

Cambrian coralomorphs: a brief review

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International Conference on Ediacaran and Cambrian Sciences

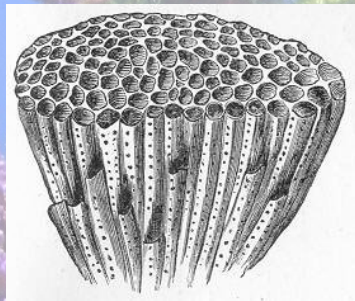
Mirinae Lee and Tae-Yoon Park

Division of Polar-Earth System Sciences, Korea Polar Research Institute



Corals?

- Class Anthozoa of Phylum Cnidaria
- Marine benthic & sessile organism



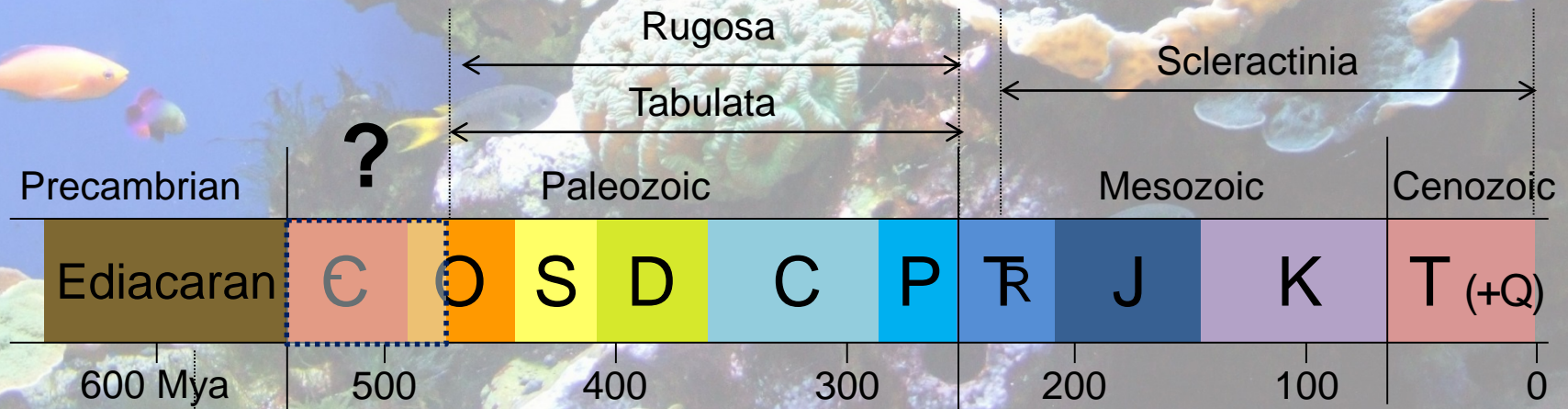
tabulate coral



rugose coral



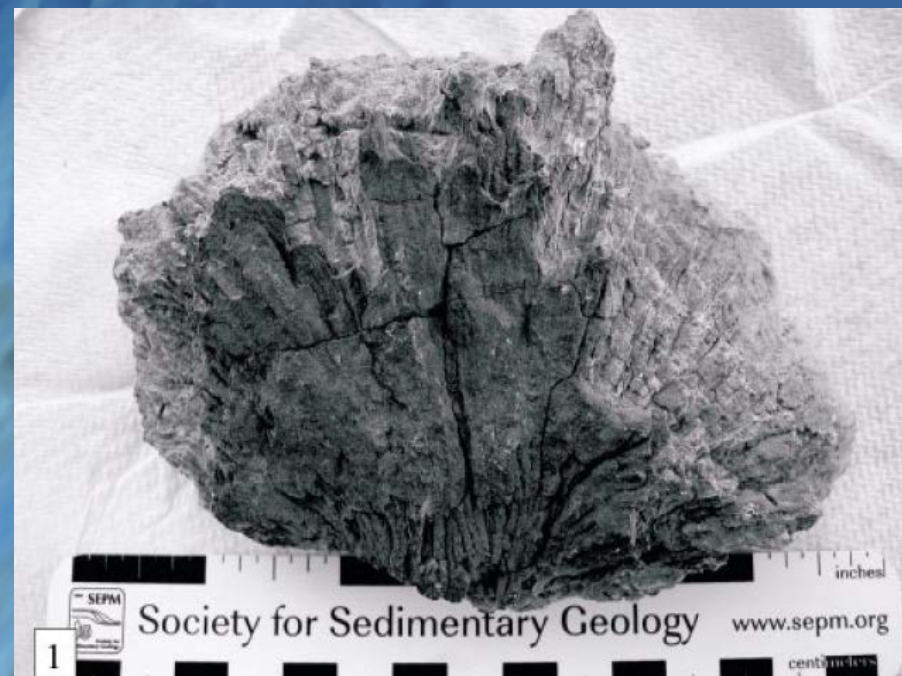
scleractinian coral



major taxa of the Cnidaria diversified (~543 Ma)

Coralomorphs: definition

- Informal group of biomineralized coral-like organisms in Early Cambrian (Jell and Jell, 1976)
- 40+ genera (Scrutton, 1997)



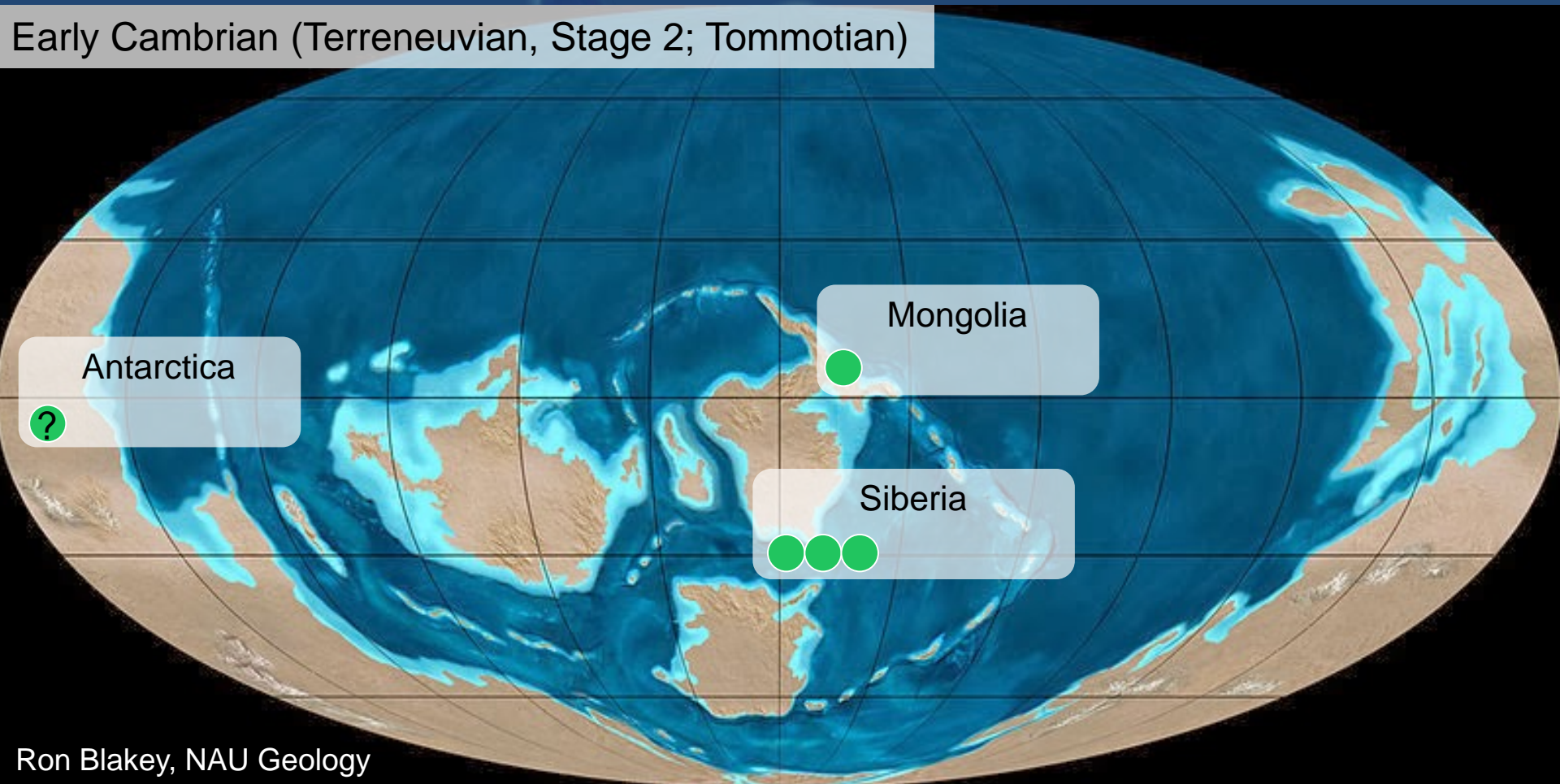
* *Paiutitubulites variabilis*
Tynan (1983)

