

**Conférence Arts & Métiers**

***"De l'Offshore pétrolier aux minerais sous-marins"***

**Par Julien DENEGRÉ, Sales Manager**

**26 novembre 2007**

**Avec mes remerciements à Ms. Steve ROGERS et Simon  
Mc DONALD, resp. Chief Development Officer et CEO de  
Nautilus Minerals et Neptune Minerals**

***Technip***

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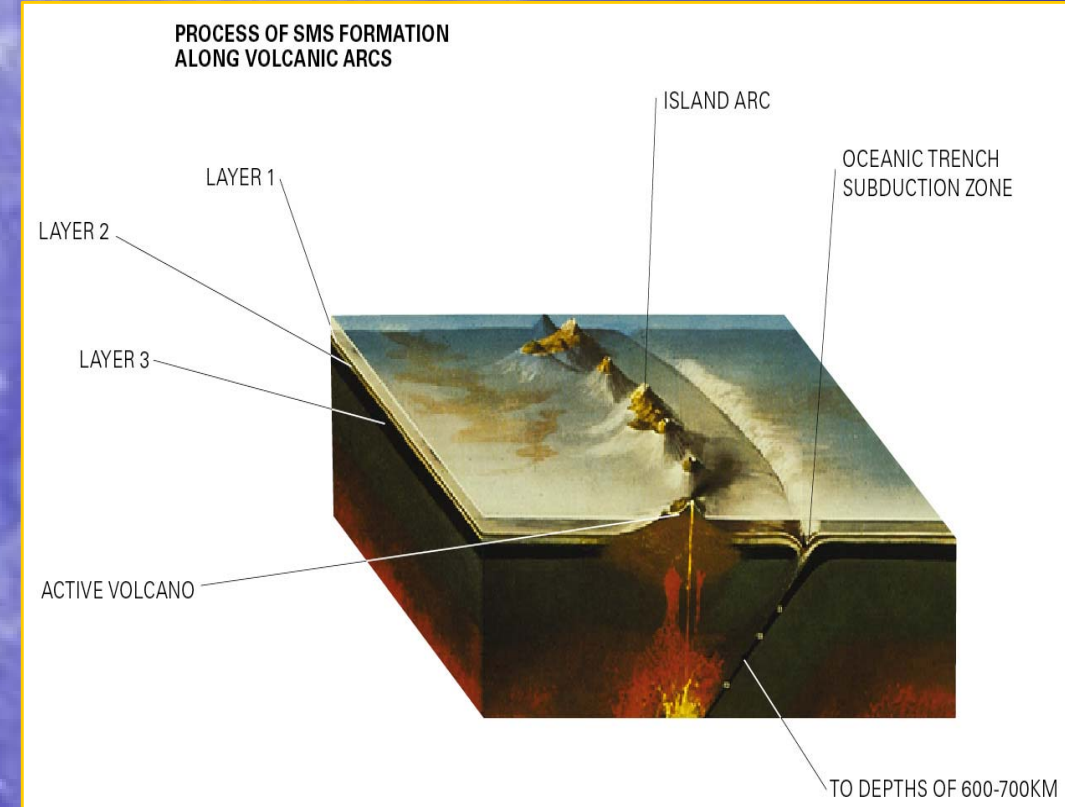
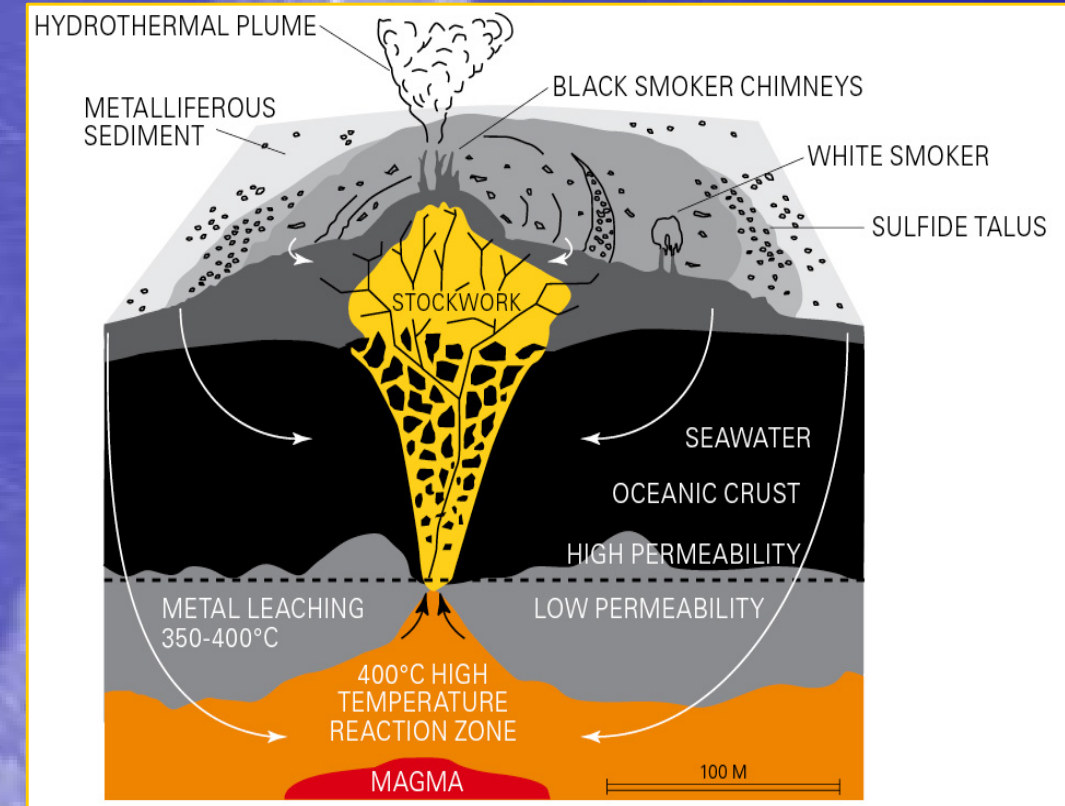
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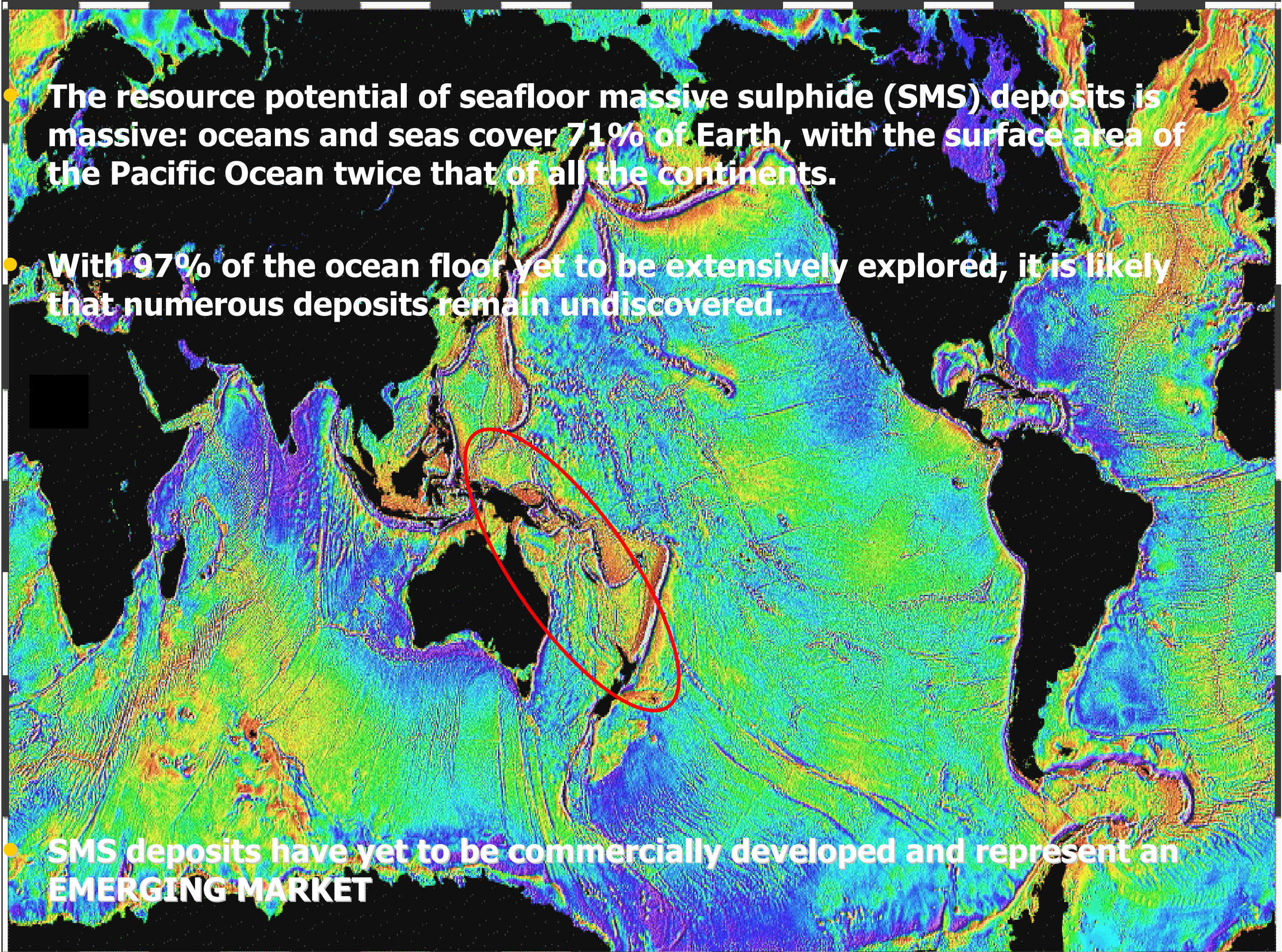
# What are SMS deposits?

