Other anomalies in the area were detected, indicating this prospective area is hydrothermally and volcanically active.

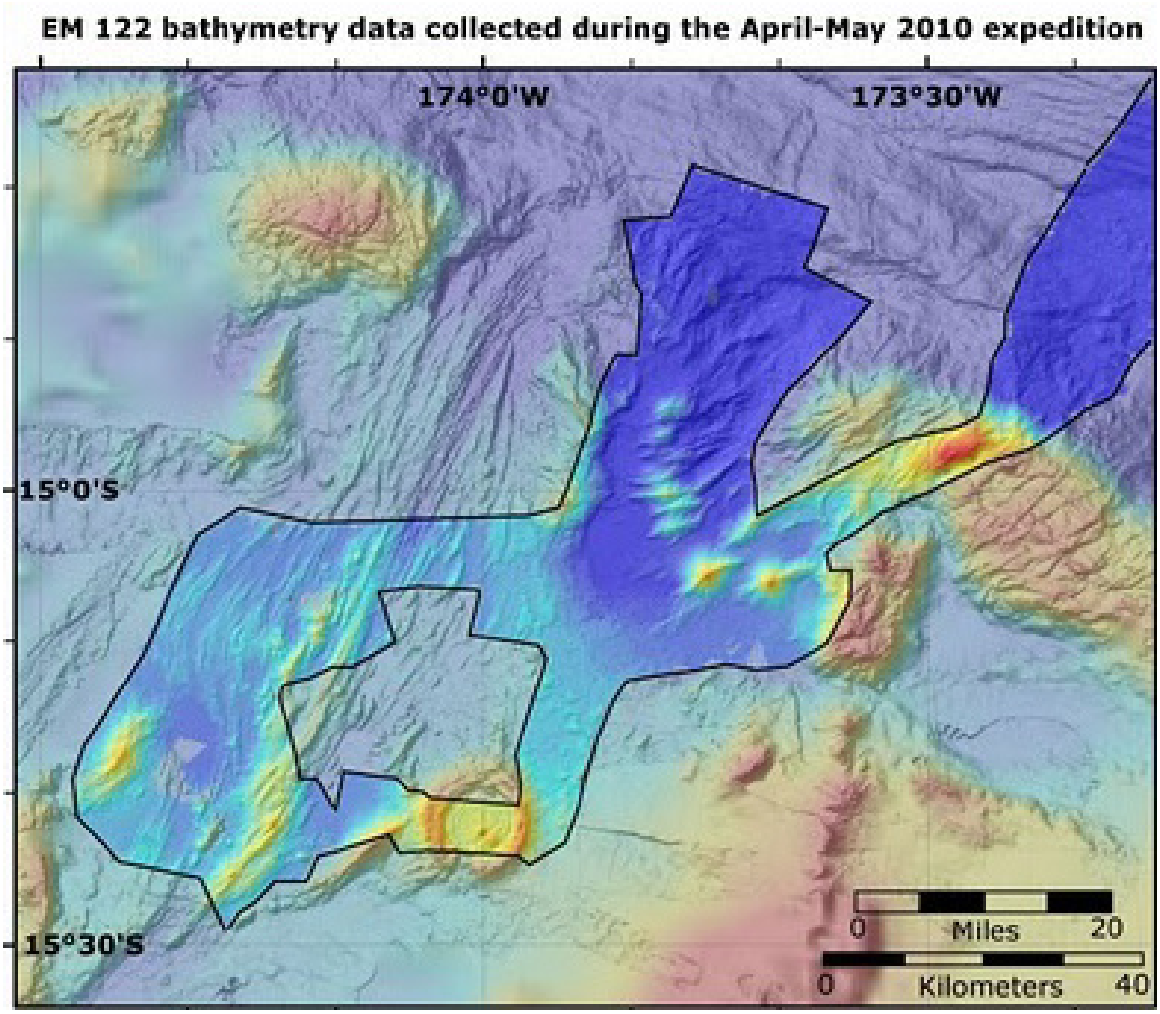


Figure 9-1: NE Lau Basin showing multi-beam survey area

Image courtesy of NOAA/PMEL

Camera tows were undertaken over several targets that indicate strong hydrothermal and/ or volcanic activity. Along the ridge crest of the Mata Tolu feature, a plume was intercepted at ~2200 m, as well as on the summit. The video confirms diffuse venting and chimney structures, just short of the ridge crest on the south side of Mata Tolu. One cluster of chimneys was observed (Figure 9-2), that have the appearance of sulfides however; as no samples were collected, the composition was not confirmed.

The NOAA Kilo Moana 2010 MSR cruise to the NE Lau Basin, Tonga was successful in locating hydrothermal or volcanic plumes and indications of mineralisation on Nautilus Minerals' Tongan tenement, highlighting the SMS prospectivity of this part of the Lau Basin.

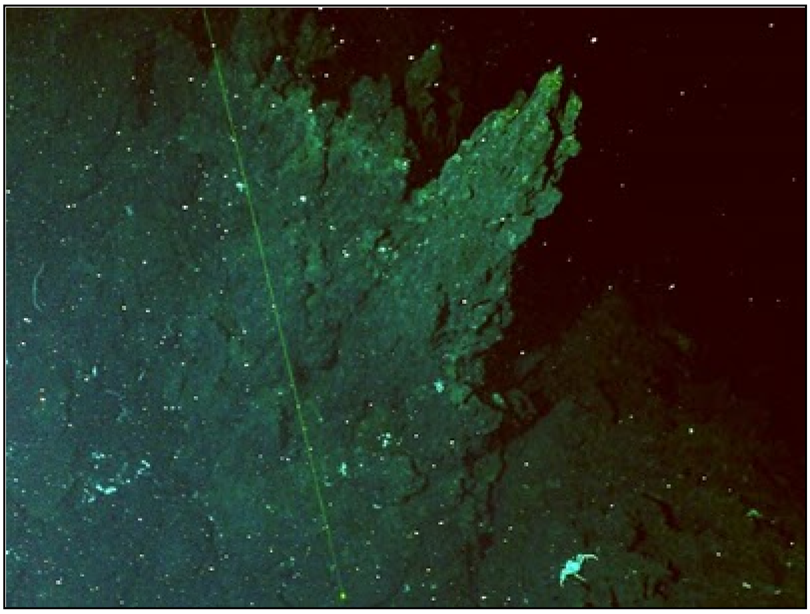


Figure 9-2: Chimney cluster at Mata Tolu

Image captured by WHOI deep tow camera system

9.10 University of Hawaii Tonga Target Generation Cruise (*RV Kilo Moana*)

Nautilus Minerals completed an autonomous underwater vehicle (AUV) survey programme on its tenements within the Kingdom of Tonga. The survey had the following objectives:

- Test plume targets generated during the 2009 Southern Surveyor survey;
- Follow up the AUV results with physical collection of seafloor samples to confirm occurrence of SMS systems relating to the plume target;
- Define a preliminary line of sight for SMS systems mapped by AUV;
- Gather AUV operations experience, to compare with ROV to gain information on exploration efficiencies;
- Maintain Nautilus Minerals' expenditure commitments in its Tongan tenements; and
- Collaborate with the Marine Science Research community on common goals.

The work program was completed by the University of Hawaii, IFM-GEOMAR and WHOI with Nautilus Minerals providing detailed planning of targets and some data processing.

