Seabed Minerals Authority
Runanga Takere Moana
COOK ISLANDS

Recent and forthcoming scientific developments on seabed minerals in the Cook Islands

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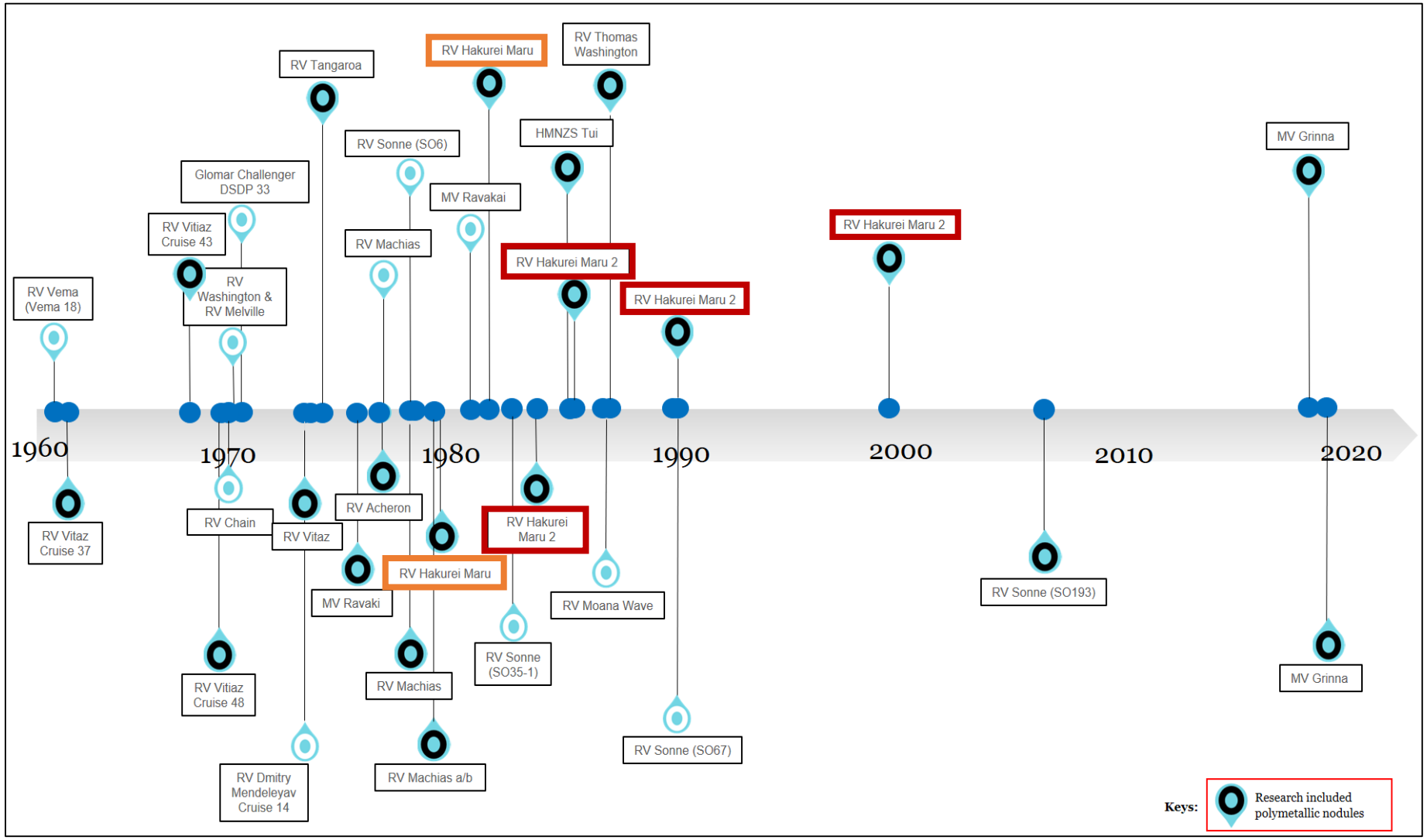
October 2022

The seabed minerals waltz?