- **SMS = Seafloor Massive Sulphides**
- **Present day mineral accumulations**
- **High Grade base & precious metals**
  - Au 2-20 g/t
  - Ag 20-1200 g/t
  - Cu 5-15%
  - Zn 5-50%
  - Pb 3-23%
- **UCS 18MPa average; density 3,3t/m<sup>3</sup>**
- **Low Tonnage**
  - 0.25 to 10Mt per mound (up to 18Mt)
- **Existing onshore analogues are world class mineral deposits**
- **Metal Value USD\$500-1200/tonne**

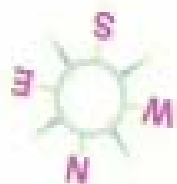
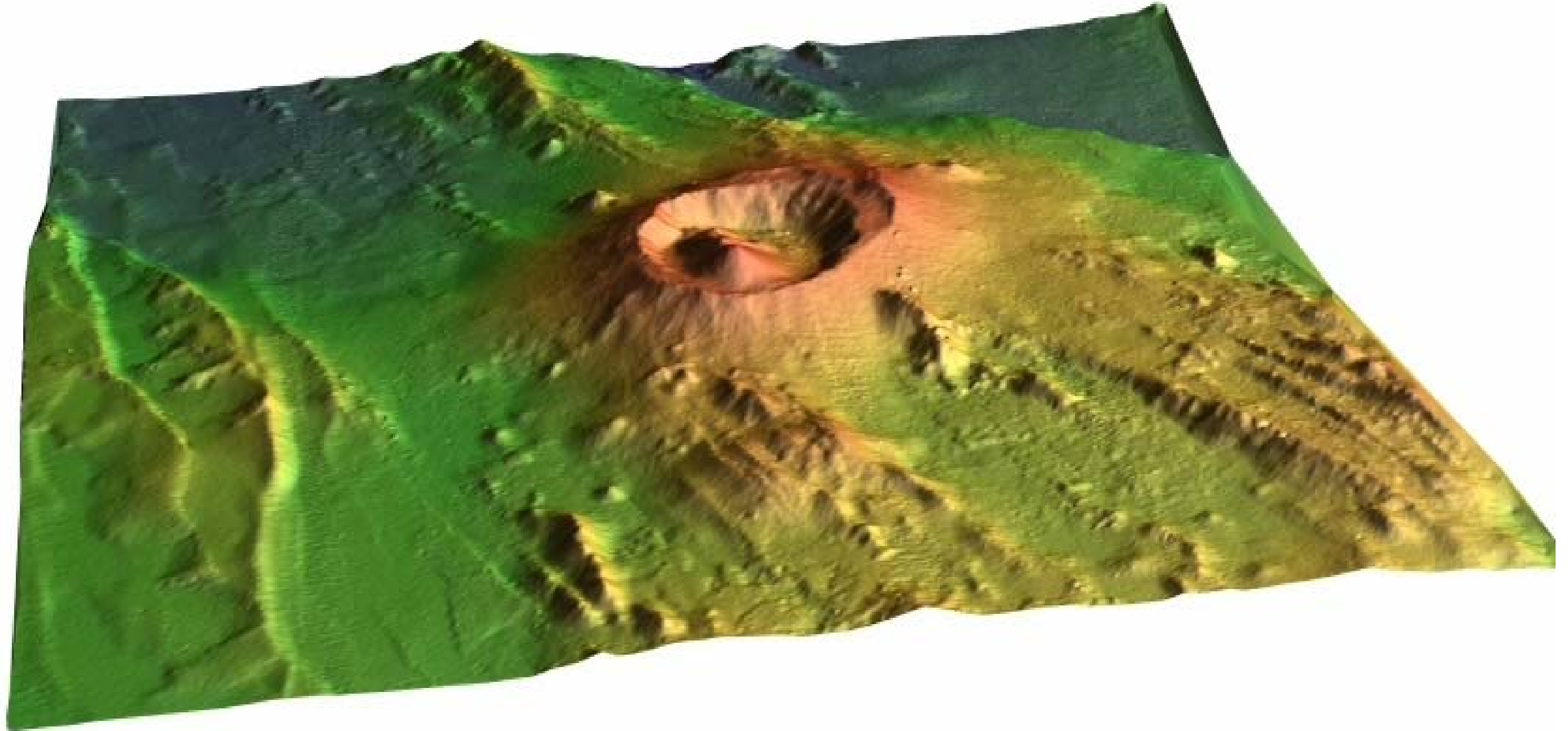


- **The resource potential of seafloor massive sulphide (SMS) deposits is massive: oceans and seas cover 71% of Earth, with the surface area of the Pacific Ocean twice that of all the continents.**
- **With 97% of the ocean floor yet to be extensively explored, it is likely that numerous deposits remain undiscovered.**

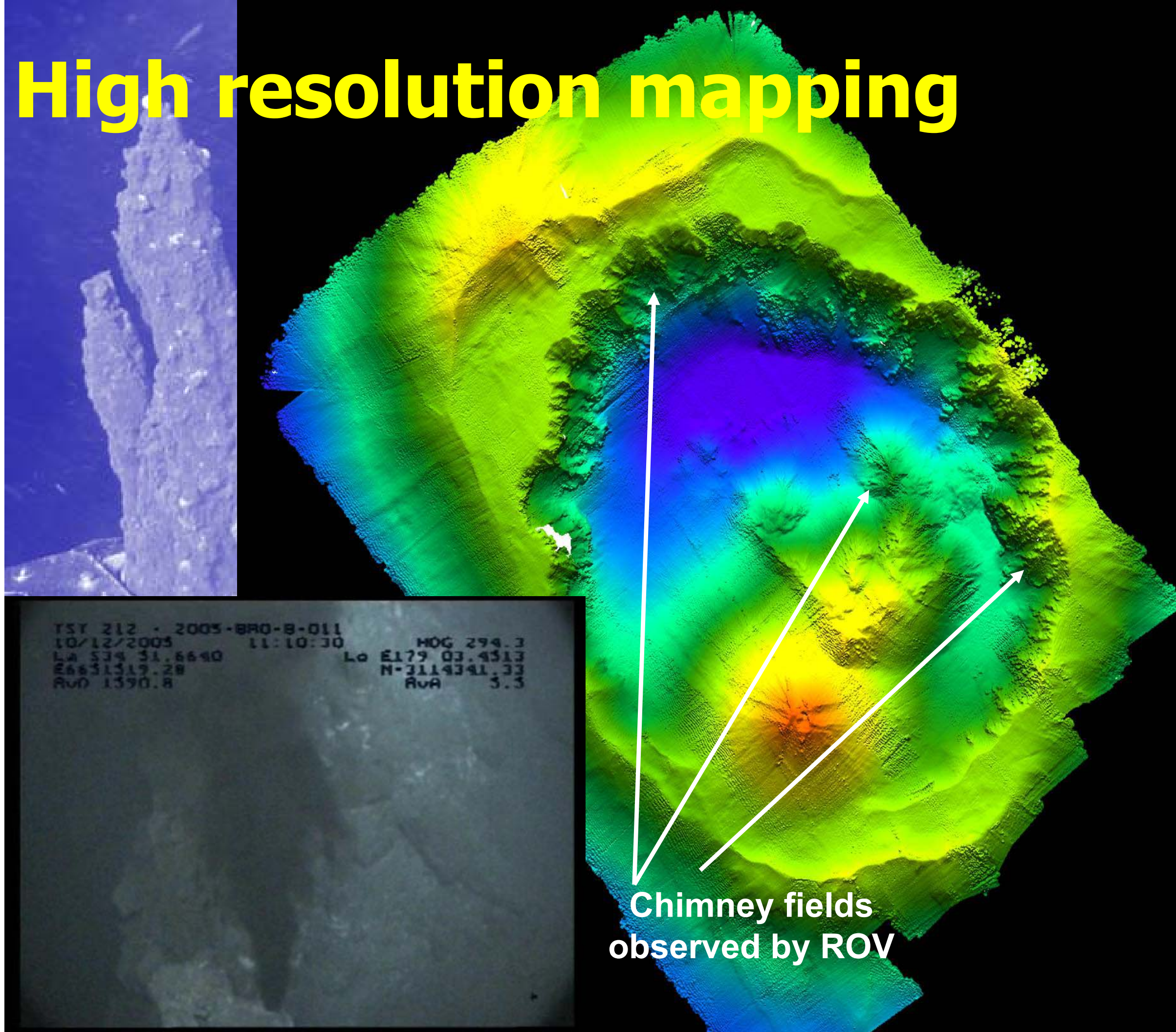
- **SMS deposits have yet to be commercially developed and represent an EMERGING MARKET**



