Miocene coral reef ecosystems in South East Asia

Nadia Santodomingo
Palaeontology Department

Supervisors:
Dr. Ken Johnson (NHM)
Dr. Lucas J. Lourens (UU)

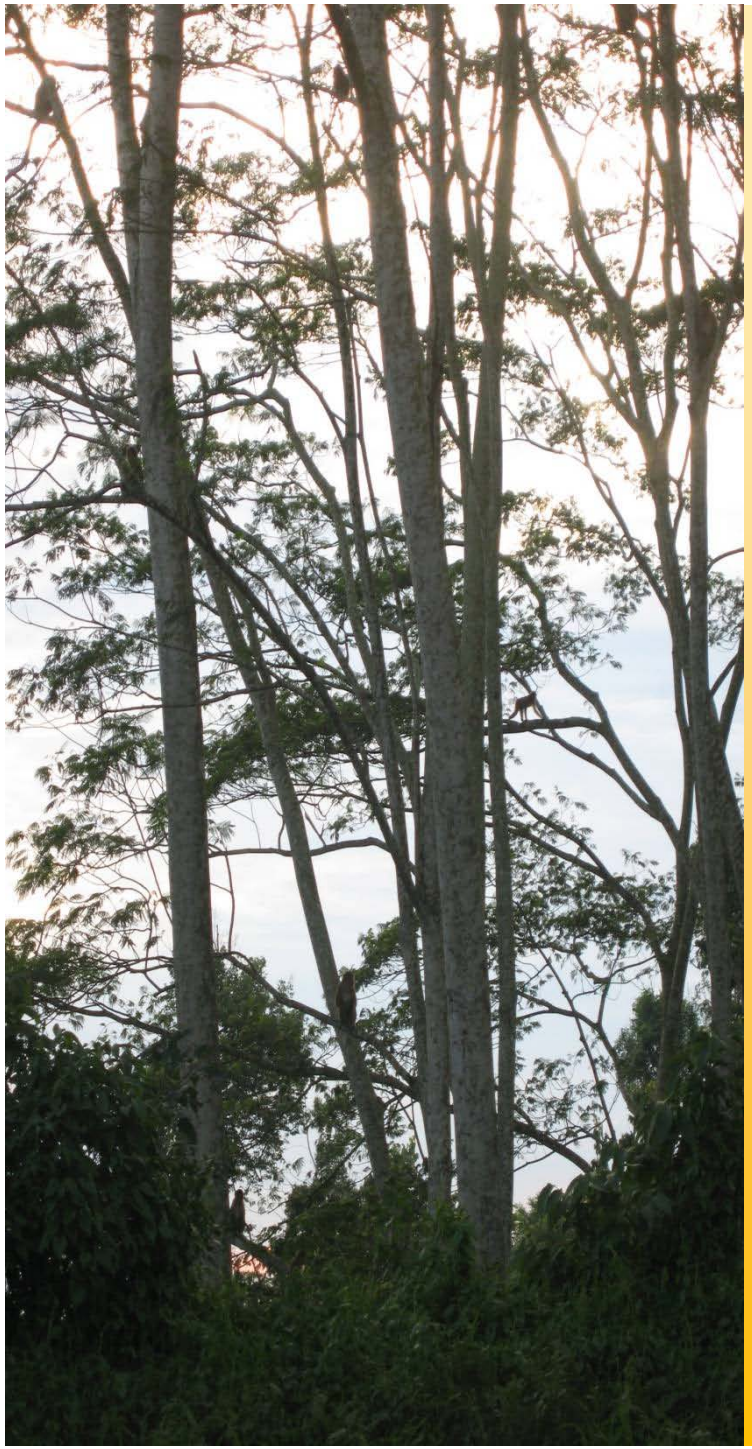
NATURAL HISTORY MUSEUM

Universiteit Utrecht

THROUGHFLOW

MARIE CURIE ACTIONS

SEVENTH FRAMEWORK PROGRAMME



Contents

- Objectives
- Fossil Data baseline
- NTA-2: Field trip
- Role in TF
- Future plans