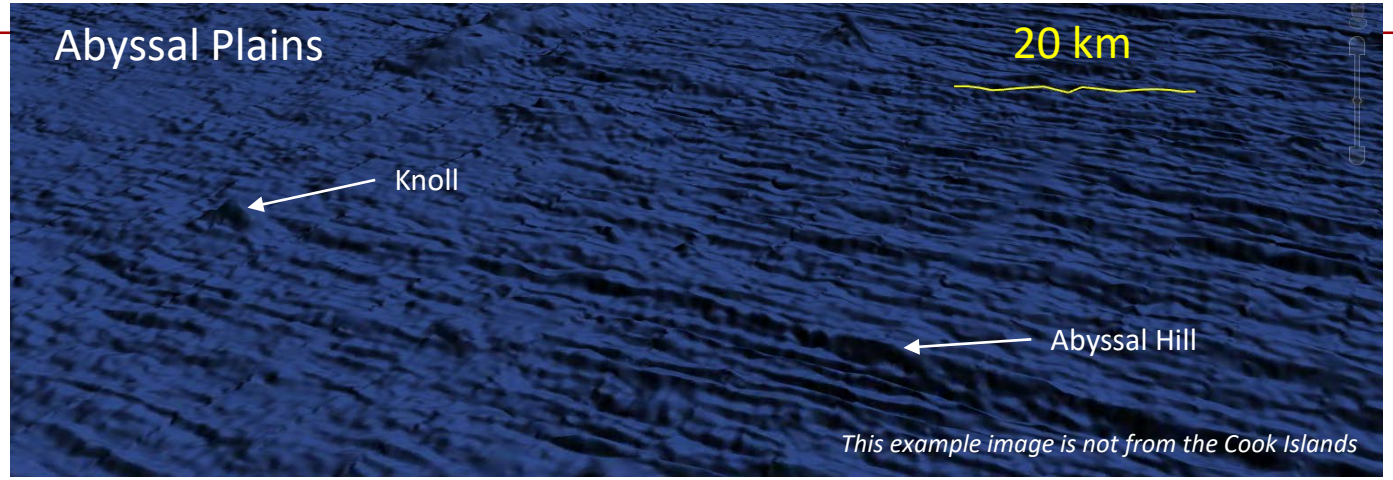


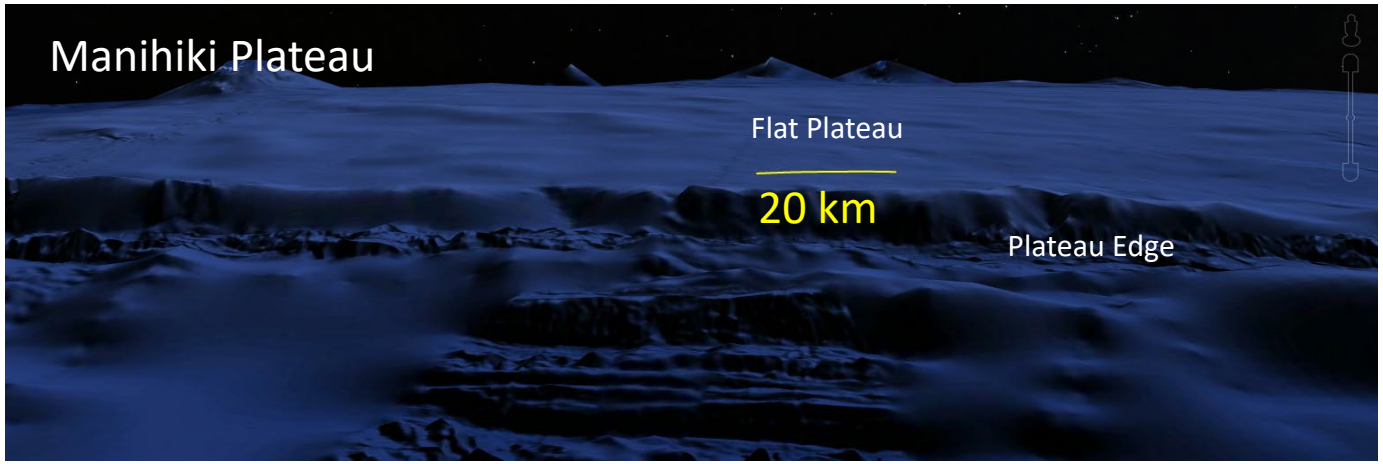
Lots of expeditions **Global datasets develop** **Lots of expeditions?**

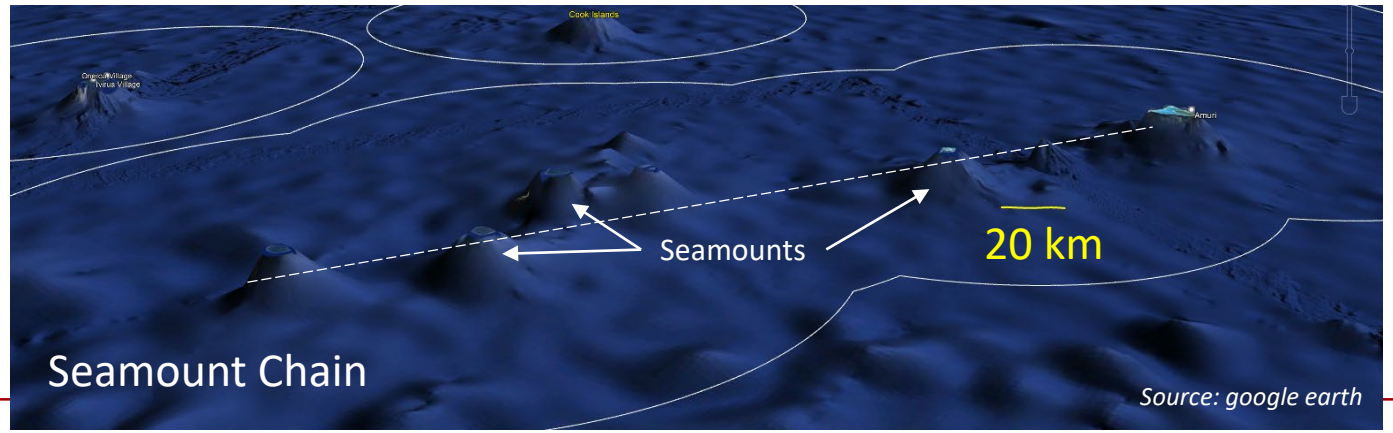
Global bathymetry

GEBCO grid in the Cook Islands shows

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.