* *Cothionion sympamatum*,
Jell and Jell (1976)

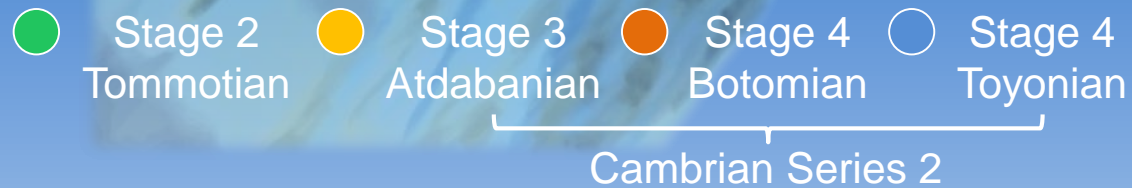
* *Harklessia yuengligensis*, Hicks (2006)

Age & distribution

Early Cambrian (Terreneuvian, Stage 2; Tommotian)

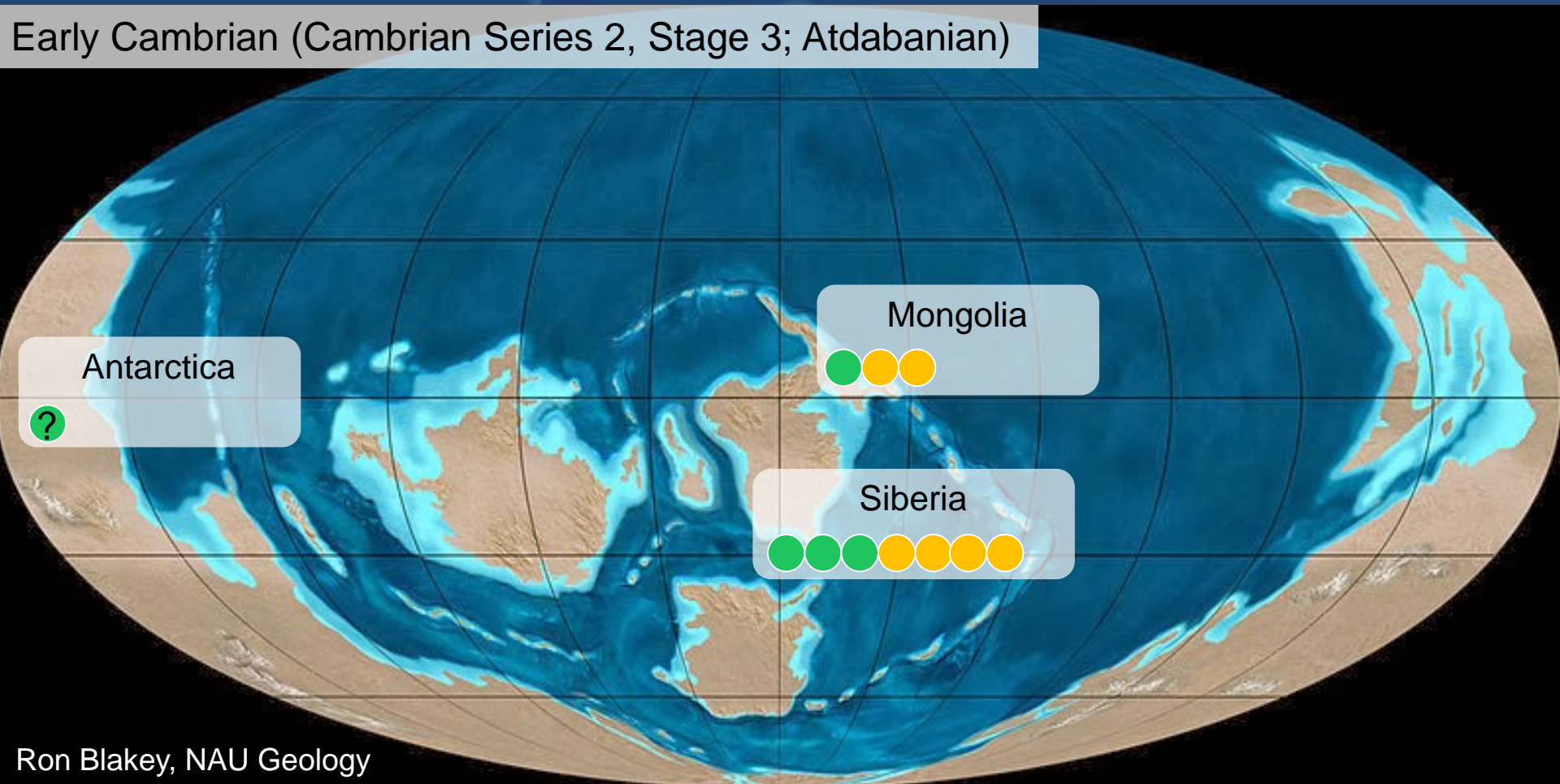


Ron Blakey, NAU Geology

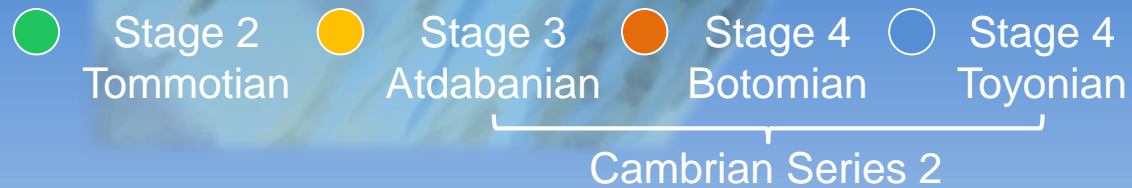


Age & distribution

Early Cambrian (Cambrian Series 2, Stage 3; Atdabanian)

