The cost of implementing proposed environmental regulations in the AREA.

ISA Workshop

Jamaica 31st July to 4th August

David Heydon

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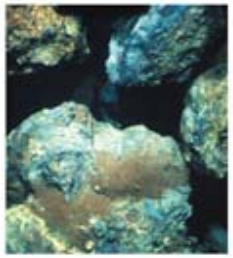

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Nautilus Minerals Ltd

- With its active exploration program over next 12 to 18 months, Nautilus seeks to collaborate with MSR groups to study the data collected.
- Environmental management is a significant element of these work programs.

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Talk Outline

- Land based permitting – current practices.
- The “seafloor mine”.
- Sea based prospecting – activities vs impacts.
- Compliance costs – land vs sea.
- Conclusions.

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Exploration and the Environment

- Land based exploration programs are **“graded”** according to “**expected impact**” prior to the start of work.
- Minimal cost in the early low impact phases ($5 -20K per program).
- **Main cost** is in the preparation of the **EIS** (environmental Impact Statement), which is produced once the company thinks it has a project that on preliminary numbers looks economic.
- ISA needs to have a similar approach in the AREA.

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Land based Mine - EIS

The cost, size and length of time spent doing an EIS for a land based mine varies enormously due to;

- Varying “land use conflicts”,
- Type of mine and it’s impacts,
- Processing options,
- Etc,etc.

- Generally takes min. 12 months, commonly 12 to 18, plus 6 mth govt review.
- Costs vary enormously, but commonly range from $3 to 10+ million.

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PNG Environment Permitting

ENVIRONMENT ACT - PERMITTING PROCESS

No Permit Required	Fast Track (Non EIA)	Permit (Non EIA)	Environment Impact Assessment
Environmental Codes of Practice e.g. Environmental Code of Practice for the Mining Industry	Registration of intention to carry out preparatory work ↓ Lodgement of application for a permit Acceptance of application for a permit ↓ Assessment Grant of Permit, Permit conditions (Director) (Acceptance to Grant: 30 days)	Registration of intention to carry out preparatory work ↓ Lodgement of application for a permit Acceptance of application for a permit Referral to NG, PG, LLG Notification of application (radio, newspaper) Conference of interested parties (discretionary) Independent expert (discretionary) Assessment Grant of Permit, Permit conditions (Director) (Acceptance to Grant: Minimum 90 days)	Registration of intention to carry out preparatory work Notice to undertake an EIA Inception Report Environmental Impact Statement Environment Consultative Group (discretionary) Provincial Environment Committee Public review (compulsory) Assessment Director's acceptance Environment Council Acceptance Approval in Principal (Minister) Lodgement of application for a Permit Acceptance of application for a Permit ↓ Assessment Grant of Permit, Permit conditions (Director)

PRESCRIBED ACTIVITIES REGULATION – CLASSIFICATION OF MINING AND PETROLEUM ACTIVITIES

LEVEL 1	LEVEL 2, CATEGORY A	LEVEL 2, CATEGORY B	LEVEL 3
Mineral Exploration Geological and geochemical surveys; seismic and other surveys; trenching, pitting or other small excavations for exploration purposes. Any drilling program at a defined prospect where the aggregate depth of all holes drilled is less than 2,500m. **Mining** Non mechanised mining Alluvial mining on an AML	**Mineral Exploration** Any drilling program at a defined prospect where the aggregate depth of all holes drilled is greater than 2,500m. **Mining and Processing** Mechanised mining on a ML involving non-chemical processing of less than 50,000 tpa. Gravel extraction operating continuously for more than 6 months and involving the extraction of less than 10,000 tpa. Quarrying involving the extraction of less than 100,000 tpa.	**Mining and Processing** Mechanised mining on a ML involving chemical processing of less than 50,000 tpa. Mechanised mining on a ML involving non-chemical processing of more than 50,000 tpa. Gravel extraction operating continuously for more than 6 months and involving the extraction of more than 10,000 tpa. Quarrying involving the extraction of more than 100,000 tpa.	**Mining and Processing** Mechanised mining on a ML involving chemical processing; except where the activity is a category B, level 2 activity. Mining on an SML. Extraction of offshore coral deposits. Submarine tailings disposal.
Petroleum Exploration Geological and geochemical surveys Seismic and other surveys	**Petroleum Exploration** Drilling of oil and gas wells	**Petroleum and Petrochemicals** Manufacture of organic chemicals requiring a Petroleum Processing Facility Licence (PPFL) Pipeline transport and storage using facilities with a holding capacity of more than 0.5 ML	**Petroleum and Petrochemicals** Recovery, processing, storage or transport of petroleum requiring a PDL or PL. Liquefaction of natural gas requiring a PPFL. Refining of petroleum or manufacture and processing of petrochemicals requiring a PPFL, except where the activity is a category B, level 2 activity.