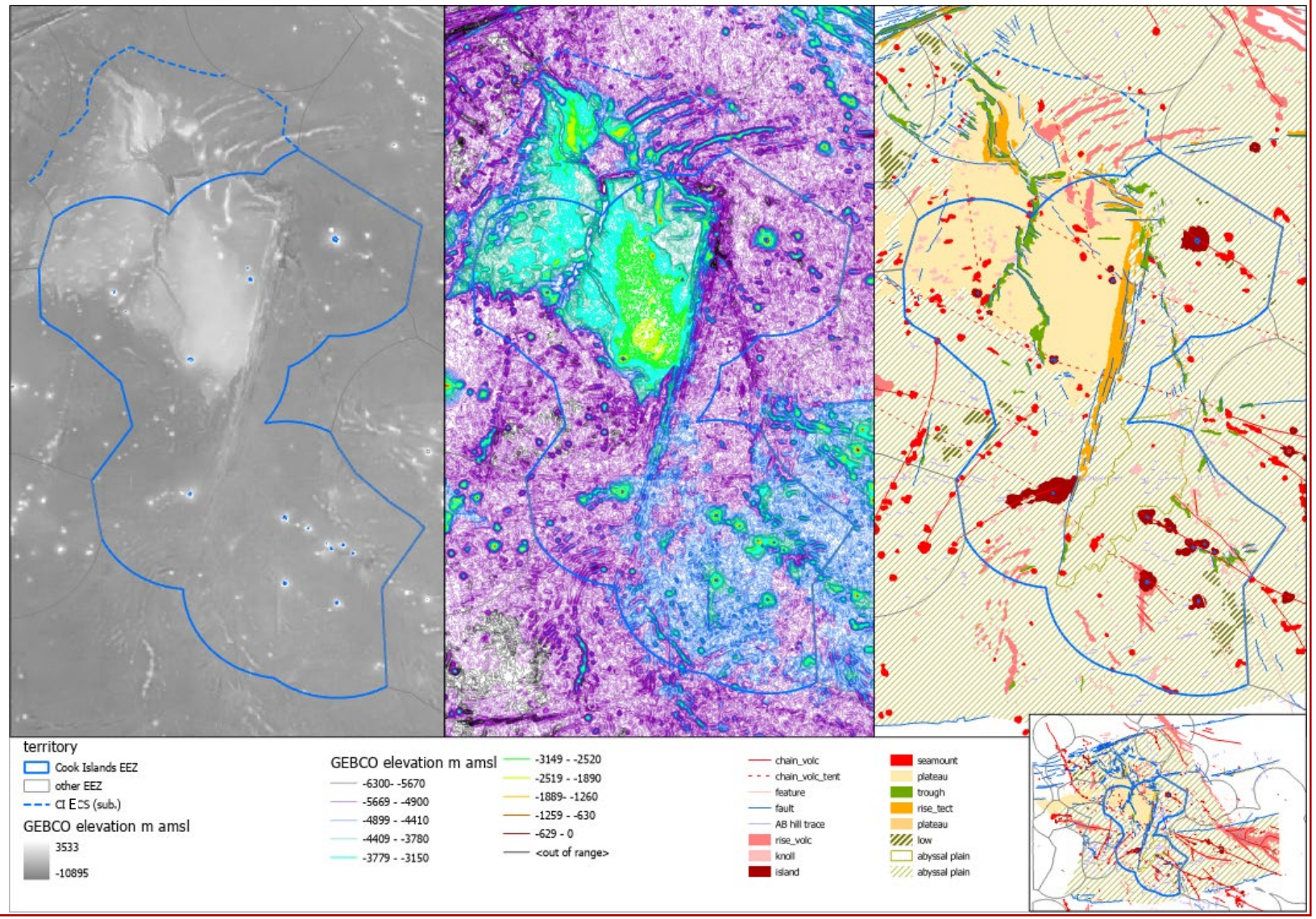






New geomorphological map

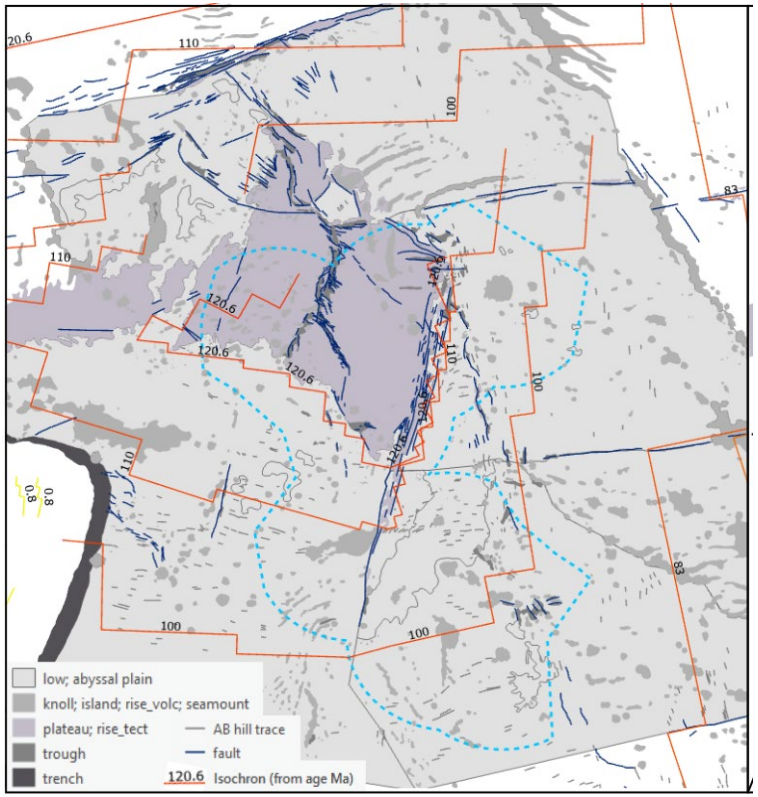
- The GEBCO 2021 grid was contoured and carefully colour coded
- Reference was also made to magnetic data
- Manual interpretation of geomorphology
  1. Abyssal plains and subtypes
  2. Plateau and associated features
  3. Knoll-Seamounts and derived chains
  4. Other tectonic features
- Interpretation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



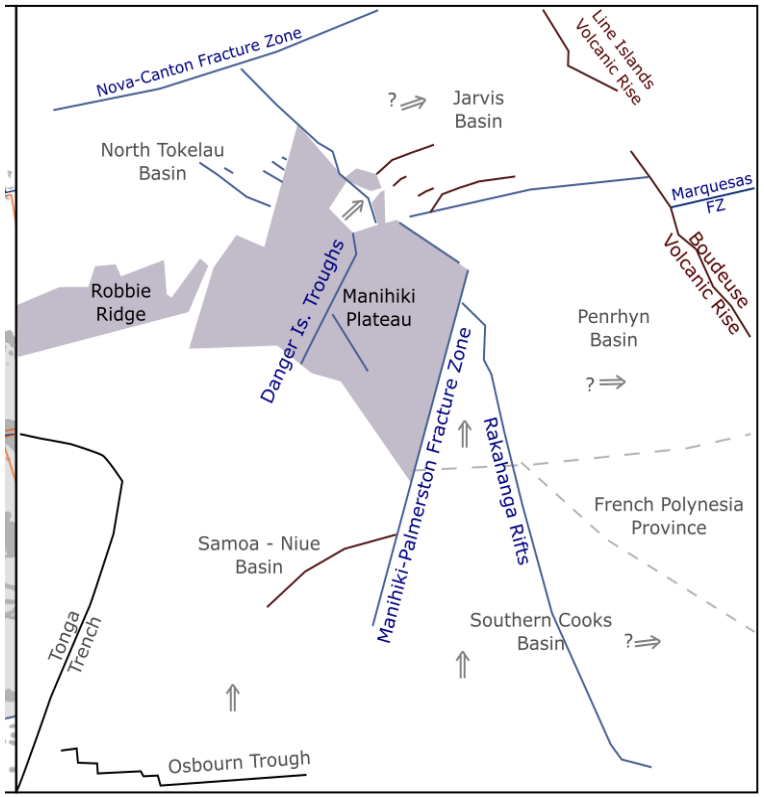
Better resolution of seabed basement geological history

