Seabed Minerals Authority
Runanga Takere Moana
COOK ISLANDS

Diverse marine minerals in a geologically diverse area - the Cook Islands Seabed

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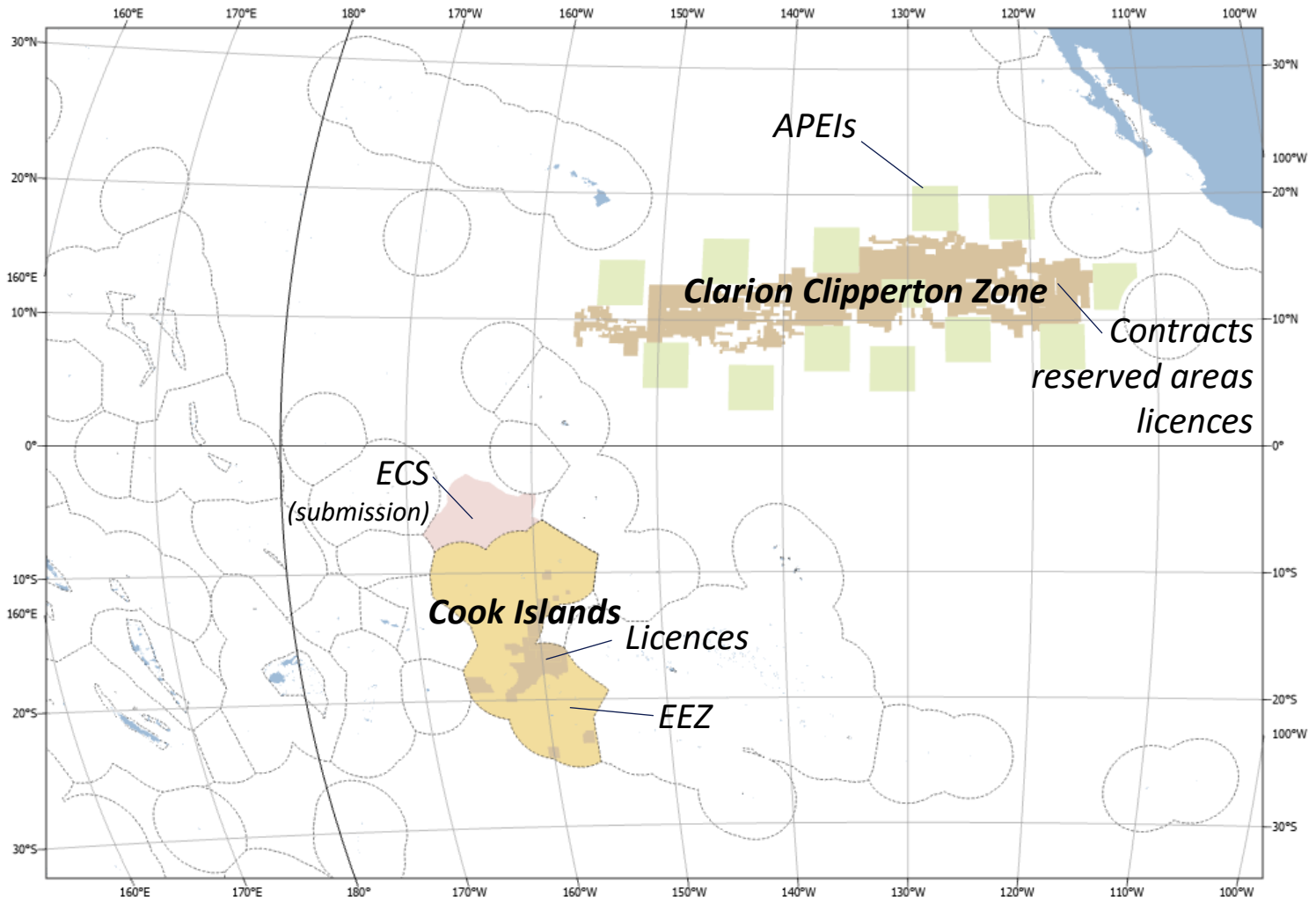


Cook Islands Seabed Minerals Authority (SBMA)

- **Independent government regulator** of seabed minerals activities in the Cook Islands EEZ. Established in 2013.
- **Licencing and Compliance Function**
  - Act, Regulations, Standards and Guidelines, Processes
- **Technical Function**
  - Evaluation and assessment, data knowledge
- **Communications and Stakeholder Function**
  - Stakeholder consultation and engagement. Coordination with public and **Seabed Minerals Working Group** (relevant Government agencies)

Regulatory Framework

- Environment Act (2003)
- Seabed Minerals Act (2009, 2019).
- Seabed Minerals (Royalties) Regulations (2013)
- Seabed Minerals (Exploration) Regulations (2015, 2020)
- Marae Moana Act (2017)
- Seabed Minerals (Exploration Fees) Regulations (2020)
- Draft Environment (Seabed Minerals Activities) Regulations (2022)
- Draft Seabed Minerals (Mineral Harvesting) Regulations (2023)

Cook Islands SBM sector – who is involved (national)

