

SCIENTIFIC GROUP PRESENTATION ON DEEP SEA MINING IN PNG

- TOPIC: NAUTILUS or SOLWARA 1 Deep Sea Mining in New Ireland Province, PNG.

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PRESENTATION OUTLINE

1. INTRODUCTION
2. AIMS & OBJECTIVES
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4. BACKGROUND
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 - Types of Mine & Waste Disposal
 - Mineral Exploration License
 - On shore issues
 - Water & Sediment Quality
 - Mitigation
5. Other Issues associated with the DSM
 - Fishing Vessels & Marine Transport Systems
 - GHG Emissions and climate change.

INTRODUCTION

- Papua New Guinea is one of the Pacific Island countries situated to the North West of Fiji and directly west of Solomon Islands .
- It is divided into four main regions. They are Highlands, Momase, New Guinea Island and Papua or Southern Region. It has a total population of over 8 million people.
- It has a total land area of 466 000 square kilometers.

OVER VIEW OF THE DSM

Nautilus Mineral Inc (referred to as "Nautilus") is the first foreign owned company in the South West Pacific to commercially explore the seafloor for massive sulphide systems, a potential source of high grade copper, gold, zinc and silver.

Nautilus' copper-gold project, Solwara 1, is under development in the territorial waters of Papua New Guinea. The Company has been granted the Environmental Permit by DEC and tenement license by the Mining Department required for resource development at this site.

Nautilus plans to extend its tenement holdings in the exclusive economic zones and territorial waters of Papua New Guinea, Fiji, Tonga, the Solomon Islands, Vanuatu and New Zealand as well as other areas outside the Western Pacific