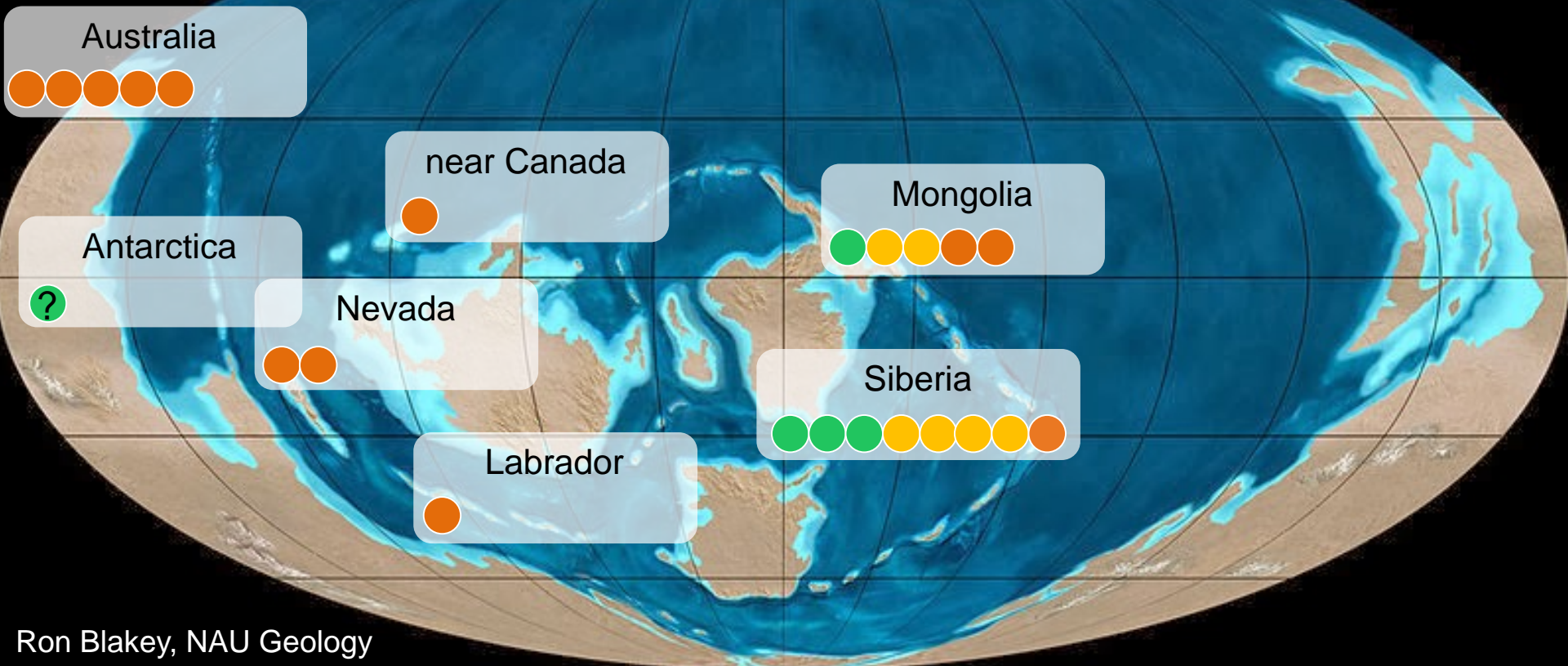


Ron Blakey, NAU Geology

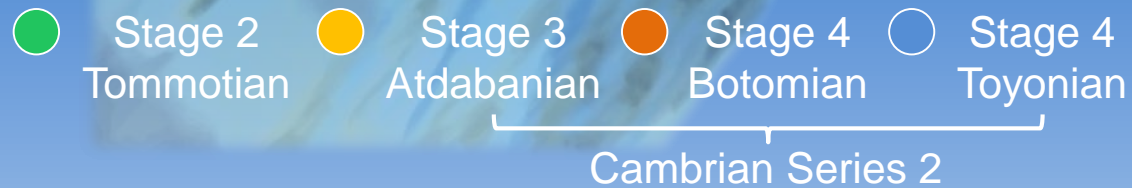


Age & distribution

Early Cambrian (Cambrian Series 2, Stage 4; Botomian)