Objectives

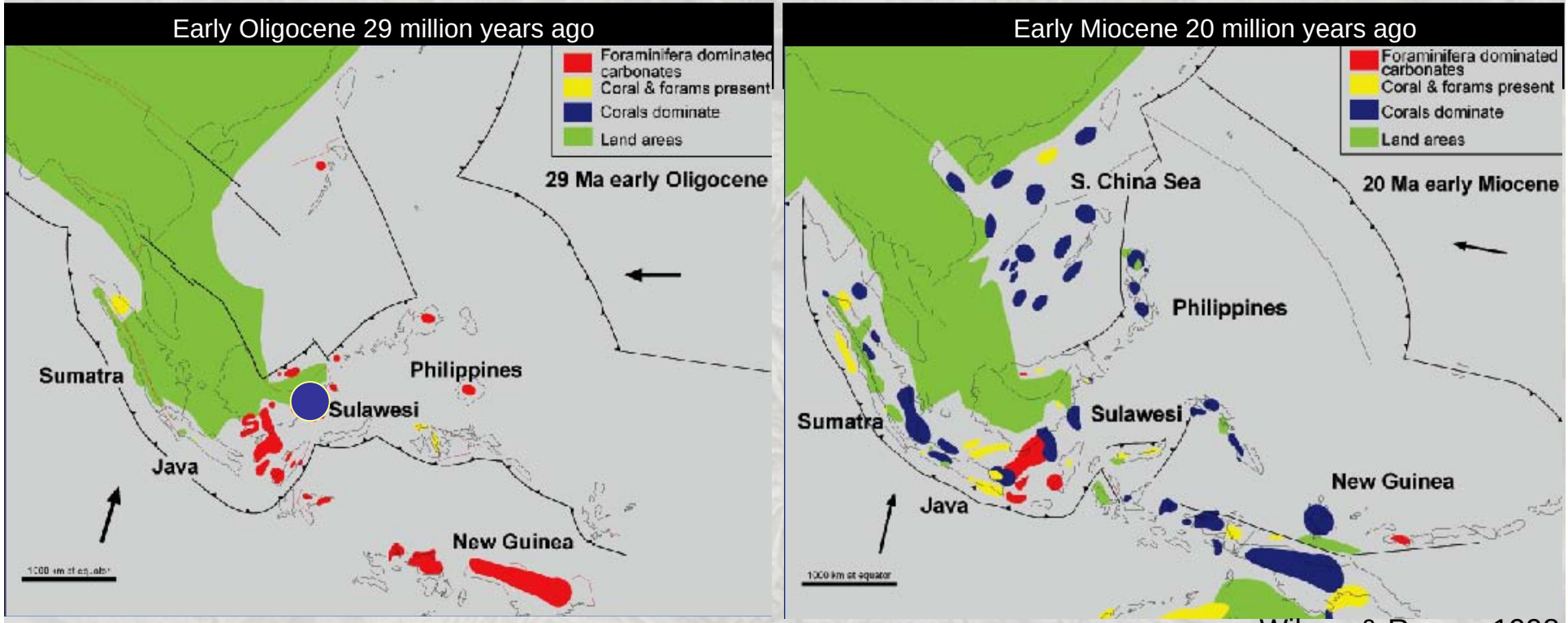
1. To identify the biodiversity of Miocene coral assemblages in SE Asia (East Kalimantan). Recent vs. Extinct ?

2. To infer the palaeoecology of Miocene reef environments in SE Asia. Integration with other PhD students.

3. To study the taxonomy, systematics, and evolution of a “target” Scleractinian taxon, i.e. Agariciidae, *Pachyseris*.

Fossil corals: Data baseline

Coral Reefs in SE Asia first appeared in Early Miocene



Wilson & Rosen, 1998

Forams

Corals

Coral Reefs in SE Asia first appeared in Late Oligocene

Sabah (NE Kalimantan): Kinabatangan area

LBF+Nannofossil+$^{87}Sr/^{86}Sr$: 28.8-27.6 Ma : Rich fossil coral community (100 morpho-spp)

McMonagle et al., 2011

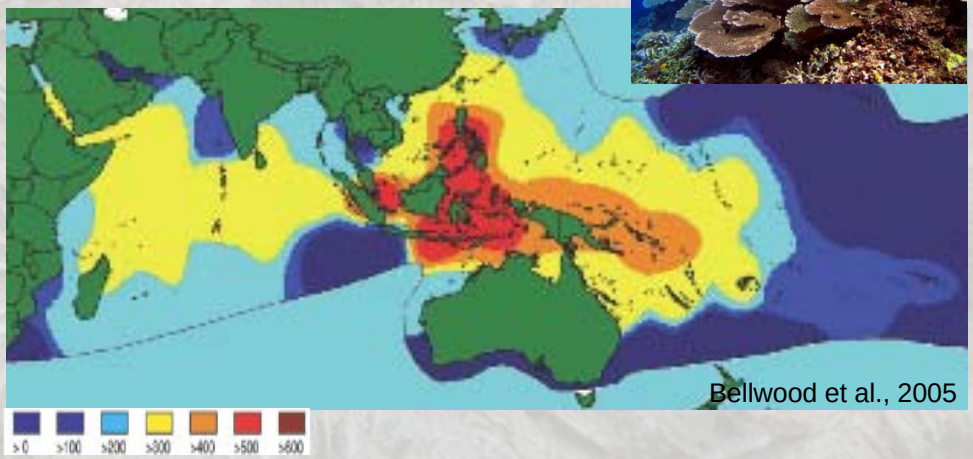
Fossil corals: Data baseline

Coral triangle:
Origin of marine diversity?