Ten AUV targets were surveyed in the 27 day cruise, resulting in a total of 1199 AUV line km, with a sensor payload consisting of Reson 7125 multi-beam or Edgetech 2200 Sidescan Sonar and secondary sensors being a magnetometer and CTD with light scattering turbidity sensor. Chimney targets were interpreted from the preliminary datasets at six of these sites. The CTD data regularly identified plumes and venting activity, providing positive confirmation that the source of previously identified plume targets had been mapped on 14 of the 16 AUV surveys. The interpretation of CTD and magnetometer data at Mangatolou Triple Junction North led directly to the discovery of sulfide chimneys on a follow-up camera tow.

In addition to AUV data, the Kilo Moana also conducted 28 dredges and 19 camera tows. Significant sulfides were only recovered on one dredge at Tahi Moana 8. Sulfide chimneys were observed at multiple locations along two camera tows, one at Tahi Moana 8, and the other at Mangatolou Triple Junction North.

During the cruise the *RV Kilo Moana* continuously acquired multi-beam backscatter and bathymetry data. This resulted in extensions to current multi-beam coverage mapped on the east and western margins, as well as the southern extension of the Fonualei Rift, and on a large area of seafloor between Samoa and the North East Lau Basin. A total coverage of 5,194 line km and 19,850 km^2 of seafloor data was achieved.

The *RV Kilo Moana* also conducted one sub-bottom profiler line over North East Lau Caldera O, and sea surface magnetometer data was collected on transits of sufficient duration to enable deployment of the towed magnetometer system, although these data are yet to be processed.

Six new SMS targets were generated during 16 AUV missions from 10 surveyed sites. These sites are now ready for ROV follow-up to confirm the occurrence of sulfides and to sample them.

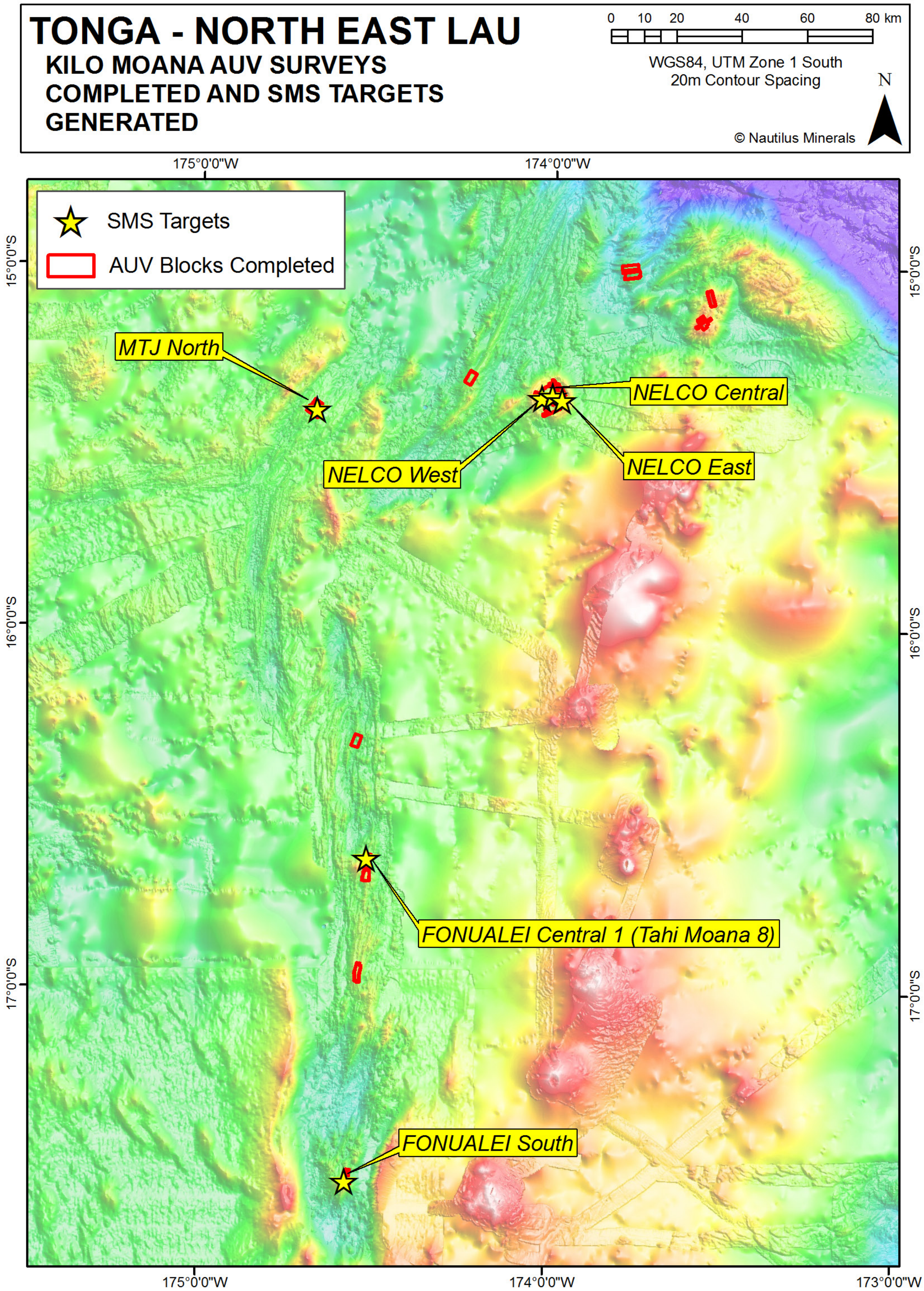


Figure 9-3: ROV ready SMS targets generated by the Kilo Moana 2011 AUV cruise, plotted on bathymetry image

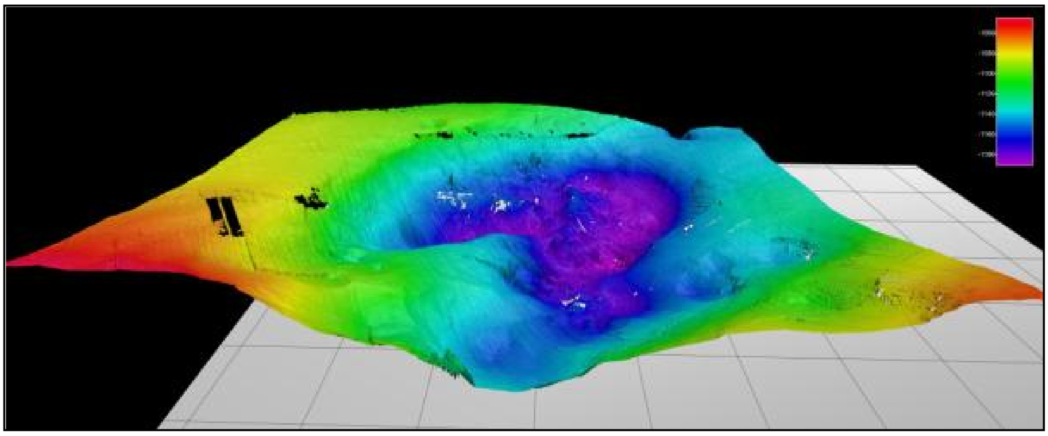


Figure 9-4: High resolution Reson 7125 400 kHz bathymetry map of the Niua chimney field

10 Drilling

No exploration drilling had been completed by Nautilus Minerals outside of the Bismarck Sea, Papua New Guinea, up to 31 December 2011.