# Swath image of target zone



# High resolution mapping



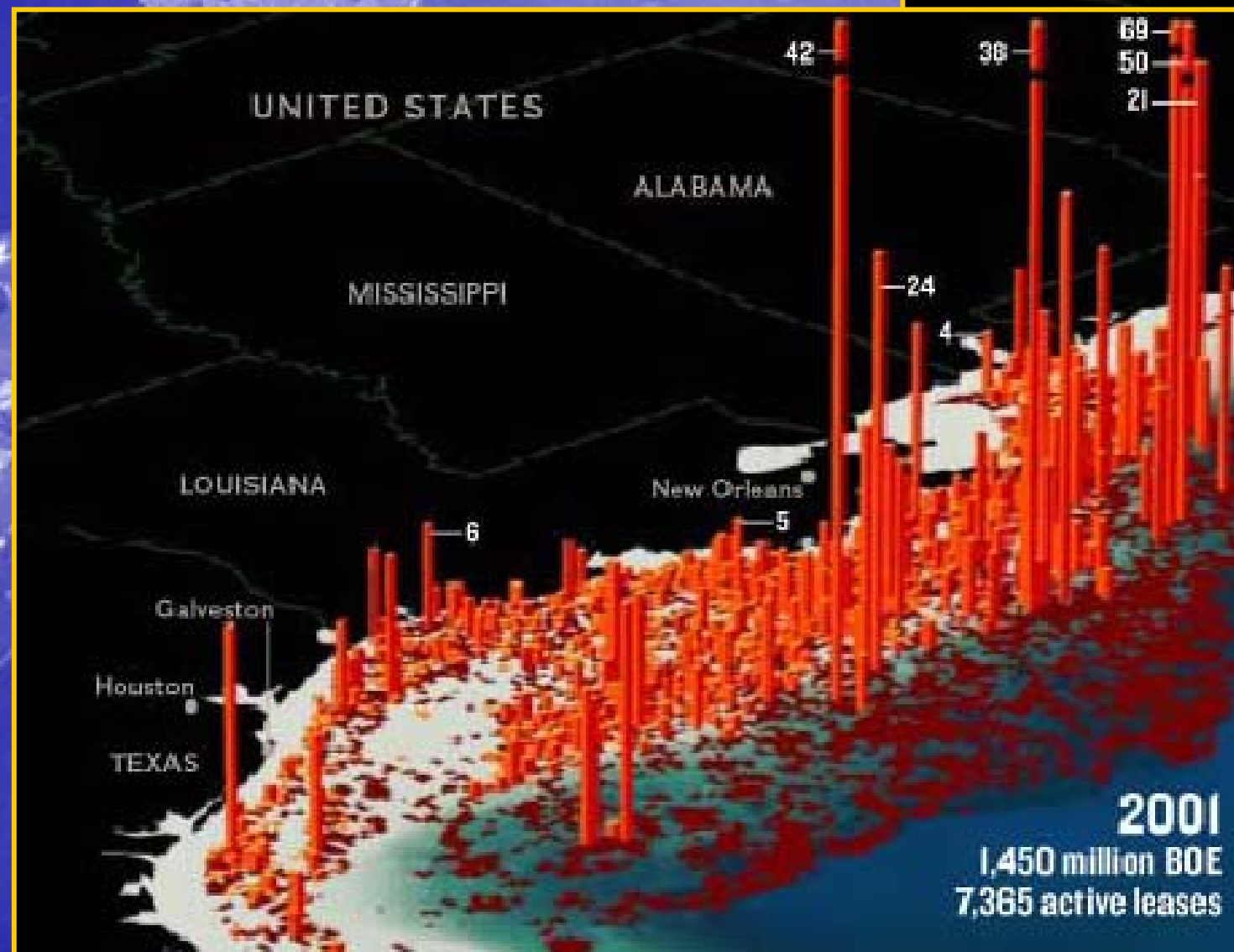
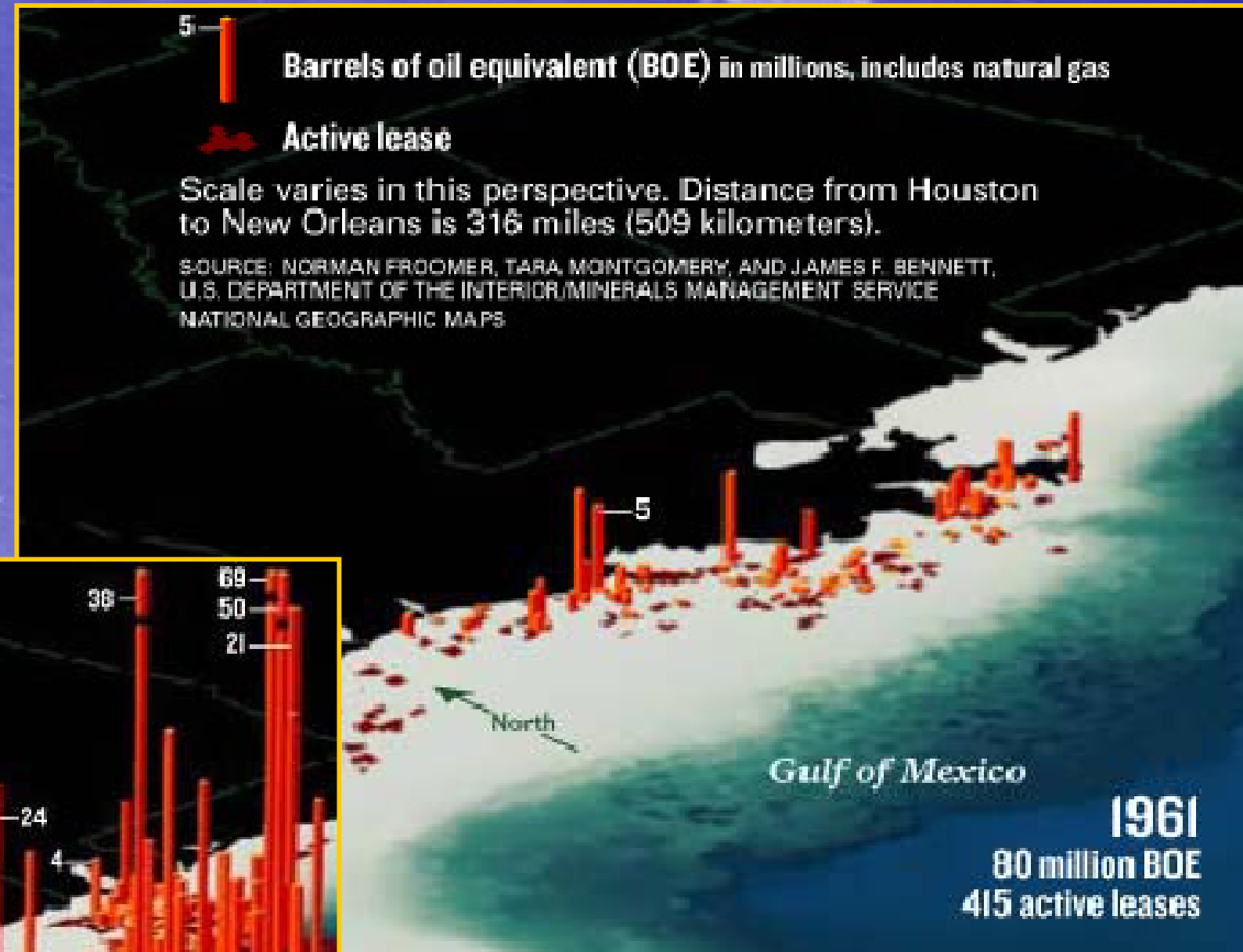
Chimney fields  
observed by ROV

# Why now? Driven criteria

- 1. Well recognized offshore oil and gas marine industry: seamount sites at depths of 120 metres to 1,800 metres under water at well within the operating range for existing technologies**
- 2. SMS deposits now provide a compelling opportunity against the backdrop of robust commodity pricing and depletion of resources from traditional sources**
- 3. Subsea mining disturbs the environment less when compared to a land-based mine**
- 4. Pacific region is stable political environment: Government legislations support offshore mineral exploration in hydrothermal inactive SMS zones over which companies plans to lodge mining license applications.**



# Offshore oil & gas industry development from 1961 to date

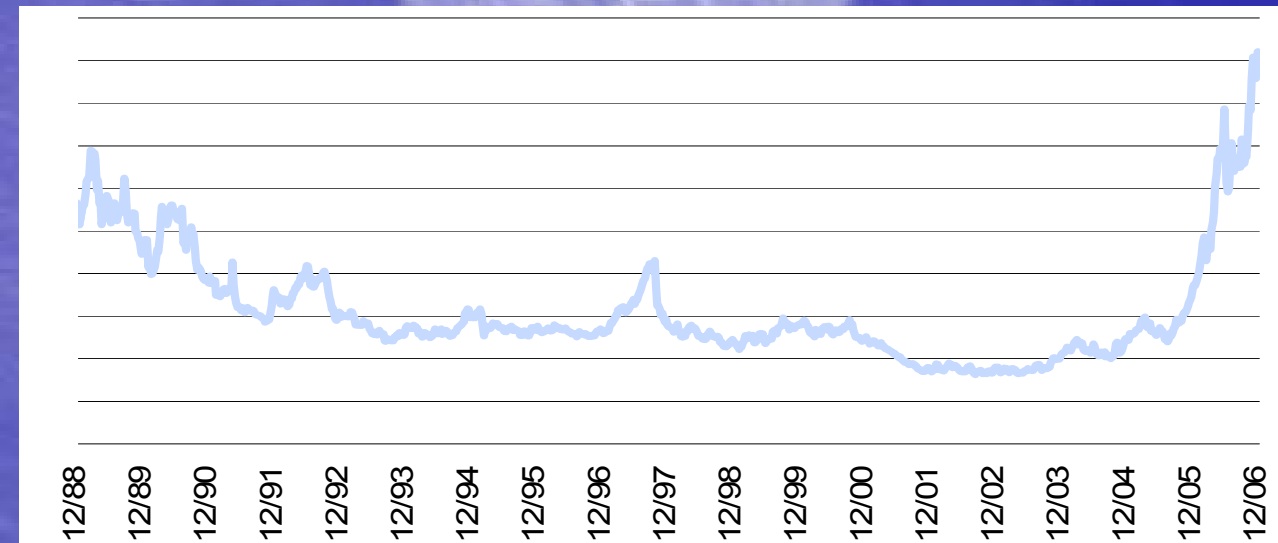


# Economical background

Copper price (LME, deflated by US CPI)

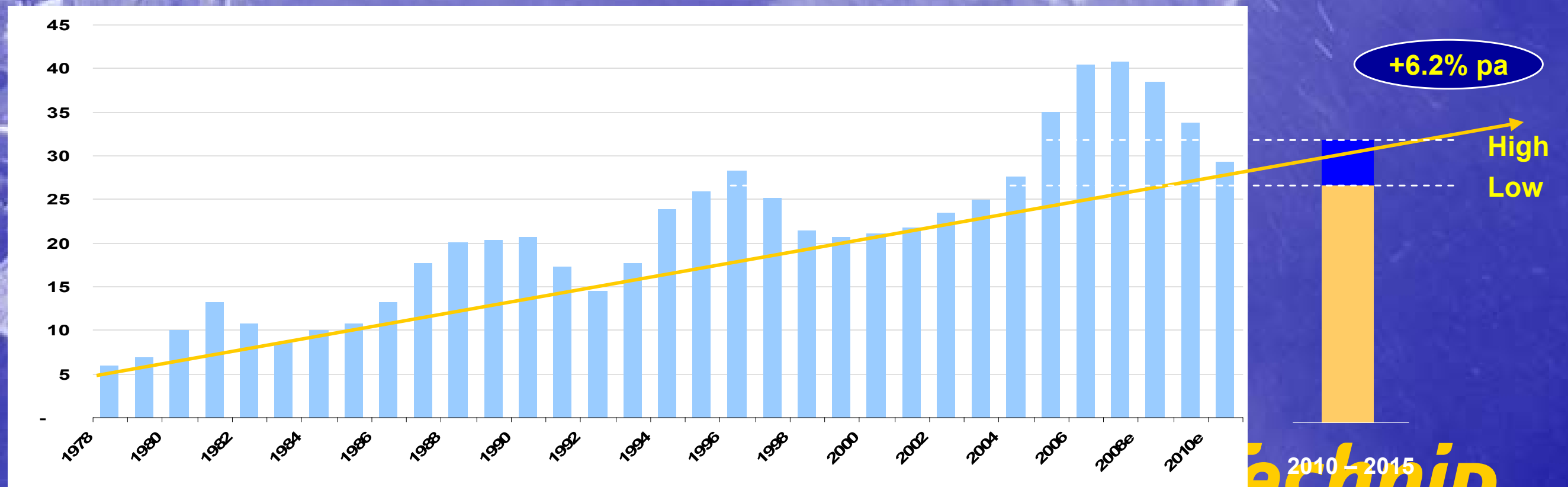


Zinc price (LME, deflated by US CPI)



## Mining and Metals CAPEX

In \$ bn



Source: CRU

# Environmental sustainability

- Onshore porphyry copper mining means:
  - Millions of tons of waste rock to move,
  - Lower grades (average 0,8% Cu on land),
- eg 200,000tpa Copper production

	Seafloor	Land o'cut
<b>Copper Grade</b>	<b>10%</b>	<b>1%</b>
<b>Ore per annum</b>	<b>2 mt</b>	<b>20 mt</b>
<b>Overburden per annum</b>	<b>0</b>	<b>60 mt (3:1 waste:ore)</b>
<b>Total tonnes per annum</b>	<b>2mtpa</b>	<b>80mtpa</b>

- Mining on the seabed has not commenced but Customers and their exploration partners are paying particular attention to the environmental aspects of their search.