Centre of speciation
Fossil species can/cannot be extinct

Centre of overlap
Modern fauna = fossil fauna Java+Kalim +Sulawesi+Papua → diversification

Centre of accumulation



Bellwood et al., 2005

Centre of survival
Modern fauna= Many fossil species +
→ diversification

Hoeksema, 2007

Fossil corals: Data baseline

Martin, 1880 - 1888 (F.W. Junghuhn)

Felix, 1913-1925

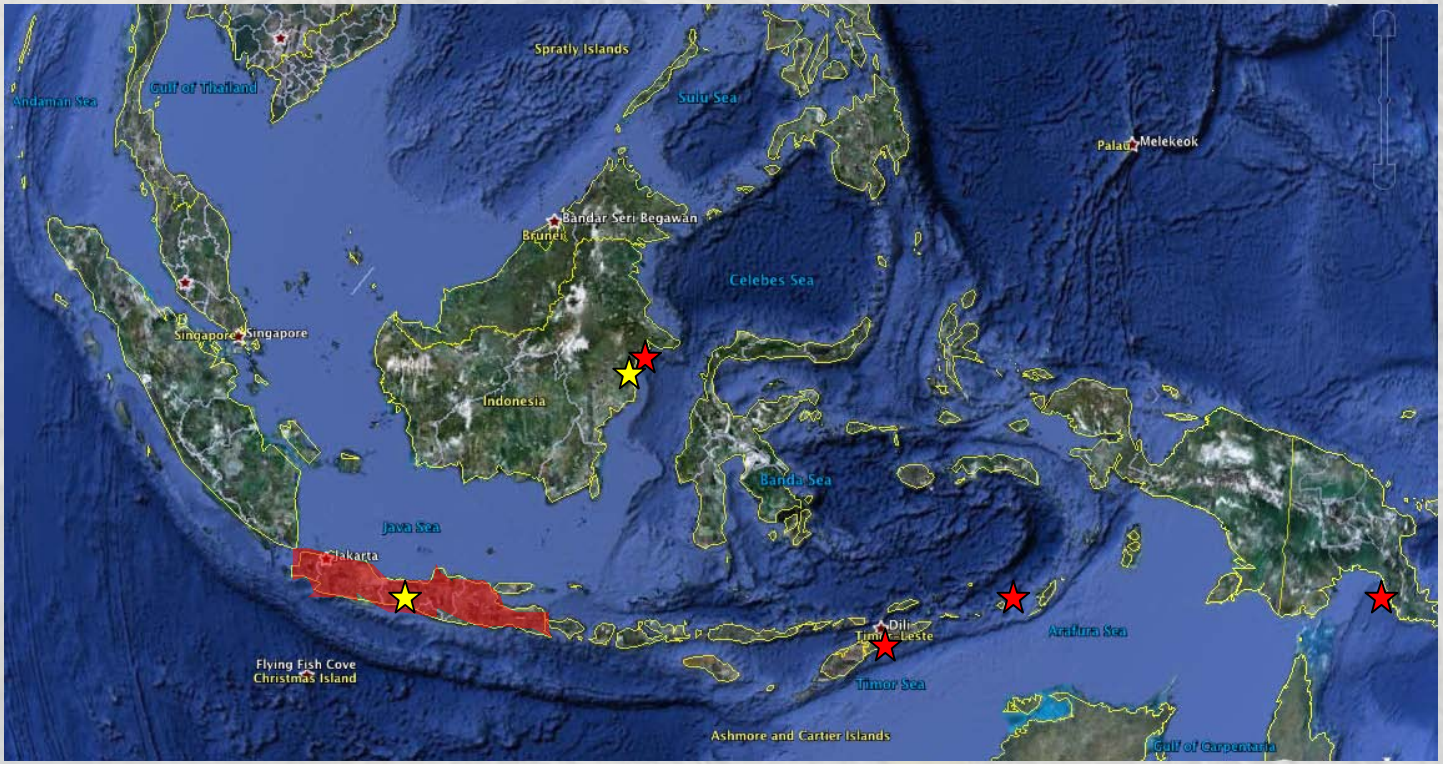
Gerth, 1931-1965

Umbgrove, 1924-1950

Veron & Kelly, 1988

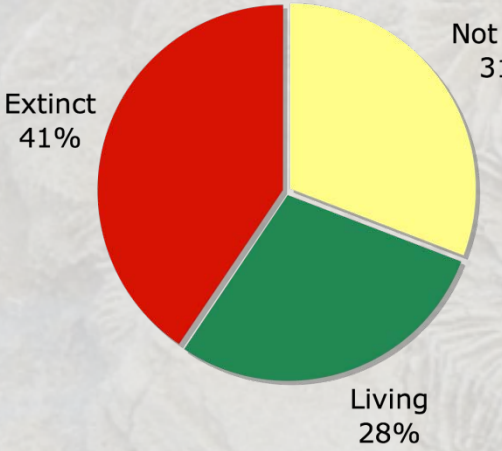
Hoeksema, 1989 (Fungiidae)

