2018 May 27 -30, Quindao, China

International Workshop

of the REMP for the Cobalt-Rich Ferromanganese Crust in the Triangle Area in the northwest Pacific Ocean

Major Factors influencing Seamount Niches

Tomohiko Fukushima

Japan Agency of Marin-Earth Science and Technology
(JAMSTEC)

Summary of this Presentation

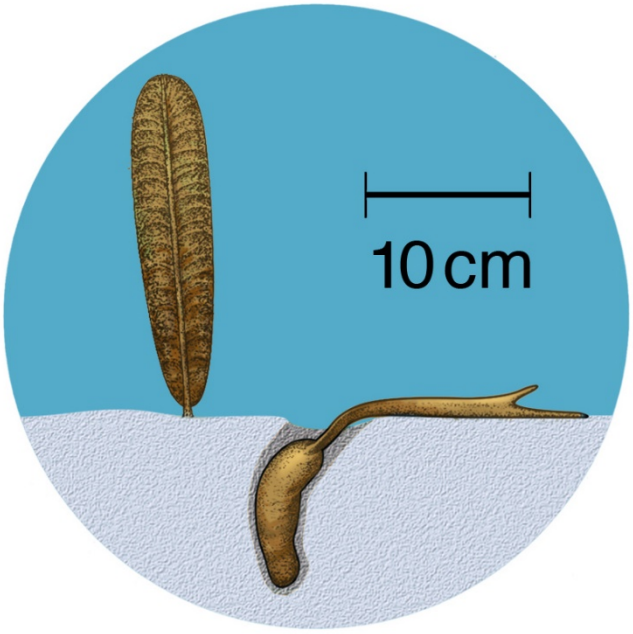
Main Topic is about “Distribution of Megafauna”.

Research has been done by the Metal Mining Agency of Japan (current JOGMEC), for the SOPAC (South Pacific Applied Geoscience Commission) in the areas of central and south Pacific Ocean.

An original purpose of this survey is to estimate quantity of mineral resources i.e. polymetallic nodules, polymetallic sulfide and cobalt-rich crust.

Results has been published in 2004 at an ISA workshop. However, in this presentation, a previous conclusion is partly changed, and add new consideration.

Megafauna



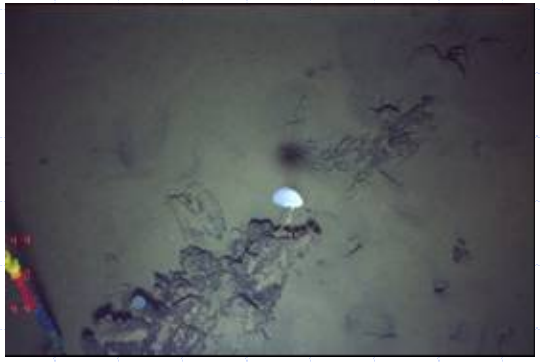
Animals large enough (larger than 2 cm) to be determined in photographs, proposed as key taxan for environmental impact assessment in deep sea mining. (ISBA/19/LTC/8)

Phylum: Porifera (Sponges)

Eurete erectum (?)

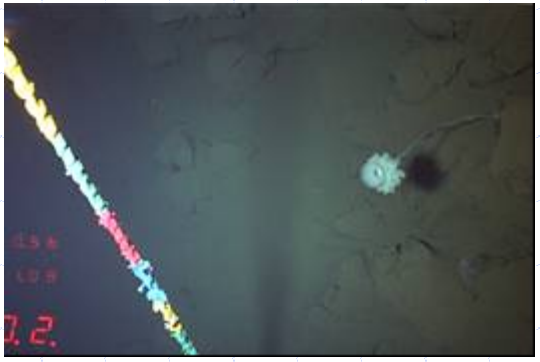
Hyalonema sp

Semperella sp.



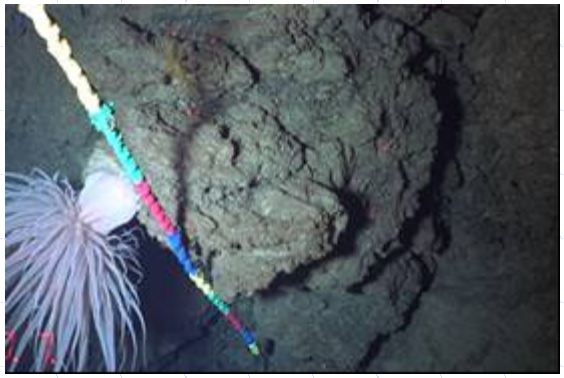
Caulophacus cf. elatus

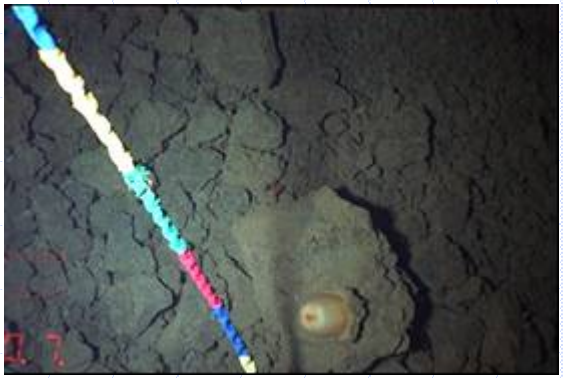
Sericolophus sp. (?)



Hyalonema sp

Phylum: Cnidaria
Class: Actinaria

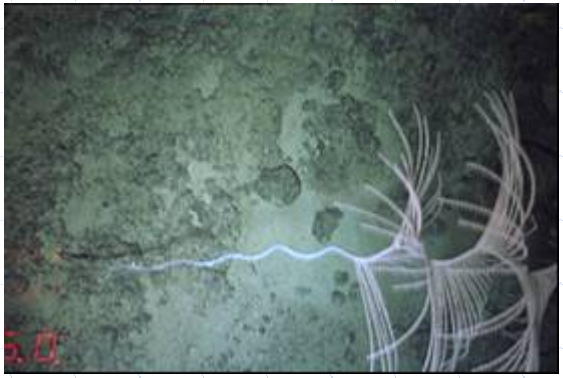




Phylum: Cnidaria
Class: gorgonacea

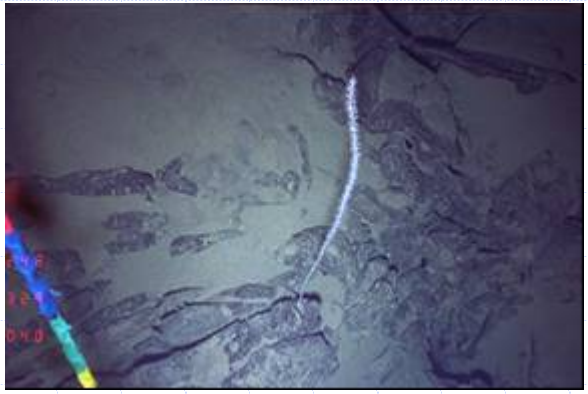
Acanthogorgia sp(?)