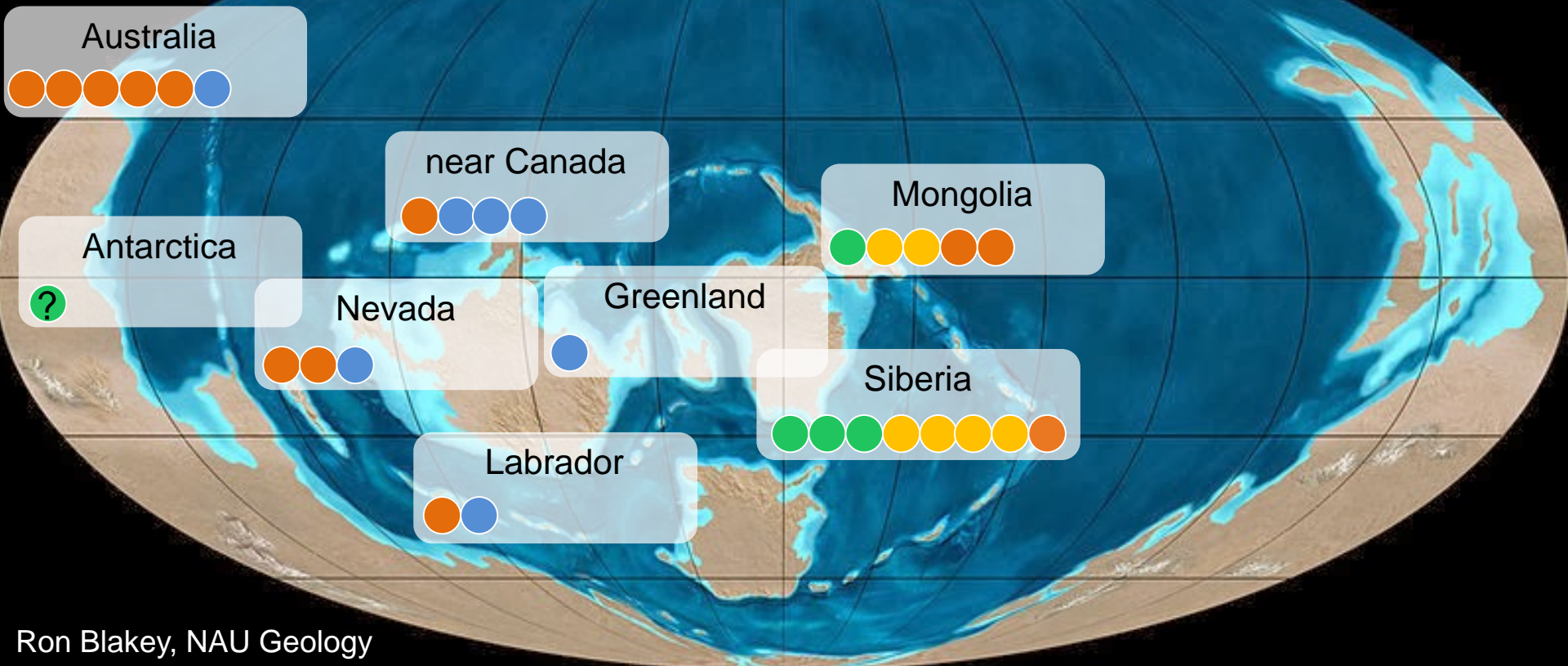


Ron Blakey, NAU Geology

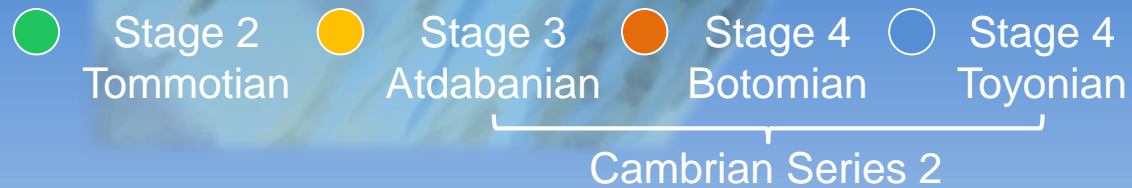


Age & distribution

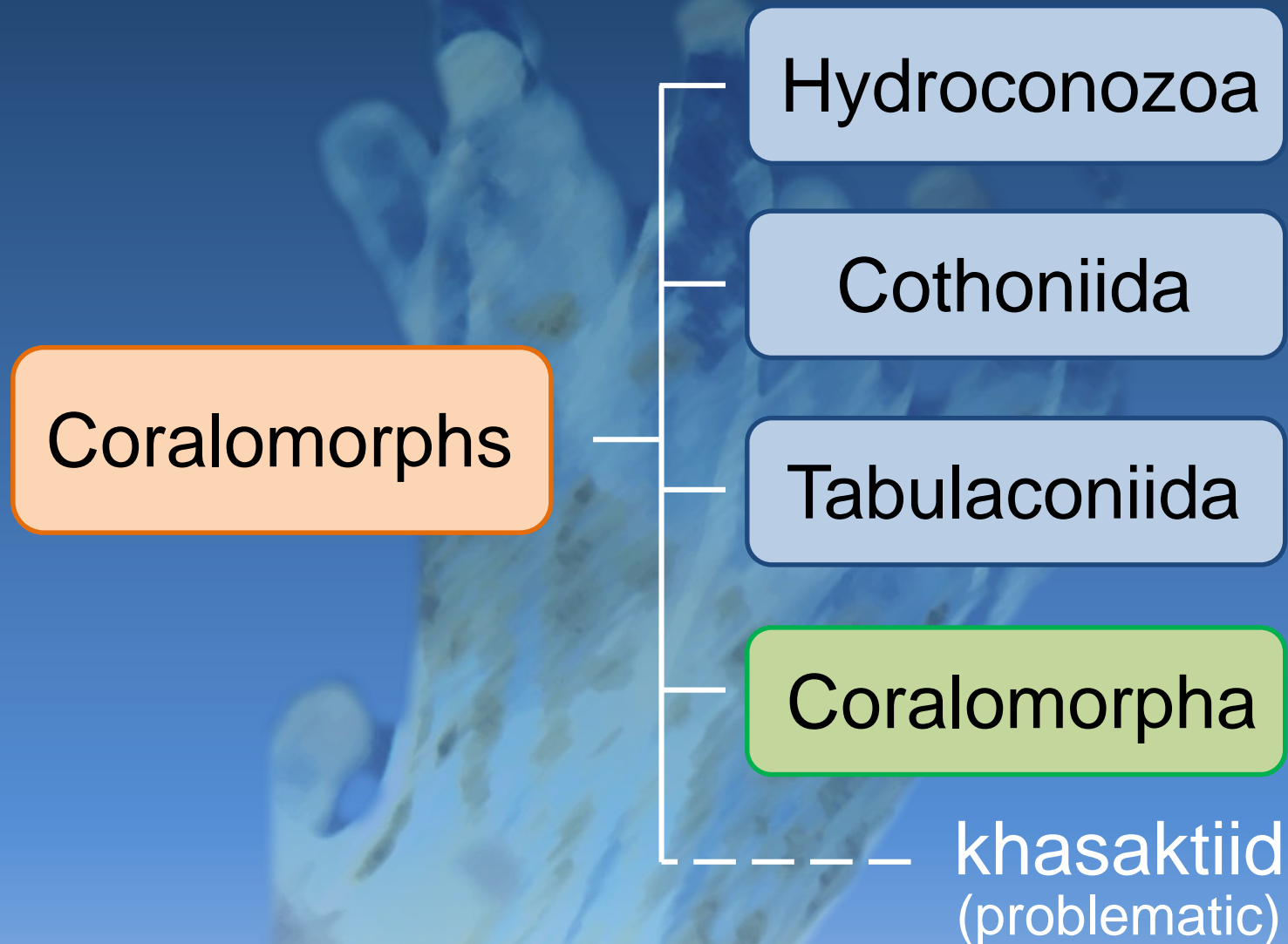
Early Cambrian (Cambrian Series 2, Stage 4; Toyonian)



Ron Blakey, NAU Geology



Coralomorphs: classification

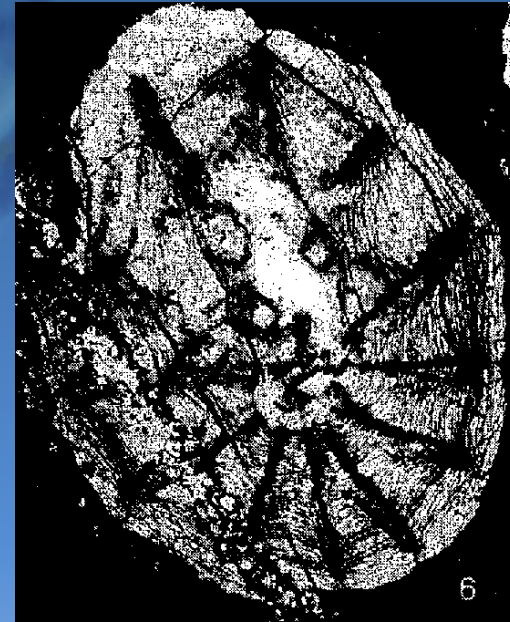


Classification - Hydroconozoa

- Order Hydroconozoa Korde, 1963
 - Cambrian Stage 3 (Lower Atdabanian) / Siberian platform
 - Conical solitary or modular organisms



* *Gastroconus venustus*,
Korde (1963)

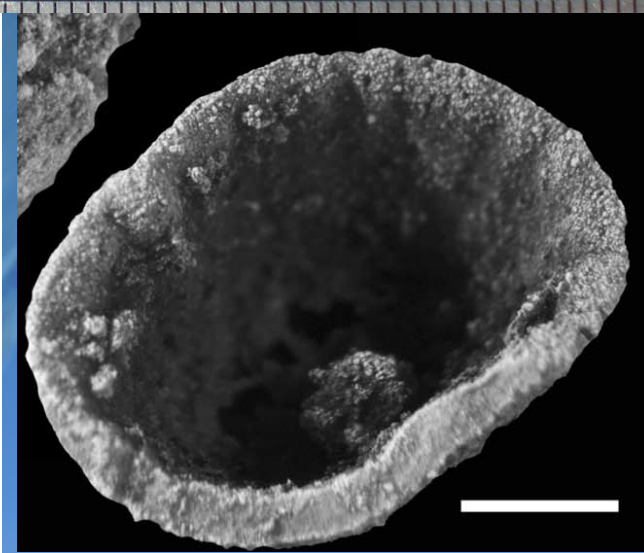
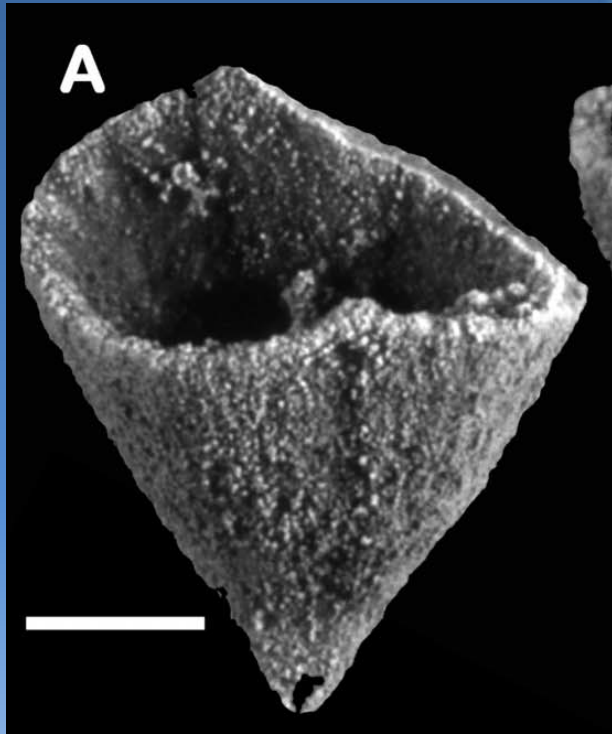


* *Hydroconus mirabilis*,
Korde (1963)

Classification - Cothoniida

- Order Cothoniida Oliver
- Solitary and modular op
- *Redlichia chinensis* Zor
- *Cothonion sympamatum*