11 Sampling Method and Approach

Seafloor sample programs entail physical sampling of seafloor sediment, rock and sulfide chimneys using ROVs. Seafloor sampling aims to collect representative samples from chimneys, sulfide mounds, sediments and volcanic outcrop. Volcanic rock samples are collected to help understand the geological setting and aid in the interpretation of geophysical signatures.

Sample locations are chosen by the geologist supervising the ROV dive. Sample numbers are assigned at the time of sampling from a pre-numbered sample ticket. Sample numbers and descriptions are entered using NautiCal when sampling has taken place. During sample processing, details are loaded directly into the Nautilus Minerals' acQuire database.

The samples are taken using the hydraulic-operated arms on the ROV. The arms are capable of picking up and manipulating loose objects, or grasping and breaking of parts of standing chimneys. The samples are placed in the GeoBox or chimney basket.

Softer samples of altered and poorly consolidated material are collected using scoops. Custom made plastic cylinders with a handle and spring loaded lid are used to collect enough material for analysis. The scoops are sometimes used during ROV mapping in areas where the manipulator arms are unable to grab a sample.

During initial target evaluation, the chimney sampling programs aim to collect around 6 to 12 chimneys at each major sulfide field and 2 to 10 volcanic samples. Where no sulfide material is discovered, 1 to 2 volcanic samples are collected to help characterise the geology over the target area. Where necessary, sampling density is increased at major sulphide fields, with additional chimney samples taken systematically across the deposit.

Sample handling during ROV operations include the following:

- GeoBox – a compartment box secured under the ROV and moved forward during sampling to expose the compartments. The box is retracted during transit to protect the samples. Each compartment, measuring 25 x 25 x 30 cm deep, has a unique identification number. The compartments are designed to hold small samples (up to 15 kg) of volcanic rock, sedimentary rock, talus or small chimneys. If space permits, scoops are able to be stored in the individual compartments.
- Chimney basket – used to collect large chimney samples up to 100 kg comprises 10 large wheelie bins, each with a unique alpha-numeric code, clearly visible during sampling operations. The basket is lowered on a separate wire and can be brought to the surface independent of the ROV, unloaded and replaced with an empty set of bins and redeployed.
- Scoops – for collecting sediment, loose rocks, talus, weathered and altered volcanic. Scoops are attached to the ROV via a pole or placed in vacant compartments in the GeoBox. Each sample scoop is made from metal tube approximately 20 cm in diameter and 30 cm long. One end is capped while the other end is spring loaded open. After each sample is collected the end cap is released to close the scoop, securing the sample. Each scoop is marked with a unique identification number.

11.1 2008 Exploration grab sampling (*MV NorSky*)

ROV grab sampling is intended to collect a set of mineralised chimney samples to characterize the tenor of the chimney fields; it is not possible to sample any underlying mineralisation in the sulfidic mounds without drilling equipment.

The samples are taken using hydraulic-operated arms on the ROV. These arms are capable of picking up and manipulating loose objects, as well as grasping and breaking off parts of standing

chimneys. The samples are placed either in the GeoBox or the chimney cage. The GeoBox comprises nine numbered compartments, each approximately 25 x 25 x 30 cm, mounted on a slide-out platform on the front of the ROV (Figure 11-1; Figure 11-2). The chimney cage (Figure 11-3) contains eight plastic garbage bins, is lowered on a separate line to the ROV and can hold larger samples than the GeoBox, up to 250 kg each.

Sample locations are chosen by the geologist supervising the ROV dive. Mineralised samples may be taken either from standing chimneys or chimney debris; samples of non-mineralised volcanic rock are also taken to improve geological understanding of the target area. Sample numbers are assigned at the time of sampling from a pre-printed set of sample number tags. Sample numbers and descriptions are loaded directly into Nautilus Minerals' acQuire database during sampling.

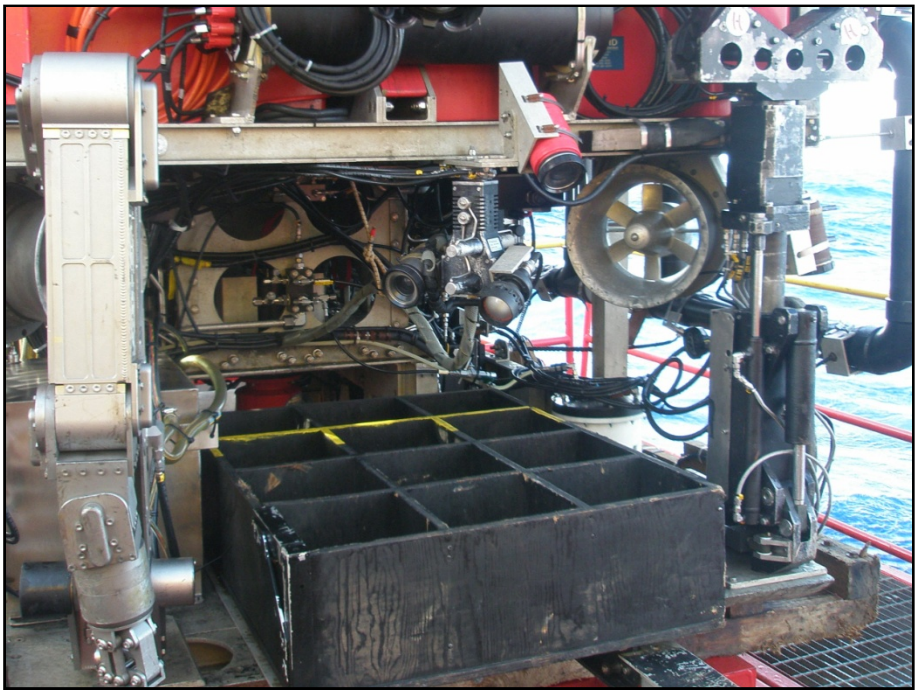


Figure 11-1: GeoBox used to hold samples on the front of the ROV

Figure 11-2: Chimney sample 20060 (Tahi Moana 1) being loaded into the GeoBox

Figure 11-3: Chimney sample cage

11.2 2009 Water sampling

A rosette containing twelve 5 L Niskin bottles for collecting water samples was mounted on the frame of the tow-yo carousel or sled (Figure 11-4). Observers on the vessel triggered the bottles remotely, either to capture samples within plume anomalies or to define background grades for a region. Processing of water samples included some or all of the following:

- Small water samples were sealed in copper tubes for subsequent helium analysis at NOAA
- pH measurements were completed onboard
- Water was filtered to collect particulates for geochemical analysis at ALS Chemex in Brisbane

On recovery of the CTD sled the water bottles were sub-sampled for 3He, pH and particulate matter; all of which are potentially indicators of hydrothermal activity. For 3He, samples were drawn into 60 cm sections of 1.6 cm diameter Cu tubing from which all air had been flushed. The tubes were cold-weld sealed into two 25 cm sub-sections and stored for shipment to the NOAA He Laboratory in Newport, OR, USA. Helium isotopes and abundances were measured using a 21 cm-radius mass rationing mass spectrometer with a 1σ precision of 0.2% for 3He/4He ratios and an accuracy of 1% for the absolute He concentration.

The pH samples were drawn into 60 mL plastic bottles, being careful to displace all air bubbles and overflowing at least three bottle volumes before sealing with fluid-displacing screw caps. Buffers and samples were allowed to come to thermal equilibrium in a bucket of water (~40 minutes) before being measured with a combination pH electrode and thermometer for quantification. Replicate precision was ±0.005pH units and the detection limit for anomalies in pH was -0.01 – 0.02pH units.