Calyptrophora sp (?)



Iridigirgia sp.

Phylum: Cnidaria
Class: Pennatulacea



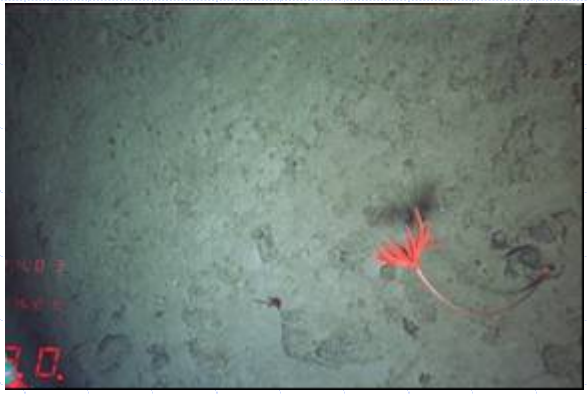
Ellisella sp.

Cirrhipathes sp (?)

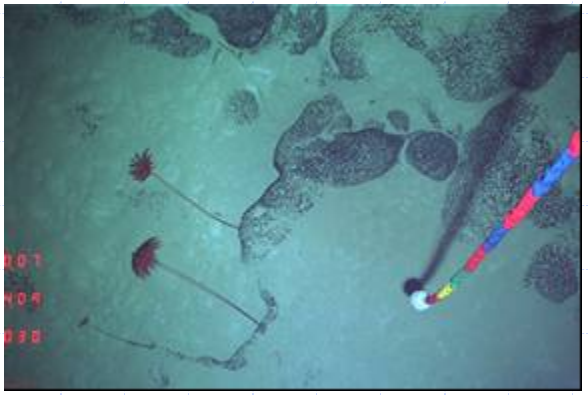
Virgularia sp.(?)

Results and Discussion

Phylum: Echinodermata
Class: Crinoidea



Proisocrinus sp (?)



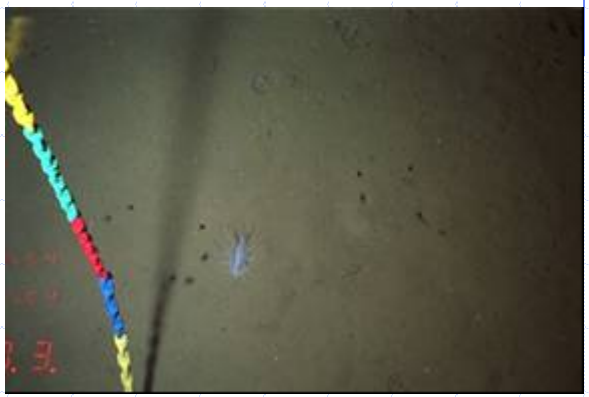
Proisocrinus sp (?)

Phylum: Echinodermata

Class: Holothuroidea

Benthodytes typica (?)

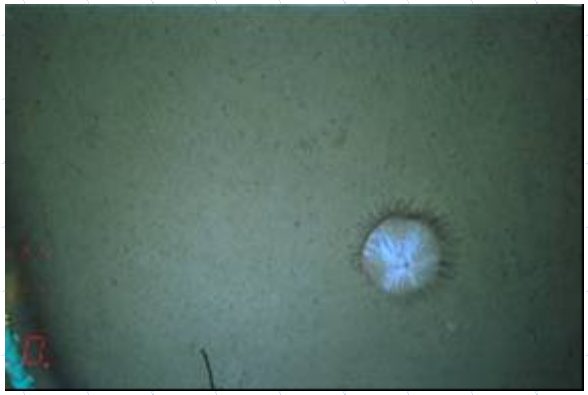
Benthodytes sp(1)



Synallactes profundi (?)

Phylum: Echinodermata

Class: Echinoidea

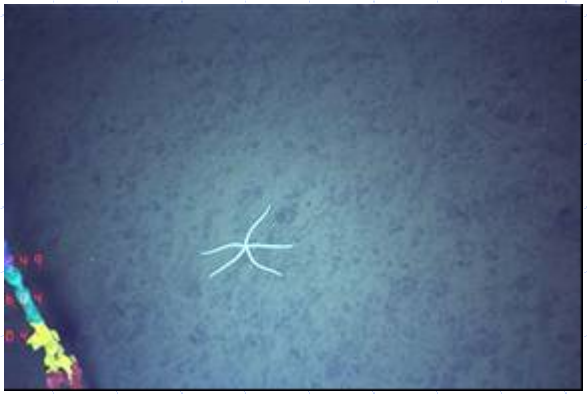


(burrowing sea urchin)

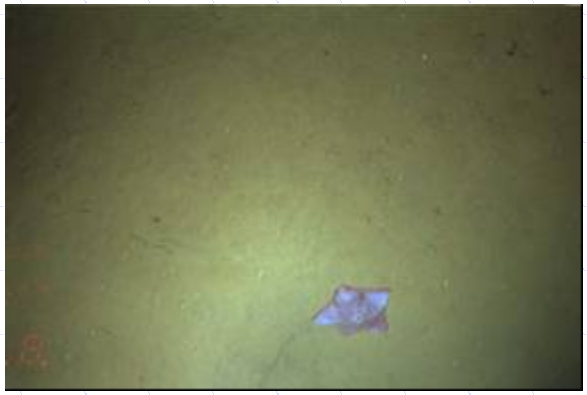
Phylum: Echinodermata

Class: Asteroidea (sea star)

Freyella sp (eight arms)



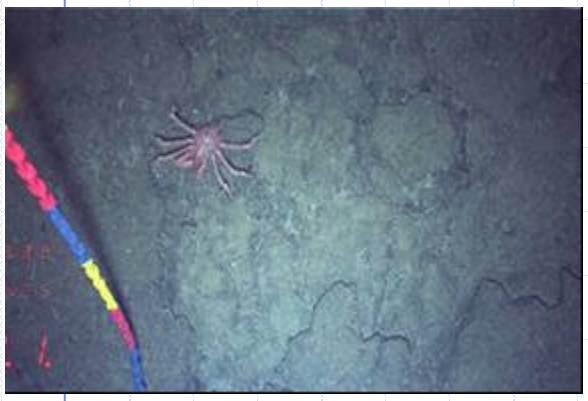
Freyella sp (five arms)



Hymenaster sp.