- 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

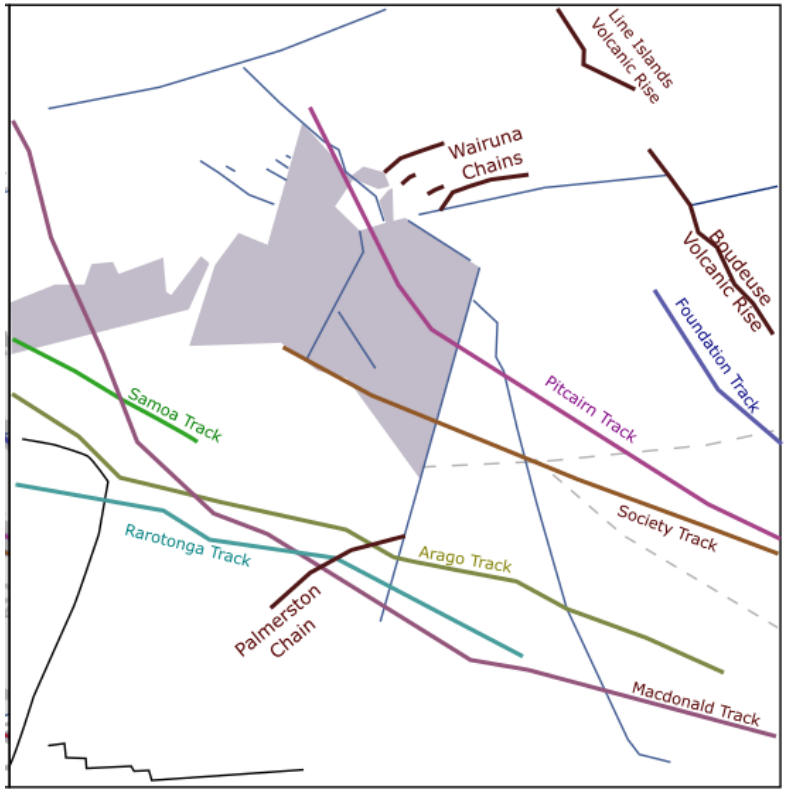
Current Setting



Seafloor Formation

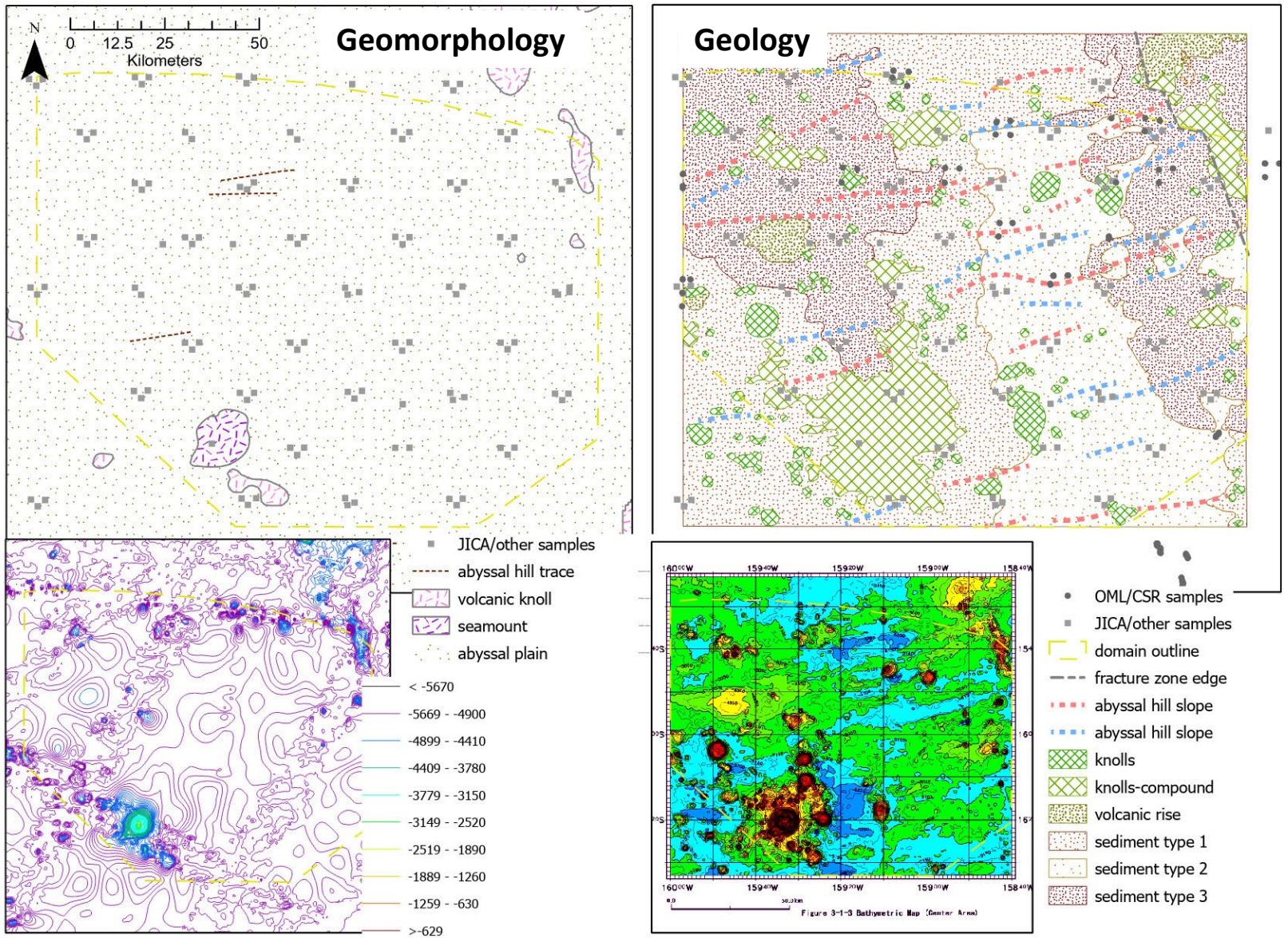


Hotspot Highway



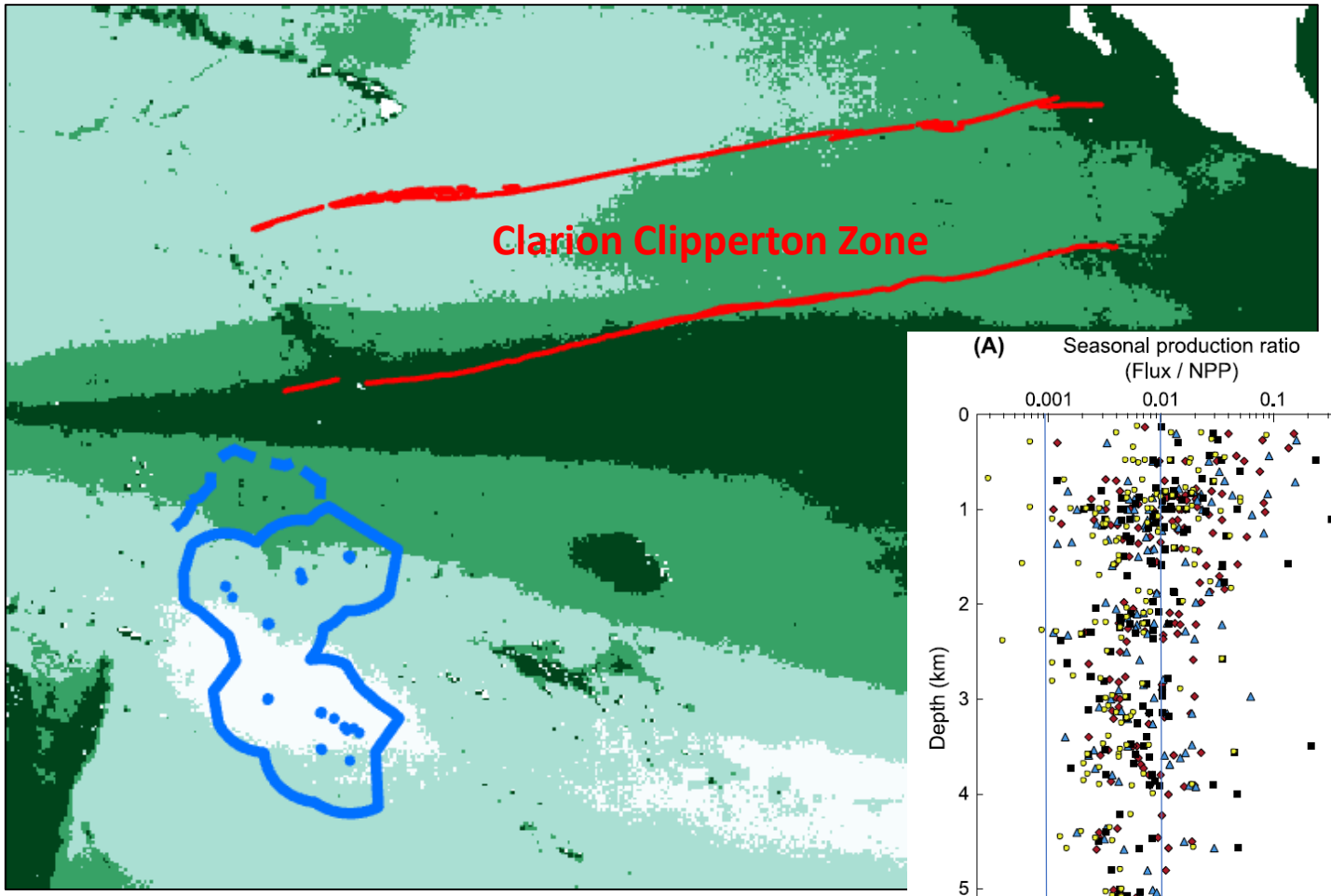
From regional geomorphology to local geology

- The regional geomorphology map is presented at 1:3,000,000
- A 1:500,000 scale geology map was possible using a small block of 15 kHz MBES data…



Another global data set - net export organic carbon