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Land based - Environmental Permitting.

- **Low impact** activities (not ground disturbing) are permitted on application.
- **Higher impact** activities are **graded**, with lower range activities having **"accepted" impact** levels, and remediation/monitoring (eg drilling, sampling).
- **High impact** (bulk sampling and trial mining), commonly have some form of limited EIS/**approval** prior to work commencing.

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The “mining cycle”.

Exploration.

- Low impact assessment of potential.

Resource delineation.

- Detailed testing of deposit to determine if economically viable.

Permitting.

- Obtaining the various approvals to mine

Mining.

- Extracting the ore

Closure

- Activities and planning to ensure the site achieves acceptable long term environmental status.

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Suggested impacts- seafloor

Low impact:

- Geophysics, video tows, modest sampling,

Moderate Impact:

- Sampling, scout drilling,

Higher Impact:

- Bulk sampling, trial mining – area specific

Mining:

- ongoing monitoring

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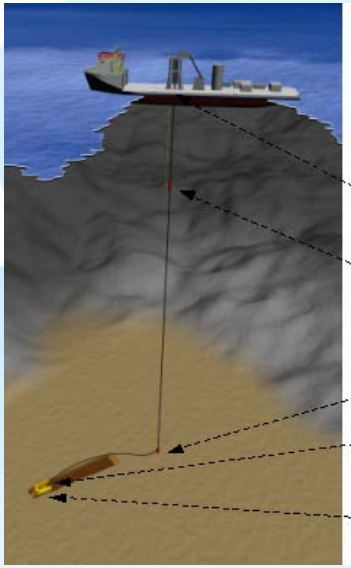
The seafloor mine

Key points:

- High grades
- small volumes
- Small footprint
- No waste dumps
- Remote mining units
- Ore transported to land for processing
- No “land use conflicts”
- mobile



- Riser - 1,620 m flexible, 229 mm ID x 320 mm OD
- Jumper - 200 m flexible, 229 mm ID x 506 mm OD
- Major riser equipment
  - Top end termination Equipment
  - Air lift joint and 51 mm ID flexible
  - Dump Valve with connection to jumper
  - Quick disconnect connector
- Excavator

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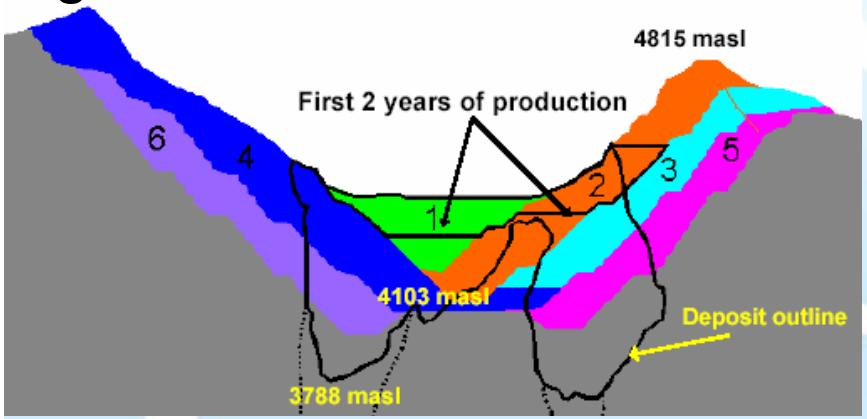
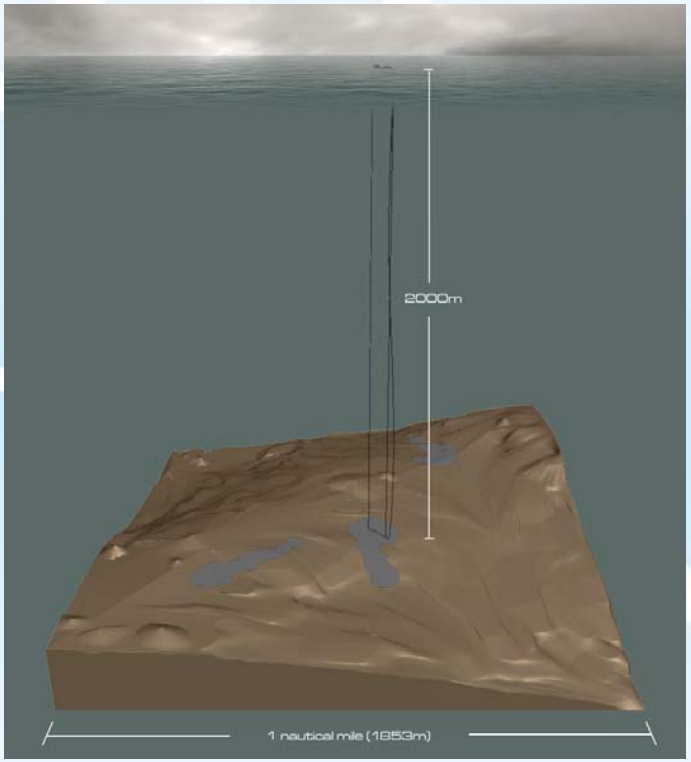
Land vs Seafloor Mine