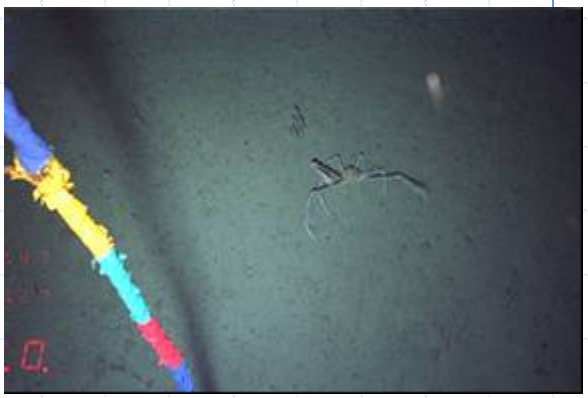
Phylum: Arthuropoda

Class: Crustacea



(galathelid crab :Anomura)

Aristaemorph sp. (Macrura)



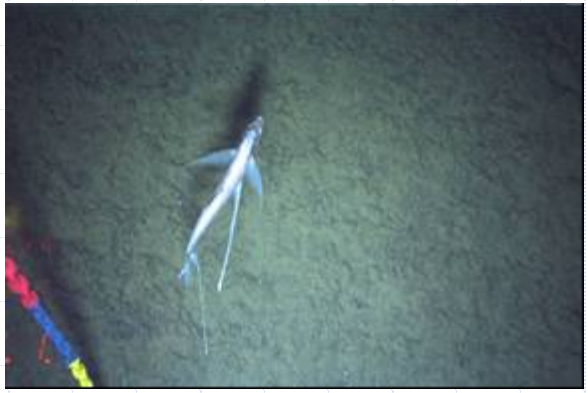
(Brachyura)

(galathelid crab :Anomura)

(Brachyura)

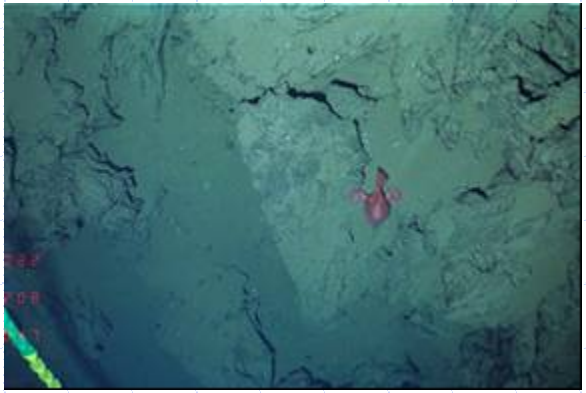
Phylum: Vertebrata

Class: Osteichthyes



Benthypteris grallator (Tripodfish)

Typhlonus nasus



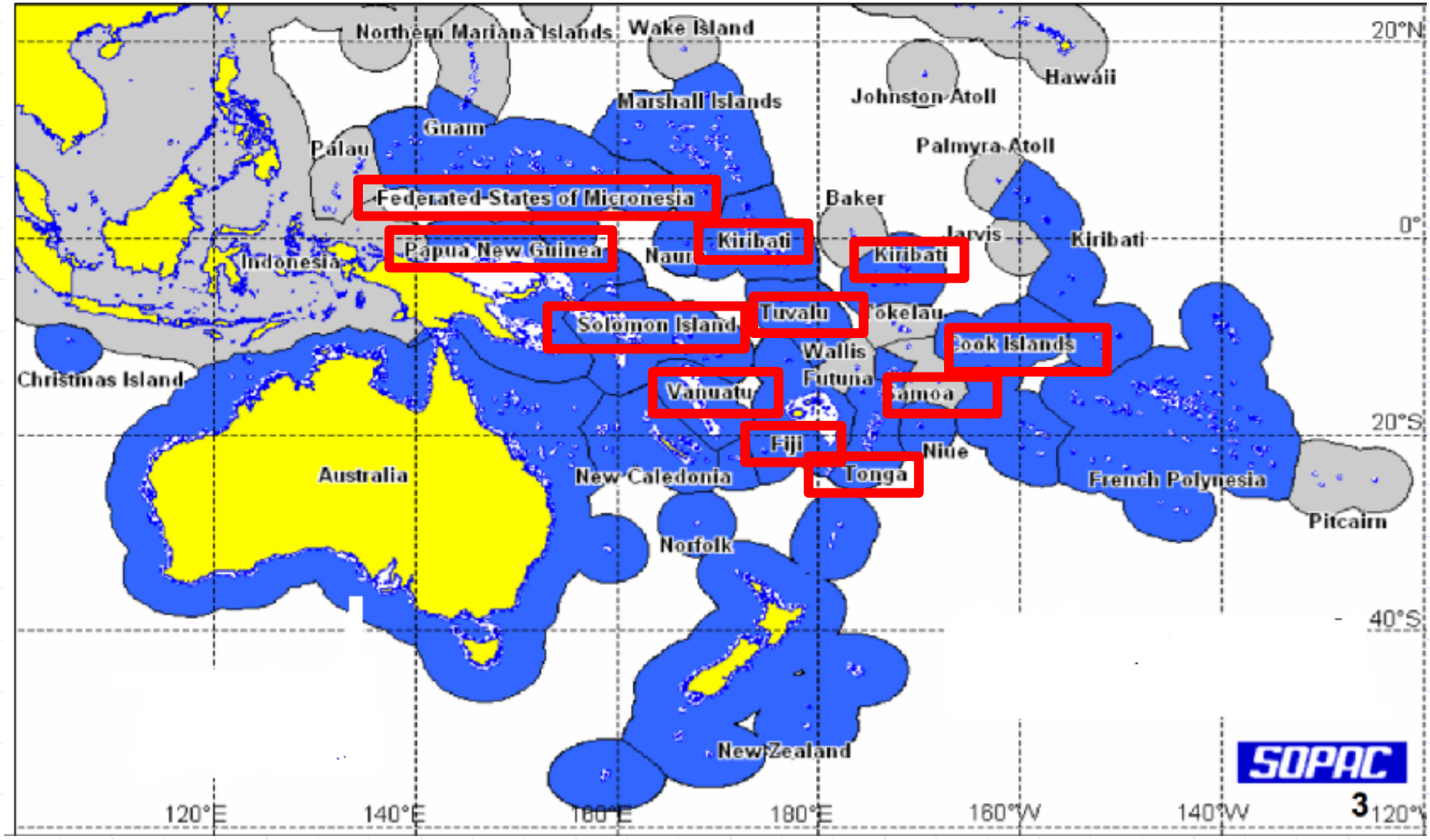
Others

Enteropneusta

Octopus (Mollusca, Cephalopoda)

(as Official Development Assistance survey for) SOPAC

At the request of Japanese government, the MMAJ has researched a potential of ocean mineral resources for SOPAC from 1985 to 2005. (deep-tow photographic data from 1985 to 1999 are used for this study).