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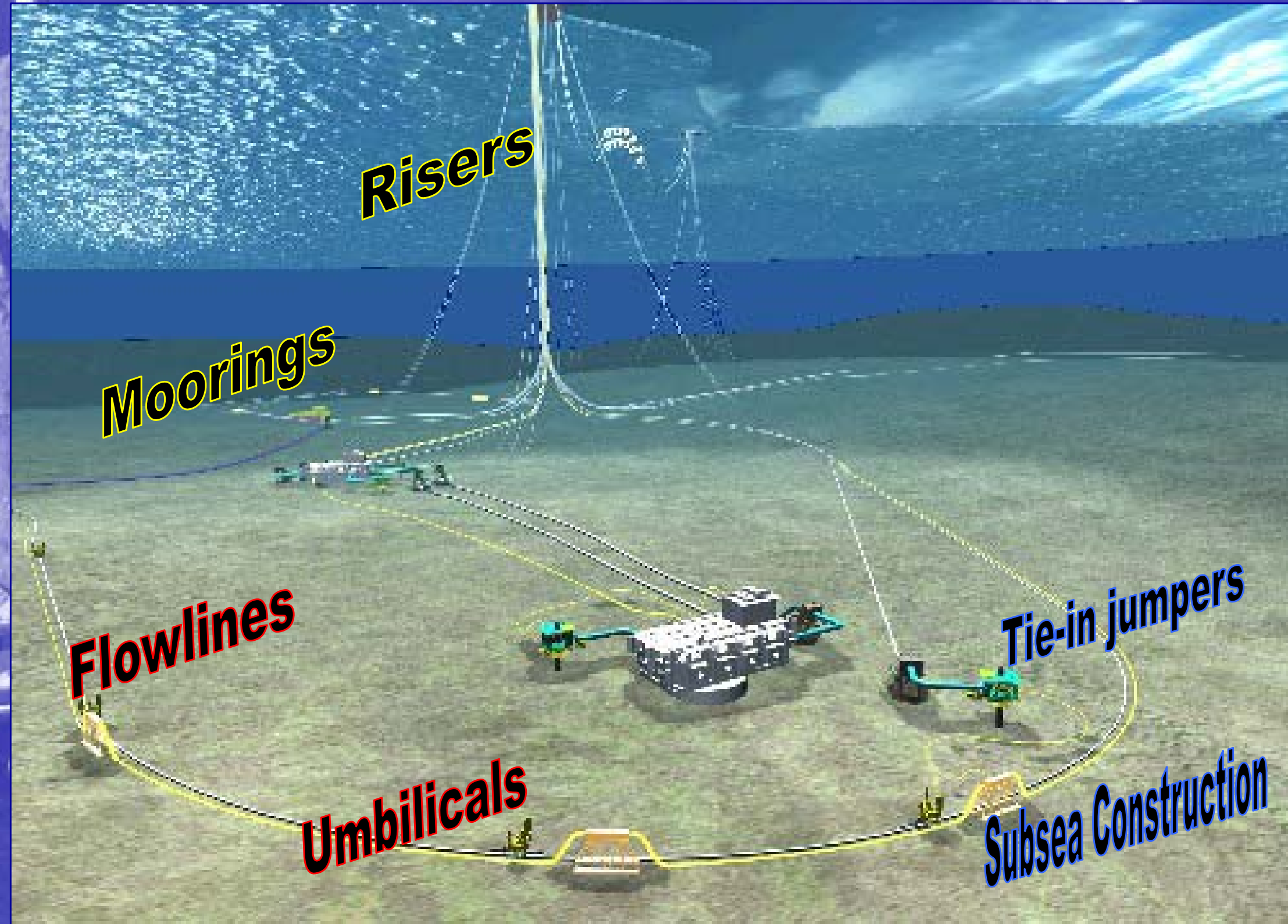
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# Typical oil & gas subsea field layout



For more details, please refer to presentation made by Georges MICHEL dated Feb 27, 2006

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# Typical oil & gas surface field layout



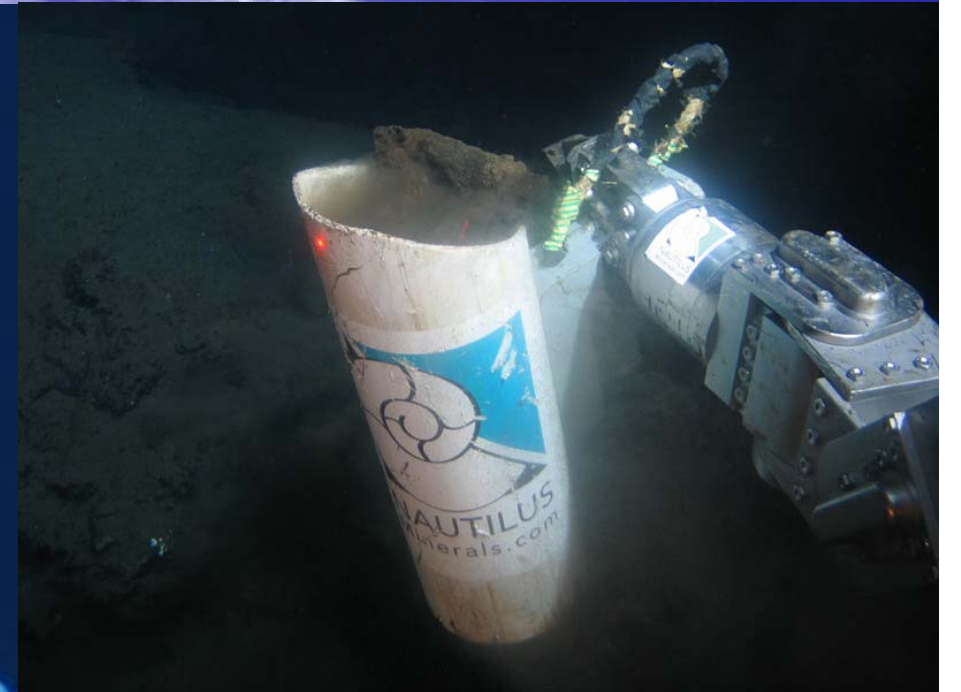
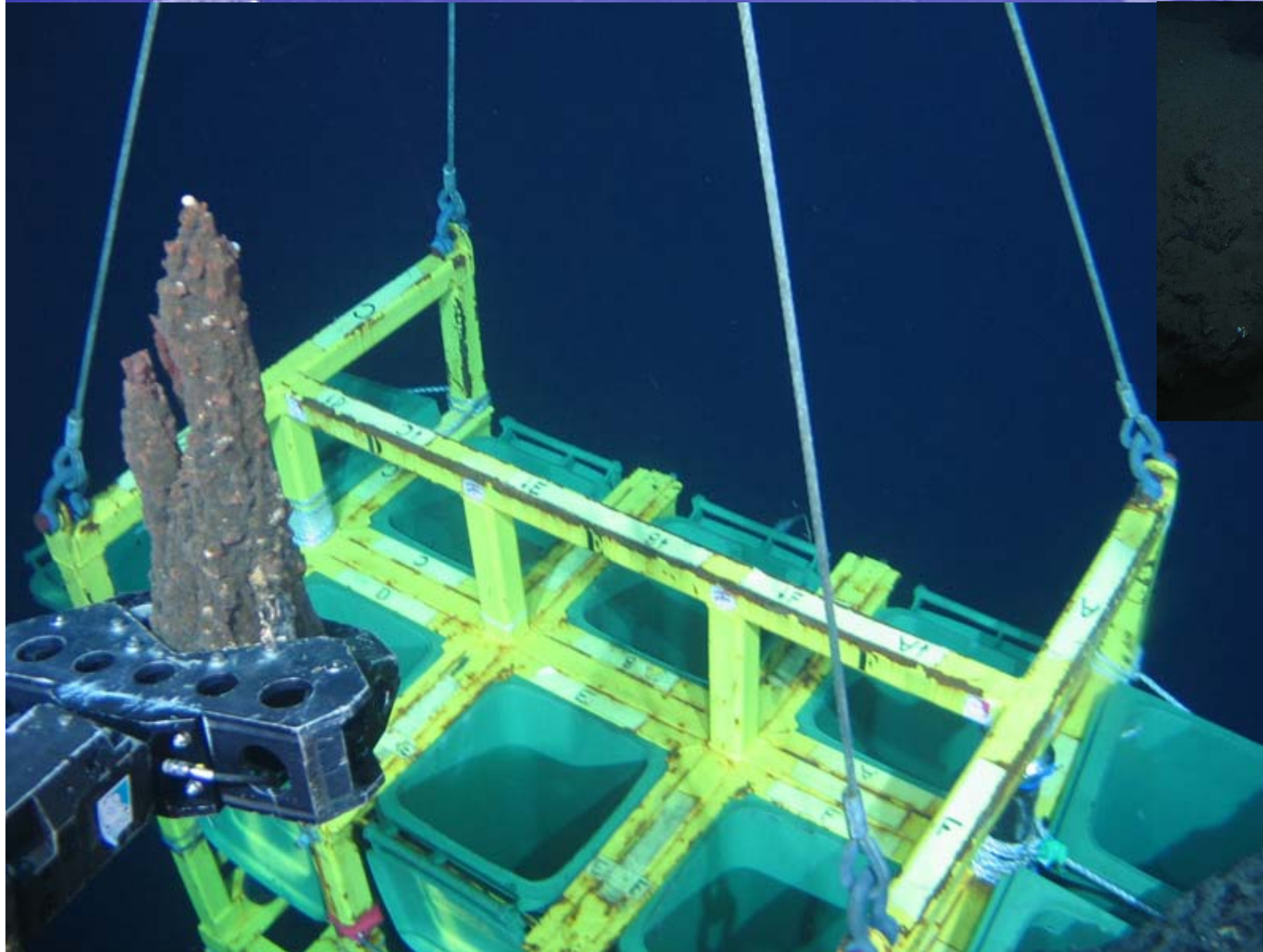
For more details, please refer to presentation made by Pierre-Armand THOMAS dated May 21, 2007

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# Subsea mining chain values

- **Exploration and SMS reserves identification**
  - By Remote operated sampling and/or
  - By Remote operated drilling and/or
  - By Remote operated bathymetry
- **SMS mining**
  - By pumping and/or
  - By grabbing and/or
  - By dredging and/or
  - By crawling
- **SMS lifting to the surface**
  - Through a flexible or rigid riser
  - By water lift and/or air lift
- **Ore separation and concentration**
  - With traditional mineral processing equipment
  - Onshore and/or offshore?