Regulators

Seabed Minerals Authority
LEAD AGENCY

Ministry of Transport
MARITIME

REGULATORY AGENCIES

National Environment Service
ENVIRONMENTAL MANAGEMENT

Ministry of Finance and Economic Management
REVENUE MANAGEMENT

Marae Moana

Minister

Public

Community Leaders

Technical Experts

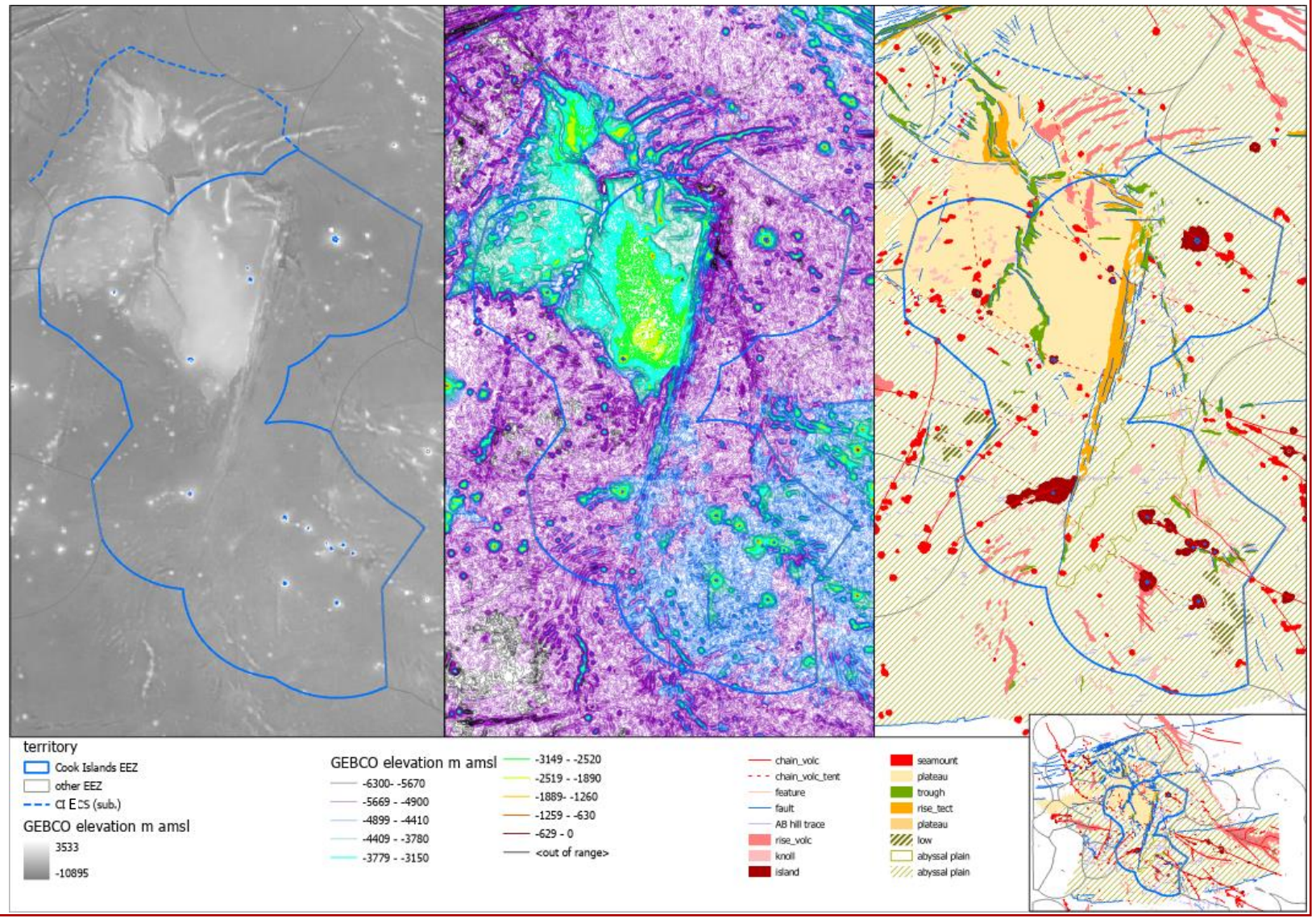
NGOs

TE IPUKAREA SOCIETY
Caring for our Environment

KŌRERO O TE `ŌRAU

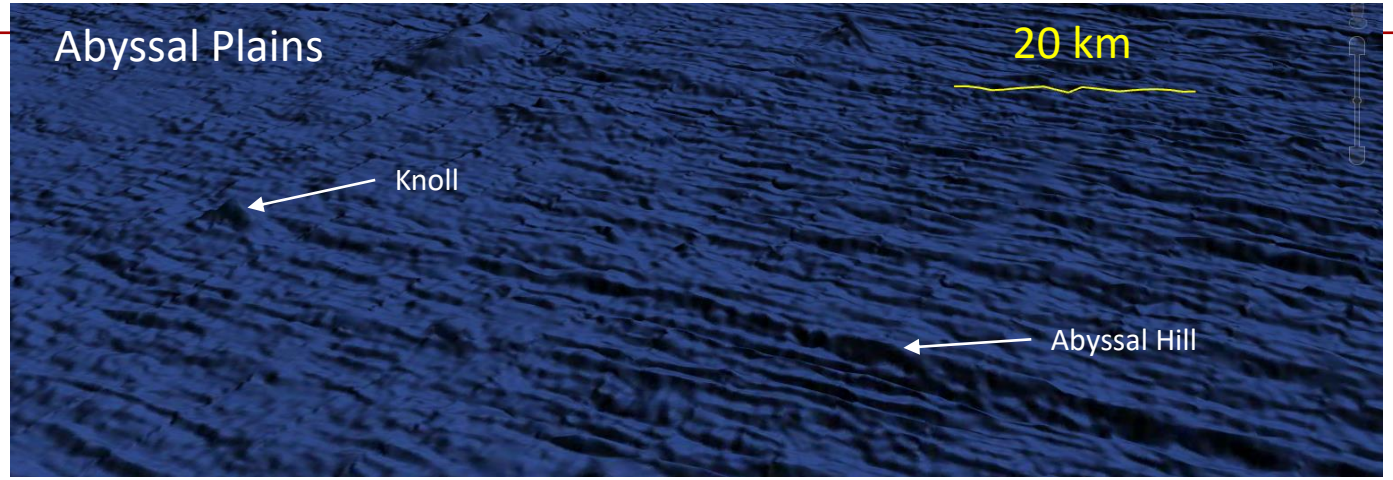
New geomorphological map

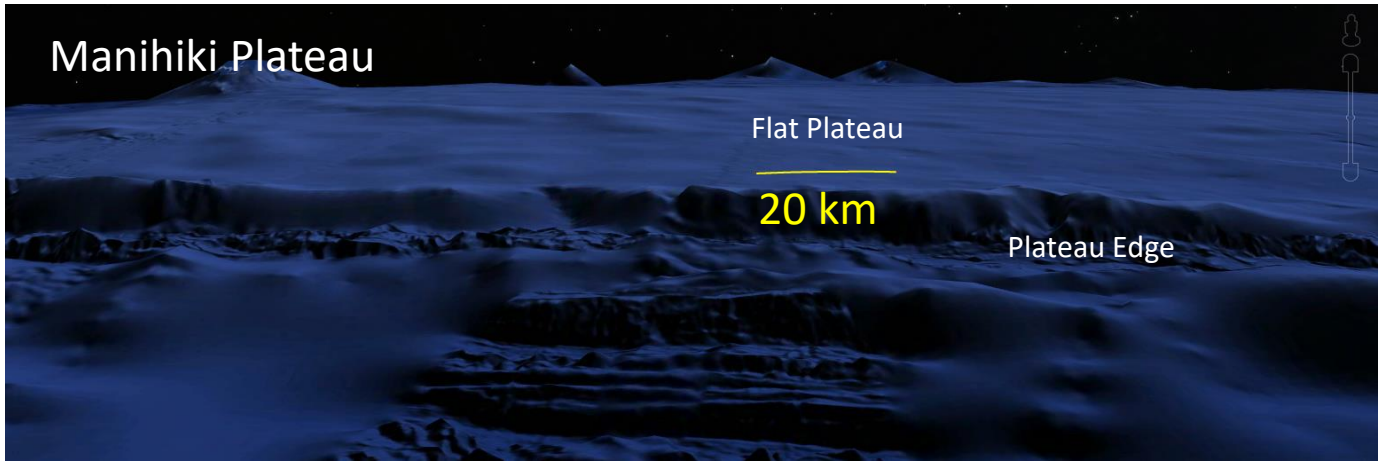
- The GEBCO 2021 grid was contoured and carefully colour coded
- Reference was also made to magnetic data
- Manual interpretation of geomorphology
  1. Abyssal plains and subtypes
  2. Plateau and associated features
  3. Knoll-Seamounts and derived chains
  4. Other tectonic features
- Interpretation covered the region as many features extend beyond our EEZ