(Survey for the SOPAC) ORIGINAL PURPOSE

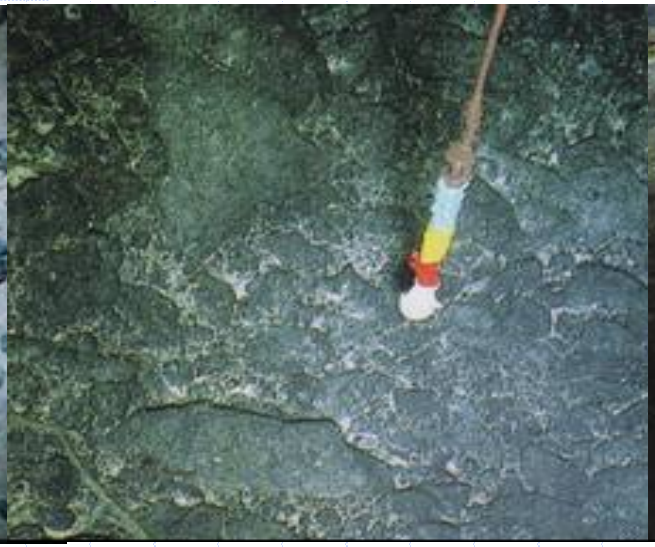
- **Original purpose is to estimate potential of mineral resources.**

Not for biological abundant place / certain animal

“Biological survey without bias”

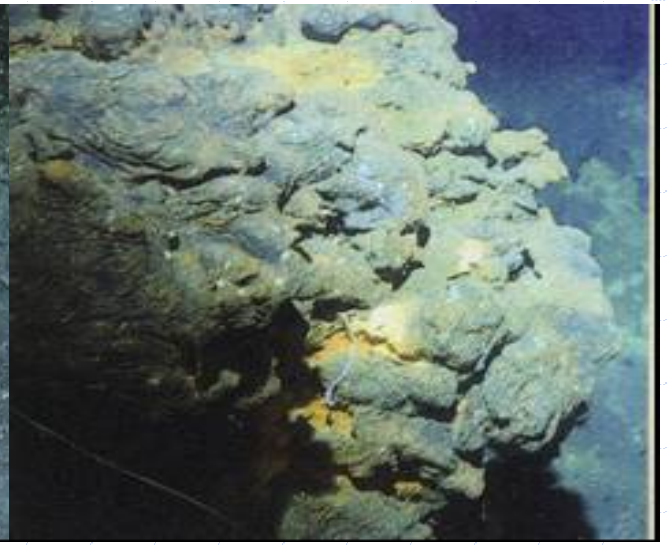
Manganese Nodules

(Metal Mining Agency of Japan)



Cobalt-Rich Crust

(Metal Mining Agency of Japan)

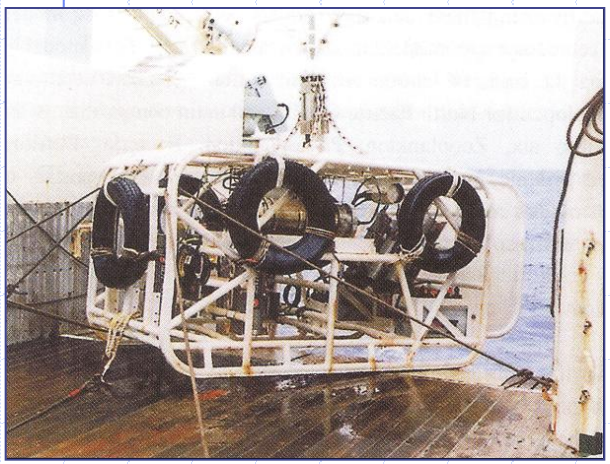


Polymetallic Sulphide

(Metal Mining Agency of Japan)

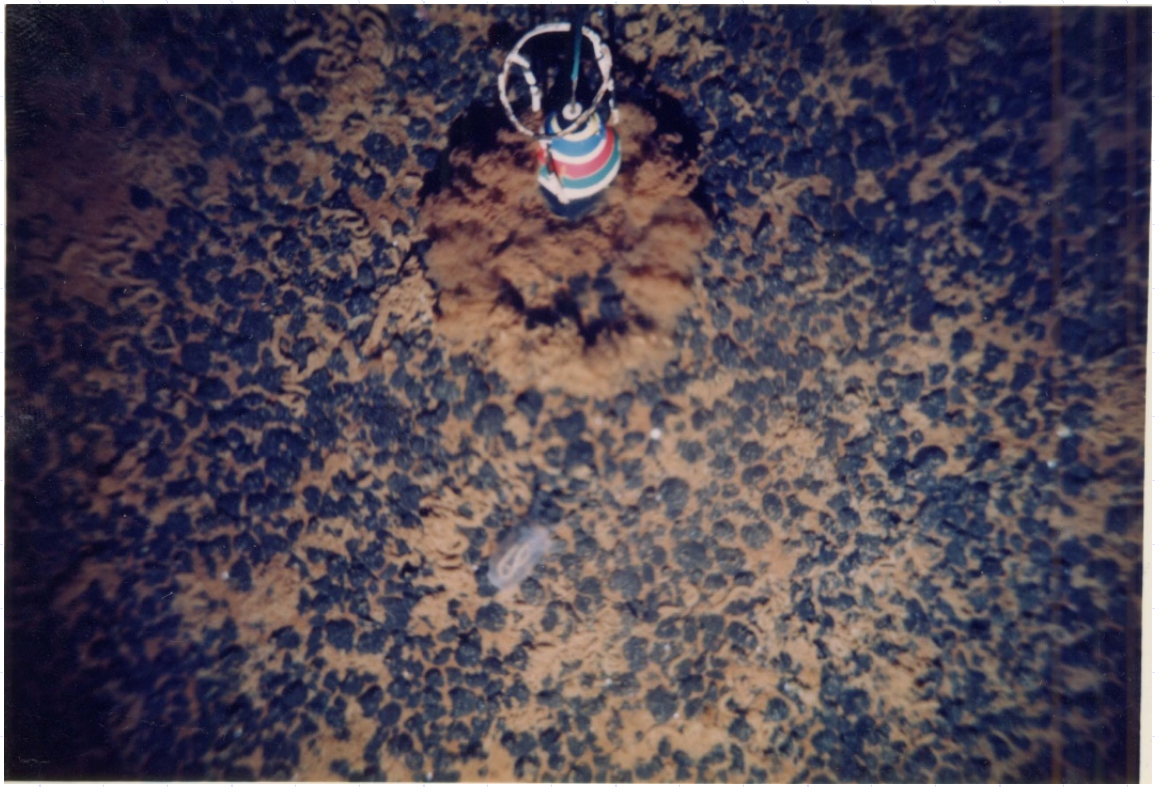
PHOTOGRAPHS

are taken along transect lines by a Deep-Tow (CDC)