# Exploration – By sampling

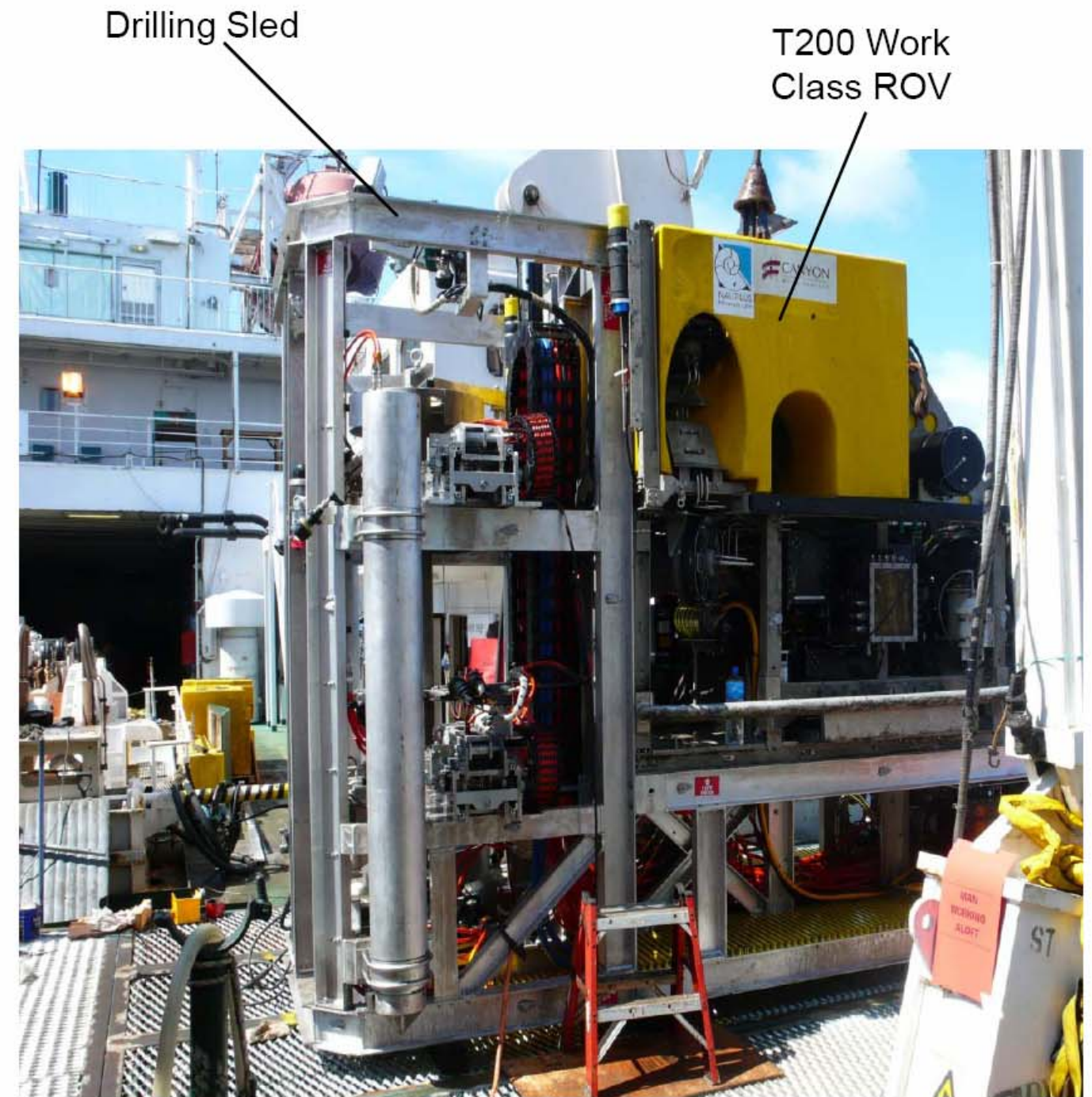
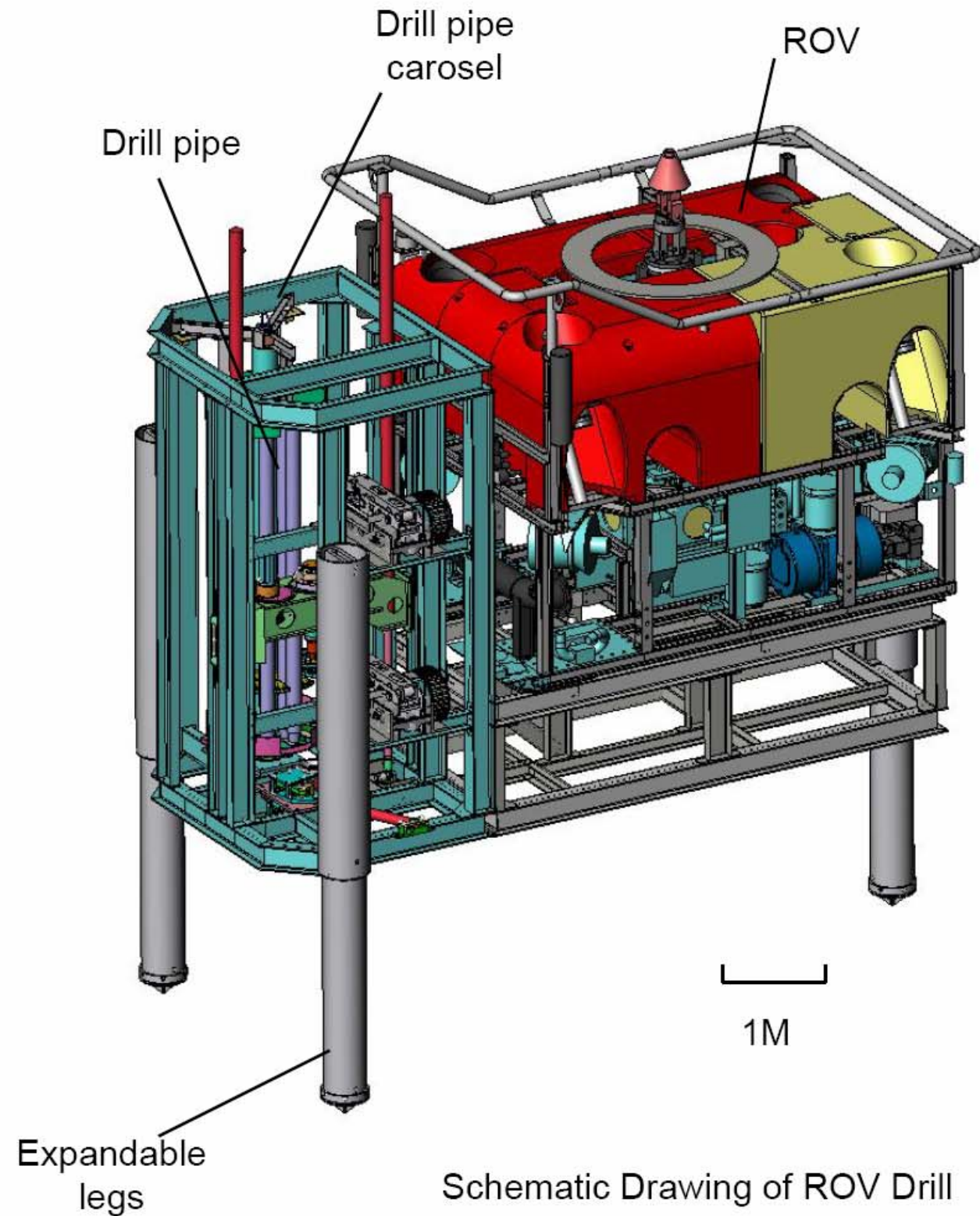