- Net export model of Lutz *et al.* 2007 as applied by McQuaid *et al.* 2019 to the CCZ.
- With one key change being addition of a very low class.
- The south Pacific has a more oligotrophic zone.



Lutz etal 2007 (g Corg/m2/yr)

0.046 - 0.67

0.671 - 1.355

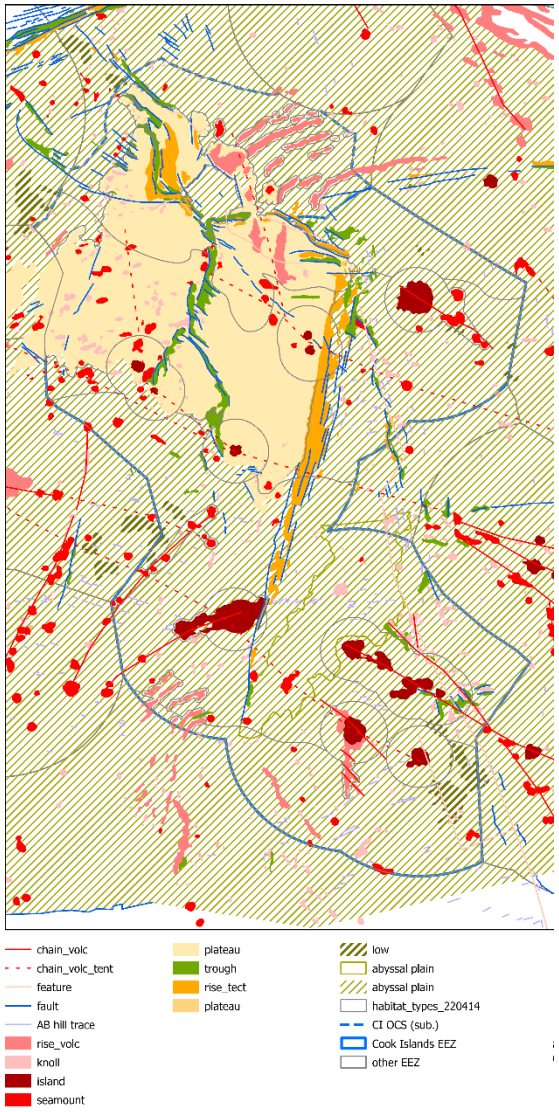
1.356 - 1.81

1.811 - 220.05

adapted from McQuaid et al 2019 classification of the CCZ

doi:10.1029/2006JC003706.

Specific Process for our seabed Habitat Management Zones



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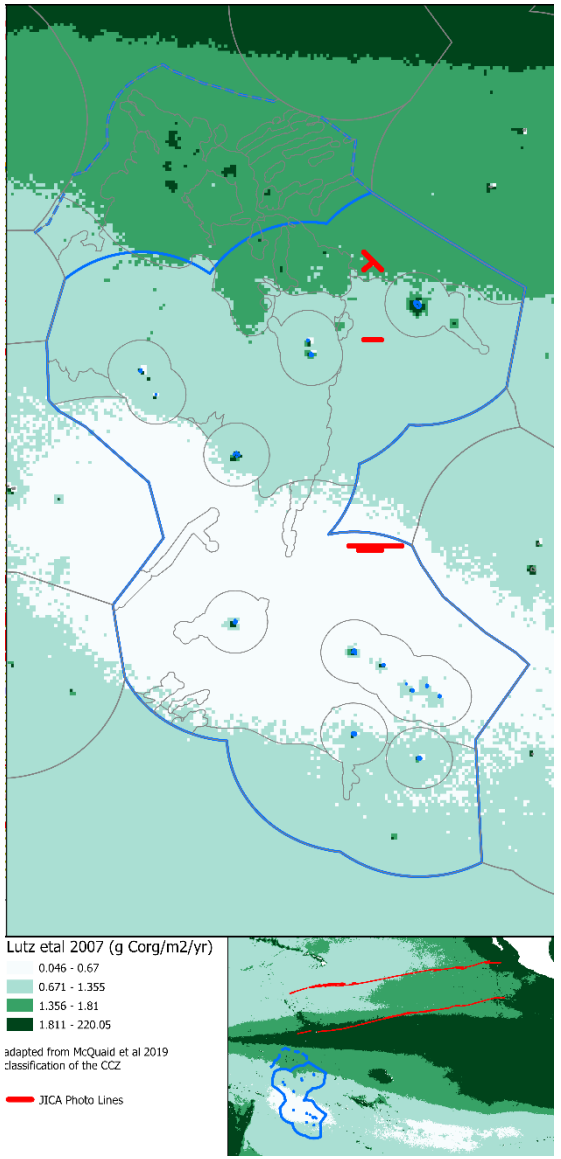