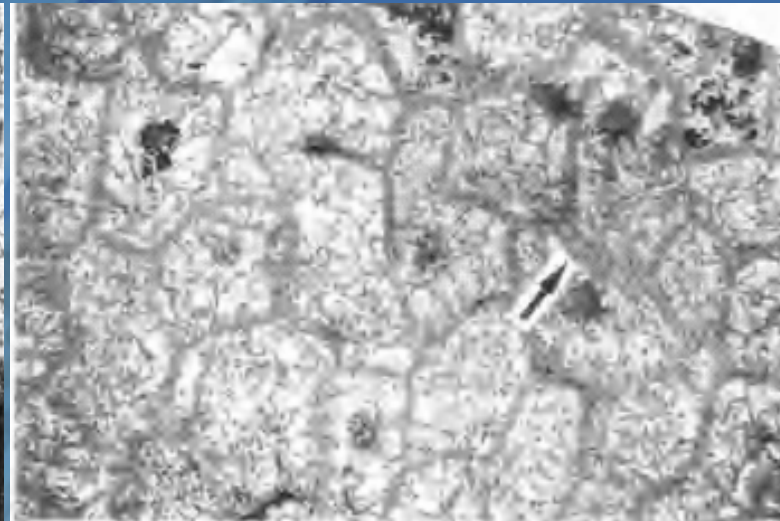
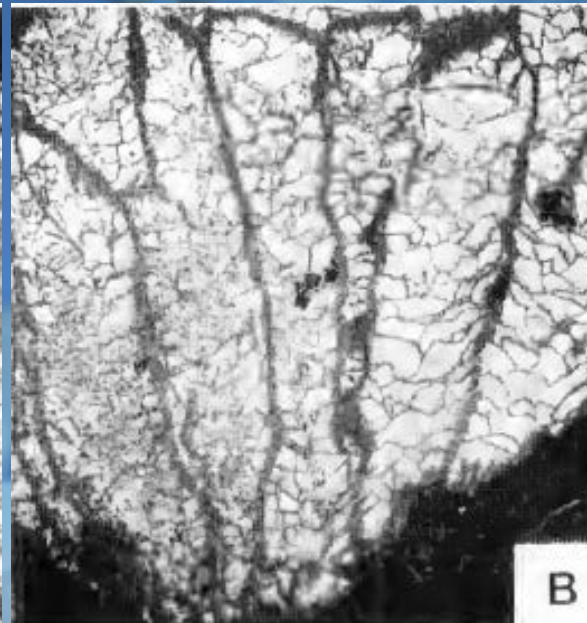
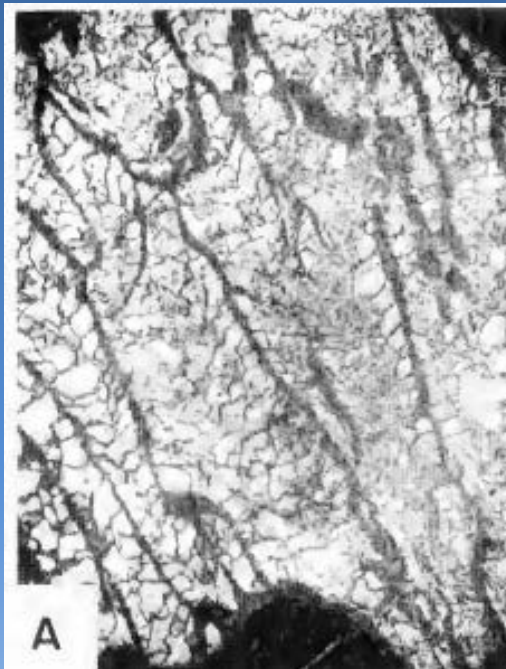
**Calceola sandalina*
Profe Josema (2006)
Devonian / Poland



* *Cothonion sympamatum*,
Jell and Jell (1976),
Peel (2011)

Classification - Tabulaconida

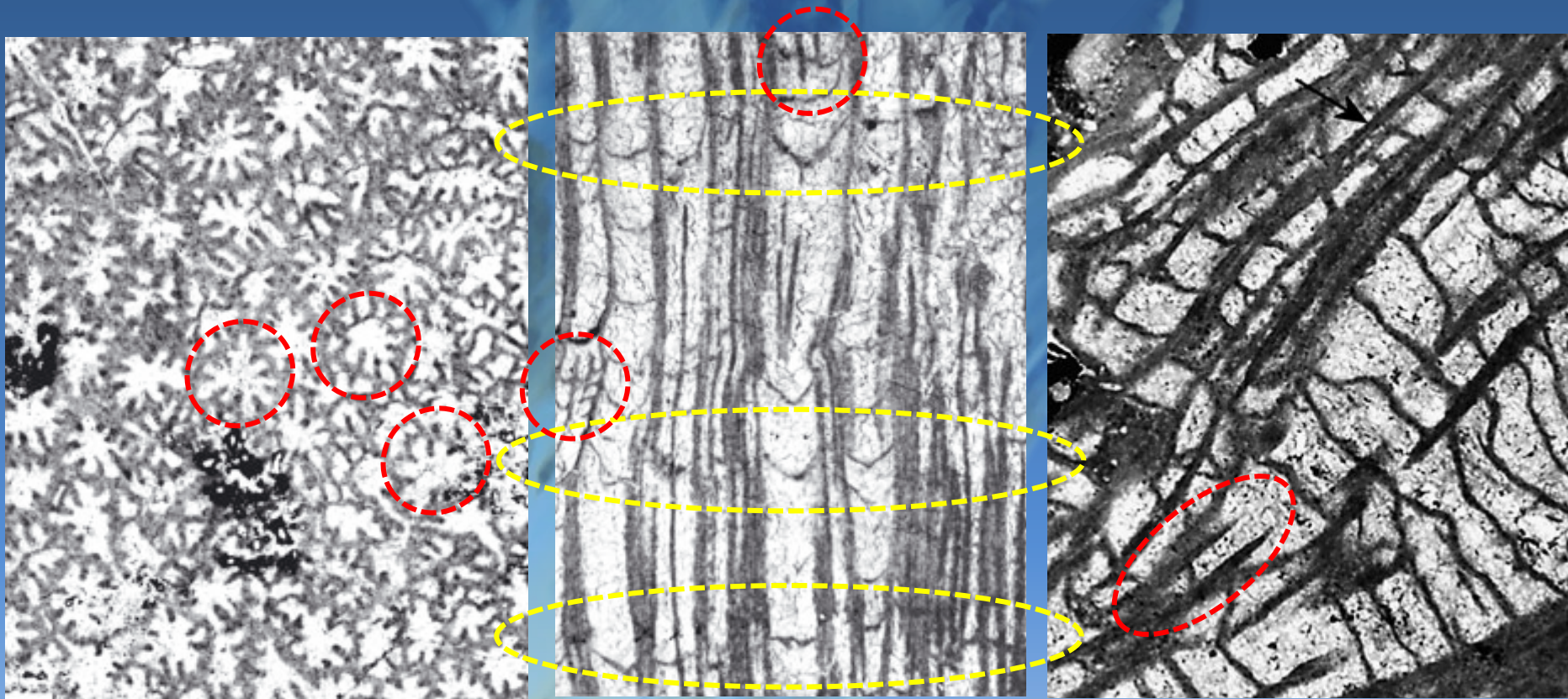
- Order Tabulaconida Scrutton, 1997
 - Undisputed Early Cambrian coralomorphs
 - Modular colonial forms
 - Resembles tabulate corals
 - No mural pores



* *Arrowipora fromensis*,
Fuller and Jenkins (1995)

Classification - Tabulaconida

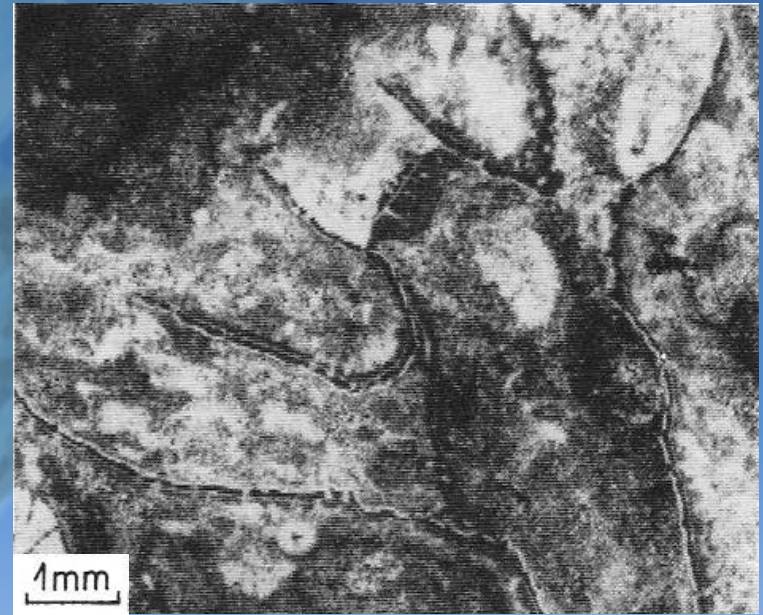
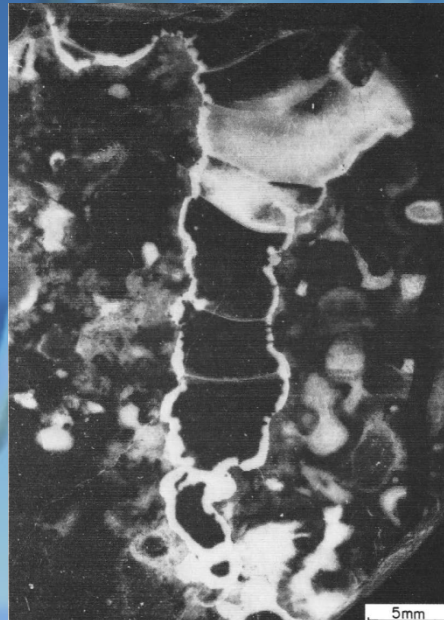
- *Flindersipora bowmani* Lafuste, 1991
 - Cambrian Stage 4 (late Botomian) / South Australia
 - Cerioid, tabulae, setpa



*Fuller and Jenkins (2007)

Classification – Coralomorpha & khasaktids


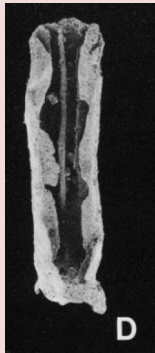


- Coralomorpha
 - Unassigned and doubtful Cambrian coral-like organisms
- Khasaktids (Sayutina, 1980)
 - Problematic?