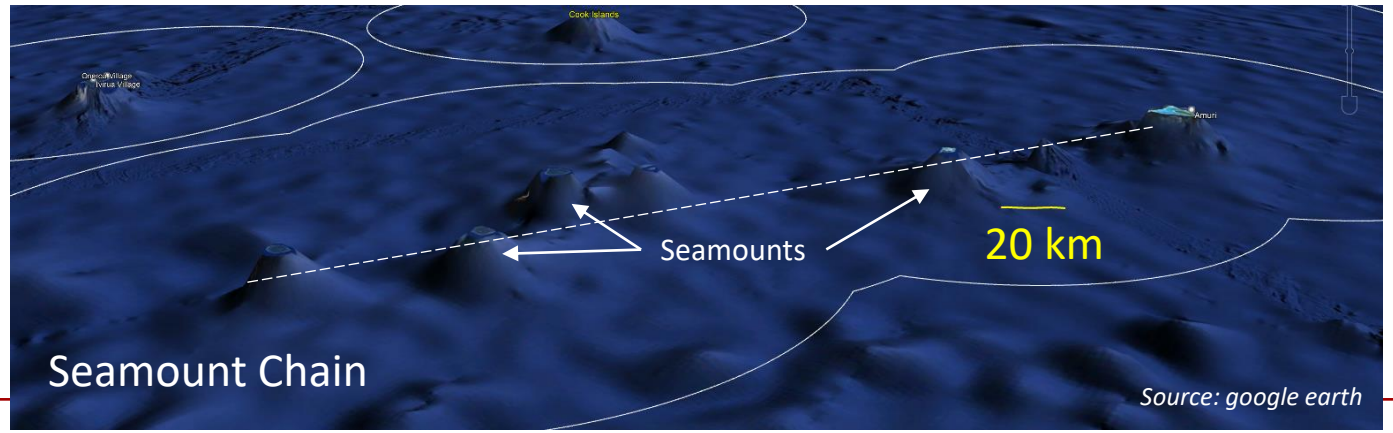


Types of landforms

1. Abyssal plains and subtypes
   a. composed of long lines of hills and valleys formed by faulting
   b. includes some volcanic knolls (small round hills), isolated seamounts and troughs
2. Plateau and associated features
   a. Composed of higher flatter area (thick sediment cover)
   b. includes some tectonic rises, volcanic knolls and troughs
3. Volcanic Knoll-Seamounts and derived chains. Composed of discrete seamounts and continuous volcanic ridges.



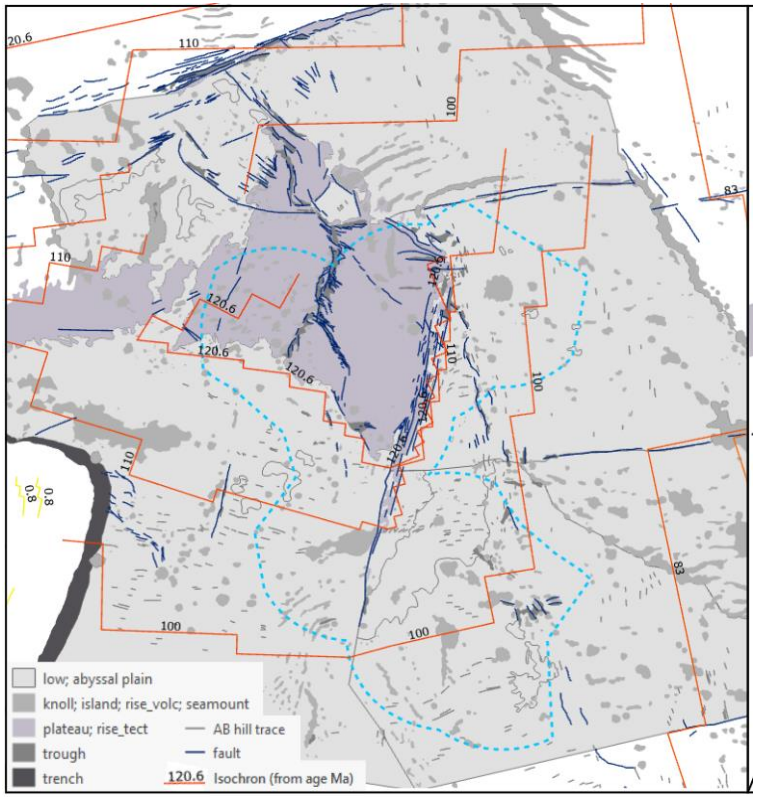




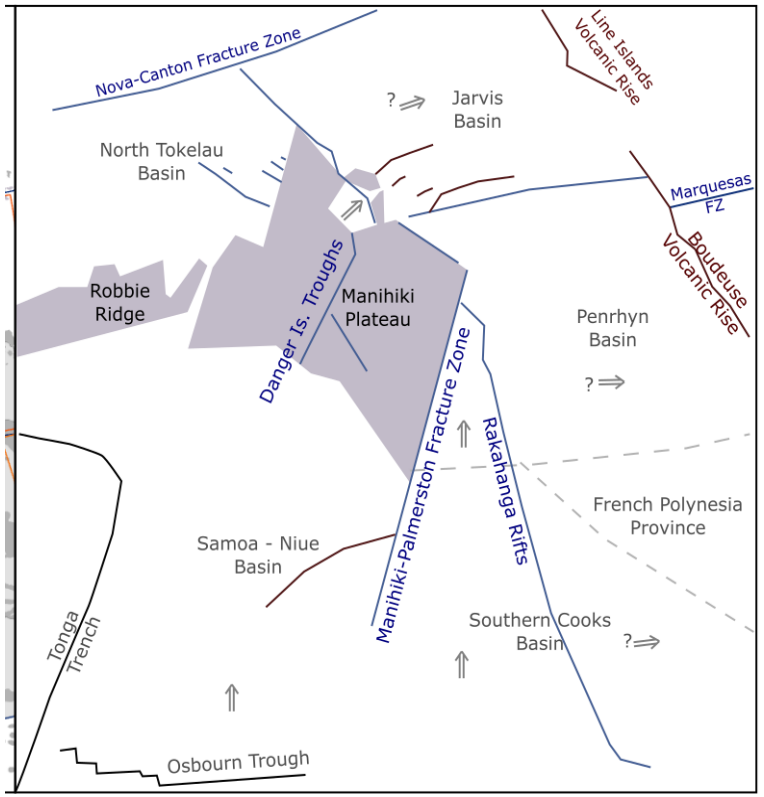
Seabed basement geological history

- Immediately after formation of the Manihiki Plateau circa 120 Ma, seafloor spreading continued to about 100 Ma in multiple locations/orientation
- The plate is then thought traveled over a group of hotspots starting from about 19 Ma