This project Johnson & Renema, 2009-2010



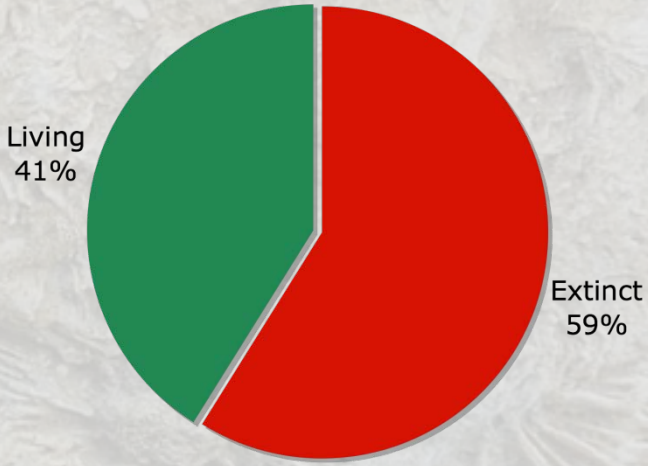
Fossil corals: Data baseline

436 usages

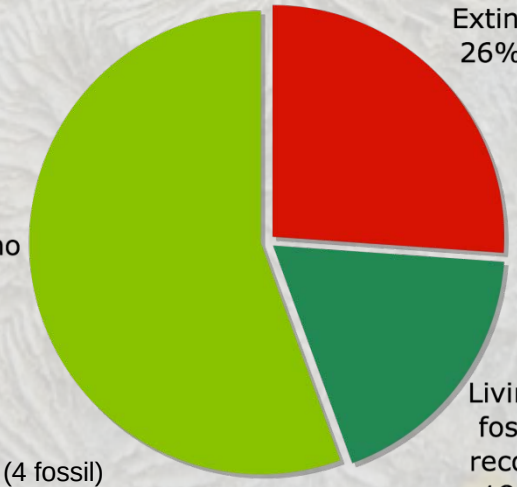


Spelling	22
Split	2
Taxonomic 1	74
Taxonomic 2	36
Re-identification	1

301 valid species



Coral Triangle Diversity: ~ 500* + 177 extinct (Tertiary)



~ 376 spp

Acropora ~100 spp ** (4 fossil)
Montipora ~50 spp (2 fossil)

*Hoeksema, 2007
** (Wallace & Rosen, 2006)

Fossil corals: Study material

East Kalimantan
127 samples
221 sampling bags

Java
114 specimens
9 families
20 genera
Early Burdigalian

NTA-2: Field methods

Stratigraphy
Identification of units with corals: mostly platy corals

Photo-transects: comparison of coral features (ratio w/h), spp

Sampling of coral specimens

Transects TF153

Transects TF59

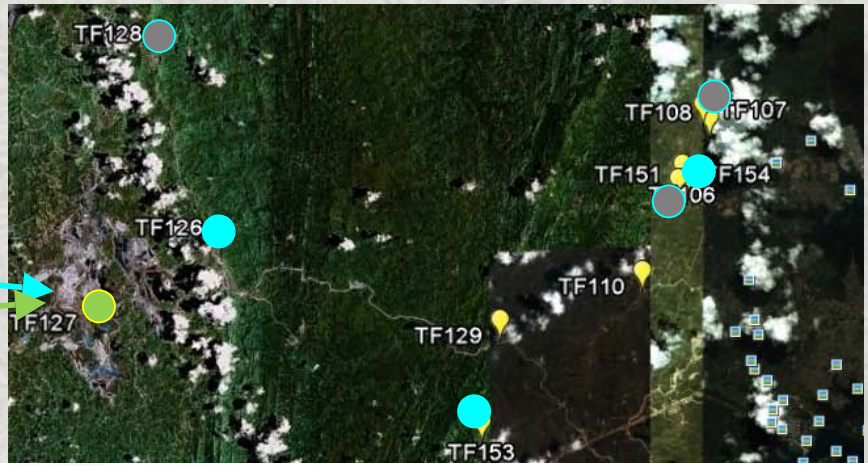
SAMARINDA

THROUGHFLOW

		5.332
Miocene	Messinian	7.246
	Tortonian	11.608
	Serravallian	13.65
	Langhian	15.97
	Burdigalian	20.43
	Aquitanian	23.03
Oligocene	Chattian	28.4 ±0.1
	Rupelian	33.9 ±0.1