Figure 1

TERRITORIAL WATERS, PAPUA NEW GUINEA LOCATION OF TENEMENTS

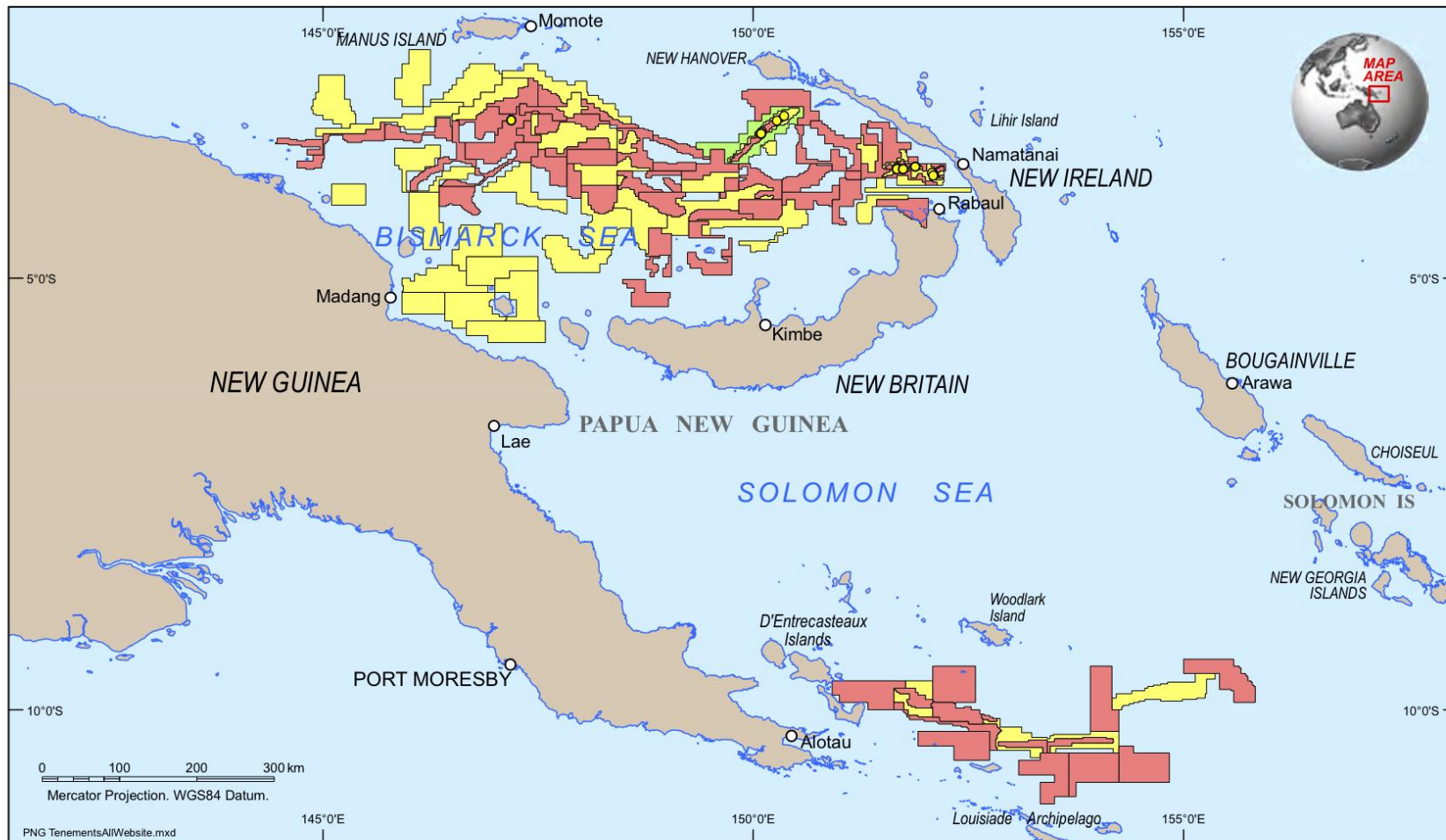
October 2010 © Nautilus Minerals

Exploration Licences

- Granted, 100% Nautilus
- Granted, Teck (transfer to Nautilus pending)
- SMS system

Exploration Licence Applications

- 100% Nautilus



SOLWARA 1 is the first proposed DSM mine in the Pacific

Located along the Bismarck Sea
approximately 30 kilometres from the
nearest coast in New Ireland Province.

Latitude $3^{\circ}47'25.06''\text{S}$.

Longitude $152^{\circ}05'41.65''\text{E}$.

Current Status: In Development Stages.

Nautilus is working on the mining lease application and the development proposal which were submitted to the Government of PNG in 2008. The Environmental Permit for the development of the Solwara 1 Project was granted in December 2009, by the Department of Environment and Conservation (DEC) of Papua New Guinea for a term of 25 years.

Geology and reserves

- Description of the geology was observed and interpreted largely from the 2007 drilling results. The drilling results showed that the mineral deposit was consistent across the sea floor. SMS deposits at Solwara Project 1 are formed in extensional fault systems which facilitate the deep circulation of seawater by way of convection cells formed in response to increased heat flow associated with submarine volcanic activity along the Pacific plate commonly known as the rim of fire.

MINERALISATION

- The deposit is formed of various massive sulphide bodies over which fields of sulphide-rich chimneys are developed.
- The current mineralisation zone is around 1.3km long and up to 200m wide. It has been drilled up to 19m below the seabed.