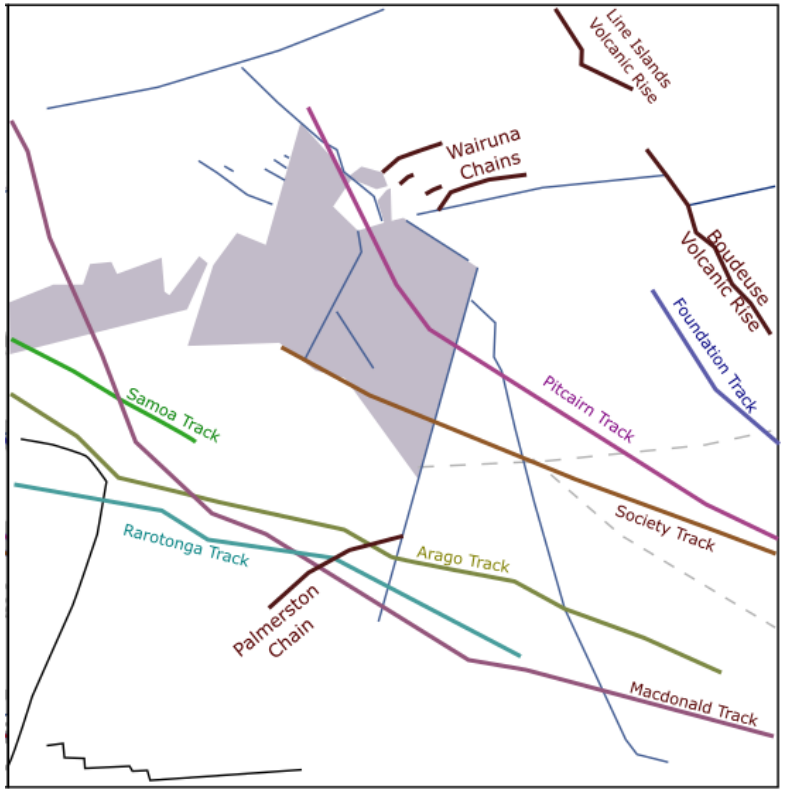
Current Setting



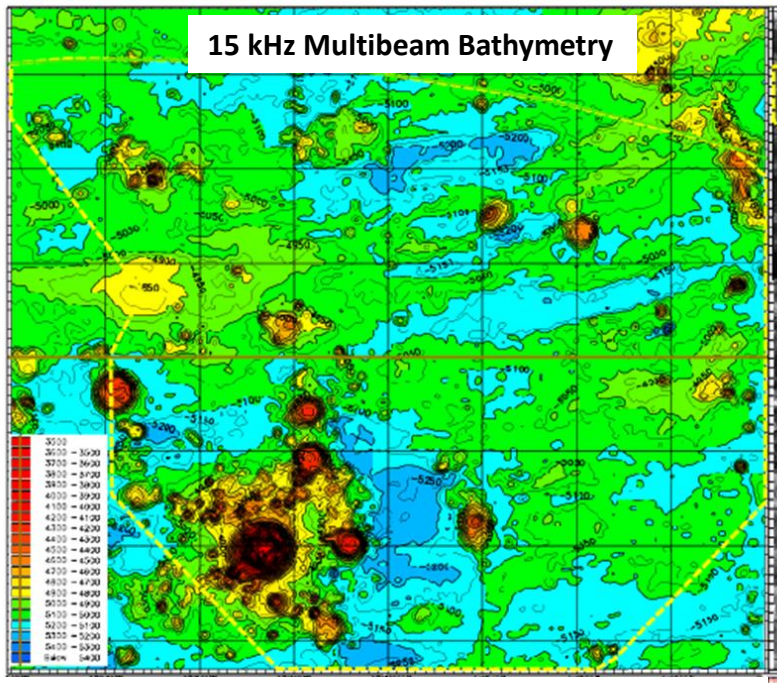
Seafloor Formation

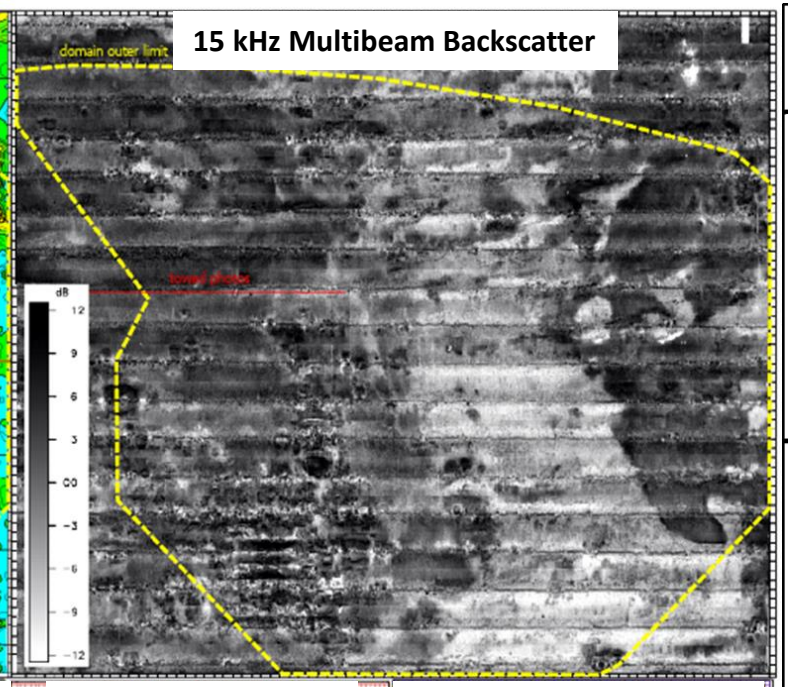


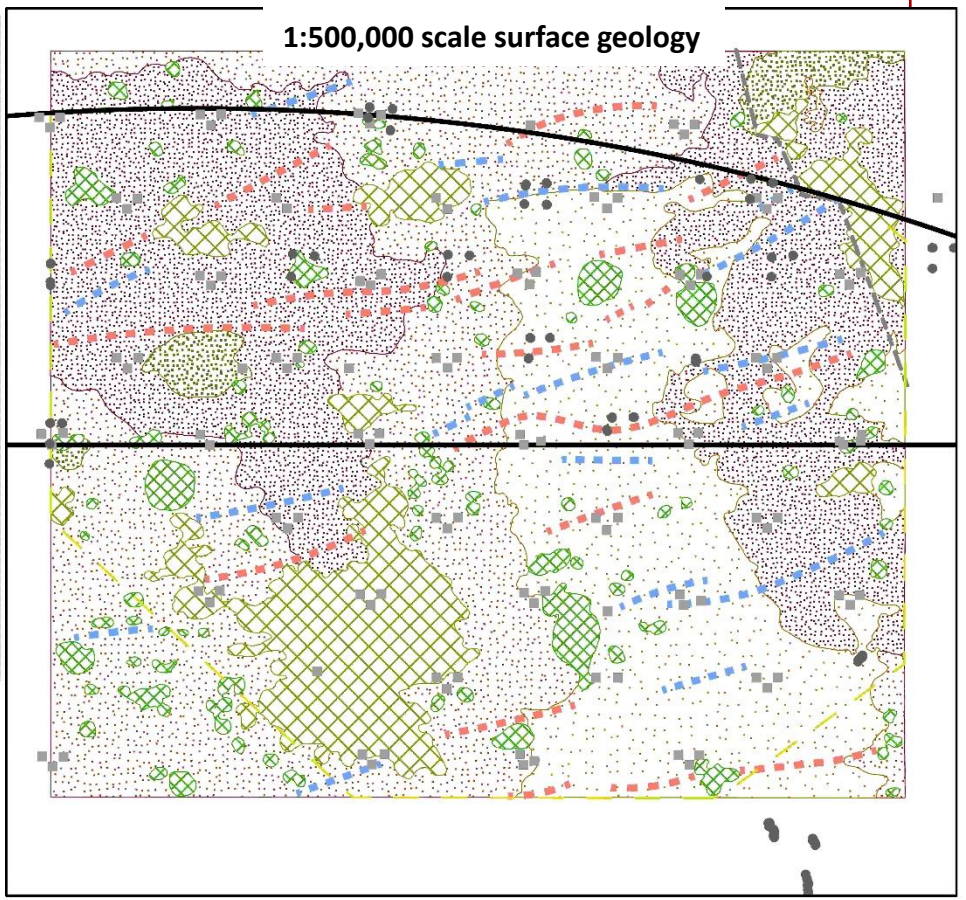
Hotspot Highway



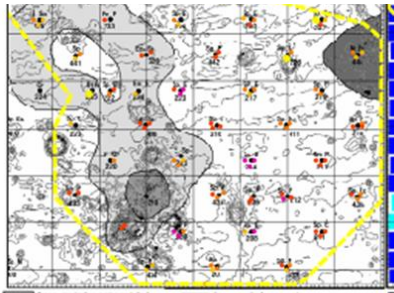