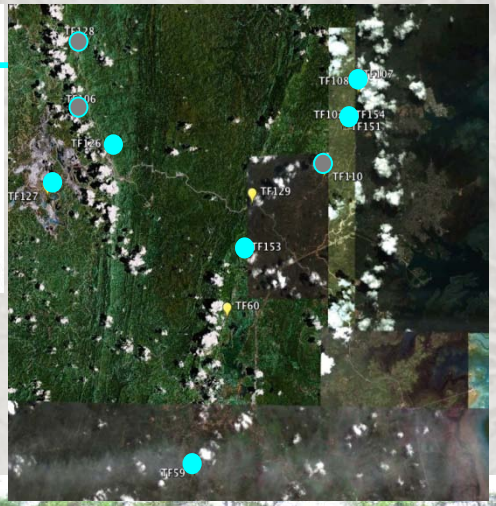
BONTANG

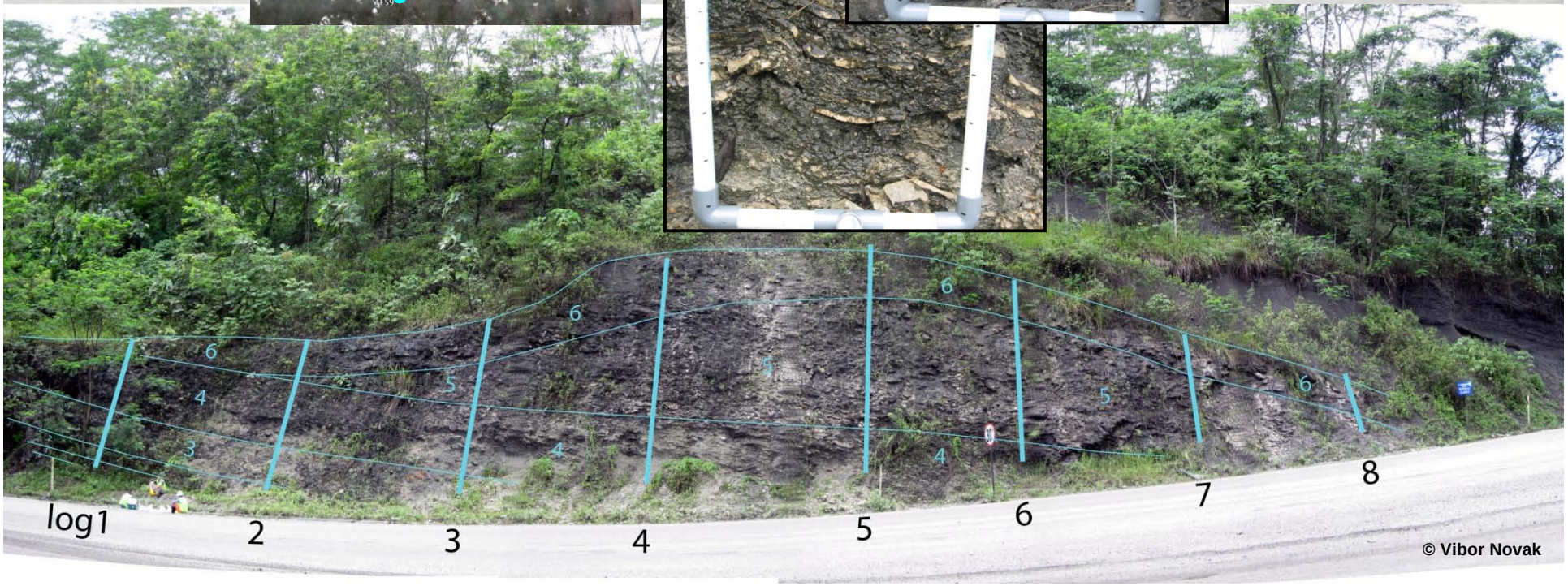
		5.332
Miocene	Messinian	7.246
	Tortonian	11.608
	Serravallian	13.65
	Langhian	15.97
	Burdigalian	20.43
	Aquitanian	