After sub-sampling for He and pH, selected water samples were filtered for particulate matter on 47 mm diameter, 0.4µm pore diameter polycarbonate membranes using vacuum filtration. In order to filter about 7L of plume water (a target volume established by historical determinations) duplicate water samples were tripped at all depths intended for filtration. The particulate samples were rinsed with purified water adjusted to pH ~ 7.5 to remove residual sea salt, then stored in plastic petri-slides for transport to the ALS Laboratory Group in Brisbane for quantification by digestion-ICP/AES.

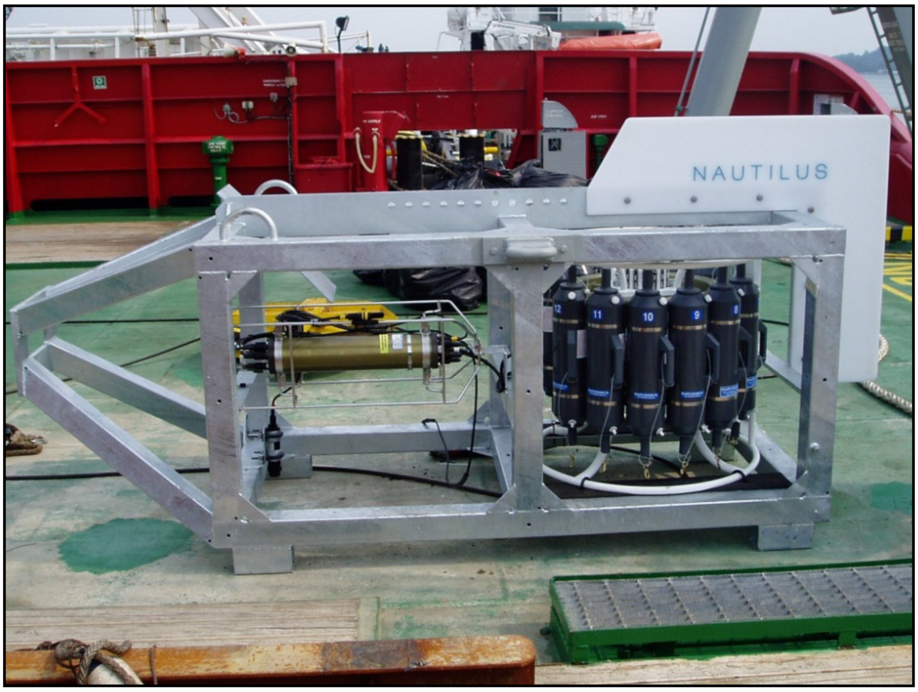


Figure 11-4: CTD sled with water bottles mounted inside the main frame

11.3 Historic CCZ sampling

Five data sets of polymetallic nodule abundance and metal content have been collated by the ISA, covering the area 110° to 160° W Longitude and 0° to 20° N Latitude (Figure 11-5).

The sources of the data are:

- All publicly available data in the International Seabed Authority's Central Data Repository (CDR);
- A proprietary database used with the permission of the Lockheed-Martin Corporation;
- Data sets provided by the Government of the Republic of Korea;
- Data sets provided by the China Ocean Mineral Resources Research and Development Association; and
- Data sets provided by The Interoceanmetal Joint Organization.

Virtually all the samples were obtained by free -fall grab sa
core recoveries were also included. Abundance (weight of nodules per unit area on the seafloor, measured in units of kg/m^2) was estimated simply by dividing the weight of recovered nodules by the surface area covered by the open jaws of the sampler (~0.25 -0.5 m^2 coverage). Free-fall grab samplers are the best tools available for the assessment of nodule abundance, but they consistently underestimate the actual abundance (Hennigar, Dick and Foell,1986).

Metal content in the samples collected was determined by a variety of methods, including atomic absorption and X-ray fluorescence. No specific information is available on sample preparation methods; the various consortia reportedly used polymetallic nodule Certified Reference Materials that were used for QA/QC, however the results of these are not recorded.

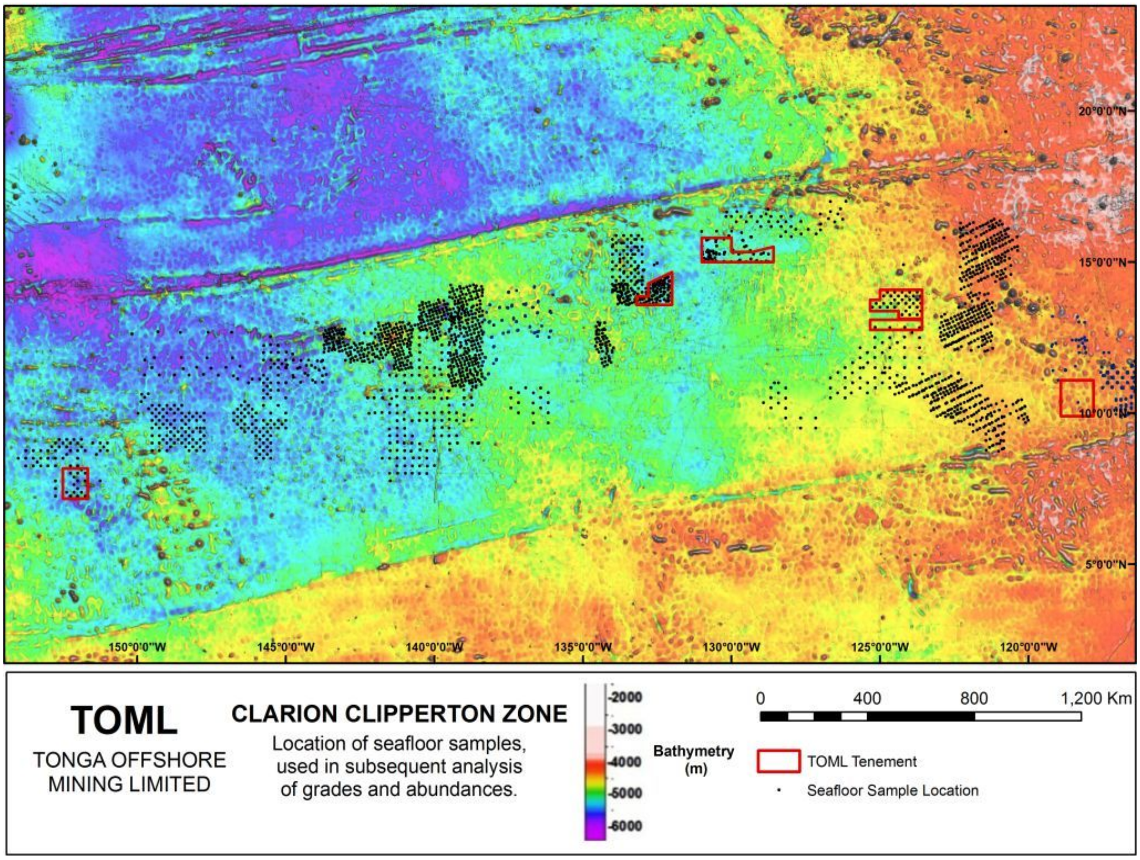


Figure 11-5: CCZ historic grab sample locations

12 Sample Preparation, Analyses and Security

12.1 Sample retrieval

Samples are brought to the surface in the GeoBox or chimney cage. When on deck, each individual sample is put into pre-numbered sample bags, and transferred to a refrigerated container (reefer). Samples are stored in the reefer until sub-sampled.