SULPHIDE MINERALISATION ON THE SEAFLOOR

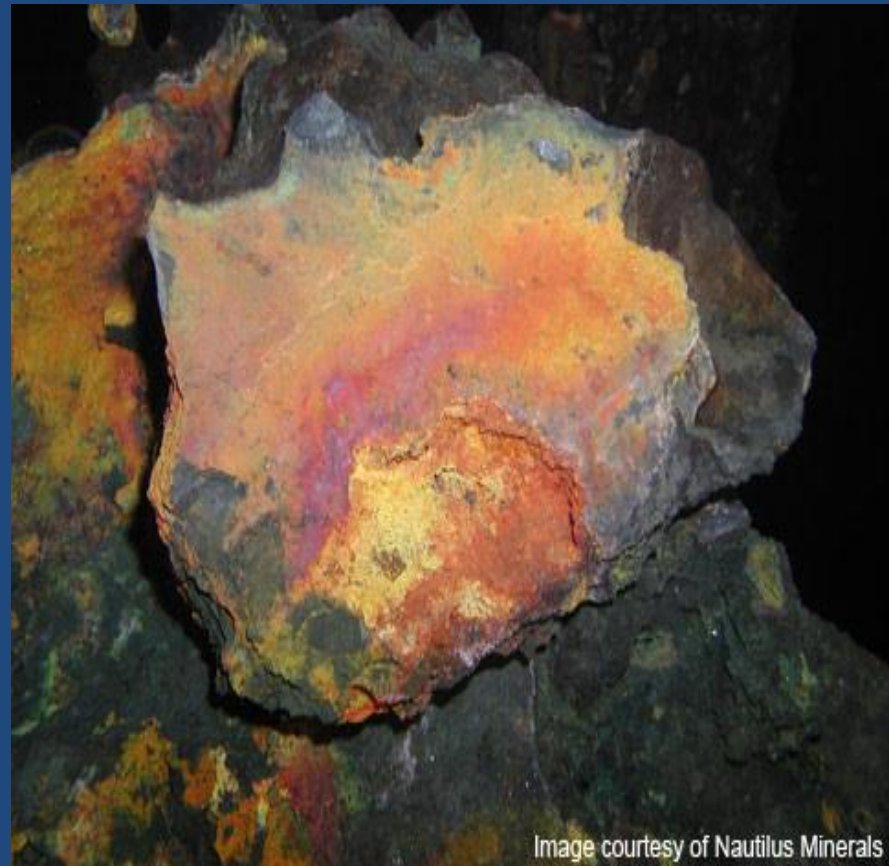


Image courtesy of Nautilus Minerals

TYPE OF MINE AND WASTE DISPOSAL

- Nautilus Minerals Is planning to extract high-grade Seafloor Massive Sulphide (SMS) deposits of copper, gold, zinc, and silver in 1600 metres of water.
- The mining project is being developed in two phases

TYPES OF MINE AND WASTE DISPOSAL

- Phase 1:

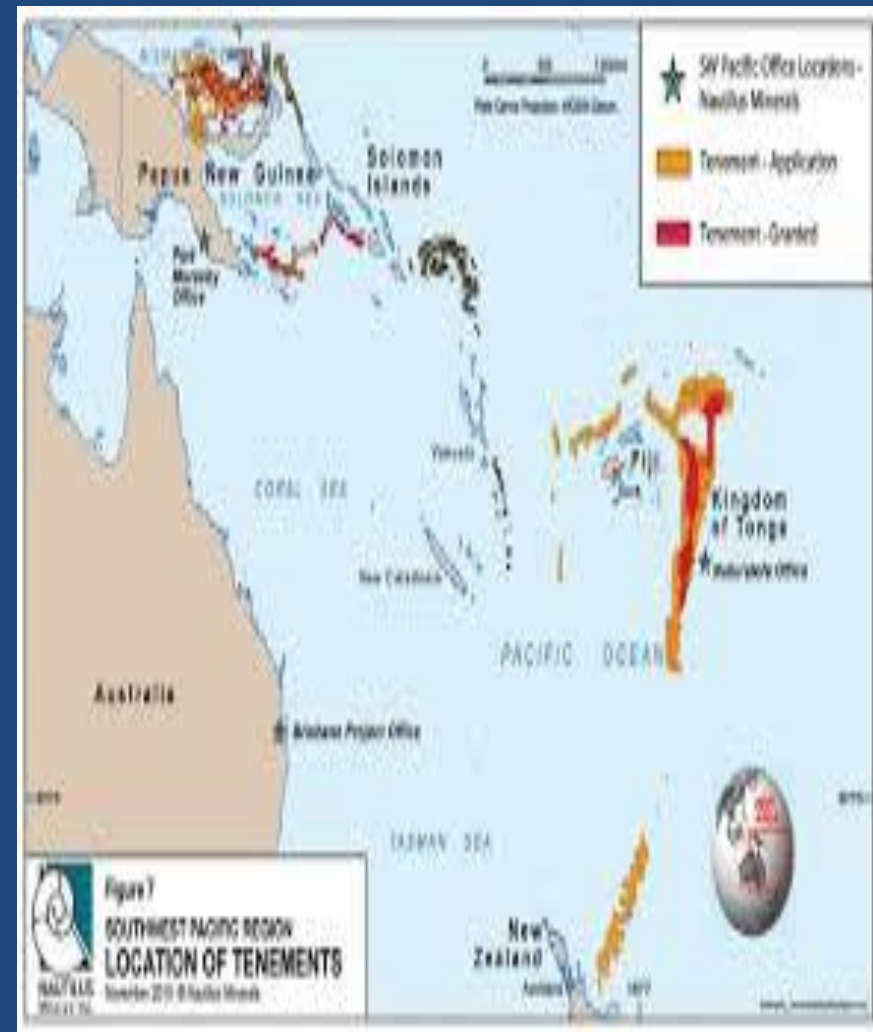
Extracting and exporting ore with no concentration or processing. No chemicals or blasting will be used for this process. Ore will be stockpiled and shipped from the Port of Rabaul for export processing.