* *Khasaktia vesicularis*, *Cysticyathus tunicatus*, *Archaeolynthus polaris*; De Brenne et al. (1990)

Comparison to Paleozoic corals

- Cone-shaped coralomorphs vs. rugose corals

Coralomorphs (14)		Rugose corals	
 <i>Paiutitubulites durhami</i>	Cone-shaped, stick	Corallum shape	Horn-shaped, stick
	Solitary / modular	Growth form	Solitary / modular
	Unknown	Mode of increase	Lateral / axial, parricidal
	Absent to rare	Tabulae	Present
 <i>P. variabilis</i>	Present or absent; up to 7(1), 8(1), and 16(2)	Septa	Present; multiples of 4
	Absent	Wall pores	Absent
	E. Cambrian ~ M. Cambrian	Age	M. Ordovician ~ end-Permian
			 <i>Tryplasma praecox</i>
			 <i>T. loveni</i>



Tryplasma praecox

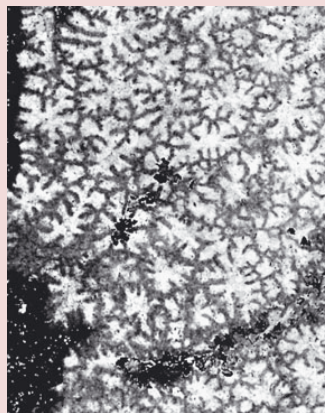


T. loveni

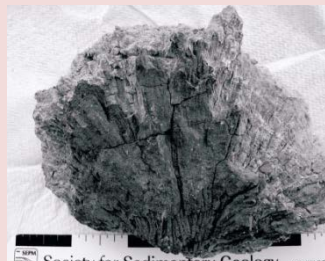
Comparison to Paleozoic corals

- Modular coralomorphs vs. tabulate corals

coralomorphs (20)		tabulate corals
Ceriod, phaceloid, dendroid	Corallum form	Ceriod, phaceloid, dendroid
Modular	Growth form	Modular
Axial?	Mode of increase	Lateral / axial
Present (9)	Tabulae	Mostly
Present (12) or absent	Septa	Present or absent
Present (5) or absent	Wall pores	Present
E. Cambrian ~ L. Cambrian	Age	E. Ordovician ~ end-Permian



Flindersipora canceli



H. yuenglignensis



Favosites basaltiformis



F. hamiltoniae

Coralomorphs: remaining issues

Coralomorphs

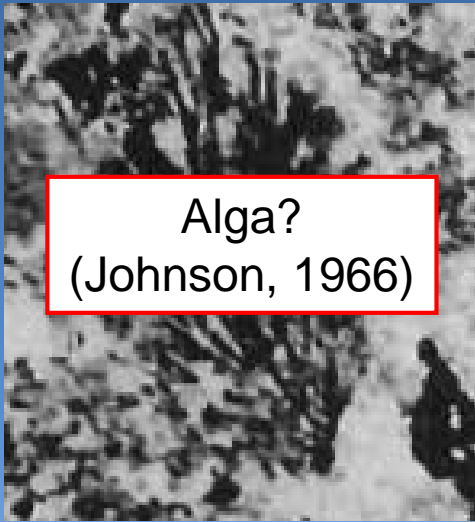
Biologic affinity?

Phylogenetic issue?

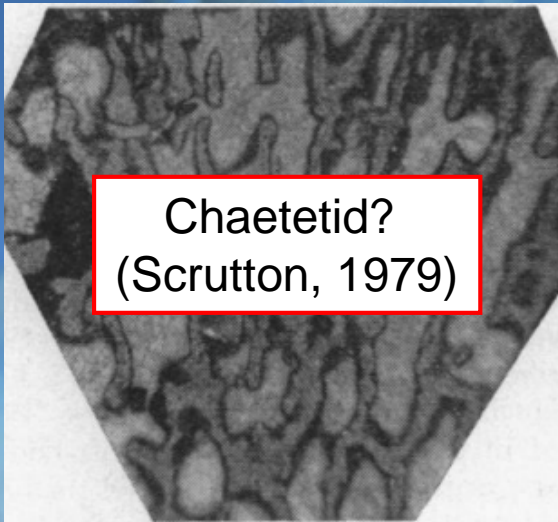
Missing gap?

Issue 1: biologic affinity of coralomorphs

- Coralomorphs → Cnidaria?
 - Lack of convincing evidence
 - Doubtful coralomorphs
 - mineralogy, size, wall microstructure, ...
- But some coralomorphs are probable **cnidian-affinity**



Alga?
(Johnson, 1966)



Chaetetid?
(Scrutton, 1979)



Stromatoporoid?
(Webby and Stearn, 2015)

* *Bija* sp.,
Wrona and Zhuravlev (1996)

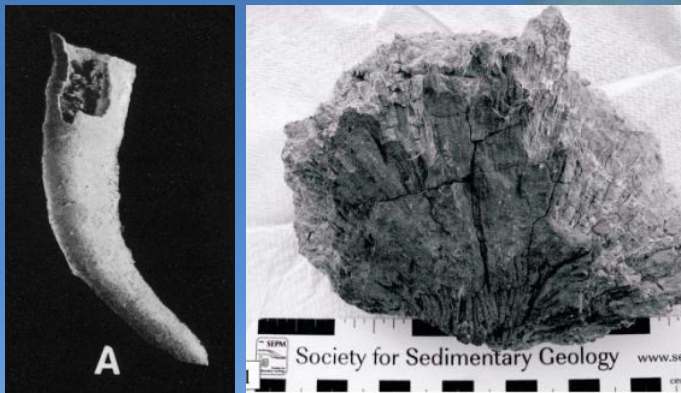
* *Cambrophyllum problematicum*,
Collinson (1955)

* *Khasaktia vesicularis*,
De Brenne et al. (1990),
Wrona and Zhuravlev (1996)

Issue 2: relationship with Paleozoic corals?