12.2 Sample storage

Samples stored in the reefer are brought out to be processed one at a time on the deck. All samples are photographed and weighed. A pneumatic hammer is used to take a sample of approximately 6 kg from the base of each chimney sample, taking a slice across the complete cross-section. If a duplicate sample is to be taken (1 in 10 samples), this is taken as a slice of the complete cross-section across the chimney next to the original sample.

12.3 Handheld XRF

12.3.1 Introduction

A Niton handheld XRF unit is used onboard to analyse samples. These analyses are only suitable as a general indication of the tenor of base metal mineralisation and are not suitable for use in resource estimation, because:

- The instrument only measure grades from the surface and near-surface part of a specimen;
- The specimen has not been crushed or pulverised to create a representative subsample; and
- Readings are not corrected for matrix effects.

Nevertheless, despite these limitations the XRF tool does produce readings that are sufficiently accurate for identification of mineralisation and management of the exploration program. Calibration testing is performed on a suite of certified reference material to correct for matrix effects and generate custom calibration factors. Duration testing was performed to optimise reading times with an acceptable level of statistical confidence.

12.3.2 Procedures

Ten readings by the XRF unit are taken on each sub-sample of collected chimney material. The sample number, prospect name and operator details are entered into the XRF unit and then downloaded along with the readings to Nautilus Minerals' acQuire database system.

During 2009, a range of standard materials provided by the manufacturer of the XRF unit were measured during each batch of work.

Figure 12-1: Niton handheld XRF (XLT592) measuring cut face of chimney sample

During the *REM Etive* drilling program, for example, the handheld XRF analyser was customised to allow for systematic data entry, enabling selected fields such as hole ID, from/ to intervals and sample ID to be entered. Individual readings were taken at 10 centimetre intervals down the full length of the recovered drill core. Pulp assay samples were analysed prior to being despatched. All readings were downloaded using the NITON proprietary file format and uploaded to Naultilus' acQuire database using MS Excel file format.

Figure 12-2: Niton handheld XRF (XL3t S900 GOLDD) measuring drill core from 2010/2011 drilling

12.4 Sample preparation

12.4.1 2008 Grab sampling (*MV NorSky*)

After a study on sample variability from chimneys collected in 2007 (Pitard, 2007) sub-samples from chimney samples collected in 2008 were taken from the base of the recovered chimney by jack-hammer or geologist's hammer. Sub-samples for analysis were packed in heavy-duty plastic bags together with a pre-printed, plasticised sample-number tag.

Duplicate samples were inserted at a rate of 1 per 10 primary samples by taking an additional sub-sample from the original grab sample.

Blank samples were inserted at a rate of 1 per 10 primary samples. Builder's sand sourced from Brisbane, Australia, was used as the blank material.

Commercial certified reference material (CRMs) were inserted at a rate of 1 per 10 primary samples. CRMs were selected arbitrarily from a range of material supplied by Geostats or OREAS.

12.5 Sample analysis

12.5.1 2007 to 2009 programs

Core and chimney samples from programs conducted from 2007 to 2009 were analysed by ALS Laboratory Group in Brisbane and Townsville. The laboratories are NATA (National Association of Testing Authorities, Australia) certified.

The samples were dried and crushed to 70% passing 2 mm in a jaw crusher. A rotary splitter was used to split 1 kg which was then pulverised in a ring mill to better than 85% passing 75µm.

Cu, Ag, Pb and Zn were measured by ore-grade analysis using inductively coupled plasma atomic emission spectrophotometry (ICP-AES) following an aqua regia digest. A number of stabilising compounds are used in the digestion to keep Cu, Zn, Pb and Ag in solution at high concentrations.

Au was analysed by fire assay using a 30 g charge and an atomic absorption spectrophotometry finish. Due to the high sulfide content, the fire assay charges were reduced for many samples.

Al, As, Be, Bi, Ca, Cd, Co, Cr, Fe, K, Mg, Mn, Mo, Na, Ni, P, S, Sb, Sr, Ti, V, W, Hg, Se, Te and Li were analysed by ICP-AES after a four acid digest and Ba was analysed by XRF.

ALS uses an extensive set of quality control procedures, including the use of blanks, duplicates and CRMs to monitor the quality of the sample preparation and analyses, and protocols for reanalysis of batches if results are unsatisfactory.

Nautilus Minerals carried out its own quality control procedures, including the insertion of duplicates, blanks, CRM and matrix-matched SRM.

Table 12-1: Assayed elements, detection limits and analytical methods ALS Chemex

Element	Detection Limit	Units	Method
Au	0.01	ppm	AAS
Ag	1	ppm	ICP-AES
Cu	0.01	%	ICP-AES
Pb	0.01	%	ICP-AES
Zn	0.01	%	ICP-AES
Al	0.01	%	ICP-AES
As	2	ppm	ICP-AES
Ba	10	ppm	ICP-AES

Element	Detection Limit	Units	Method
Be	0.5	ppm	ICP-AES
Bi	2	ppm	ICP-AES
Ca	0.01	%	ICP-AES
Cd	0.5	ppm	ICP-AES
Co	1	ppm	ICP-AES
Cr	1	ppm	ICP-AES
Fe	0.01	%	ICP-AES
Ga	10	ppm	ICP-AES
Hg	1	ppm	ICP-AES
K	0.01	%	ICP-AES
Mg	0.01	%	ICP-AES
Mn	5	ppm	ICP-AES
Mo	1	ppm	ICP-AES
Na	0.01	%	ICP-AES
Ni	1	ppm	ICP-AES
P	10	ppm	ICP-AES
S	0.01	%	ICP-AES
Sb	2	ppm	ICP-AES
Se		ppm	ICP-AES
Si	0.01	%	ICP-AES
Sr	1	ppm	ICP-AES
Te	0/01	ppm	ICP-MS
Ti	0.01	%	ICP-AES
V	1	ppm	ICP-AES
W	10	ppm	ICP-AES

12.6 Metal analysis of particulate matter filtered from Niskin water samples

Water samples of between 2-10 L were filtered through a filter pad which collected very fine particulate matter that was floating in the water column anomaly detected by the real time sensors on the CTD unit. This filter pad is sent to ALS Chemex Environmental Laboratory in Brisbane for analysis. The filter pad and particulate matter are dissolved together in aqua regia and analysed through solution on an ICP-MS. A suite of 26 elements commonly associated with SMS systems assayed.

12.7 Sample security

Tamper-proof security tags were applied to all sample dispatches, plastic containers and polyweave bags. The tags were positioned so that if the container or polyweave sack were tampered with, the seal would break. Each plastic tub was individually numbered, and the samples packed, security sealed, weighed and photographed.

A Sample Shipping Form was used to track samples dispatched to the analytical laboratory. The form recorded the security identification tags used for each dispatch. During each stage of the dispatch the Custodian and Receiver signed the form indicating acceptance of the samples and that the security tags and packages were intact and that no evidence of tampering observed.

Upon receipt at the laboratory, the dispatch was checked for evidence of tampering and that the original security tags were in place. The security tags were removed, samples inspected and prepared for quarantine treatment. Following quarantine, samples were processed under standard laboratory security procedures.

In SRK's opinion, the sampling methodology, sample preparation, sample analysis and sample security procedures used for the sampling programs are appropriately designed and were implemented correctly.