3m

2m



CDC: Continuous Deep- Sea Camera System

PHOTOGRAPHS and COVERED AREA

	MN		CRC		PS	
Country	No. of Photo	(ha)	No. of Photo	(ha)	No. of Photo	(ha)
Kiribati	950	0.57	1,773	1.06		
Cook	794	0.48				
Tuvalu	73	0.04	753	0.45		
PNG					1,073	0.64
Vanuatu					2,560	1.54
Solomon					1,524	0.91
Tonga					1,736	1.04
Samoa			589	0.35		
RMI			3,428	2.06		
FSM			3,311	1.99		

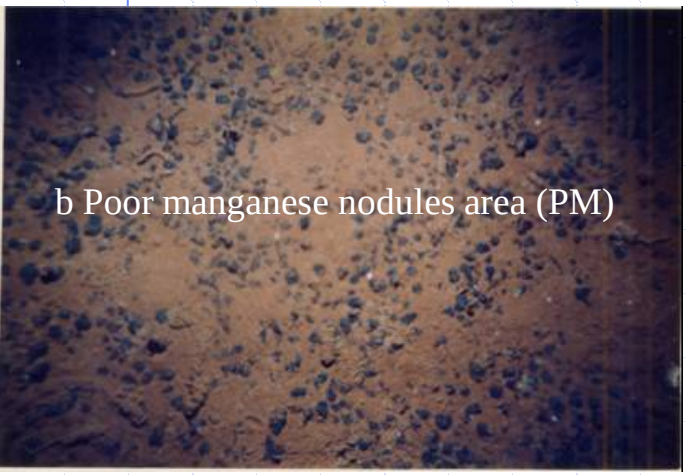
Covered Area (ha) = (3m * 2m) / 10000 * No. of Photograph

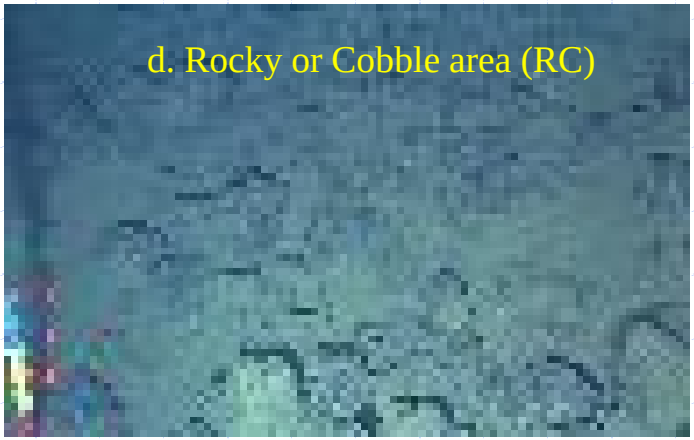
Number of Photo; 18562 (MN area; 1847, CRC; 9854, PS; 6893)

Coverd Area; 1.13 ha (MN area; 1.09, CRC; 5.91, PS; 4.13)

Still photographs data were Classified according to

SEABED Conditions



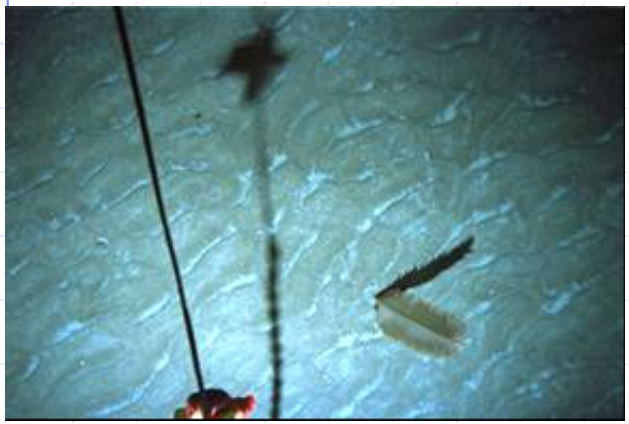


ORGANISMS data were Classified

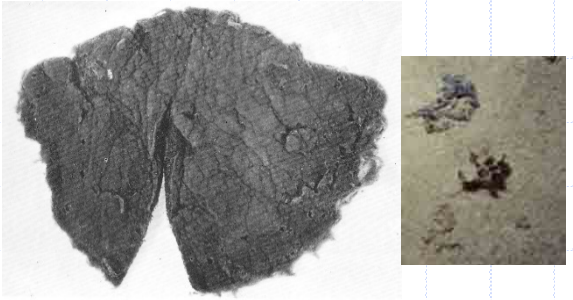
Countable or Uncountable

(quantitative or no quantitative)

Countable



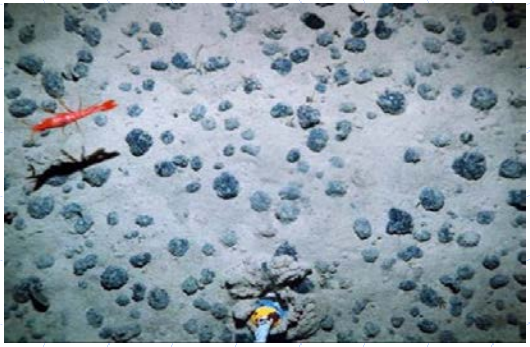
Uncountable



Xenophyophorea

Left: Tendal, 1972, Right: Blum, H.