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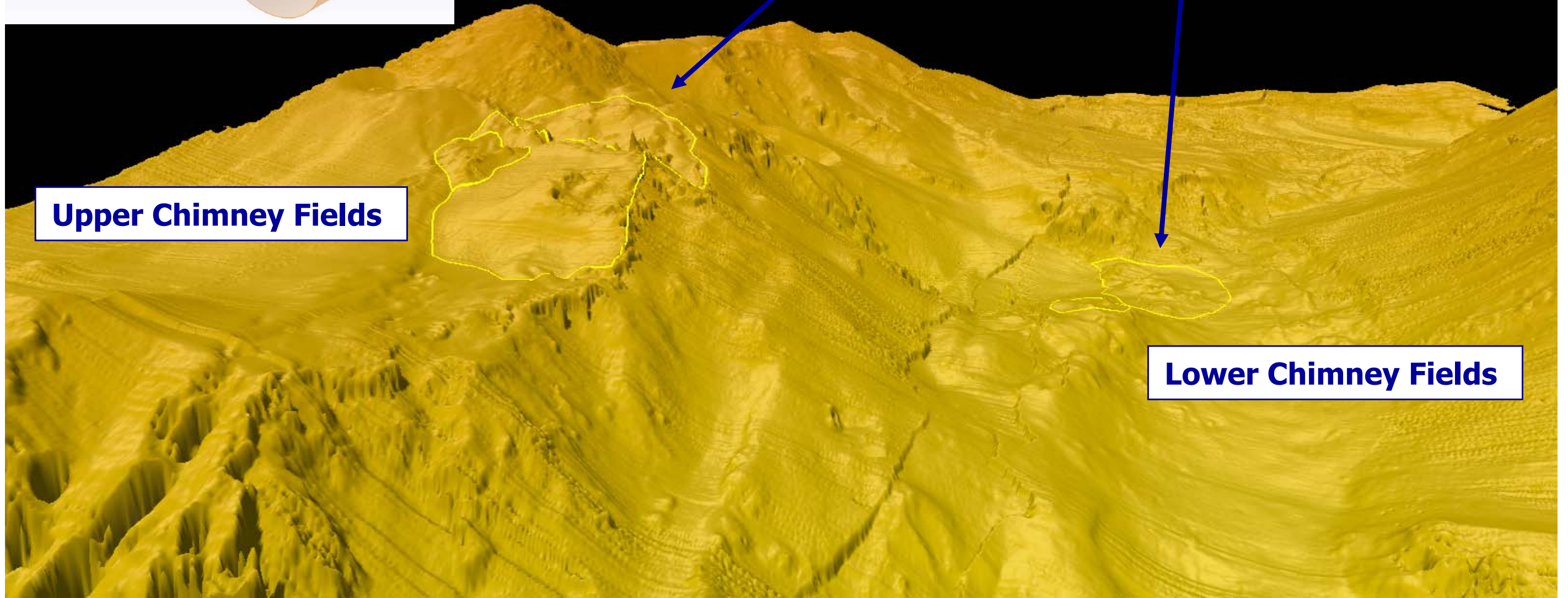
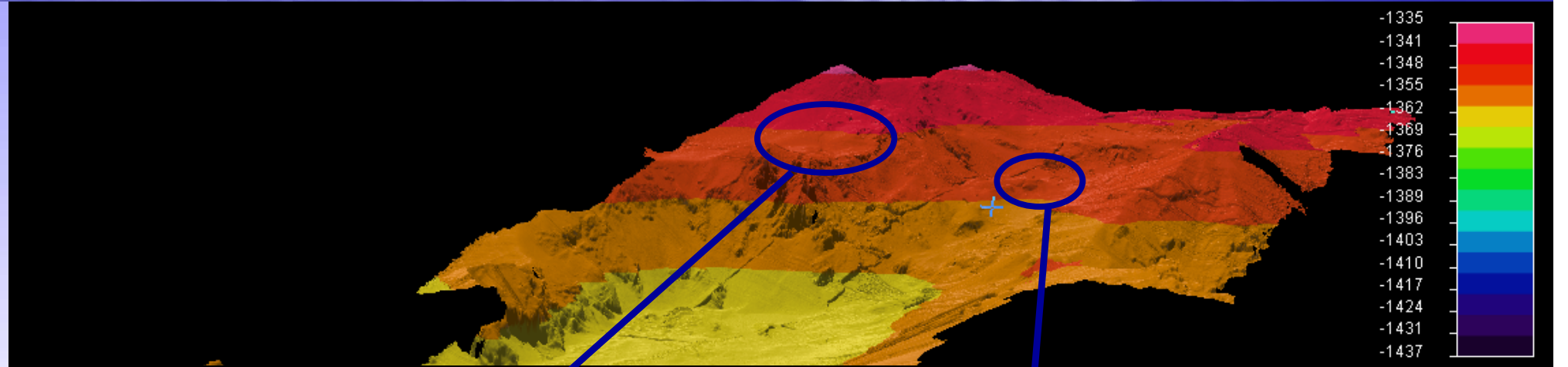
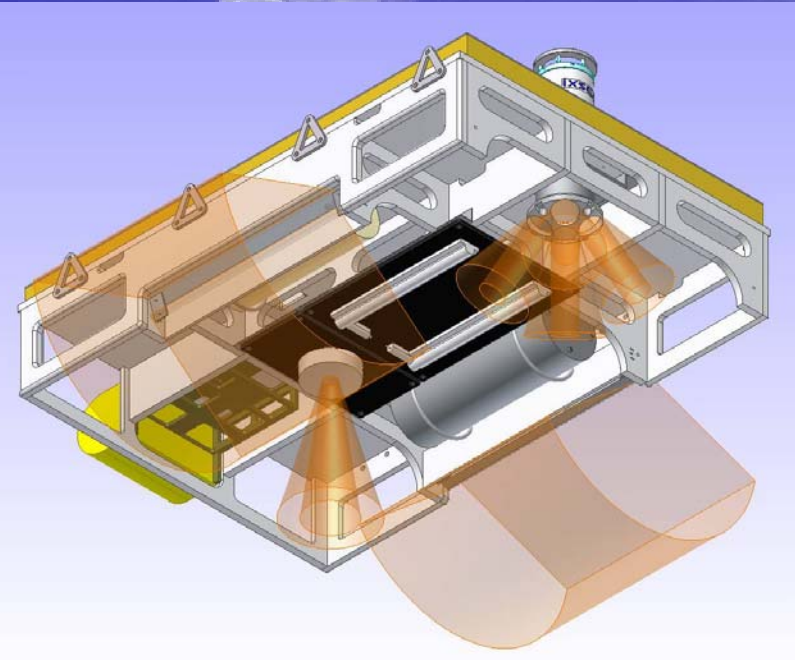


# Exploration – By drilling

Perry Slingsby "ROV Drill" – PNG 2007



# Exploration – ROV Bathymetry



**Upper Chimney Fields**

**Lower Chimney Fields**

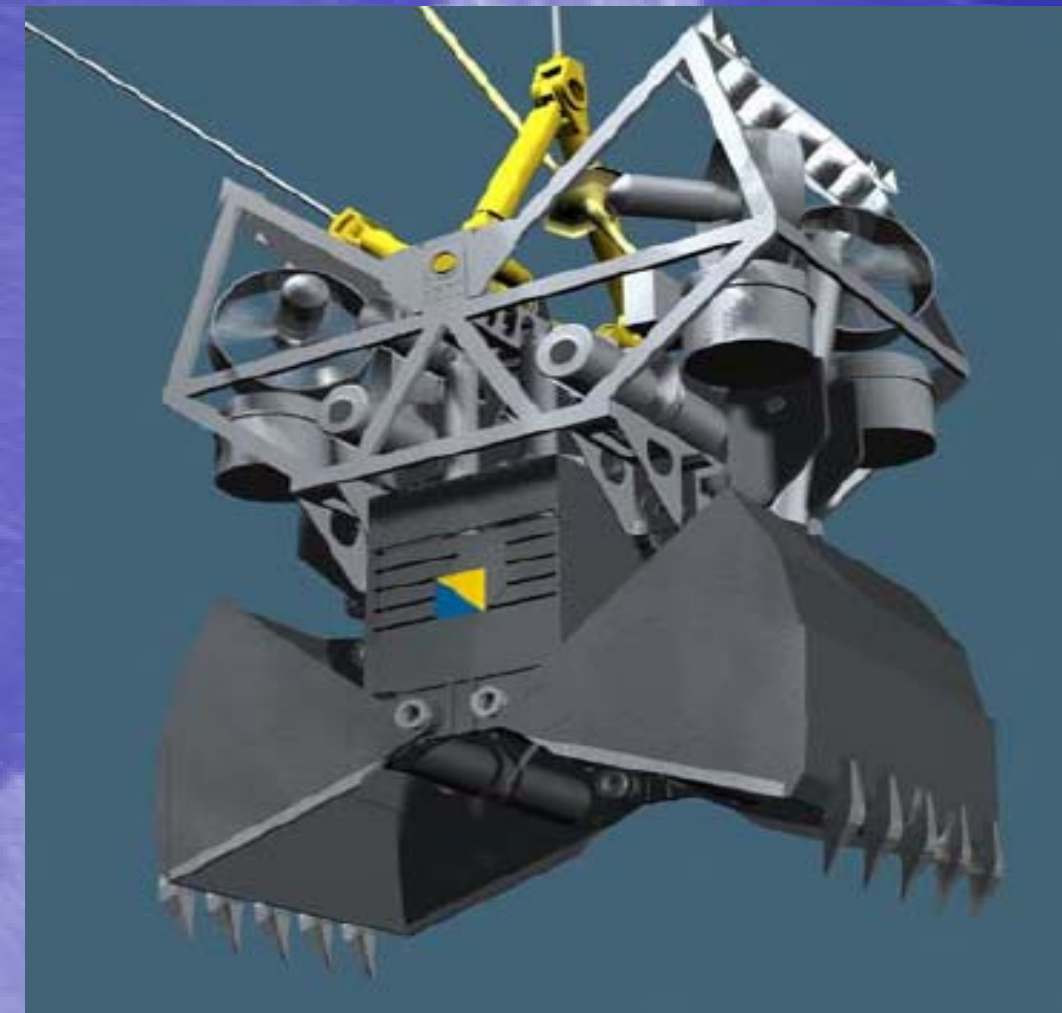
# SMS Mining – By pumping



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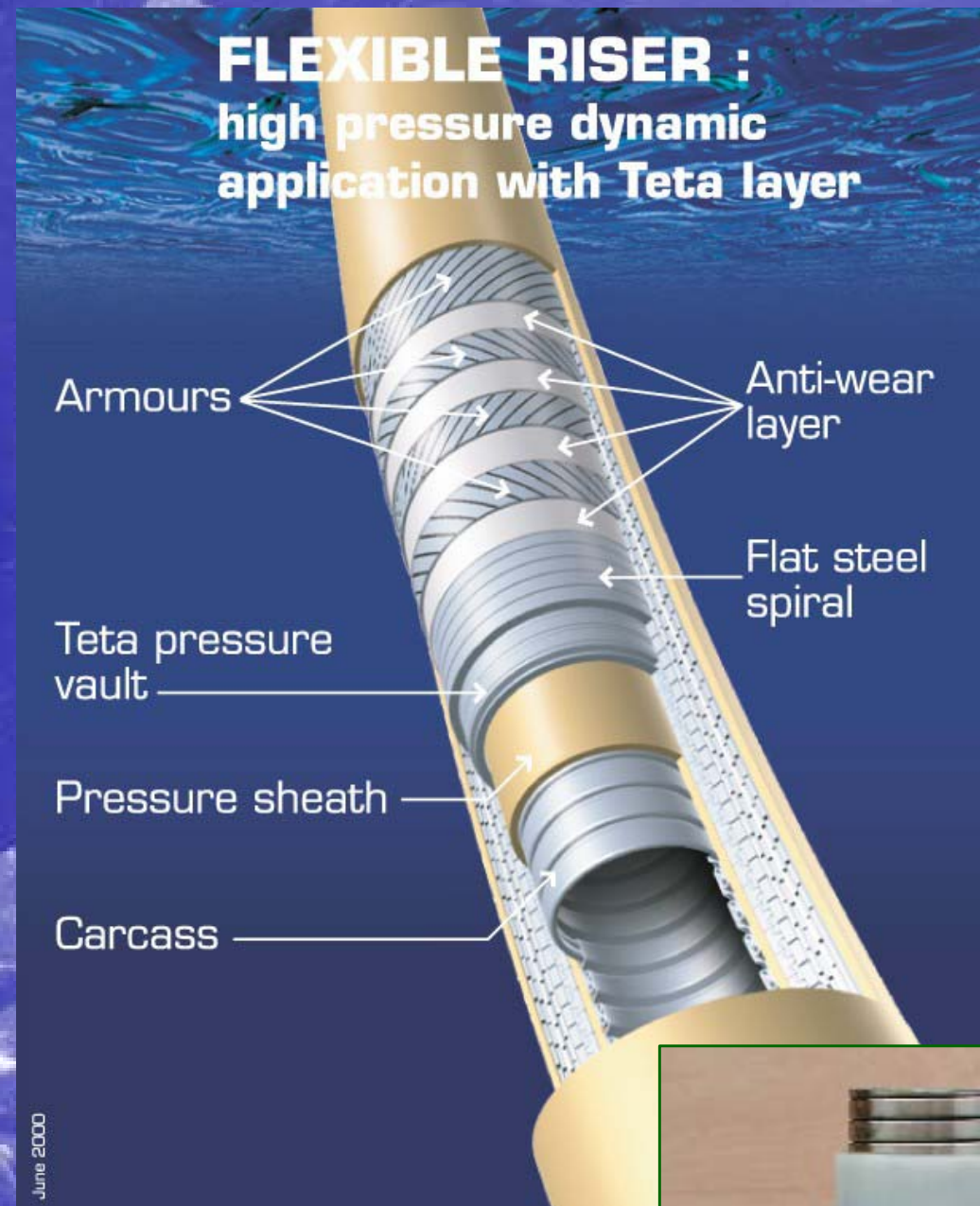