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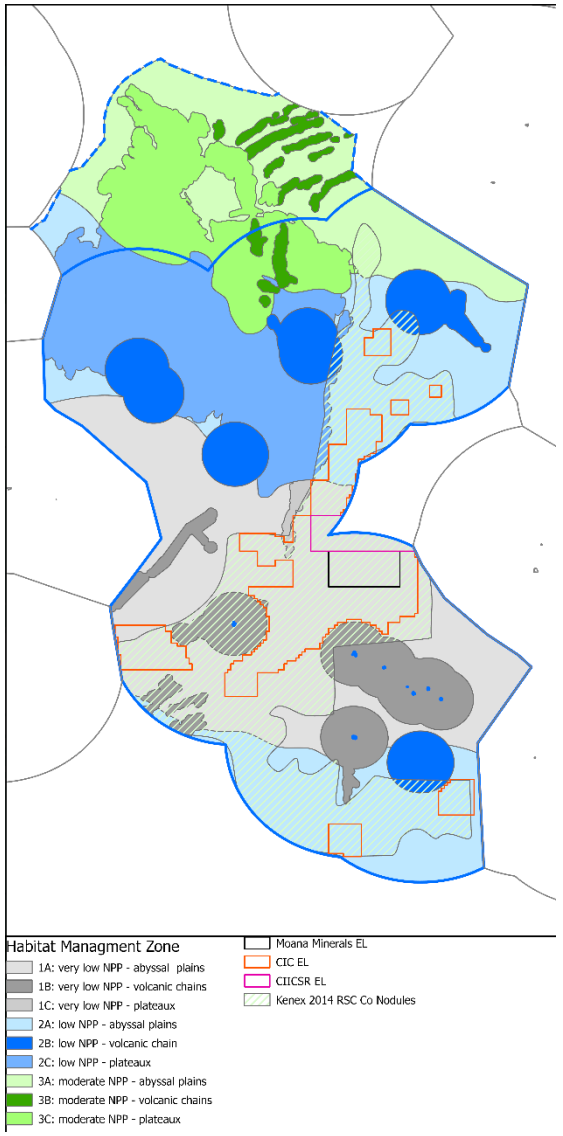


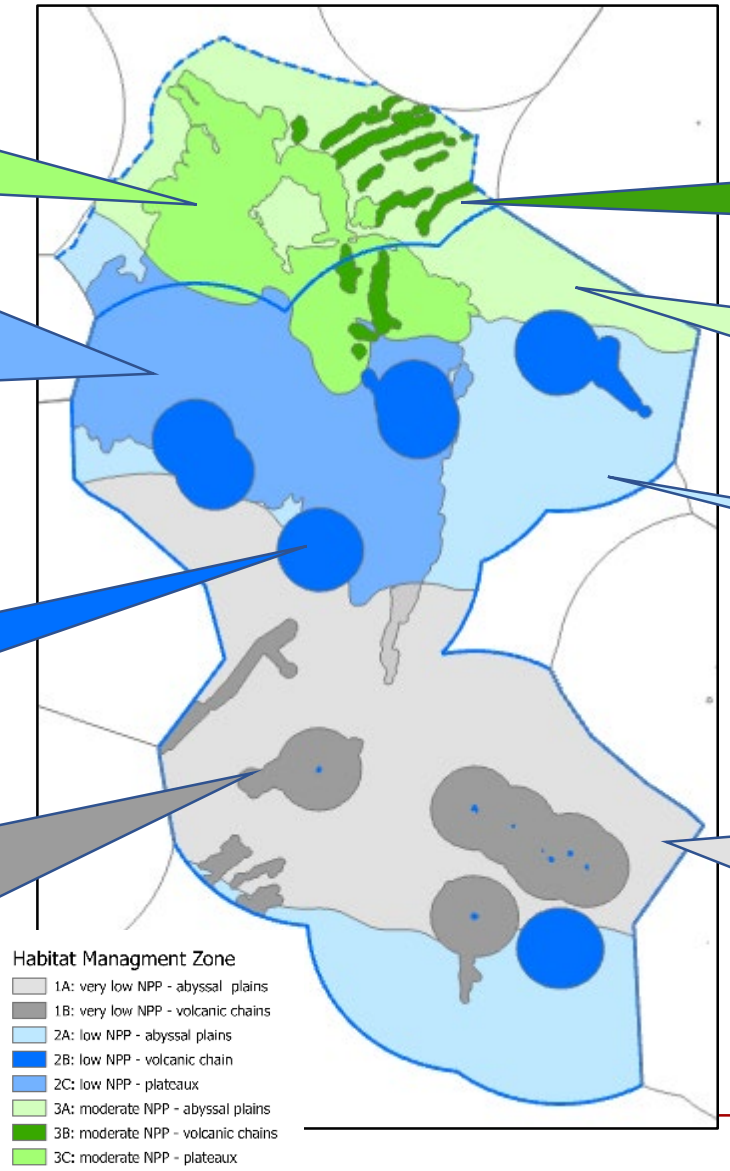
What are the Habitat Management Zones

3C: plateau with a **moderate** supply of organic carbon

2C: plateau generally ~1,000 to 2,000 m above the plains including adjacent and internal fault-ridges and rifts. With a **low** supply of organic carbon

2B: **chain of seamounts, and knolls,** with a **low** supply of organic carbon

1B: **chain of seamounts, and knolls** with a 5 k buffer zone. If islands are present extends to the 50 nm set-aside area. With a **very low** supply of organic carbon



3B: **chain of seamounts, and knolls,** with a **moderate** supply of organic carbon

3A: **abyssal plains,** with a **moderate** supply of organic carbon

2A: **abyssal plains,** with a **low** supply of organic carbon

1A: **abyssal plains** with occasional knolls or clusters of knolls, isolated seamounts and occasional rifts (deeper valleys), with a **very low** supply of organic carbon