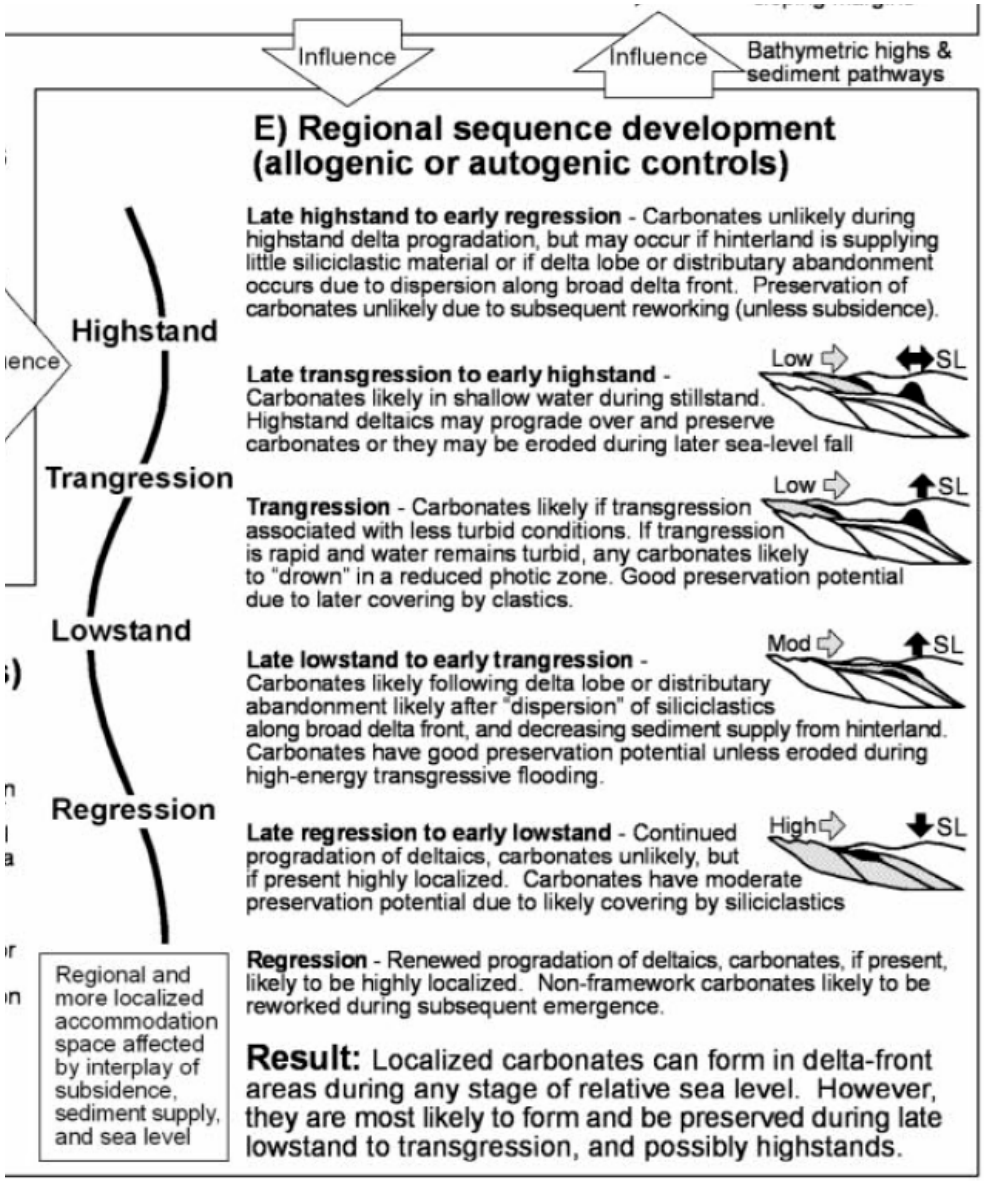


BONTANG

		5.332
Miocene	Messinian	7.246
	Tortonian	11.608
	Serravallian	13.65
	Langhian	15.97
	Burdigalian	20.43
	Aquitanian	23.03
Oligocene	Chattian	28.4 ±0.1
	Rupelian	







Delta-front Patch Reef

•Carbonates occur in areas of high siliciclastic input.

•Turbid-water reefs may have moderate to high biodiversity, adaption to turbid-waters.
- -mobility, heterotrophy,
- -morphology to capture light.

• Patch-reef development on soft substrates / shallow waters.