Seabed geology map of part of the Cook Islands nodule field



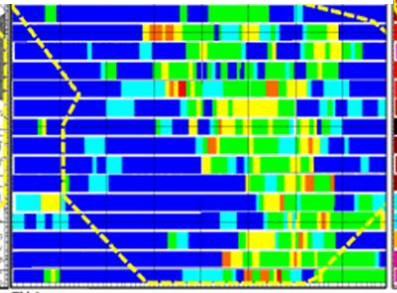




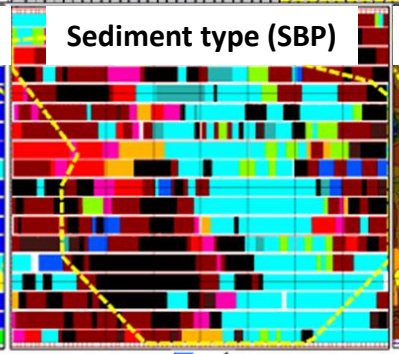
Nodule types/abundance



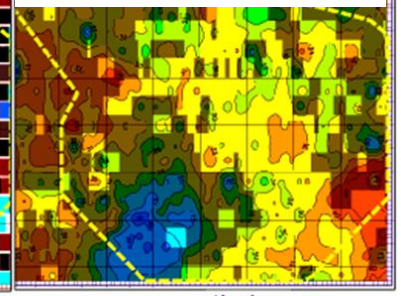
Thickness transparent layer



Sediment type (SBP)