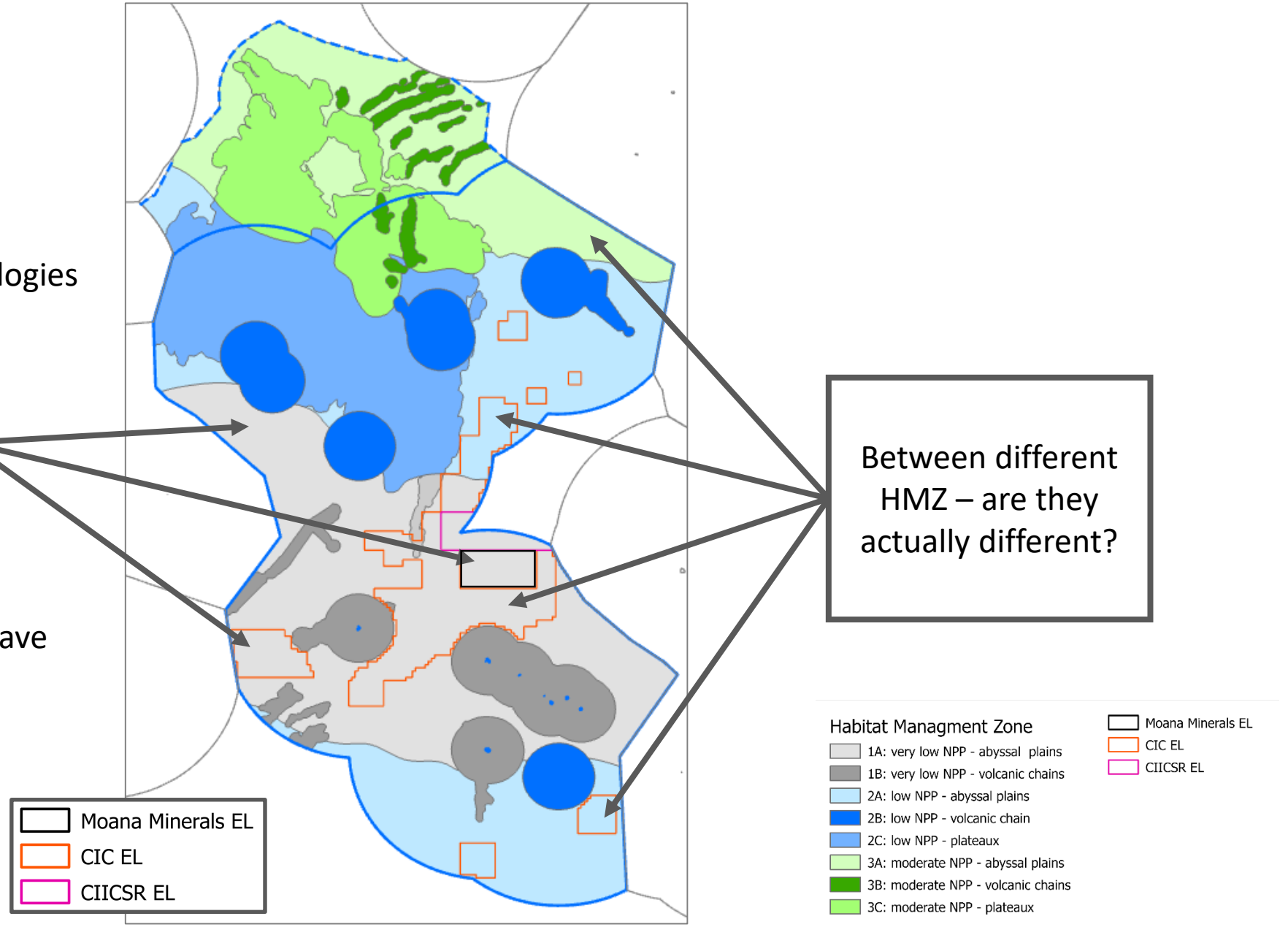
Testing?

Two key questions
Example for A type morphologies

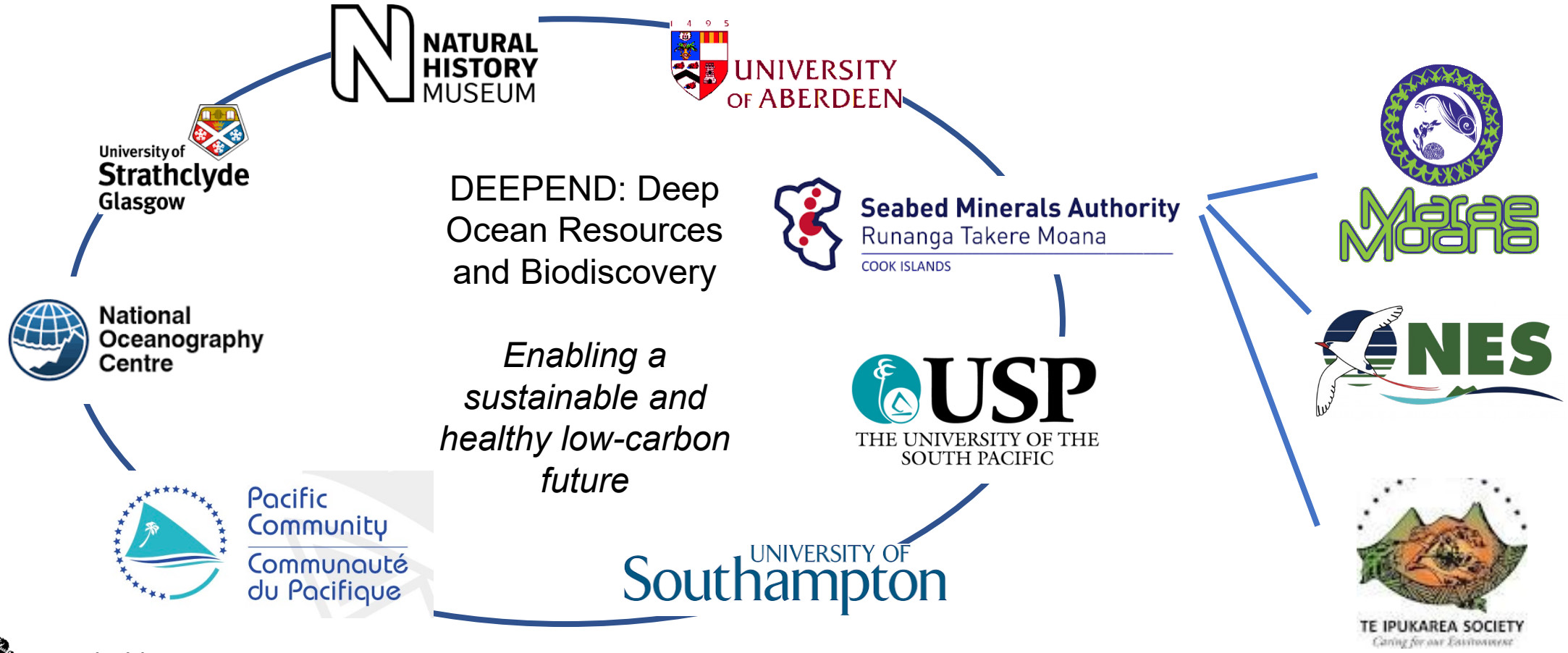
Between parts of a defined HMZ – are they truly the same?