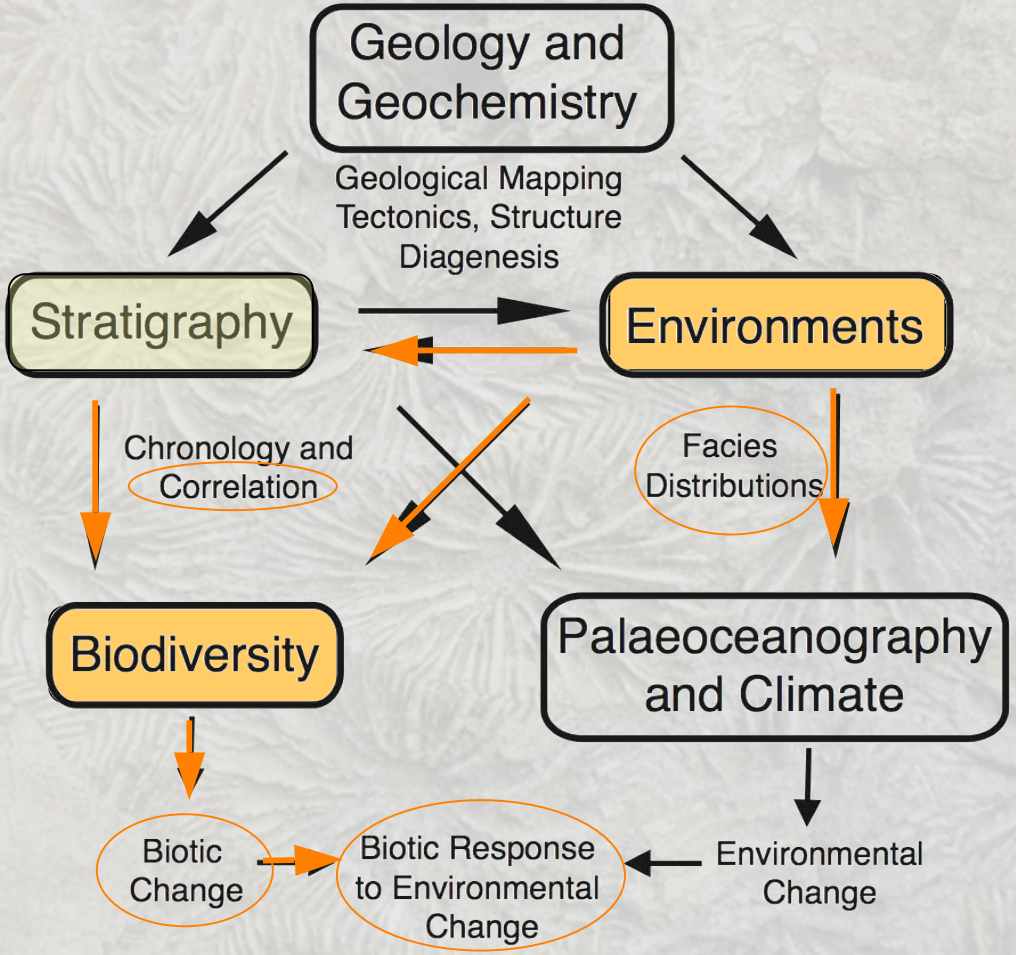
•Carbonate production and bioherm or patch-reef development may occur in turbid-water, delta-front areas as localized or more regionally extensive units during any phase of eustatic sea level.
Interplay of factors control carbonate development and preservation:
- Tectonics
- Eustasy
- Delta switching
- Currents
- Amount and size fraction of siliciclastic sediment

Wilson, 2005

Summary of the work accomplished

Section name	Latitude	Longitude	Code	No. samples	No. bags	Photo-transect	Colony forms	Sampling type
Top reef Stadion	-0.58573	117.11900	TF51	9	21	no	pl>br	St
Batu Putih 2	-0.46891	117.12127	TF52	8	13	no	pl>br	St
Badak	-0.32203	117.29750	TF56	15	31	unit 7	pl>ms>br	St
Top reef in Mine	-0.58467	117.11983	TF57	13	24	no	pl>br	St
AMP Km27	-0.01819	117.35292	TF59	5	10	unit 4	pl>ms>br	St
Batu Putih 1	-0.46626	117.12183	TF76	10	13	no	pl>br	St
Batu Cermen	-0.43234	117.13783	TF79	8	20	units 2,3,4	pl>ms>br	St
Coral-Mollusc clumps	0.16727	117.44348	TF102	19	19	coral clumps	br	St
NN	0.18897	117.44445	TF107	3	3	no	br>pl	St
NN	0.18528	117.44638	TF108	3	3	no	br>ms	Float
3D-Reef	0.15130	117.30438	TF126	12	23	units 4-5	pl>so	St
Monkey Section	0.20746	117.28673	TF128	1	1	no	pl>so	Float
The rooster's crest	-0.48119	117.11406	TF130	1	1	no	br	St
Molluscs	0.16723	117.43736	TF151	1	1	no	br	St
Rainy Section	0.09644	117.38037	TF153	4	6	unit 12	pl>br	St
Tridacna	0.16729	117.43973	TF154	7	19	units 3-4	br>ms	St
Millipede Hill	0.17145	117.28764	TF106	1	1	no	ms	Float
Badak II	-0.31000	117.39793	TF54	1	1	no	pl	Float
Top hill	- 0.47658	117.11658	TF77	4	6	no	ms	Float
NN	0.18732	117.47622	TF113	2	5	no	br>ms	Float
		Total	20	127	221	12		

Role in TF


Geology and Geochemistry
Geological Mapping
Tectonics, Structure
Diagenesis
Stratigraphy
Environments
Chronology and Correlation
Facies Distributions
Biodiversity
Palaeoceanography and Climate
Biotic Change
Biotic Response to Environmental Change
Environmental Change