13 Data Verification

13.1 Quality Assurance/Quality Control (QA/QC)

Sample preparation and geochemical analyses were verified by the use of reference samples including CRMs, secondary reference materials (SRM), blank samples and duplicate samples. These materials were submitted without marks which would identify their origin to the laboratory staff. They therefore provide quality control independent of the laboratory.

In view of the observations of Cu mineralisation in the core, the correlation between the hand-held XRF results and the laboratory geochemical analyses, the observed chain of custody of the samples from the ship to the independent laboratory, and the quality control samples, independent corroborative sampling was judged unnecessary.

During 2007 and 2008, QA/QC material was inserted into sample dispatches at the rate of four QA/QC samples per 10 primary samples. During 2009 ROV programs QA/QC material was inserted into sample dispatches at the rate of five QA/QC samples per 15 primary samples.

13.2 Coarse repeats

Coarse repeats were taken during 2008 at the assay laboratory from stored coarse-rejects. The results are tabulated in Table 13-1 and Table 13-2. These show that the repeat assays are very similar to the original, suggesting that the original split is representative of the sample crushed.

Table 13-1: Grab sample coarse repeats Cu, Pb and Zn results

	Original Cu	Repeat Cu	Original Pb	Repeat Pb	Original Zn	Repeat Zn
Count	9	9	9	9	9	9
Minimum	0.08	0.09	0.1	0.09	1.14	1.16
Maximum	30	30.2	1.9	1.95	34.5	33.6
Mean	10.78	10.73	0.71	0.68	12.1	11.67
Median	8.09	8.08	0.67	0.54	5.43	5.19
Standard Deviation	10.58	10.67	0.52	0.55	11.60	11.12
Coefficient of Variation	0.98	0.99	0.73	0.80	0.96	0.95

Table 13-2: Grab sample coarse repeats Au and Ag results

	Original Au	Repeat Au	Original Ag	Repeat Ag
Count	9	9	9	9
Minimum	57	55	0.08	0.1
Maximum	320	331	50.1	47.5
Mean	189.56	186.89	19.24	18.76
Median	158	164	18.7	19.2
Standard Deviation	77.77	80.47	15.38	14.63
Coefficient of Variation	0.41	0.43	0.80	0.78

14 Adjacent Properties

14.1 Neptune Minerals Inc

Neptune Minerals Inc. (‘Neptune’) was founded in January 2011 and has since acquired control of Neptune Minerals plc. Neptune now controls licensed tenement in New Zealand. Neptune also acquired control of Dorado Ocean Resources Limited, which in turn had acquired a substantial interest in Bluewater Metals Pty Ltd, the holder of licensed tenements in the Solomon Islands, Vanuatu and Tonga.

14.2 Korea Ocean Research & Development Institute (KORDI)

The Korea Ocean Research & Development Institute (KORDI), an agency of the Republic of Korea Ministry of Land, Transport and Maritime Affairs acquired five prospecting licences in Tonga to the east of Nautilus Minerals’ Valu Fa prospecting licences in 2008. KORDI announced they would carry out a 25 day exploration programme in January 2010 on behalf of a syndicate of four private companies, and claims it will start commercial extraction in 2012 from mid-ocean ridges.

KORDI also acquired three special prospecting licence areas in Fiji in 2011.

14.3 CCZ Exploration Areas

Seven contractors to the ISA have granted exploration licences in the CCZ near Nautilus Minerals’ application:

1. Yuzhmorgeologiya (the Russian Federation);
2. Interoceanmetal Joint Organization (consortium comprising Bulgaria, Cuba, Slovakia, Czech Republic, Poland and the Russian Federation);
3. The Government of the Republic of Korea;
4. China Ocean Minerals Research and Development Association (COMRA);
5. Deep Ocean Resources Development Company (Japan);
6. Institut français de rechèrche pour l’exploitation de la mer (France); and
7. The Federal Institute for Geosciences and Natural Resources (Germany).

The contractor licences have been granted for 15 years. Work programs and progress are reviewed annually by the Legal and Technical Committee of the ISA during its annual meeting. Each contractor is sponsored by a State, or group of States. To date, no production has taken place by these competitors.

Tonga Offshore Mining’s applications are surrounded by granted exploration tenements as well as ground held by the “Enterprise” (the ISA Reserved Areas) (Figure 14-1). The Enterprise acts as a “land bank” for the ISA, and holds ground that was worked by the original “Pioneer Investors” (those consortium who worked in the CCZ during the 1970s and 1980s prior to the ascension of UNCLOs and part XI), and land “surrendered” to the ISA by contractors, in accordance with part XI of UNCLOS and the 1994 Implementation Agreement. These are the “Reserved Areas”, set aside by the ISA for developing nations.

The ISA Legal and Technical Committee approved the grant to Tonga Offshore Mining in July 2011. Formal signing bringing into for the Contract of Work for the polymetallic nodules area did not take place until January 2012.

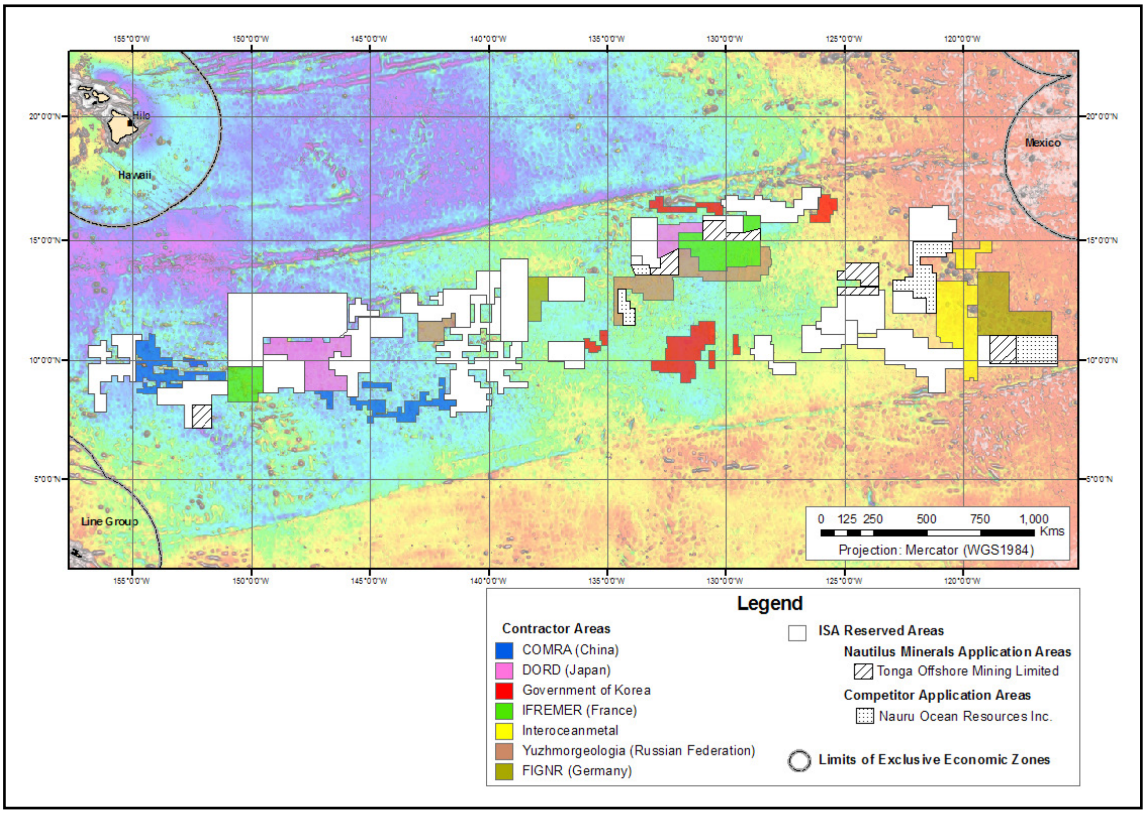


Figure 14-1: Location map of the CCZ showing granted exploration tenements (contractor areas), applications and ISA Reserved Areas

15 Mineral Processing and Metallurgical Testing

15.1 Introduction

No metallurgical testwork has been undertaken on any Nautilus tenement or property outside the Bismarck Sea, Papua New Guinea.