Between different HMZ – are they actually different?

Note: B type morphologies have the greatest range in depths. The plateau also has <1 km depth variation (see backup)



DEEPEND: Collaboration on Marine Genetic Resources

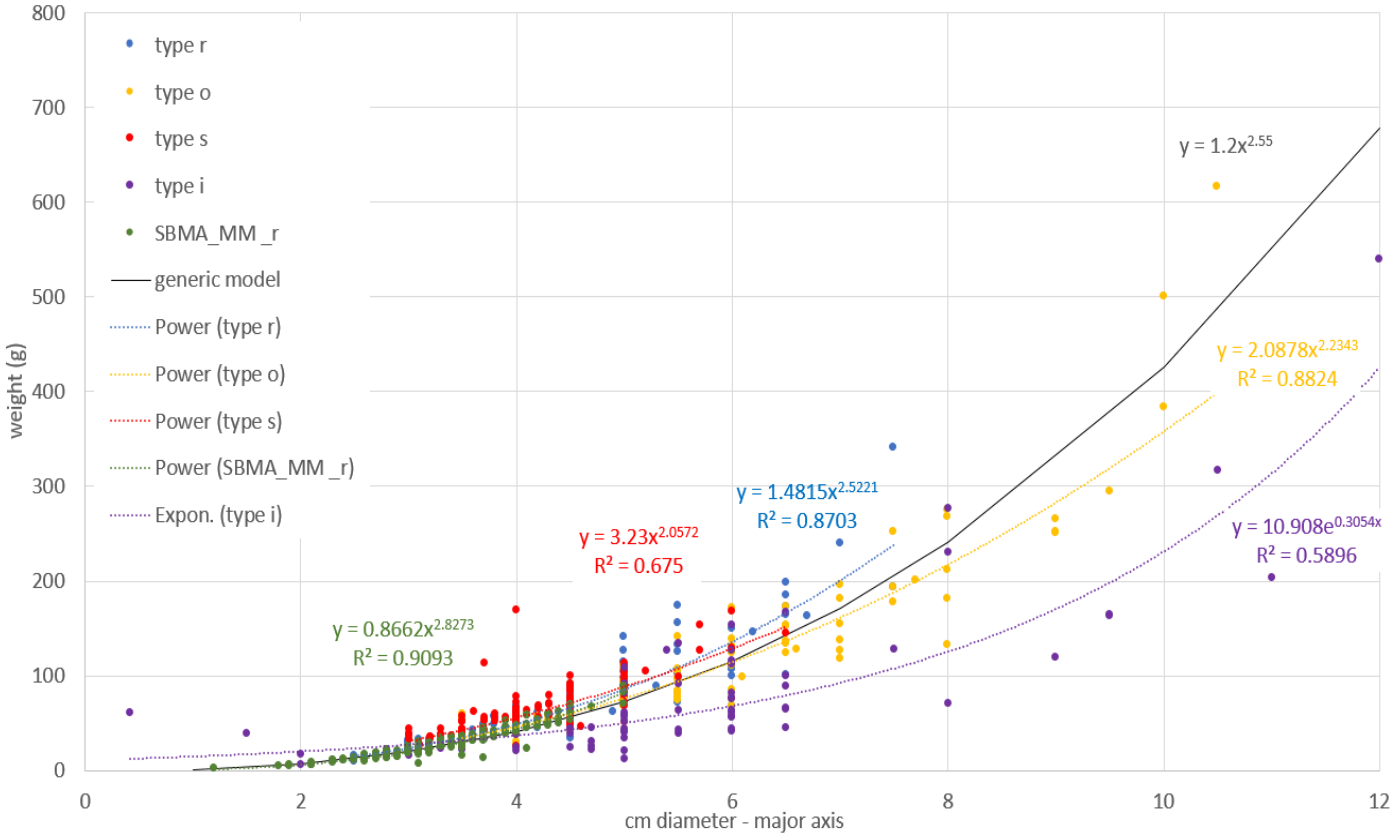


Funded by UK:
Department for Environment Food & Rural Affairs

First samples being processed for metagenomics and metabolites, integration planned with forthcoming exploration work

Nodule size-weight relationship from photographs

- In some cases, using photos offers more cost effective and environmentally friendly sampling
- While this has been known since the 1970s, we have demonstrated much more precisely where and how we can use images of nodules to estimate their weight and thus abundance
- Special thanks to JICA/MMAJ, CISR and Moana Minerals



Cook Islands SBM Exploration Programme by numbers

22 expeditions between 1974 and 2007

3 exploration licence holders

5 years exploration licence term

10 SBMA staff

8 Govt agencies in SBM WG

Over 20 partner experts and institutions

30 years since the seabed area was last systematically explored

$193m combined expenditure

$143m by licence holders to undertake exploration surveys, studies, assessments

$27m injection into the local economy during exploration phase

$1.2m combined annual licence fees over 5 years. SBMA mainly govt funded.

Over 60 expedition legs planned over the next 5 years

Exploration activities regulated by:

4 primary Acts

3 subsidiary Regulations

13 Standards and Guidelines

254,654 km^2 out of 1,969,900 km^2 of EEZ issued for exploration

13% of EEZ to be systematically explored

Call to researchers

- Considerable fundamental work needs to be done
- Barrier to entry for independent researchers is being lowered
- Two vessels to be based in the Cook Islands will be available for MSR (reduced mob/demob)
- Research permit process under review to expedite applications, especially for short programmes

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Results

Codes	Abyssal Plains etc	Volcanic Chains etc	Plateaux etc
Very low	1A	1B	1C
Low	2A	2B	2C
Moderate	3A	3B	3C
High	Not present in CI EEZ+ECS		

% of EEZ+ECS	Abyssal Plains etc	Volcanic Chains etc	Plateaux etc
Very low	26%	7.9%	0.39%
Low	20%	7.9%	14%
Moderate	12%	2.1%	10%

% HMZ under EL	Abyssal Plains etc	Volcanic Chains etc	Plateaux etc
Very low	32%	0.24%	17%
Low	11%	0%	0%
Moderate	0%	0%	0%