Non-quantitative



Faster Motile fauna

ORGANISMS were sorted out by Feeding Types

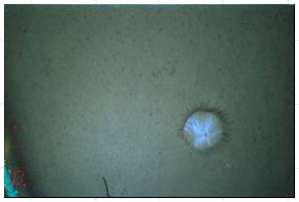
a. Suspension feeder:

Porifera, Cnidaria, Crinoidea, Ascidiacea



b. Deposit feeder:

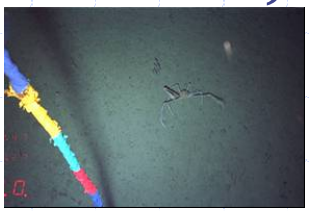
Holothuroidea, Echinoidea, Hemichordata


c. Others:

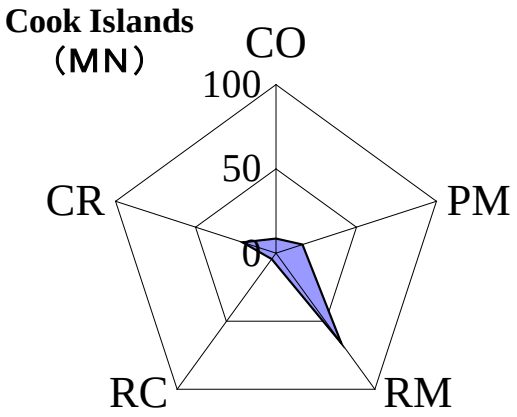
Photo from other area

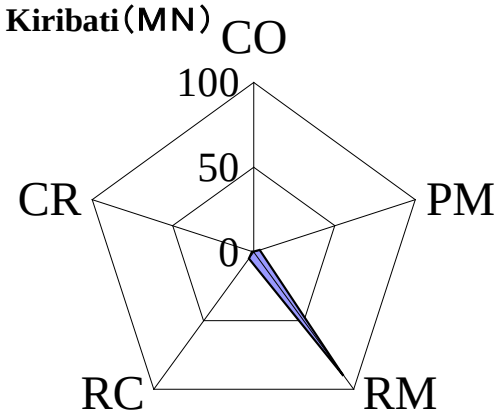
Annelida, Mollusca, Asteroidea, Ophiuroidea,

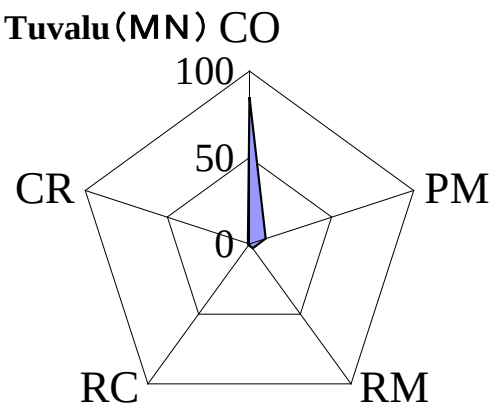



Results and Discussion

Seafloor condition in manganese nodules area



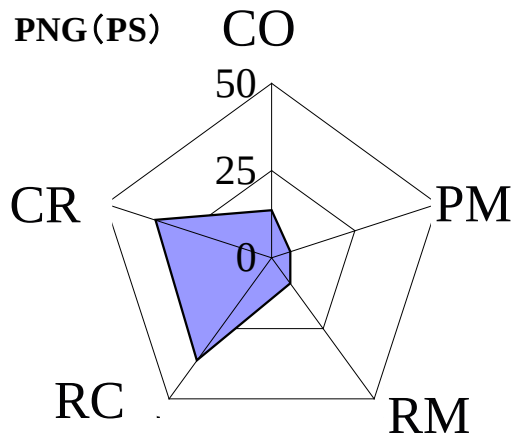




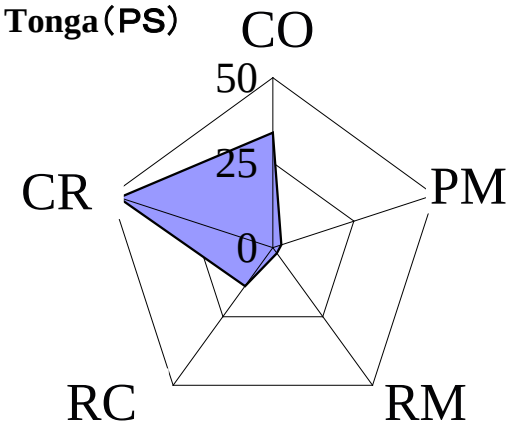
CO: Clay or ooze
PM: Poor manganese nodules area
RM: Rich manganese nodules area
RC: Rockey or cobble area
CR: Crust area

Seafloor condition in Polymetallic Sulphides area

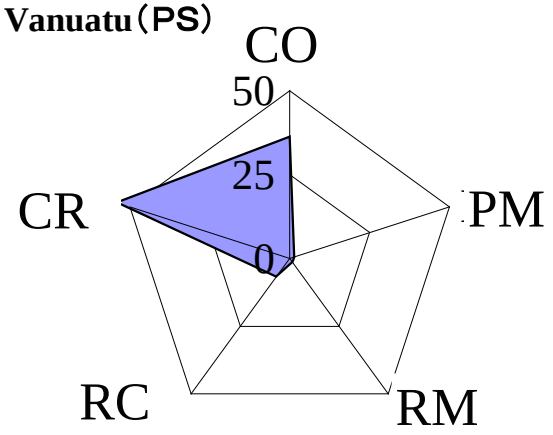
PNG（PS）



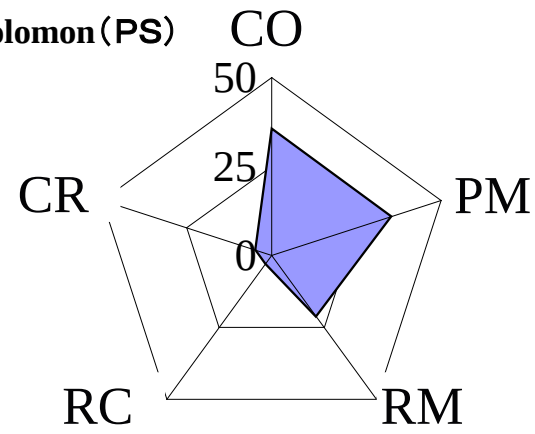
Tonga（PS）



Vanuatu（PS）



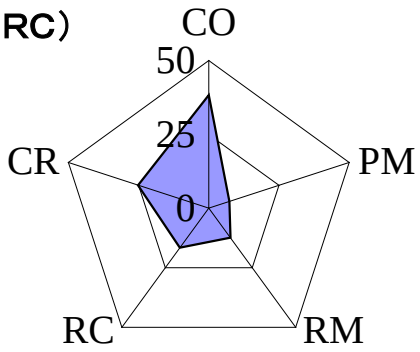
Solomon（PS）



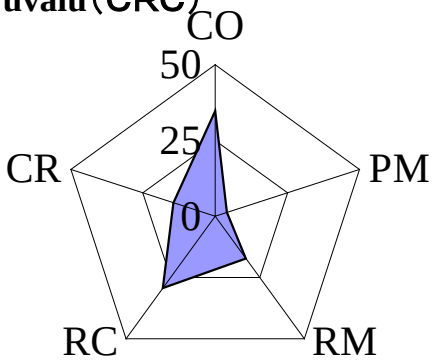
CO: Clay or ooze
PM: Poor manganese nodules area
RM: Rich manganese nodules area
RC: Rockey or cobble area
CR: Crust area