16 Mineral Resources and Mineral Reserve Estimates

No mineral resources and minerals reserve estimates have been completed on any properties outside of the Bismarck Sea, Papua New Guinea.

17 Other Relevant Information

17.1 PNG Environmental Assessment

17.1.1 Environment Act 2000

The Environment Act 2000 defines the activities which require an Environmental Impact Assessment (EIA) process prior to the approval of an Environmental Permit. It sets out three levels of activities, ranging from Level 1 to Level 3 activities, where Level 3 activities are defined as those that may result in serious environmental harm. It also sets out the EIA process to be followed, which commences with the registration with the Department of Environment and Conservation (DEC) of the intent to carry out preparatory work for an activity. After review DEC serves a notice, for Level 3 activities, to undertake an EIA process. The first step in this process is to prepare and submit an Environmental Inception Report (EIR) under Section 52 of the Environment Act 2000. Once the EIR is approved the proponent commences with the preparation of an Environmental Impact Statement (EIS). Once submitted, the EIS is assessed by DEC and other parties and if approval is recommended the DEC grants approval in principle, after which an Environmental Permit may be issued. Under Section 66 of the Environment Act 2000 a condition of the permit may be the preparation and carrying out of an Environmental Management Plan (EMP), based on the findings and mitigation measures contained in the EIS.

17.1.2 Key environmental regulations

- Environment (Council's Procedures) Regulation 2002
- Environment (Prescribed Activities) Regulation 2002
- Environment (Water Quality Criteria) Regulation 2002
- Environment (Fees and Charges) Regulation 2002

17.1.3 Other relevant legislation

- The Fauna (Protection and Control Amendment) Act 1974
- The International Trade (Fauna and Flora) Act 1979
- Dumping of Wastes at Sea Act 1979
- Prevention of Pollution at Sea Act 1979

17.1.4 International standards and conventions

- International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL)
- United Nations Convention on the Law of the Sea (UNCLOS) (1994)
- Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP) (1990)
- Kyoto Protocol to United Nations Framework Convention on Climate Change (1997)
- International Finance Corporation (IFC) Performance Standards
- IFC General EHS Guidelines
- World Health Organisation (WHO) Standards
- Montreal Protocol on Ozone Depleting Substances
- Convention on Biological Diversity (1993)

17.1.5 Nautilus Minerals' mandated requirements

- Nautilus Minerals Environmental Policy
- Nautilus Minerals Solwara 1 Project Statement of Requirements

17.1.6 Default or voluntary codes and guidelines

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guidelines
- Australian National Environment Protection (Ambient Air Quality) Measures
- Equator Principles established by the World Bank.
- Lihir Gold Mine DEC standards
- Lihir PNG Standards (reported in Lihir Responsible Environmental Management Fact Sheet 4)
- PNG Code of Conduct for Mining
- International Marine Minerals Society Code for Environmental Management of Marine Mining
- InterRidge Code of Conduct

17.1.7 Waste management

The aim of waste management is to employ practices which avoid waste in the first instance, progressively moving through less preferable alternatives. If waste generation cannot be avoided the measures of most relevance to the Project are likely to be a combination of recycling, treatment and disposal. Management of solid, liquid and hazardous waste are the key issues of concern.

17.2 Other information

In November 2008, Nautilus Minerals announced that Anglo American increased its shareholding in Nautilus Minerals from 5.7% to 11.1% by acquiring 5,177,066 shares at CAD1.33 (USD1.13)* and 3,756,636 shares at CAD1.46 (USD1.24)* pursuant to an anti-dilution right granted to it, that the subscription has now been completed. Total funds received were approximately CAD12.4 million (USD10.5 million). Nautilus Minerals made an application for 8,933,702 common shares to be admitted to AIM and TSX. The shares were admitted to trading in November 2008.

On 17 February 2009, Nautilus Minerals announced that Teck Cominco Limited had confirmed its exploration expenditure in Papua New Guinea and Tong during 2008 to be USD14.8 million. This exceeded the minimum expenditure required for Teck to earn the right to form a joint venture with Nautilus Minerals in the countries of PNG and Tonga which was set at USD12 million. Despite this expenditure in 2008, Teck elected not to participate further in PNG and Tonga where it would have been required to meet a USD25 million expenditure commitment in each country over the next two years.

Teck also advised Nautilus Minerals that it wishes to retain the right to joint venture with Nautilus Minerals in New Zealand, Japan, Fiji and Northern Marianas, subject to the grant of title.

Mawarid Mining LLC, a subsidiary of MB Holdings Company LLC, an oil and gas, mineral mining and processing group based in Muscat, Oman, holds approximately 9.98% of Nautilus, acquired in September 2011. Mawarid Mining was established in 1997 to explore and develop mining opportunities in Oman and internationally. It was the first private sector company to engage in the exploration and development of copper and gold in the Sultanate of Oman.

Subsequent to the period of this report, in February 2012, Teck notified Nautilus Minerals that it would be exercising its right to participate in the Fiji tenements.

18 Interpretation and Conclusions

The geology of the SMS systems in the Nautilus Minerals exploration tenements is similar to that of volcanic-hosted massive sulfide (VHMS) deposits in terrestrial settings throughout the world (e.g. Hellyer in western Tasmania, Australia and Eskay Creek in north-west British Columbia, Canada). It is widely accepted by the scientific community that the SMS deposits forming on the seafloor today are direct modern-day equivalents of these terrestrial VHMS systems.

Based on recent exploration, Nautilus Minerals is able to demonstrate a track record of success with respect to the discovery of active and fossil SMS systems containing Cu-Zn-Au-Ag mineralisation. Nautilus Minerals has built a pipeline of exploration prospects within its offshore exploration tenements in Tonga.

In Tonga a large inventory of quality exploration targets awaits testing and drilling.

Nautilus Minerals has also lodged tenement applications over known SMS systems in the North Fiji Basin.

Based on reviews of several engineering studies completed for Nautilus Minerals, and recent advances in seafloor engineering, largely driven by the petroleum and telecommunications industries, SRK is of the opinion that there is available to Nautilus Minerals the necessary equipment and technology to explore for, and potentially develop and mine these SMS systems.

SRK completed five site visits of certain Nautilus Minerals PNG tenements between 2005 and 2008, and reviewed remote data gathering and sampling methods.

The exploration techniques used by Nautilus Minerals are appropriate and reasonable for defining the nature and extent of Cu-Zn-Au-Ag mineralisation in the SMS systems on the exploration tenements.