Seafloor mine = smaller Footprint

= less waste rock, tailings, land owner/social, greenhouse gases,





Less impact than onshore mine for similar metal production

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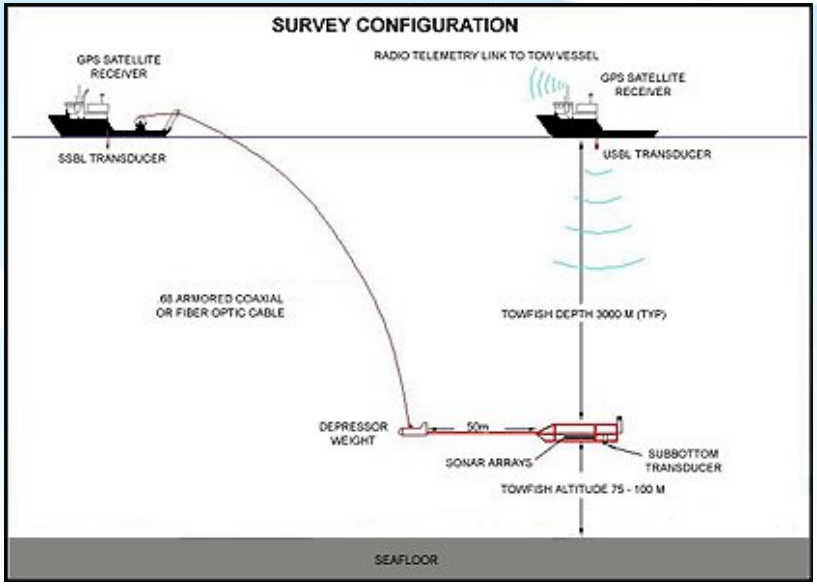
Environmental Impacts - exploration

- **GEOPHYSICS**:
- Mostly ‘non grounded’ ie no contact with seabed (like airborne survey over land)
- Passive measurement of natural features



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Envrionmental Impacts - exploration

- **SAMPLING**:
- Disturbance of a very **limited area**
- Used by MSR groups as well.
- Various techniques.

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Environmental Impacts - Exploration

- **DRILLING**:

- Ship or ROV based.
- **Limited** surface disturbance (70mm – 2” core holes), and impact.
- Sample collected at depth.

- No need for access tracks – as on land.
- Consumables these days are all biodegradable.