Seafloor condition in Cobalt Rich Crust area

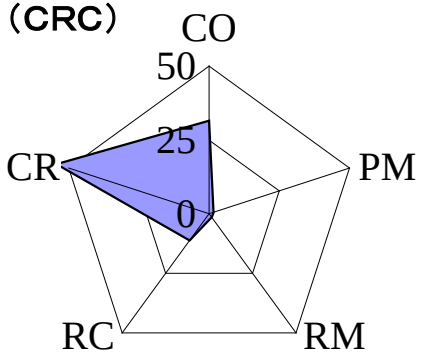
Kiribati (CRC)



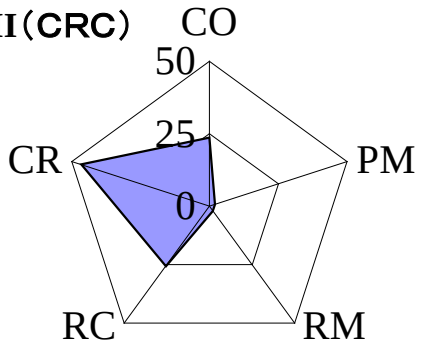
Tuvalu (CRC)



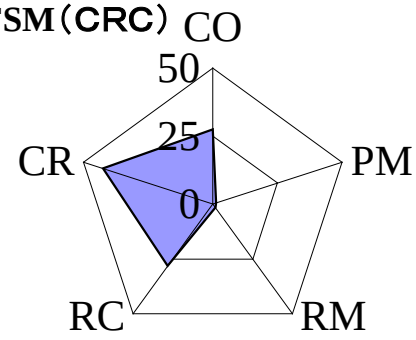
Western Samoa (CRC)



RMI (CRC)



FSM (CRC)



CO: Clay or ooze
PM: Poor manganese nodules area
RM: Rich manganese nodules area
RC: Rockey or cobble area
CR: Crust area

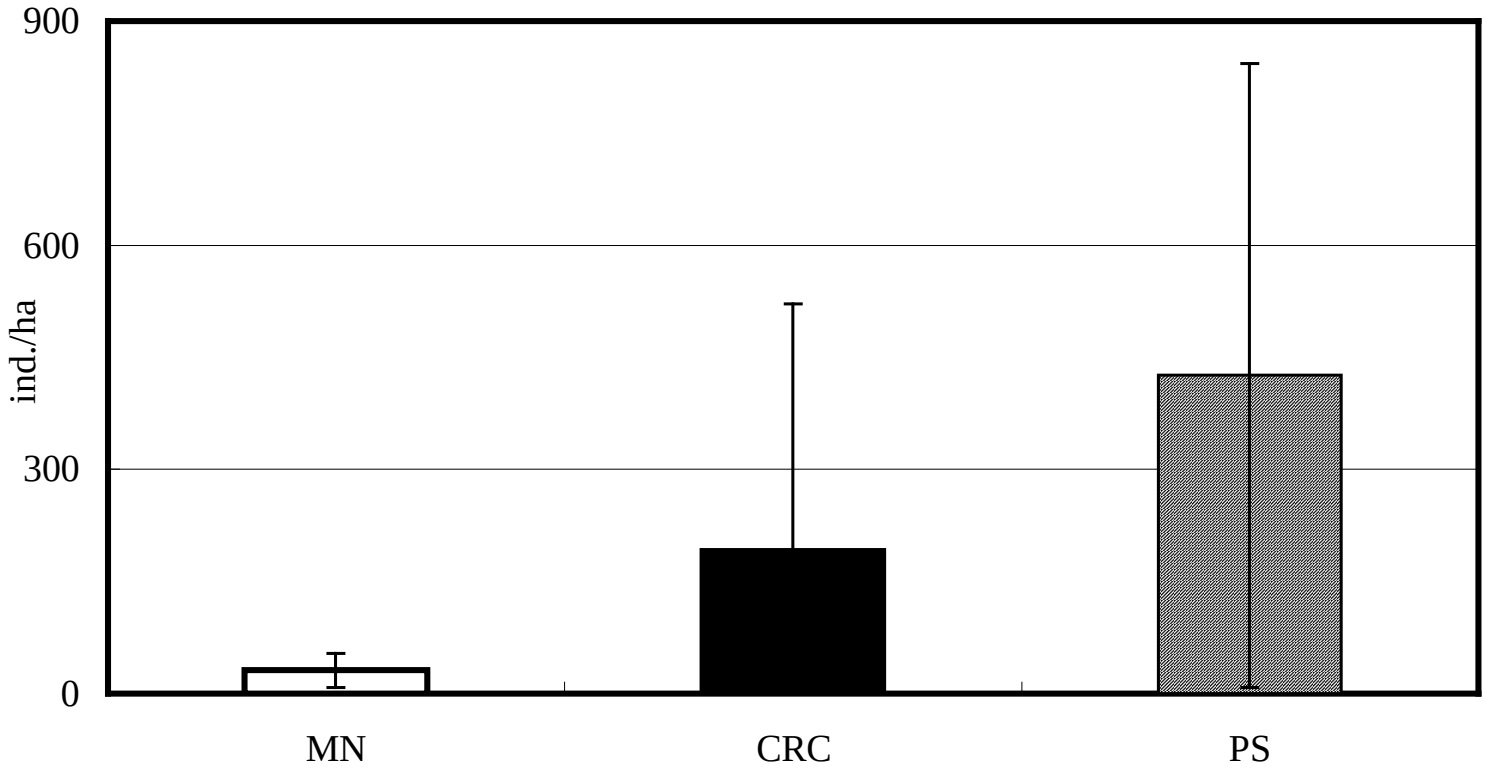
The most variety seafloor feature are observed in CRC