The exploration sequence is:

1 Location of active and fossilised spreading centres and rift zones in national waters and associated economic exclusions zones (EEZ);

2 Preliminary compilation of historic research data generated from over 25 years of offshore activity in the EEZ;

  - Direct detection of SMS mineralisation, using:
  - Water geochemistry and plume sensors;
  - side-scan sonar/bathymetry/sub-bottom profiling and mapping using video cameras;
  - deep-tow magnetic, electrical, electromagnetic and other geophysical methods;
  - dredging and direct sampling with an ROV.

3 Core drilling, in order to determine the in situ continuity of thickness and grade of massive sulfide mineralisation.

During 2011, on its exploration tenements in Tonga, Nautilus Minerals completed an Autonomous Underwater Vehicle (AUV) trial, in collaboration with the academic institutes that demonstrated the efficiency at which this technology can identify and map SMS targets, at high resolution.

No resource estimates have been defined for any prospects outside the Bismarck Sea, Papua New Guinea, and as such, these areas are considered speculative by nature, and involve varying degrees of moderate to high exploration and financial risk.

SRK is of the view that the projects are sufficiently prospective to warrant exploration with the techniques and programs indicated to SRK during the assessment. In SRK's opinion the directors and staff of Nautilus Minerals have the appropriate technical and management expertise to manage the proposed exploration program.

19 Recommendations

To maintain the exploration pipeline, Nautilus Minerals needs to identify further SMS targets over and above those already known.

Nautilus Minerals has successfully trialled Autonomous Underwater Vehicles (AUV) in their exploration process to improve the quality and efficiency of exploration data acquisition. The 2011 AUV trial from the Kilo Moana demonstrates a possible step-change improvement in the efficiency of the local scale Target Generation and Target Testing exploration stages.

Nautilus Minerals has numerous targets in Tonga that require testing, including 32 plume targets defined in 2009. Sixteen of these sites in the North East Lau region were followed up in 2011 (including 12 using AUV mapping, which was much more efficient than the ROV programmes previously deployed, although these sites still require some ROV follow up before they become drill-ready), however targets in the remainder of the Lau Basin remain unconfirmed.

In SRK's opinion, Nautilus Minerals' proposed activities are appropriate for exploring for new SMS deposits and adding to the current SMS resources.

Excluding rental costs associated with maintaining Nautilus Minerals' large tenement position it is estimated that an annual exploration budget of US$10 million dollars would be sufficient to deliver the SMS exploration projects recommended above. This is subject to market conditions regarding the contracting of vessels, equipment and expertise.

Exploration for polymetallic nodules in the Clarion Clipperton Zone (CCZ) represents a new opportunity for Nautilus Minerals. Previous work has highlighted the resource potential within the CCZ area in the Pacific Ocean. Since the previous work in this area was done in the 1970s, deep sea engineering technology has advanced significantly. Many of the techniques Nautilus Minerals is developing for SMS production may also be applicable to the commercialisation of polymetallic nodule production.

United Nations Convention on the Law of the Sea (UNCLOS) has been adopted, and the International Seabed Authority (ISA) established, with responsibility for controlling all deep-sea mining in international sea areas. In 2001-02, the Authority signed 15-year contracts with several parties, giving them exclusive rights to explore for nodules in similar regions of the seabed, each 75,000 km2 in size. It is recommended that Nautilus Minerals pursue its exploration license applications through the ISA, as sponsored by the Kingdom of Tonga.

Once granted, an exclusive exploration license within the Clarion Clipperton Zone (CCZ) the following work program is recommended:

- In Year 1, a compilation and detailed review of all existing data on the exploration area under contract, including detailed literature reviews of possible metallurgical treatment methods. Nautilus Minerals has already obtained samples recovered in previous nodule sampling programs by third parties. Initial metallurgical test work of these samples may help in the design of the subsequent exploration, bulk sampling and testing programs.
- In Year 2 and Year 3, carry out exploration cruises. These cruises should include seafloor surveying, sampling, and environmental studies. The principal aim of this work would be to establish the size and grade of the resource, to appropriate modern commercial resource reporting standards (e.g. NI 43-101), and obtain sufficient bulk sample to allow the principal metallurgical characteristics to be determined.

Possible budgets required to complete the polymetallic nodule exploration projects in years 2 and 3 may total US$2 million to US$4 million.

On completion of the exploration cruises, the following programs may also be undertaken:

- Base line environmental studies;
- Resource estimation studies;
- Engineering and metallurgical studies, and design work for both the onshore and offshore components; and
- Preliminary economic and commercial studies to provide scoping estimates for CAPEX and OPEX for mining, transportation and processing options.

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CERTIFICATE OF QUALIFIED PERSON

To accompany the Report entitled "Nautilus Minerals Incorporated NI 43-101 Technical Report 2011 PNG, Tonga, Fiji, Solomon Islands, New Zealand, Vanuatu and the ISA" dated March 23, 2012.

I, Philip Edward Jankowski, do hereby certify that:

1. I am a graduate from the Australian National University with a Bachelor of Science degree in Geology in 1986 and a Graduate Diploma in 1988; and a graduate from the University of Western Australia with a Master of Science degree in Geology in 2000.
2. I have continually practiced my profession since 1988.
3. I am a Member of The Australasian Institute of Mining and Metallurgy and a Chartered Professional.
4. I am a Director of Baltica Consulting Pty Ltd, and an Associate Consultant to SRK Consulting (Australasia). I hold office at Knutsford Street, Fremantle, WA 6160, Australia.
5. I have 23 years' mining industry experience, including mine geology and exploration roles and, I have worked as a geologist in open pit and underground gold mines and as a resource geologist.
6. I have read the definition of "qualified person" as set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a qualified person for the purpose of NI 43-101.
7. I completed a site visit to the Property, which consisted of a trip in the *MV NorSky* (20 September to 3 October 2009) and witnessed ROV sampling; and on the neighboring Nautilus Minerals Bismarck Sea Property the *REM Etive* (25 to 30 January 2011) and witnessed core drilling.
8. I confirm that, as of the date of this Certificate, to the best of my knowledge, information and belief, this report contains all scientific and technical information that is required to be disclosed to make this report not misleading.
9. Neither I, nor any affiliated entity of mine is at present, or under an agreement, arrangement or understanding expects to become, an insider, associate, affiliated entity or employee of Nautilus Minerals Incorporated, and/or any associated or affiliated entities.
10. Neither I nor any affiliated persons or entity of mine, own, directly or indirectly, nor expect to receive, any interest in the properties or securities of Nautilus Minerals Incorporated, or any associated or affiliated companies.
11. I am independent of Nautilus Minerals Incorporated, in accordance with the application of Section 1.5 of NI 43-101.
12. My prior involvement with the subject of this report relates to the preparation of the report entitled "Nautilus Minerals Incorporated NI 43-101 Technical Report 2010, PNG, Tonga, Fiji, Solomon Islands, New Zealand, Vanuatu and the ISA" dated June 6, 2011 commissioned by Nautilus Minerals Inc.

13. I have read the NI 43-101 and Form 43-101F1, and have prepared the technical report in compliance with NI 43-101 and Form 43-101F1.
14. I am responsible for every section of this Report
15. I consent to the filing of this Report with the relevant securities commission, stock exchange and other regulatory authorities as may be determined, including general publication in hardcopy and electronic formats to shareholders and to the public.

Dated March 23, 2012

(Signed by) Philip Edward Jankowski

Baltica Consulting Pty Ltd

SRK Associate Consultant, MSc, MAusIMM(CP)