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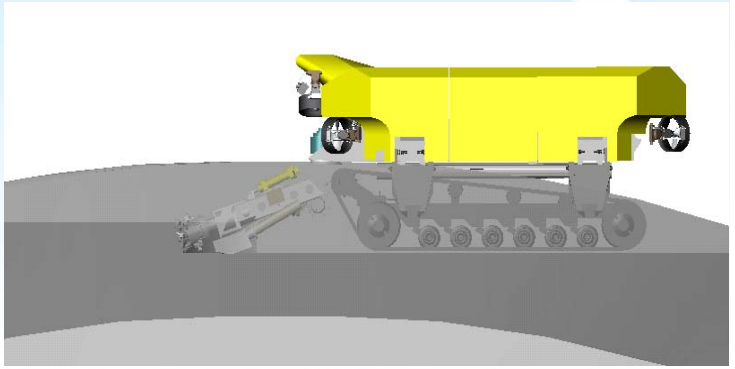
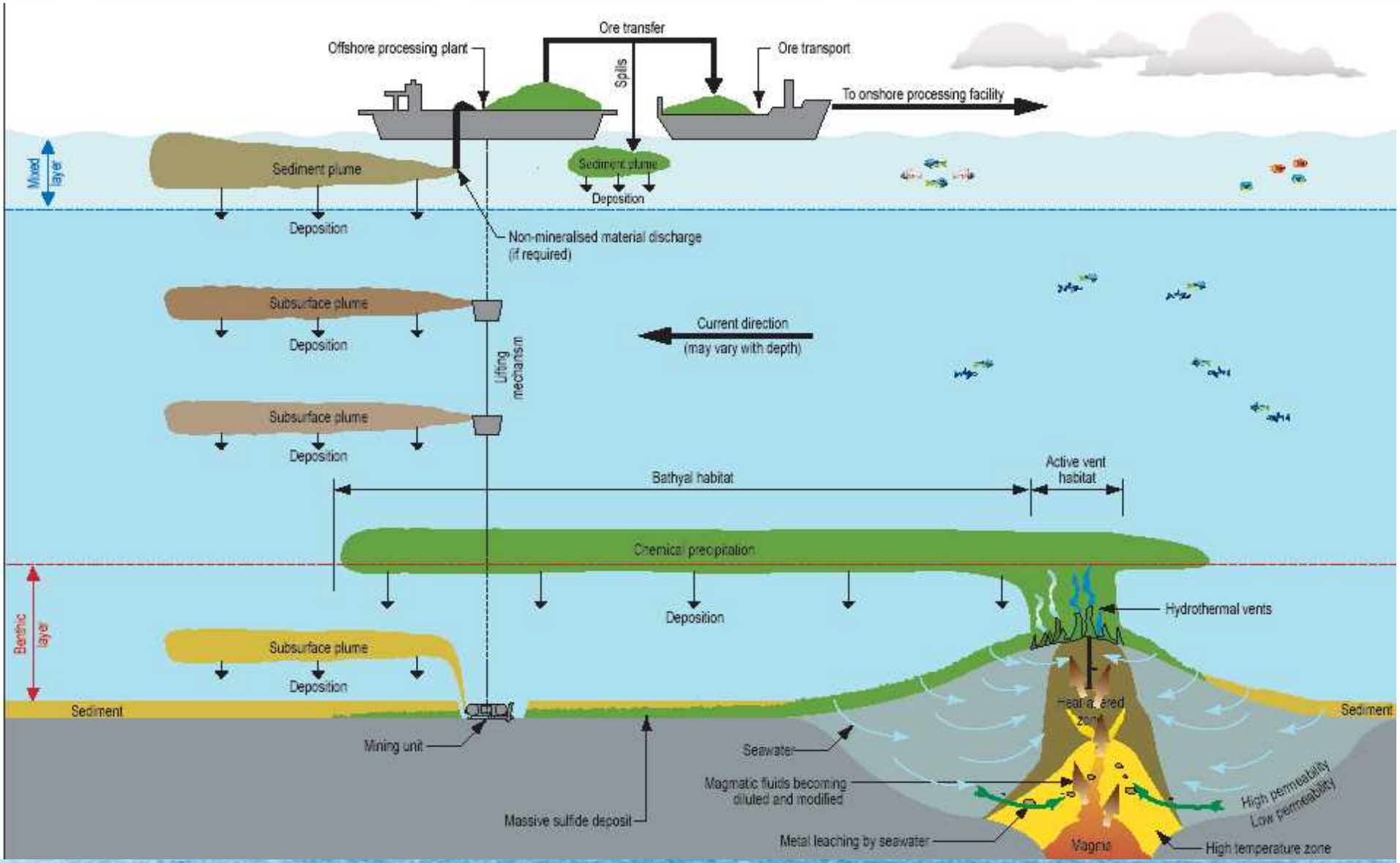
Environmental Impacts – trial mining

- **TRIAL MINING** :
- In practice would only involve disturbing a small amount of the total resource.
- Provides valuable data on project economics before any mining lease is applied for.
- Detailed monitoring of environmental impacts will greatly aid mine permitting.



Potential Environmental Stresses - during mining



Environmental compliance - costs for seafloor mine

- Location will be a significant influence on costs.
- The ability to collaborate with MSR groups has the potential to reduce costs.
- The level of impact is similar to MSR groups up to bulk sampling, or serious resource drilling.
- use what we know.

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Environmental compliance - costs on land.

- Low impact work – minimal added cost ($5 to 20K per program).
- EIS – costs vary widely depending on country and setting. Costs increase as project advances. (common ranges $3 to 10+ million).
- Land use conflict studies – another cost for land based operations. Can have a “human impact”. Cost can be significant.
- Other competing issues can be significant (water quality/use, ARD, dust, etc).
- Closure costs – can be significant for large surface mines (>$US20 mill).

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Conclusions – seafloor exploration.

- Mobilisation is a major cost for any program studying seafloor polymetallic sulphides.
- $US2 to 5 million+ per cruise is common. 3 to 4 cruises would be needed to complete a 12 month EIS (so likely cost range $US8 to 20 million!).
- Specialist equipment can be expensive
- Land based exploration programs have their environmental impact “graded”, and accepted before work starts, and allow for “progressive rehabilitation”.
- Programs in the AREA should follow a similar pattern so money and resources are not wasted.
- Collaboration is vital (MSR’s and miners).
- Cost of compliance is significantly reduced once the project is in production.

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Conclusions

- ISA has a vital job
  - will need to manage all data, tenements, etc, make all this information available to workers in the AREA so we can improve our environmental compliance and monitoring.
- Classify “expected impacts” as on land, to aid permitting and compliance.
- The first mines, like exploration, are likely to be within Territorial Waters and/or EEZ’s.
- These use modified existing “land based” legislation (eg PNG), and work well.
- Why not learn from these!

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