Plans

While waiting for the samples…

1. Follow with the identification of Java's material. Visit to Leiden to confirm species. New records?

2. Revision of literature on geology / platy coral communities

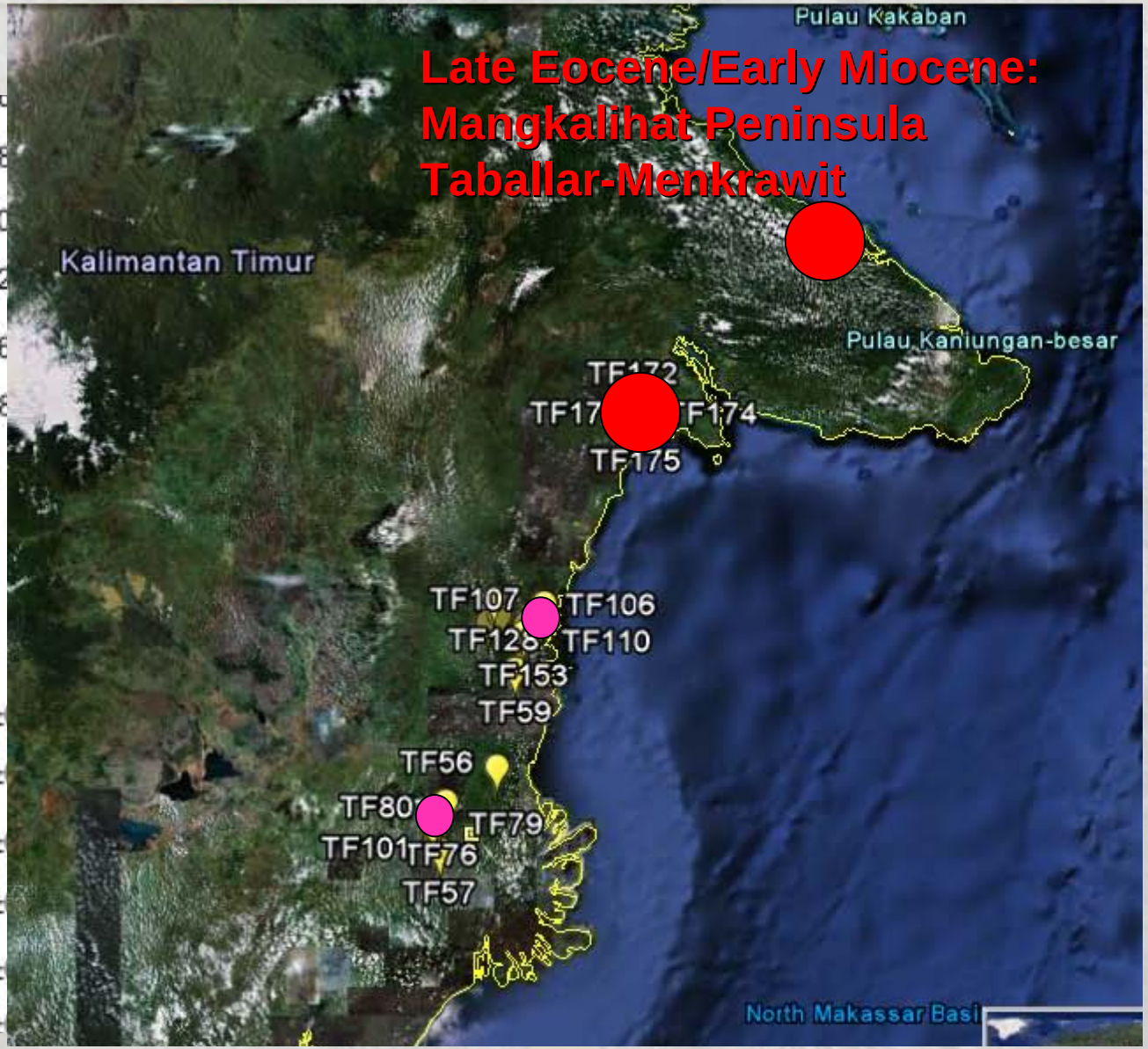
3. Preparation of presentation for the Fossil Cnidaria & Porifera Symposium

4. Collaboration on a paper based on museum occurrences

5. Registration to PhD at Utrecht University

Plans

Pliocene	Gelasian	2.588
	Piacenzian	3.600
	Zanclean	5.332
Miocene	Messinian	7.246
	Tortonian	11.608
	Serravallian	13.65
	Langhian	15.97
	Burdigalian	20.43
	Aquitanian	23.03
Oligocene	Chattian	28.4 ±
	Rupelian	33.9 ±
Eocene	Priabonian	37.2 ±
	Bartonian	40.4 ±
	Lutetian	48.6 ±
	Ypresian	55.8 ±




Questions?