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30th IAS MANCHESTER
International Association of Sedimentologists

Global sea level changes and sedimentological characterization of Cretaceous carbonate deposits in Gulf of Venezuela

Pinto, D.; Moreno, N.; Padrón, V.

Gobierno Bolivariano de Venezuela | Ministerio del Poder Popular de Petróleo y Minería

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OBJETIVE

The aim of this research is to propose sedimentologic model, characterize the diagenetic processes and define sea level changes of the carbonate succession deposited during the Cretaceous, based in the detailed core analysis of the wells in the surrounding areas at Gulf of Venezuela in Río Negro Formation, Cogollo Group and La Luna Formation.

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- MICROFACIES ENVIRONMENTAL DISTRIBUTION

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7. **DIAGENESIS CHART RESULTS**
8. **ISOTOPIC ANALYSIS**
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10. **CONCLUSIONS**

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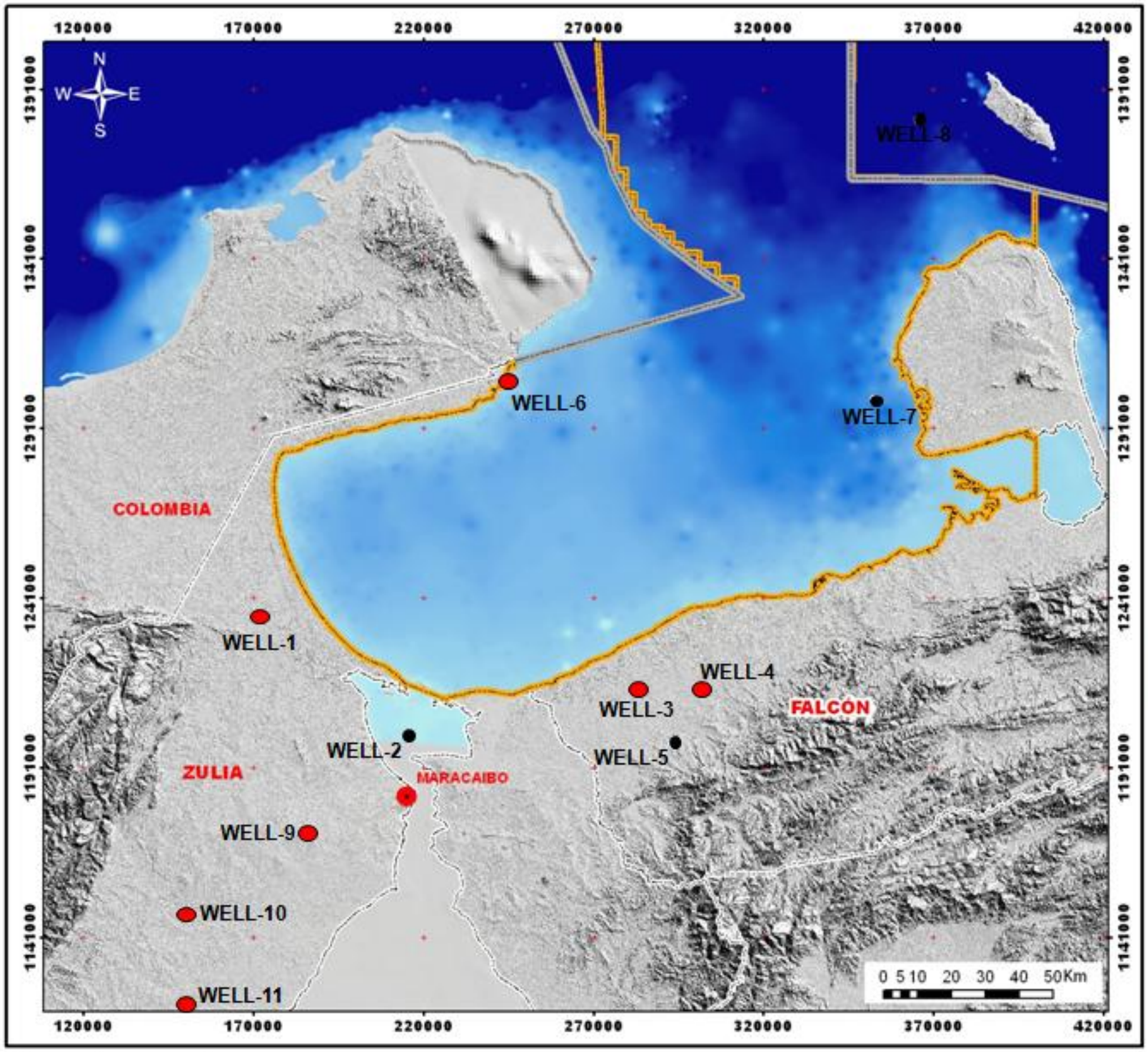
CORED WELLS
GULF OF VENEZUELA