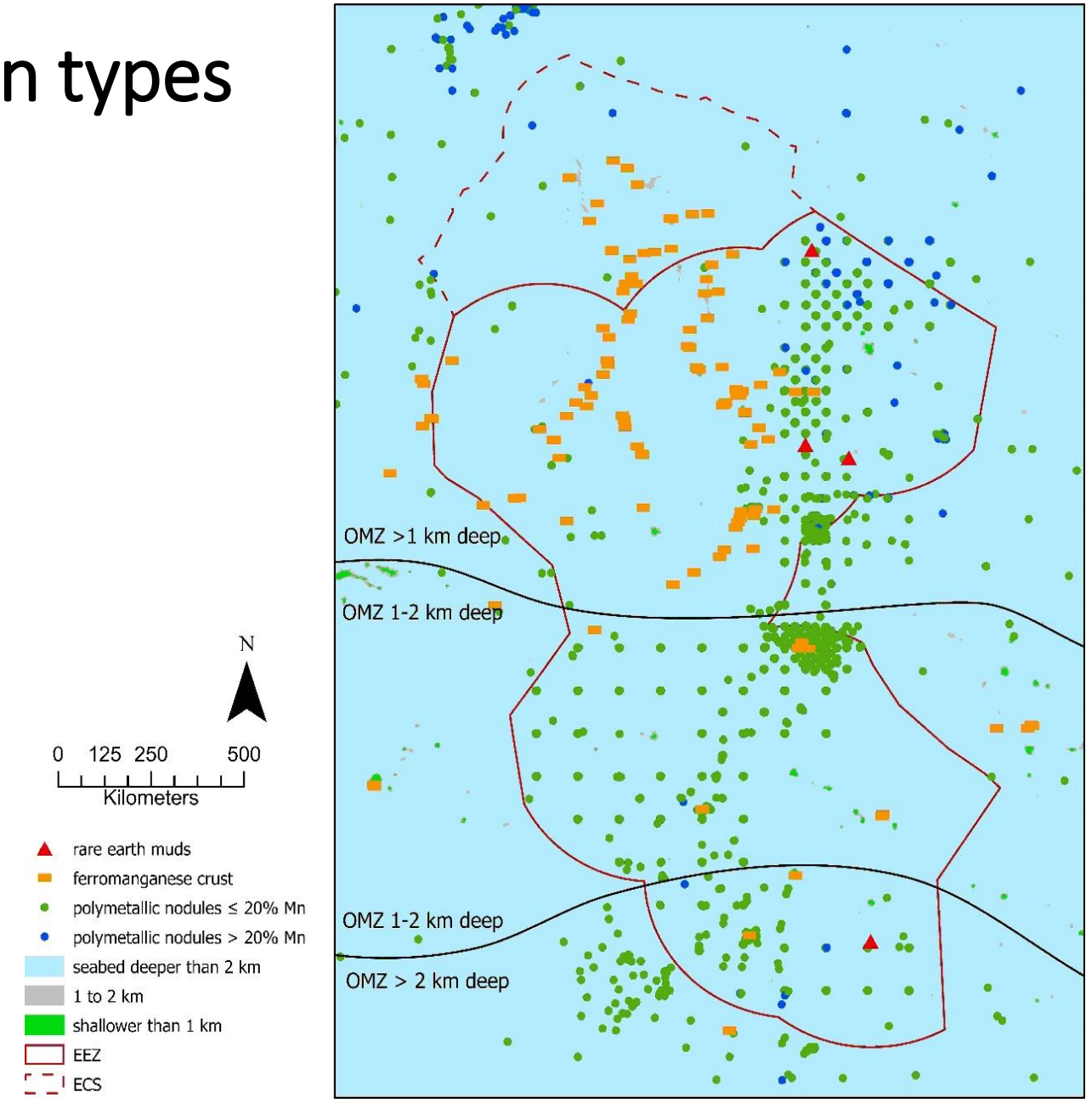


MFES nodule abundance



Overview of mineralization types

- Cook Islands is best known for its nodule deposits
- Different grades of nodules are found in different areas – most notably there is a change with latitiude
- Occurrences of Ferro-manganese crusts both on the plateau/seamounts and on the abyssal plains
- REE rich muds have also been found at just a few sites (but these have very rarely been sampled/analysed for



OMZ is oxygen minimum zone, source World Ocean Atlas 2018

Four chemical classes of nodules

- **Situation 1, high cobalt (Co) nodules (hc):**

up to double the Co of other known occurrences. Very low sedimentation and highly oxygenated bottom water promotes a high proportion of slow hydrogenetic growth.

- **Variant 1, low Co, low nickel nodules (lcln):**

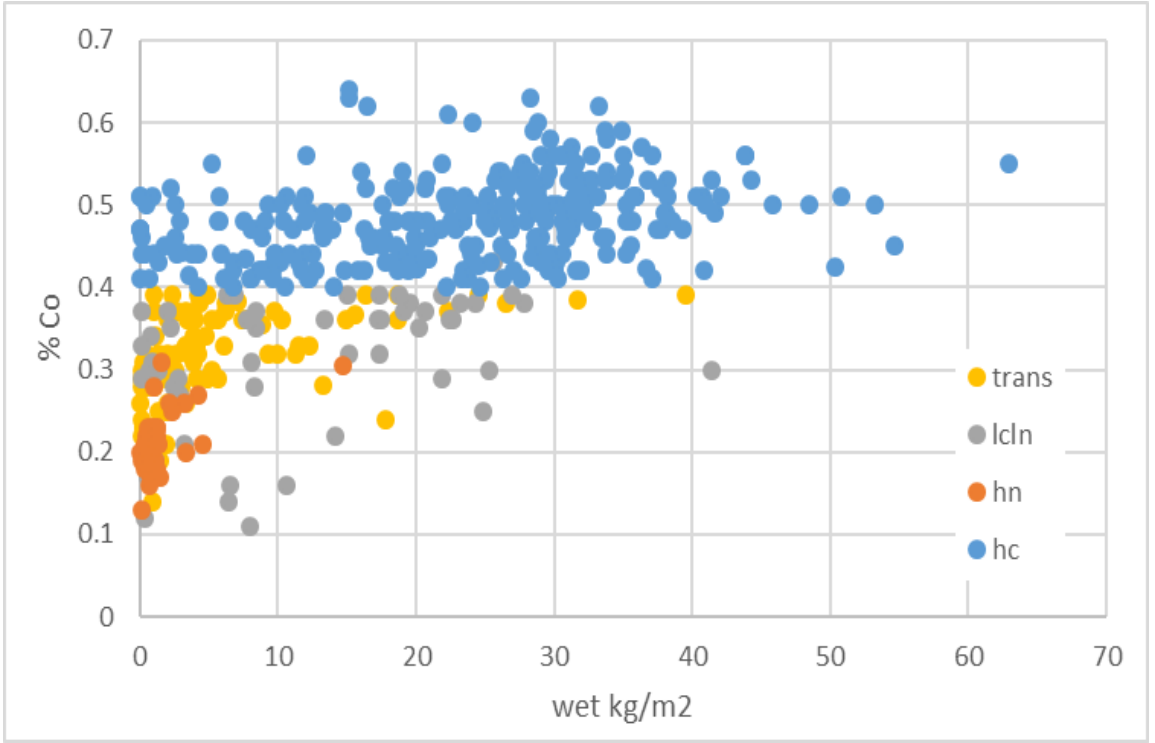
near identical chemistry to the high Co nodules (apart from Co itself). Maybe due to less effective function of the bottom water (above).

- **Situation 2, high nickel nodules (hn):**

in the northern part of EEZ at similar transitional levels of primary productivity to the CCZ.

- **Variant 2, Transitional moderate cobalt moderate nickel nodules (trans):**

may have formed under mixed environments for the high cobalt and high nickel situations above.