- “Cambrian corals” (Hicks, 2006; Landing et al., 2018)
- Phylogenetically **NOT** related?
 - Too few coralomorph occurrences
 - Lack of convincing evidence

Coralomorphs



Early Cambrian (Stage 2-4)

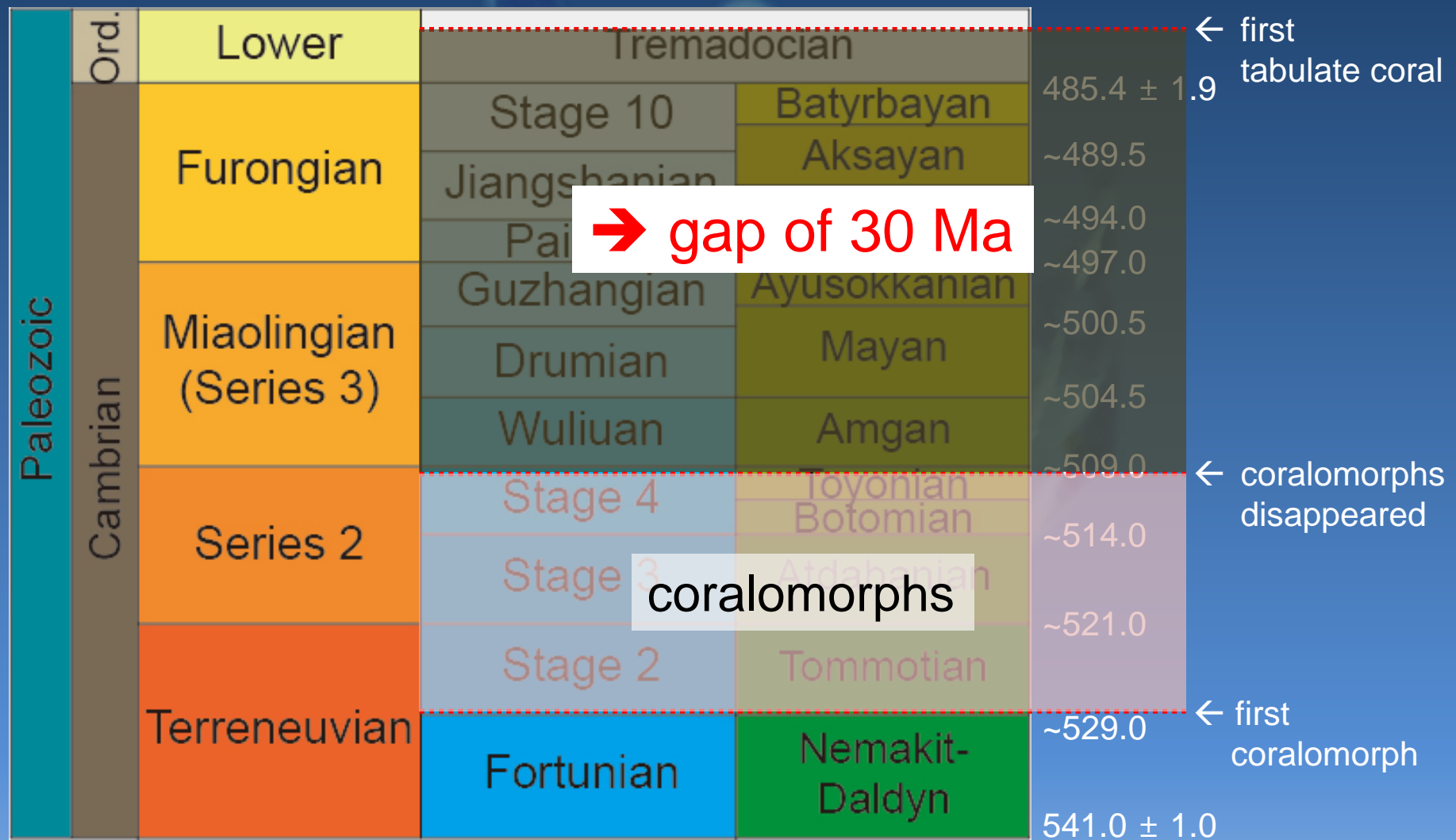
Rugosa and Tabulata



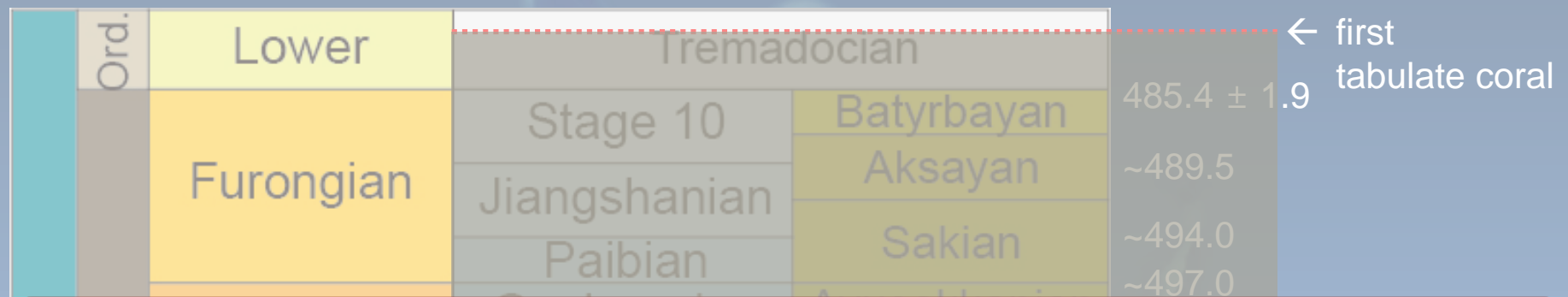
Ordovician - Permian



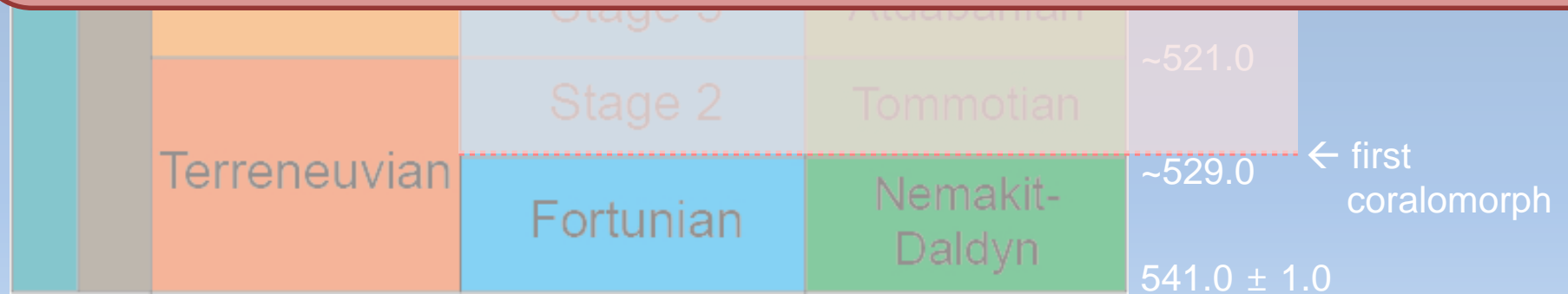
Issue 3: missing gap



Issue 3: missing gap



→ Need **further discovery** and **study** to elucidate the phylogenetic relationships between coralomorphs and true Paleozoic corals



Summary

- Coralomorph
 - Cambrian coral-like organisms
 - Early Cambrian (Stage 2 - 4)
 - 4 Orders, one problematic group / 40+ genera
 - Remaining issues for coralomorphs
 - Biologic affinity – cnidarian?
 - Unrevealed phylogenetic relationships
 - Missing gap of 30 Ma
- ➔ Further discovery of coral-like organisms from **Cambrian Series 3** and **Furongian** will help to unraveling problems on coralomorphs and Paleozoic corals!