# SMS Mining – By dredging or grabbing



Scanmaskin - subsea excavator

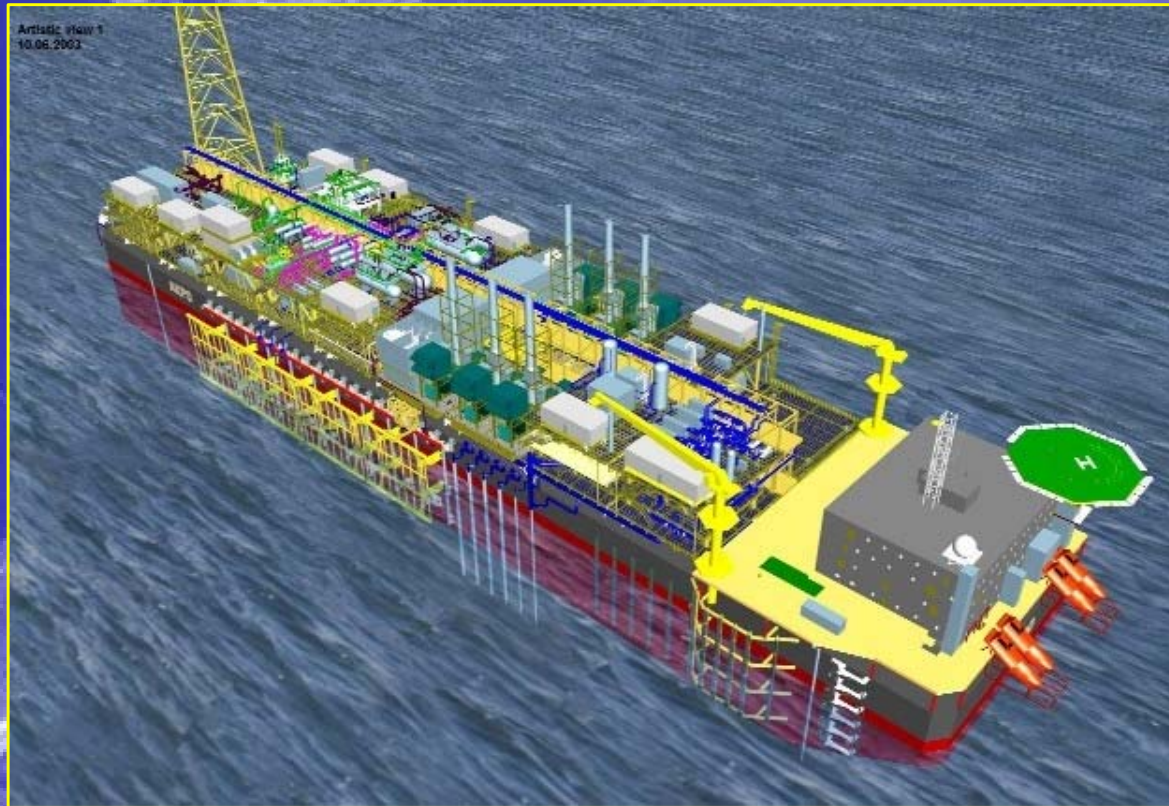
# SMS lifting – With flexible pipe technology



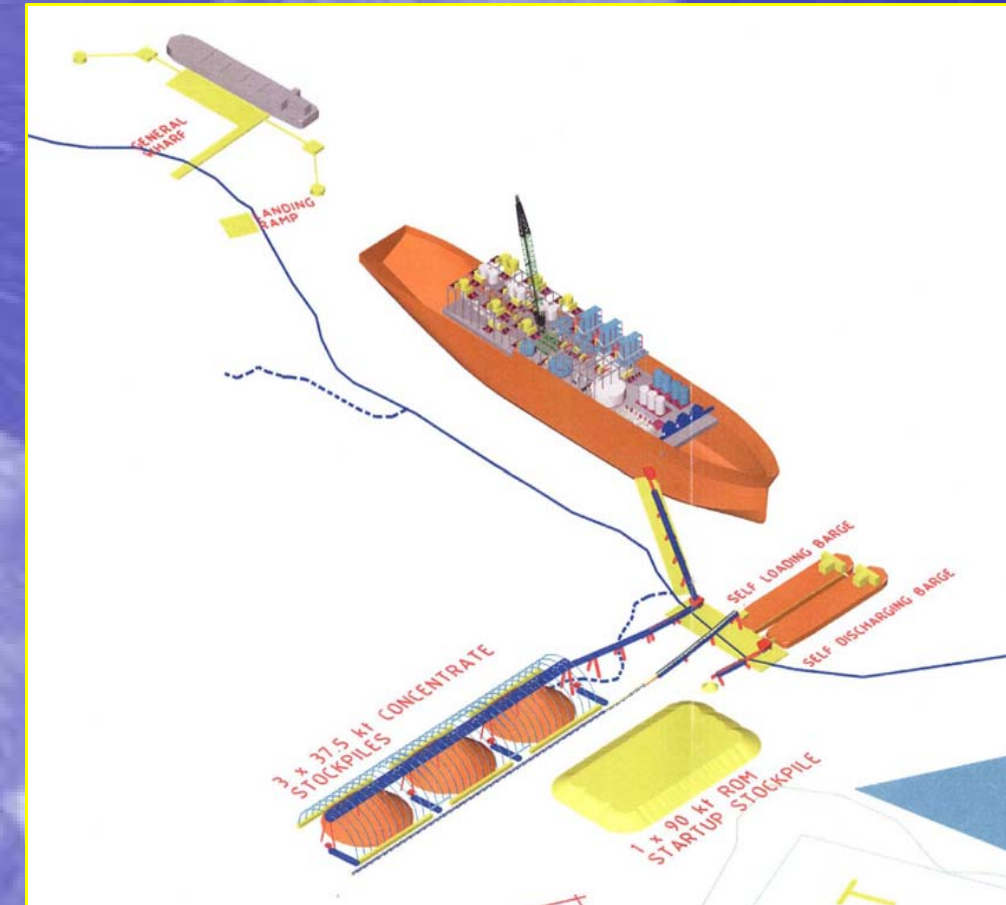
- Major R&D program launched to meet primarily Oil & Gas market requirements
- Good alignment between market need and product qualified
- Current proven utilization
  - Deepest installed flowline: 1,900 m
  - Deepest tested line: 9" in 2,100 m
- Maximum water depth capability conservatively estimated to be:
  - ID ≤ 8"            ≥ 2,500 m
  - ID ~ 10"            ~ 2,200 m
  - ID ~ 12"            ~ 1,800 m
  - ID ~ 14"            ~ 1,600 m
- Flexible pipe offers the following advantages:
  - No vortex induced vibrations
  - Quick connect - disconnect
  - Excellent fatigue life
  - Re-usability



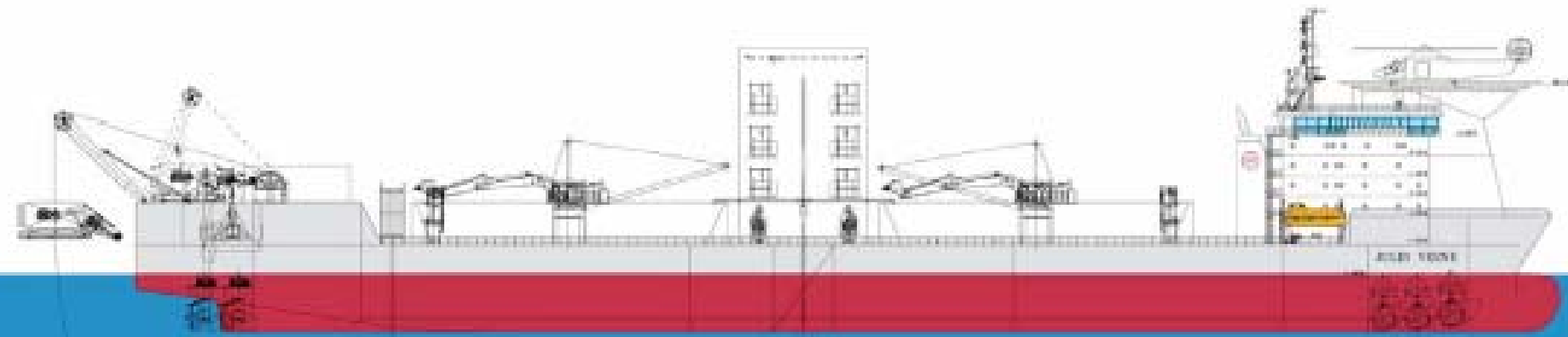
# Ore concentrator – Floating unit



?