- Phase 2:

- A. Construction of a treatment or concentrator facility. During the mining operation, approximately 130,000 tons of unconsolidated sediment (1600 m deep over some of the deposit) and 115,000 tons of waste rock will be removed and pumped onto deeper nearby seabed areas down-slope.
- B. Ore will be transported 50 km south to shore, by vessels each 85 m long, for temporary storage at the Port of Rabaul on north New Britain Island. In Phase 1 of the project, the ore will be exported from Rabaul via 3-6 ore bulk carriers per month to a foreign processing facility and smelter.

EXPLORATION LICENCES

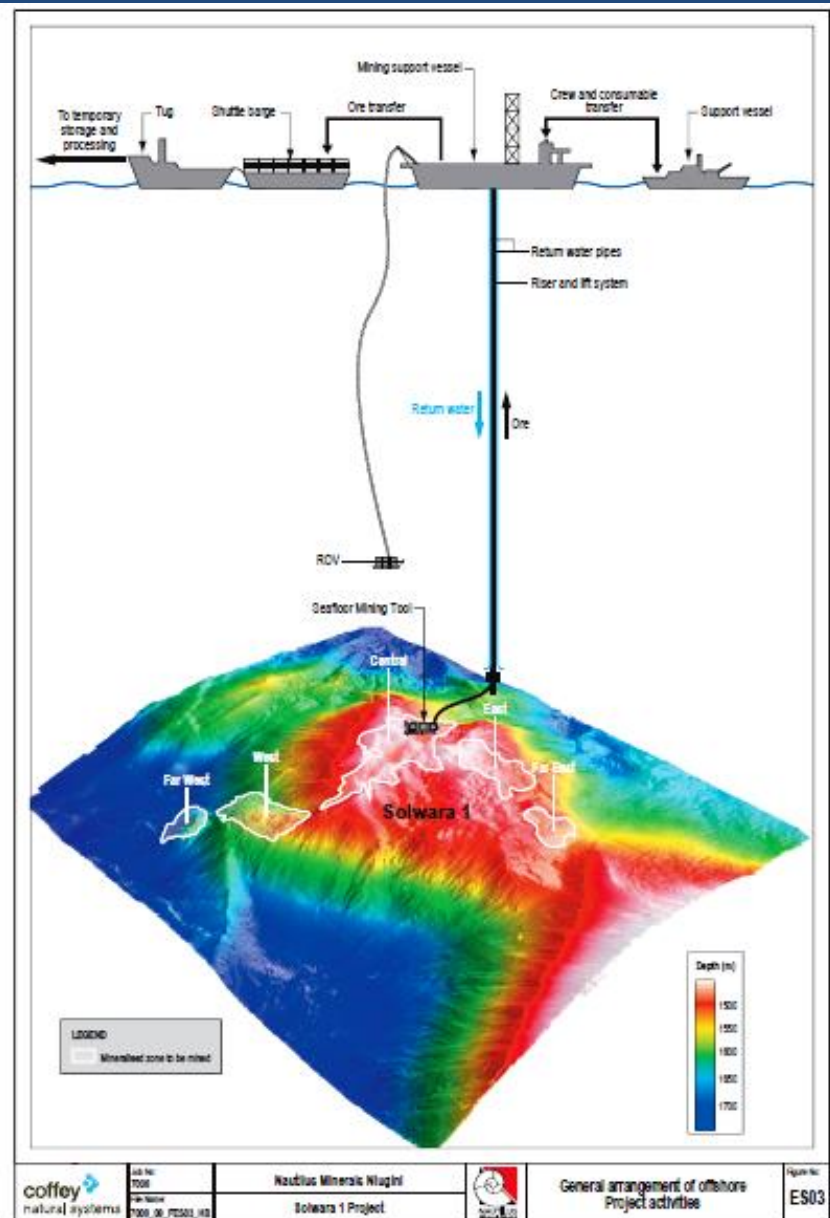
- The development involves the recovery of high-grade polymetallic Seafloor Massive Sulphide (SMS) deposits that are located at approximately 1,600 m water depth on the floor of the Bismarck Sea, New Ireland Province, Papua New Guinea (PNG), about 50 km north of Rabaul.
- Within PNG, Nautilus holds exploration licences in the Bismarck and Solomon seas, including 51 granted exploration licences covering 107,917 km² and 37 exploration license applications covering 88,906 km². Outside PNG, Nautilus holds granted prospecting licences in Tonga and the Solomon Islands and has applications pending in Fiji and New Zealand.