CORED WELL LOCATION

WELL LOCATION

STUDY AREA

MARITIME BOUNDARY

CONTINENTAL BOUNDARY

CAPITAL CITY

BACKGROUND:
SRTM 90m Satellite Image, Bathymetry (*Armada Venezolana*, 1999)

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corazón VENEZOLANO

CRETACEOUS CORE SAMPLES and ANALYSIS GULF OF VENEZUELA

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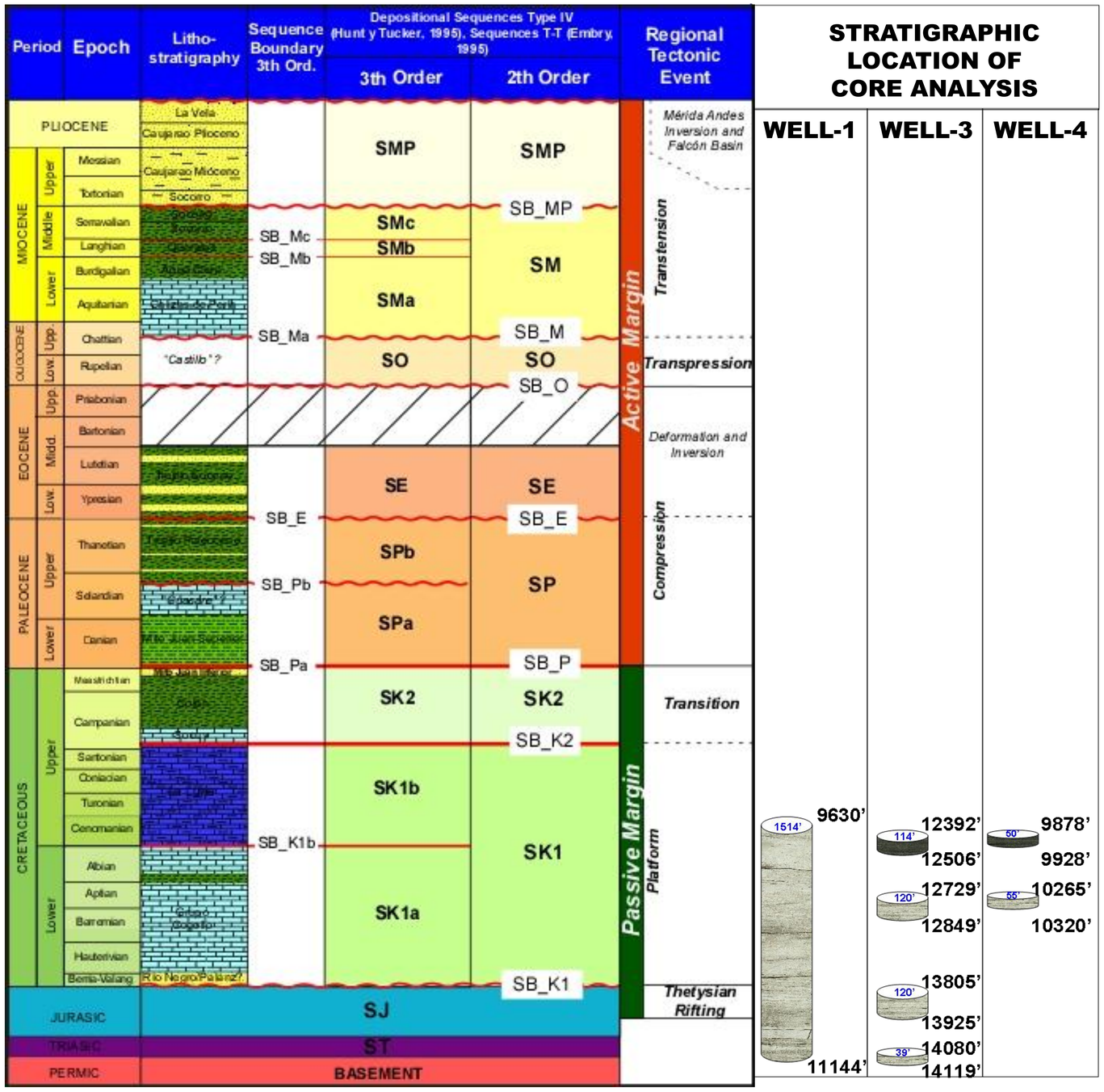