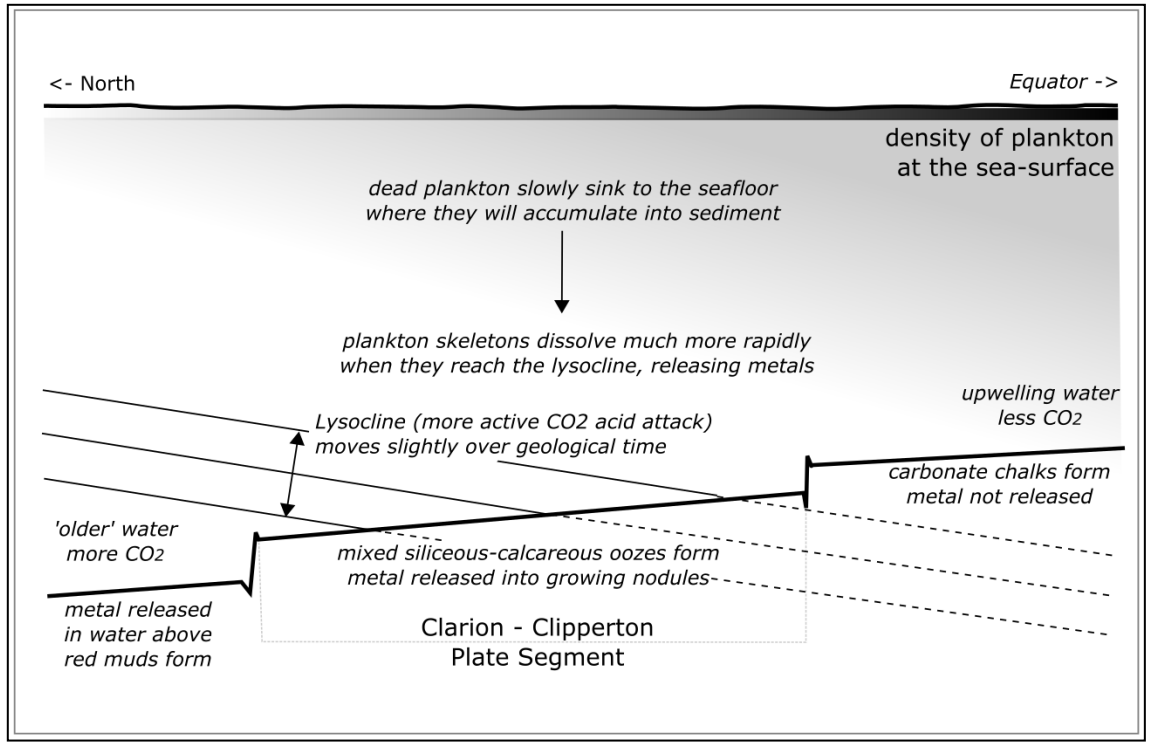
Nodule abundance versus cobalt by grade type

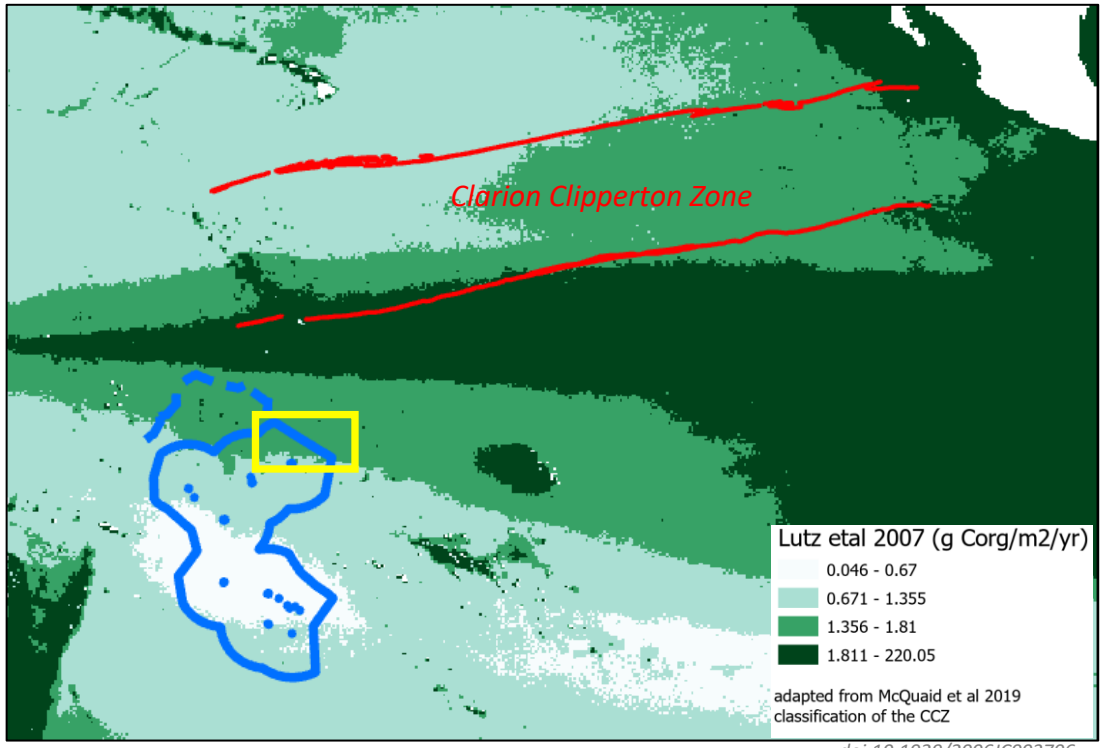
Note that:

1. There is spatial and other grade distinctions between the classes
2. Samples are not de-clustered.

High Ni-Cu nodules – an exploration play

- High Ni-Cu-Mn nodules were sampled by JICA/MMAJ in the northern part of the EEZ in 1985
- Samples at 40-80 km spacing only returned very low abundances (<5 kg/m^2)
- Grade and abundance are not related elsewhere – ideal conditions (stability) may be restricted
- The 1985 expedition did not have multibeam technology…