HOW IT ALL WILL WORK

- The offshore production system comprises three main components: the seafloor production tools (SPTs), the riser and lifting system (RALS), and the production support vessel (PSV). Using the SPTs, rock is disaggregated by two large robotic machines that excavate material using a continuous cutting process, unlike coal or other bulk continuous mining machines on land.

- On deck of the PSV, the slurry is dewatered by conventional methods. The dewatered solid material is transferred to a transportation barge moored alongside the PSV. The return seawater is pumped back to the seafloor through the riser pipes, which also provides hydraulic power to operate the RALS pump. Discharge of the return water close to the seafloor helps to minimize impacts to surface waters.



How it all will work....cont

The Auxiliary Cutter (AC) is a preparatory machine that deals with the initial terrain and creates benches for the other machines to work. It will operate on tracks with spud assistance and has a boom-mounted cutting head for flexibility. The second machine, the Bulk Cutter (BC), has higher cutting capacity and will be limited to working benches created by the AC. Both machines leave cut material on the seafloor for collection by the Collecting Machine (CM).



Auxiliary Cutter



Bulk Cutter

FIG: Picture display Auxiliary Cutter and Bulk Cutter

COLLECTING MACHINE

The CM, also a large robotic vehicle, will collect the cut material by drawing it in as seawater slurry with internal pumps and pumping it through a flexible pipe to the RALS. The RALS comprises a large pump and rigid riser pipe hanging from a vessel which delivers the slurry to the surface.



WATER AND SEDIMENT QUALITY

- Water quality was mostly typical of open ocean water, with most trace metals below detection limits, except in some samples taken close to chimneys where ambient concentrations of total metals (i.e., copper, lead and zinc) were higher than ANZECC/ARMCANZ (2000) guidelines for 95% protection.
- Toxicity tests of elutriate water prepared to represent conditions in water and sediments discharged after dewatering were undertaken to determine potential effects if these were to be discharged in shallow or mid-water depths. While these showed some toxicity to surface test organisms (and at surface temperatures), the findings are not relevant given that the return water will be discharged close to the seafloor, where fluids discharged from vents are naturally elevated in metals and the resident animals are tolerant of these highly mineralised areas.