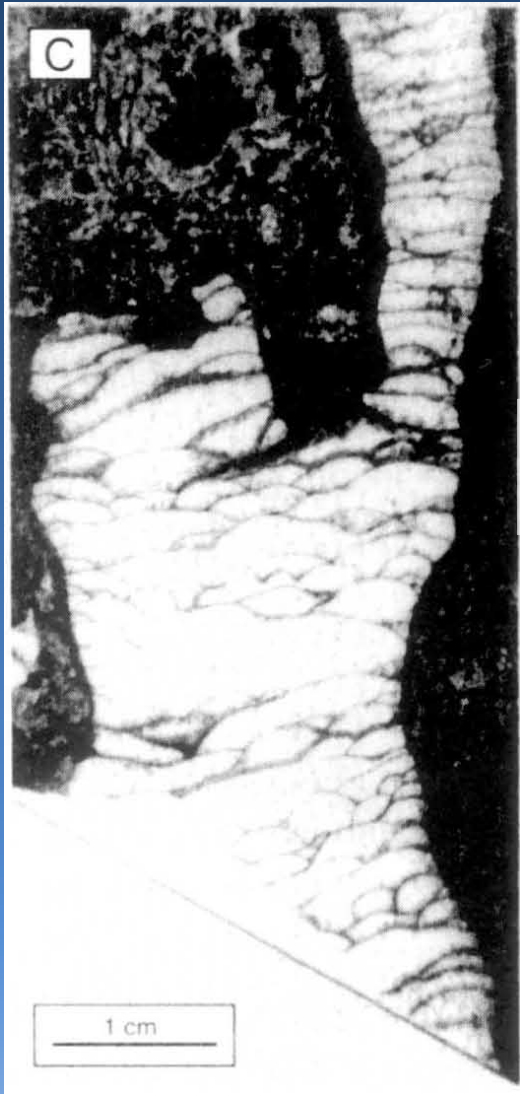
Acknowledgment

- Korea Polar Research Institute
 - research fund “PE18160”
- Image sources
 - <http://wallpapers3d.info/coral-wallpaper-57-wallpapers/>
 - <https://ocean.si.edu/ocean-life/invertebrates/close-coral-polyp>
 - <https://www2.nau.edu/rcb7/>
 - <http://www.thefossilforum.com/index.php?/gallery/image/20530-calceola-sandalina-devonian-holly-cross-mts-poland/>
 - <http://www.stratigraphy.org/index.php/ics-chart-timescale>
 - <http://fossilid.info/7938>
 - <https://www.uhu.es/museovirtualpaleontologia/galerias/invertebrados/fichas/corales.html>
 - <https://www.bigfossil.com/favosites-basaltiformis---devonian-germany-9974-p.asp>
 - <http://viewsofthemahantango.blogspot.com/2014/02/favosites-hamiltoniae-coral-from.html>
 - <http://lenta-vremeni.ru/248/cambrian-eon---chronozoom>
 - <https://www.mcgill.ca/redpath/article/ordovician-diorama>

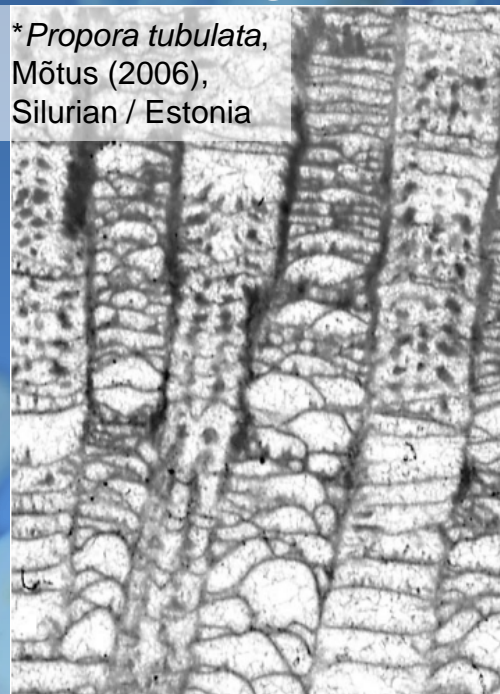


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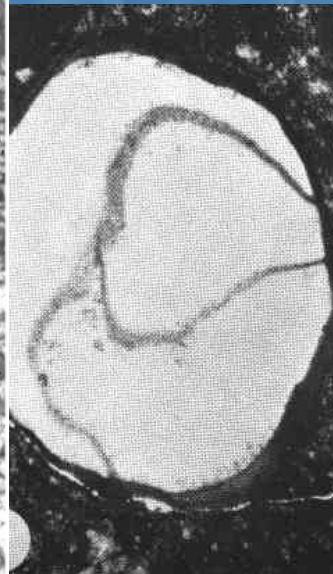
Coralomorphs



- *Tabulaconus kordae* Handfield, 1969
 - Early Cambrian (Tommotian)
 - western Canada / Siberian platform
 - single cups / low modular?



bed tabulae



*De Brenne and Reitner (2001)

*Handfield (1969)

*Gangloff (2003)

Coralomorph problem




[Volume 91, Issue 1](#) January 2017 , pp. 73-85

A lowermost Ordovician tabulate-like coralomorph from the Precordillera of western Argentina: a main component of a reef-framework consortium

Marcelo G. Carrera ^(a1), Ricardo A. Astini ^(a1) and Fernando J. Gomez ^(a1) 

<https://doi.org/10.1017/jpa.2016.145> Published online: 21 December 2016

The biological affinity of *Amsassia*: new evidence from the Ordovician of North China

Ning Sun , Robert J. Elias , Dong-Jin Lee 

First published: 31 March 2014 | <https://doi.org/10.1111/pala.12106> | Cited by: 7

Abstract

Amsassia shaanxiensis sp. nov. occurs in the Middle Ordovician part of the Jinghe Formation in Yongshou and the lower part of the Upper Ordovician Beiguoshan Formation in Longxian, Shaanxi Province, north-central China. In addition to module

Palaeobiological features of the coralomorph *Amsassia* from the Late Ordovician of South China

Mirinae Lee, Robert J. Elias, Suk-Joo Choh & Dong-Jin Lee

Received 22 Nov 2017, Accepted 29 Apr 2018, Published online: 24 May 2018

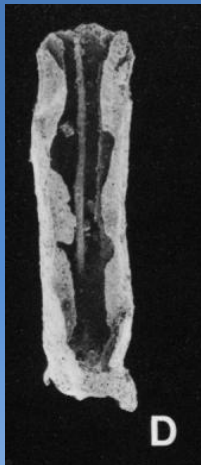
e
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Problem#3: relationship with corals

- cone-shaped coralomorphs vs. rugose corals

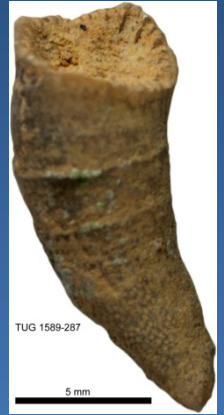


Paiutitubulites durhami



P. variabilis

coralomorphs (14)		rugose corals
cone-shaped, stick	corallum shape	horn-shaped, stick
solitary / modular	growth form	solitary / modular
< 1 mm ~ < 300 mm	diameter range	few mm ~ 140 mm
mostly unknown	mode of increase	lateral / axial, parricidal
absent to rare	tabulae	always
present or absent; up to 7(1), 8(1), and 16(2)	septa	dominant; multiples of 4
absent	wall pores	absent
E. Cambrian ~ M. Cambrian	age	M. Ordovician ~ end-Permian



Tryplasma praecox

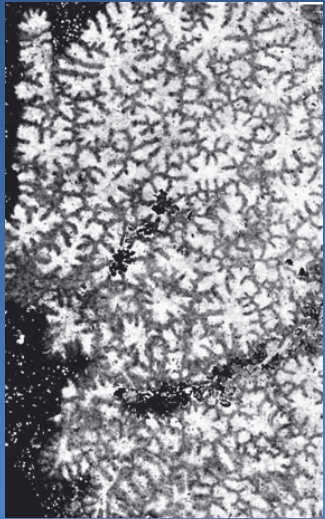


T. loveni

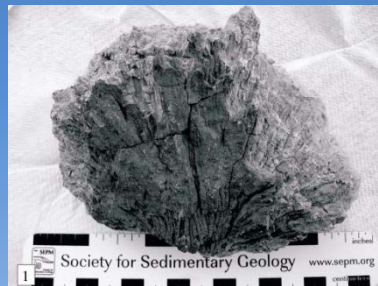
Problem#3: relationship with corals

- modular coralomorphs vs. tabulate corals

coralomorphs (20)		tabulate corals
cerioid, phaceloid, dendroid form	corallum form	cerioid, phaceloid, dendroid..
modular	growth form	modular
< 1 mm ~ < 140 mm	diameter range	> 1 mm ~ 100 mm
axial (5)/ intercorallite (<i>Harklessia</i>)	mode of increase	lateral
present (9)	tabulae	mostly
present (12) or absent	septa	present or absent
present (5) or absent	wall pores	present
E. Cambrian ~ L. Cambrian	age	E. Ordovician end-Permian



Flindersipora cancelli



H. yuengligensis



*Favosites
basaltiformis*



F. hamiltoniae

Issue 2: relationship with Paleozoic corals?

- Phylogenetically **NOT** related?
 - Differ from key characters
 - Lack of convincing evidence

→ Need more discovery of coralmorphs / corals