# Possible deepwater mining vessel using existing technologies



Power cable

Riser

ROV

Crawler / Excavator / Cutter

**Placer Dome  
Deepwater Mining  
Project**

**Technip**



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# Presentation of Nautilus Minerals



- **Listed - TSX-V (Symbol NUS in May, 06), AIM (December, 06)**
- **US\$290 million in cash**
- **Industry Shareholders: 141 million shares**
  - **Epion Holdings (Mr. Alisher Usmanov, \$5.5 b annual revenue)...23,2.8%**
  - **Anglo American (\$24 b market cap, Canada)...5.9%**
  - **Teck Cominco (\$16.7 b, Canada)...5.4%**
  - **Barrick Gold (\$25.6 b, Canada)...3.6%**
- **Total of 360,000km<sup>2</sup> of tenements offshore, mainly in Papua New Guinea**
- **Other tenement holdings in Tonga, Fiji, New Caledonia**

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# Nautilus Minerals prospects in PNG

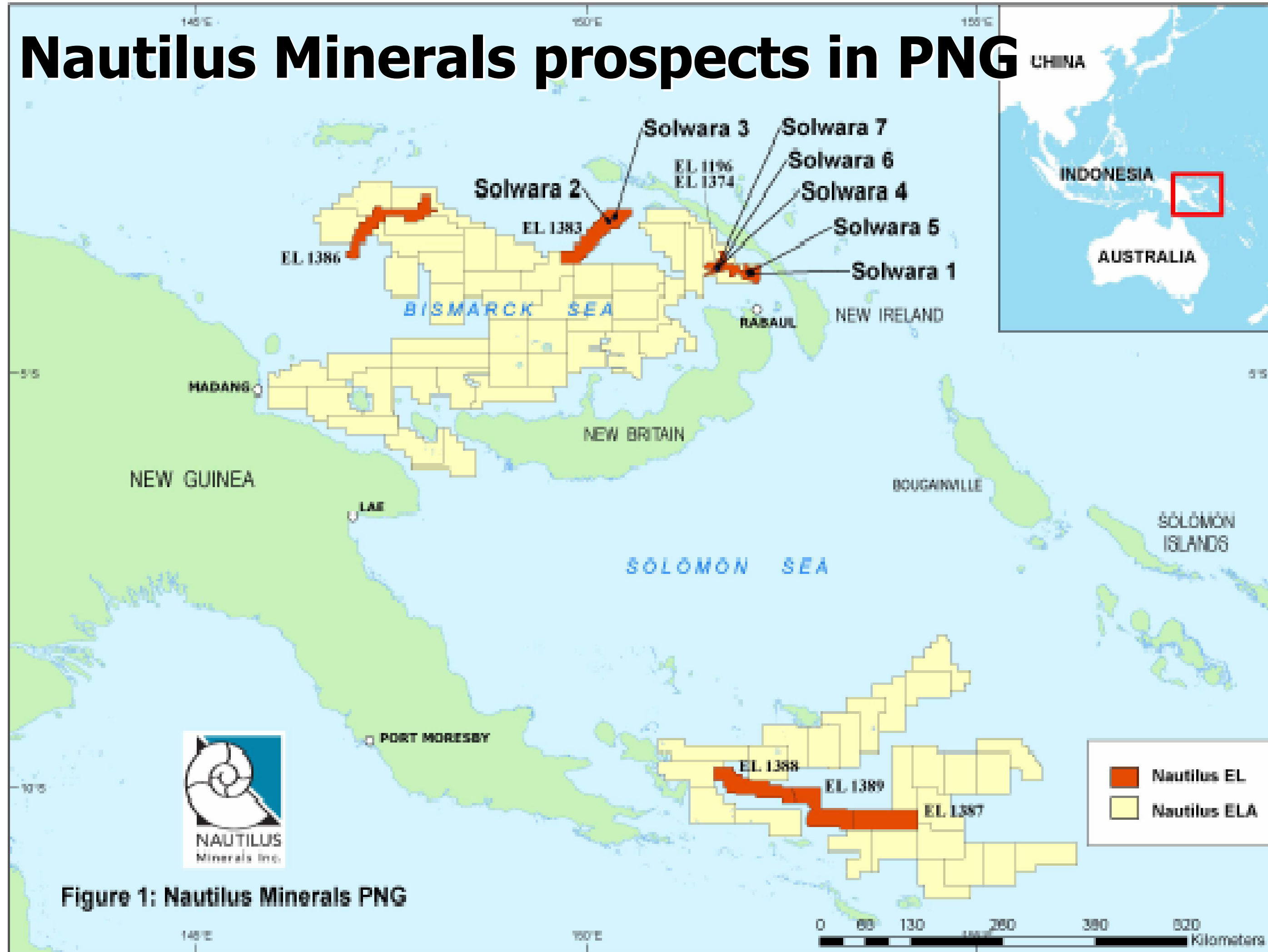


Figure 1: Nautilus Minerals PNG

# Presentation of Neptune Minerals



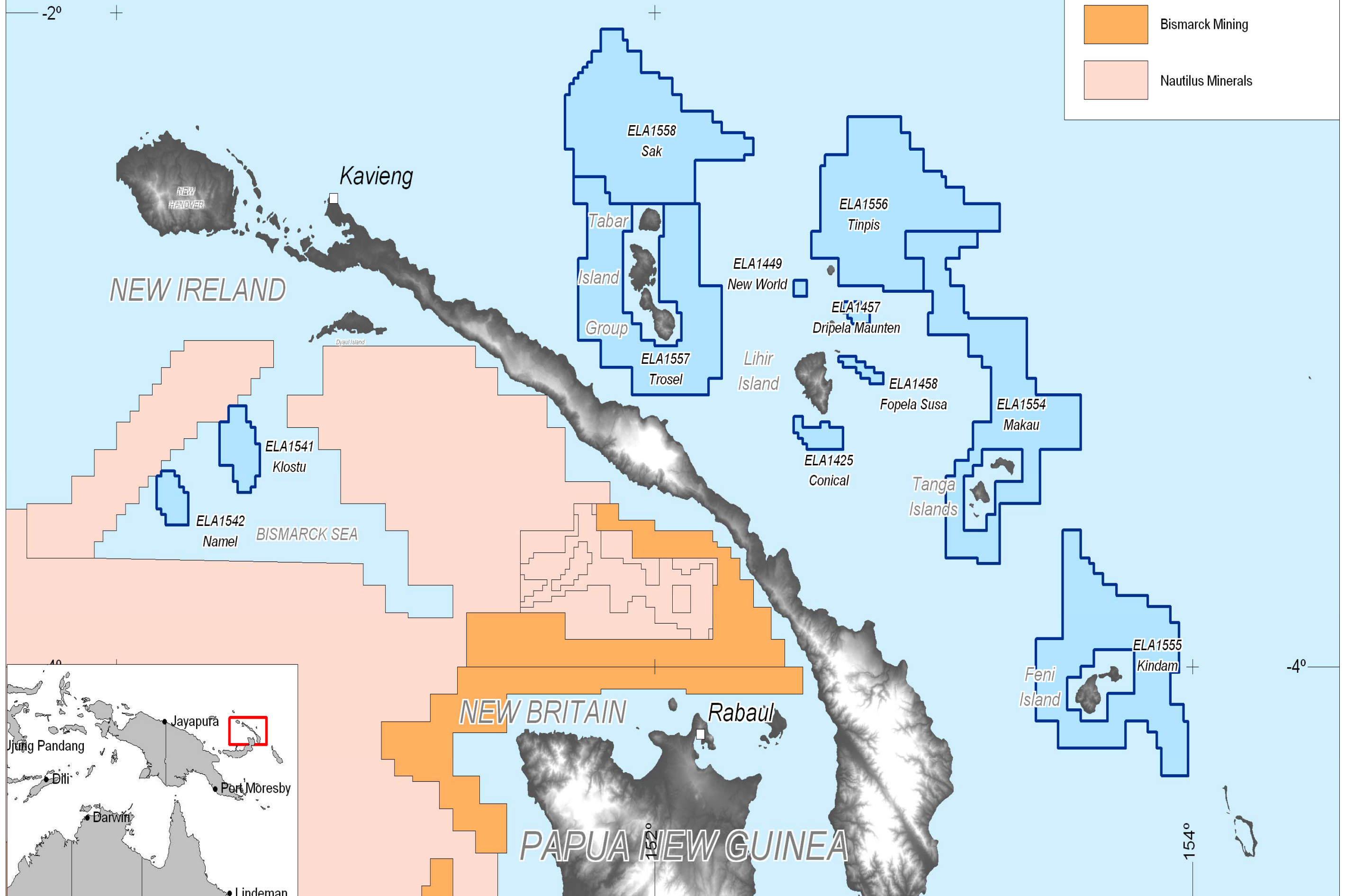
- Neptune Minerals
  - UK-registered company
  - Founded in 1999
  - Focus to explore, develop and commercialise SMS deposits.
- Granted exploration tenements - 265,000 km<sup>2</sup>
- Current applications - 362,000 km<sup>2</sup>
- Neptune undertook coring and seafloor mapping
- Company's granted prospecting license (PL 39-195), within New Zealand's 200 nautical mile Exclusive Economic Zone in 1,800 metres of W.D.
- The average metal content of the composite sample was 11.2g/t gold, 122 g/t silver, 8.1% copper, 5% zinc and 0.5% lead.

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# Neptune Minerals prospects in PNG

Papua New Guinea - Current Tenements

- Neptune Minerals - ELA's
- Bismarck Mining
- Nautilus Minerals



# Company comparison (June 2007)

CRITERIA / EVENT	NEPTUNE	NAUTILUS
Company formed	1999	1997
Seed capital	2005	1997
Exploration license applications made	1999	1997
Public listing and capital raising	October 2005	May 2006
Exploration programs conducted to date	1	3
Economic evaluations	Yes	Yes
Engineering studies	No	Yes
Environmental report submitted / approved	No	Yes
Government approval to mine / Mining Lease granted	No	Yes
Large mineral company investors	1	4
Market Cap (as at June, 2007)	US\$ 25M	US\$ 289M

# Technip involvement

- *With Nautilus Minerals*

- In June 2006, Nautilus awarded Technip to complete a Pre-FEED study of the offshore components of a development on its Solwara 1.
- Since April 2007, Technip is advising Nautilus on its offshore vessel and mineral extraction technologies.

- *With Neptune Minerals*

- In October 2007, Technip has been commissioned a conceptual engineering scoping study for technologies that may be used for the commercial development of SMS deposits.
- The scope of the current conceptual report is to identify and compare several options with regard to the following operations:
  - Sub-sea mining tools and strategy;
  - SMS lifting alternatives;
  - SMS processing;
  - Water and Tailings disposal;
  - Transport and offloading techniques.



Thank you for your attention

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