ONSHORE ISSUES

- Potential Onshore issues are those that occur on or in the vicinity of the Port of Rabaul. Pollution of the marine environment can arise from spills of ore, hydrocarbons or chemicals or from inappropriate disposal of waste. The risk of pollution and product spillage is likely to be greater around areas such as refuelling stations and loading/unloading areas.
- The highly sulphidic nature of the ore may give rise to the potential for acid generation once exposed to air during the dewatering process, transport and while temporarily stored in stockpiles. Acid rock drainage (ARD) increases the ability for heavy metals to leach from the ore into the surrounding environment, resulting in contamination and potential toxicity to aquatic organisms and groundwater.

MITIGATION

- Best management practices will be applied to prevent spills or discharges of ore, hydrocarbons or contaminated water to the land or marine environment a designated refueling area. The company should also provide tier 1 oil spill response equipment and have trained officers to deal with any spill events should they occur.
- Waste from ships will be managed in accordance with the MARPOL 73/78 Convention and the Protection of the Sea (Prevention of Pollution from Ships) Sea Dumping Act 2013 which restricts the disposal of food wastes or untreated sanitary wastes / mining wastes within 12 nautical miles of land. The MSV is more than 12 nautical miles from land and food scraps and sewage will be treated to MARPOL standards. Before disposing at appropriate venues.
- To prevent ARD, the stockpiles will be covered to reduce infiltration of rain and low pH runoff. The ore will be dewatered to 8% moisture content offshore prior to transport onshore. Stockpiles will be bunded and covered to limit exposure to wind and water. Clean water runoff will be diverted away from the stockpiles and drainage from the stockpiles will be directed into sedimentation ponds to enable monitoring and treatment, if necessary. Any contaminated runoff will be neutralised and solids returned to stockpiles and water treated to ANZECC/ARMCANZ (2000) standards and either discharged to Simpson Harbour or returned to the MSV for discharge at depth with return water.

Other issues as a result of the DSM

Fishing Vessels & Marine Transport

Other issues identified relates to the management and control of possible interactions between fishing vessels and other vessels operating near the Project area. This includes:

- Establishment of a 500-m-radius exclusion zone around the MSVS .
- Installation of appropriate devices to allow monitoring and communication with approaching vessels.
- Regular communication with PNG's National Maritime Safety Authority and National on regulatory issues such as marine pollution and other safety issues.
- Revision of nautical charts (in consultation with PNG's National Maritime Safety Authority) to include the location of the MSV, exclusion zone and routine shipping routes to be used by the Project.

GHG EMISSIONS AND CLIMATE CHANGE ISSUES

- Greenhouse gas (GHG) emissions from the Phase 1 Project consist almost entirely of fuel combustion (CO₂ emissions), the majority arising from the MSV. As there is no ore processing within PNG in Phase 1, total GHG emissions are relatively low compared to other PNG mining projects and therefore the (CO₂) emissions in the context of potential climate change impacts is minor and relatively low comparable to other sources of emissions.

CONCLUSION

- Production system at Solwara 1 has two main components, the Vessel, the Riser and Lifting system and the Seafloor production tools
- Ore is ground up on the seafloor by the seafloor production tools and sent to the surface as slurry inside the riser and lifting system. At the surface this slurry is dewatered and the filtered material is exported while the filtered water is returned to the seafloor and released.
- This method ensures there is no impact on the upper most layer of the water column where most of the fish and other marine life are found.
- The proposed mining method will leave a very small footprint in the environment, because there is no need to build excess roads or buildings, there will be no blasting or use of chemicals used in mining and since there is no one living on the seafloor, there won't be people relocated to other places.
- The Seafloor production tools have been delivered and are on their way to Oman now. The riser and lifting system and the pump are being going through the final checks before being delivered and the building of the vessel has commenced and is on schedule.

- This brings us to the end of my presentation. If you want more information regarding the DSM, please go to the company's website [www.Nautilus Nuigini Minerals Ltd](http://www.NautilusNuiginiMineralsLtd.com.pg) or email wselau@nautilussolwara1.com.pg and you get more information. With that;
- THANK YOU ALL FOR LISTENING and wish you all a safe trip back to your lovely countries.