Faunae

	Phylum	Class	Order	MN	CRC	PS
1	Protozoa	Rhizopodia	Xenophyophores	○	○	○
2	Porifera	hexactinellida		○	○	○
3				-	○	○
4	Cnidaria	Anthozoa	Actinaria	○	○	○
5		Anthozoa	Gorgonacea	-	○	○
6		Anthozoa	Pennatulacea	○	○	○
7		Bryozoa		-	○	○
8	Annelida	Polychaeta		-	-	○
9	Mollusca	Decapoda		-	○	○
10	Echinodermata	Crinoidea	Comatulida	-	○	○
11		Crinoidea		○	○	○
12		Asteroidea		○	○	○
13		Echinoidea		-	○	○
14		Holothuroidea		○	○	○
15		Ophiuroidea		○	○	○
16	Arthropoda	Crustacea	Macrura	-	○	○
17		Crustacea	Anomura	-	○	○
18		Crustacea	Brachyura	-	○	○
19		Crustacea		-	○	○
20	Prochordata	Ascidiacea		○	○	○
21	Hemichordata	Enteropneusta		-	○	○
22	Vertebrata	Chondrichthyes		-	○	○
23		Osteichthyes		○	○	○

Compare to MN area, faunal diversity is rich in CRC

Abundance and Standard Deviation of Megafauna



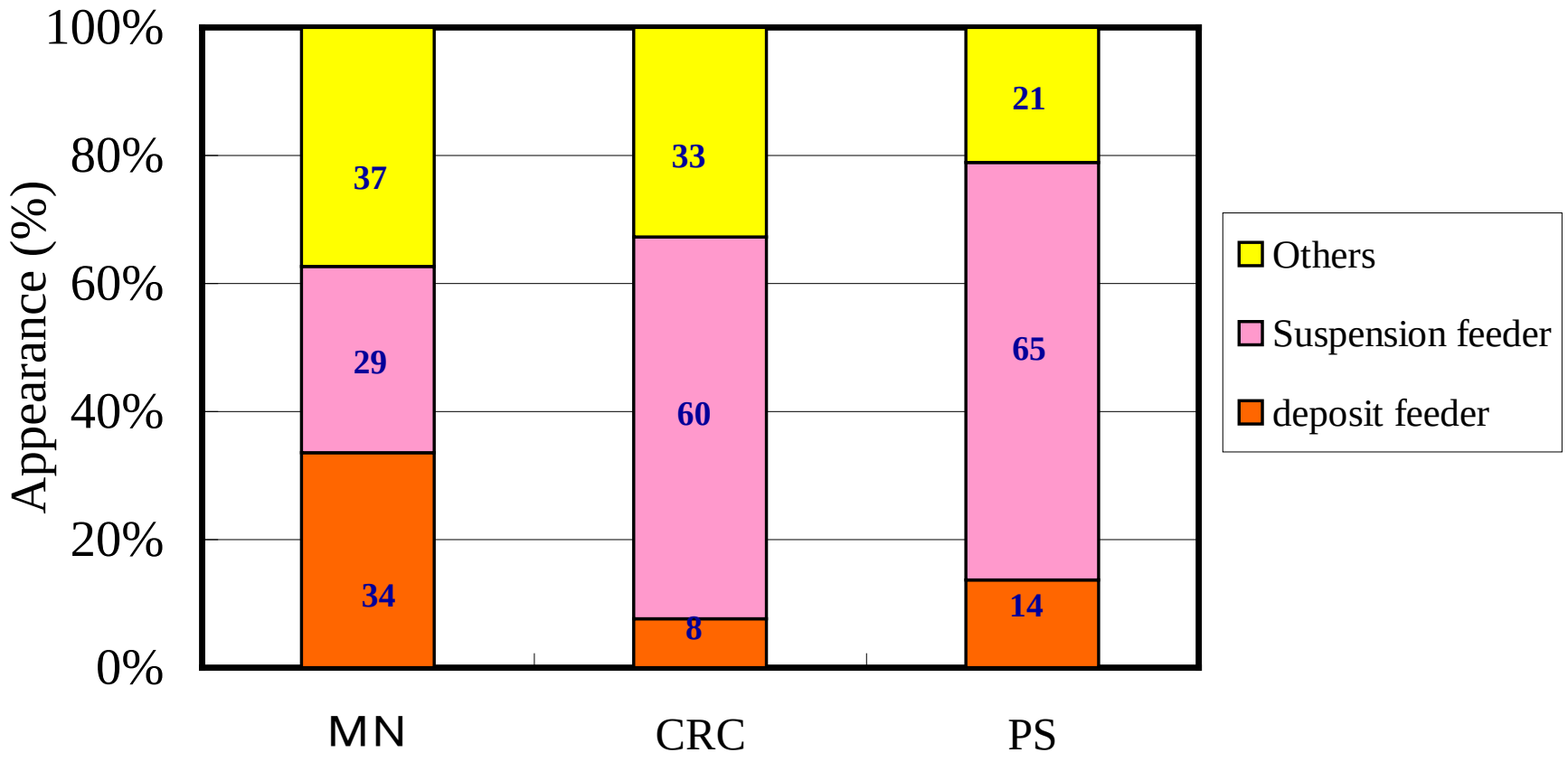
31±23 (inds±SD)

193±329 (inds±SD)

426±418 (inds±SD)

The ratio (SD/means) is the highest in CRC

Ratio of Feeding Type



Percentages of suspension feeder is the highest in the CRC

Result Summary

parameters	MN	CRC	PS
habitat condition	monotonous	diverse	diverse
faunal diversity	lower	higher	higher
Suspension feeder	poor	abundant	abundant
abundance	poor	midium	rich
SD/means ratio	small	large	large

habitat condition was determined by conditions of seafloors

faunal diversity was determined by the number of faunal group

S/D ratio: Ssuspension feeders / Deposit feeders

Comparison between CRC, and MN and PS area

Sea bottom conditions in CRC area are diverse (Clay, Ooze, Crust and Nodules). It can be speculated that the diversity reflects large variations of megafauna abundance (larger SD). (= diversity of habitat / diversity of organisms)

Large heterogeneity of abundance and larger faunal diversity suggest that target of the environmental evaluation need to be diverse (variety of evaluation target for EIA are exist).

Seamount is a three-dimensional topography, and complex water flow exist. Therefore distributions of suspension feeders are influenced by current velocity and direction (water flow and suspension feeders are closely related)

SCENARIO

If a mining is done, the topography will change, and accordingly the direction and velocity of water flow may change.

As a result, the place where the sediments are blown up may be changed / the place barely rocky are may be buried by sediment (= habitat change).

Also, the feed supply route to the suspension feeder may change.
(= change in water flow means feed supply route may change).

This is one of the imaginable influence scenario.

ANSWER

Major Factors influencing Seamount Niches

Although limited research results, change of current direction and velocity, that is accompany with mining activity, is speculated as one of major influencing factors in the CRC area.

However, considering that the variability of megafauna distribution is large, various evaluation targets are necessary. That is also features of CRC.

Thank you

for your kind attention