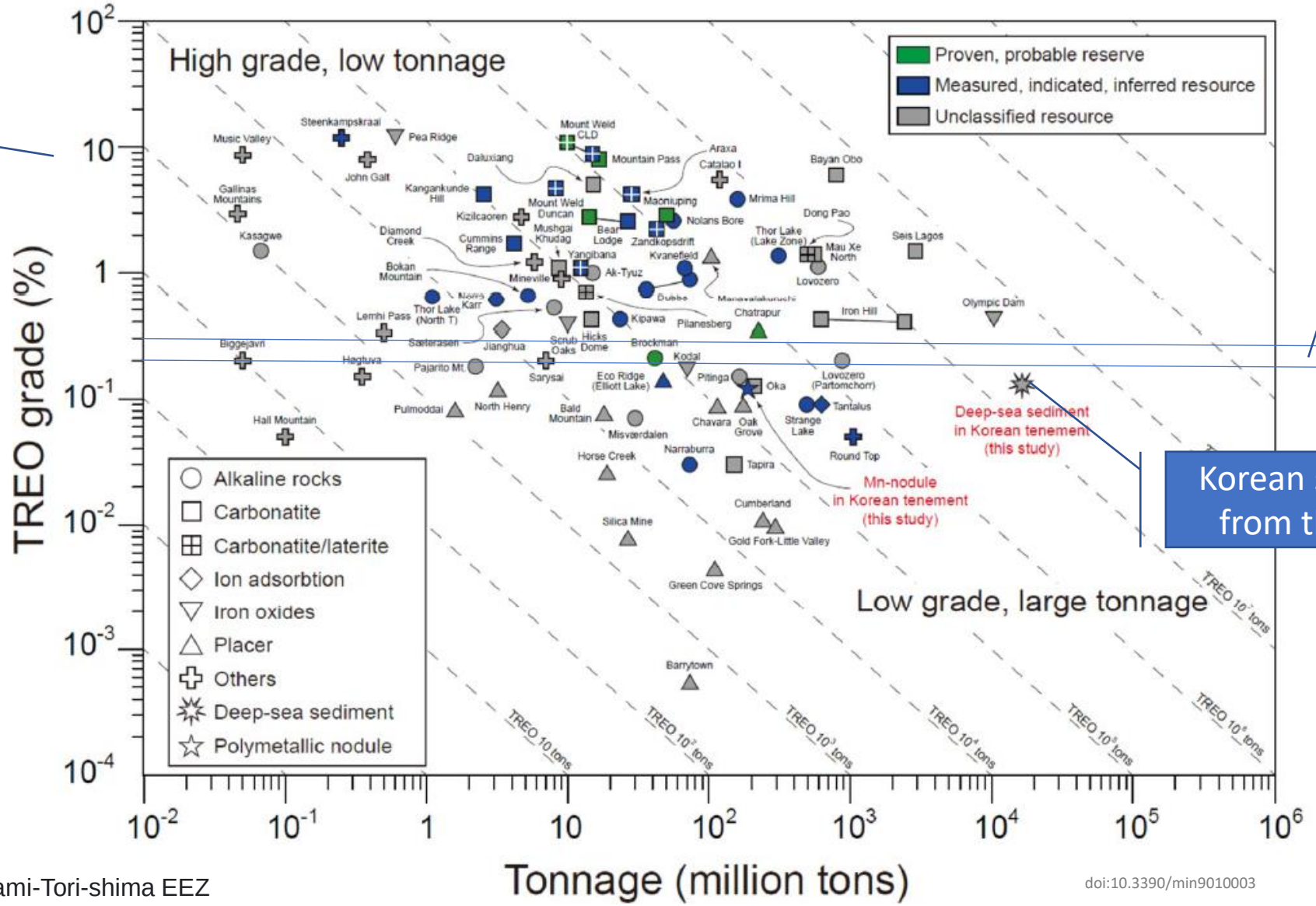


doi:10.1029/2006JC003706.

doi:10.1029/2006JC003706.fa

Rare Earth Element muds

Note log scales!



Japan, Cook Islands samples

3,000 ppm

2,000 ppm

Korean samples from the CCZ

Other benefits:
Readily extracted?
Little to no overburden
Easier to process?
Little radionuclides
More valuable ‘basket’

Japan is the Minami-Tori-shima EEZ

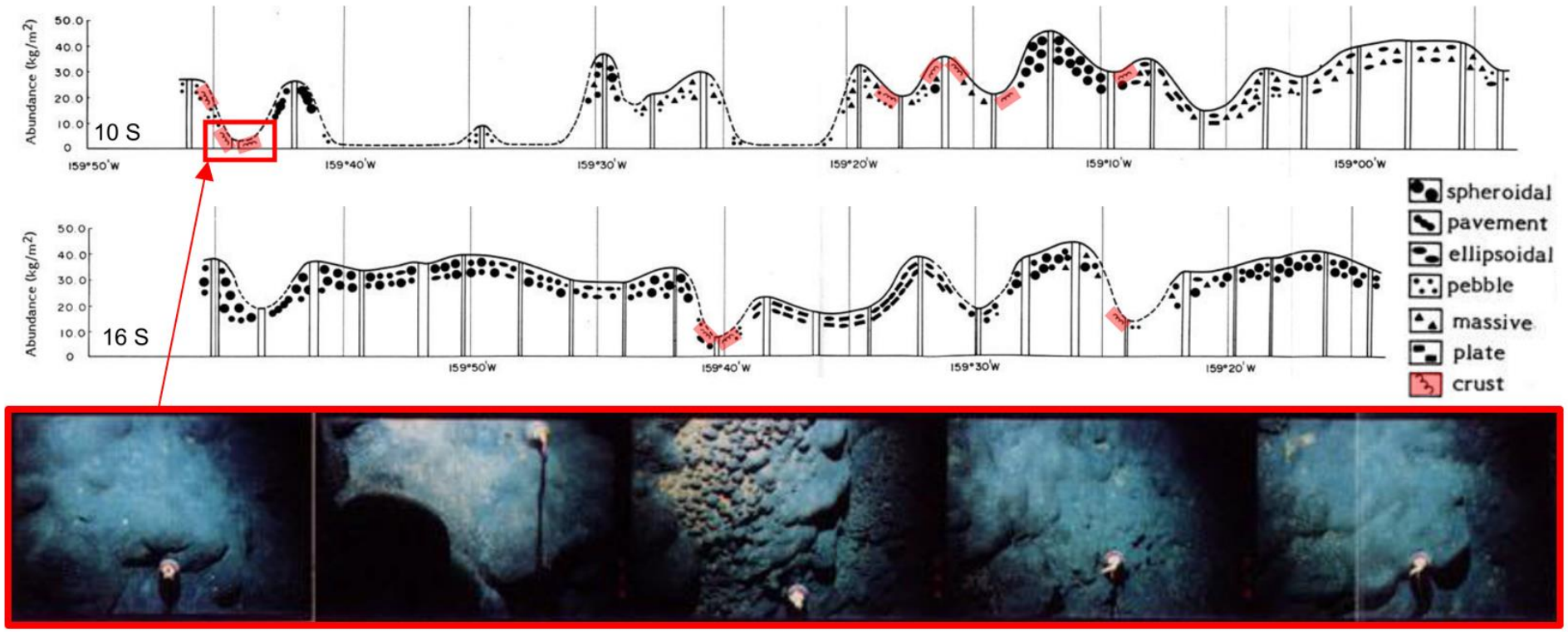
doi:10.3390/min9010003

Cobalt rich crusts

Found in three forms (as seen also in the CCZ)

1. Massive on hard substrate – by far the most common
2. Massive within the sediment – locally common
3. Fragments on the sediment – unlikely to be material

The massive crusts have been noted (never mapped) on the edges of the Manihiki Plateau and amongst the nodules on the abyssal plains.



Status

- At this stage the Cook Islands is only allowing exploration of its marine minerals. Environmental considerations will be foremost before any development is allowed to proceed further.
- While the environmental risk profile for nodules is acceptable to development proponents, a scoping EIA/study might well be required for the other mineral types