STRATIGRAPHIC LOCATION OF CORE ANALYSIS

WELL-1	WELL-3	WELL-4
9630'	12392'	9878'
11144'	12506'	9928'
	12729'	10265'
	12849'	10320'
	13805'	
	13925'	
	14080'	
	14119'	
1514'	*393'*	*105'*
(462m)	*(120m)*	*(32m)*

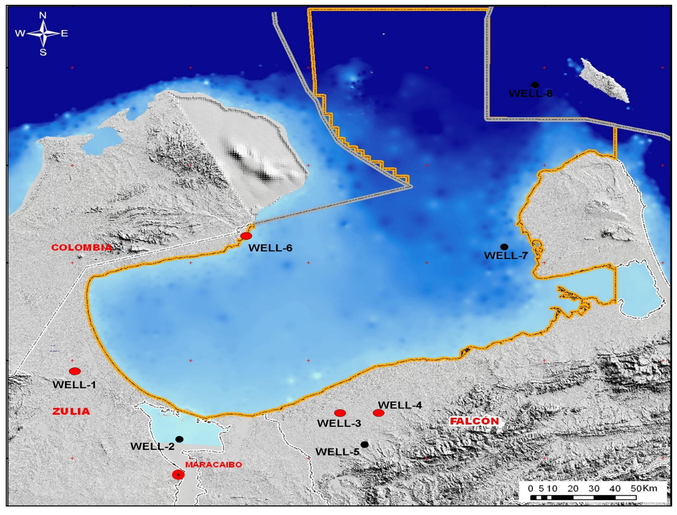
Modified from PGO Golfo de Venezuela (2013)

TOTAL AMOUNT OF ANALYZED CORES
2012 Feet (628 mt.)

LABORATORY ANALYSIS

- **843 thin sections** of 6 wells, belonging to the same area, were analyzed.

- **336 samples for isotopes analysis** ($\delta^{13}C$ and $\delta^{18}O$) of Well-1, were analyzed.



STRATIGRAPHIC RANGES OF PLANCTIC AND BENTHIC FORAMINIFERA. GULF OF VENEZUELA

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Ma	145	140	135	130	125	120	115	110	105	100	95	90	85	80	75	70	65
AGE	CRETACEOUS																
	EARLY											LATE					
	Ber 145.5	Val 140.2	Hau 136.4	Bar 130	Apt 125			Alb 112				Cen 99.6	Tur 93.5	Con 89.3	San 85.8	Ca 83.5			Ma 70.6	

*Praechrysalidina infracretacea

Macroglobigerinelloides bolli

Macroglobigerinelloides ultramicrus

Marginotruncana schneegansi

*Neoflabellina isabellae

Marginotruncana sinuosa

Marginotruncana unaulaa

*Chapmanella decipiens

Marginotruncana marginata

Heterohelix globulosa

*Orbitoloina (Mesorbitoina) texana

Heterohelix reussi

INDEX TAXA

(Stratigraphic ranges from Premoli Silva and Sliter (1995) and Bou Dager-Fadel (2008))

SEDIMENTOLOGIC COLUMN OF WELL-1: SK1a SEQUENCE

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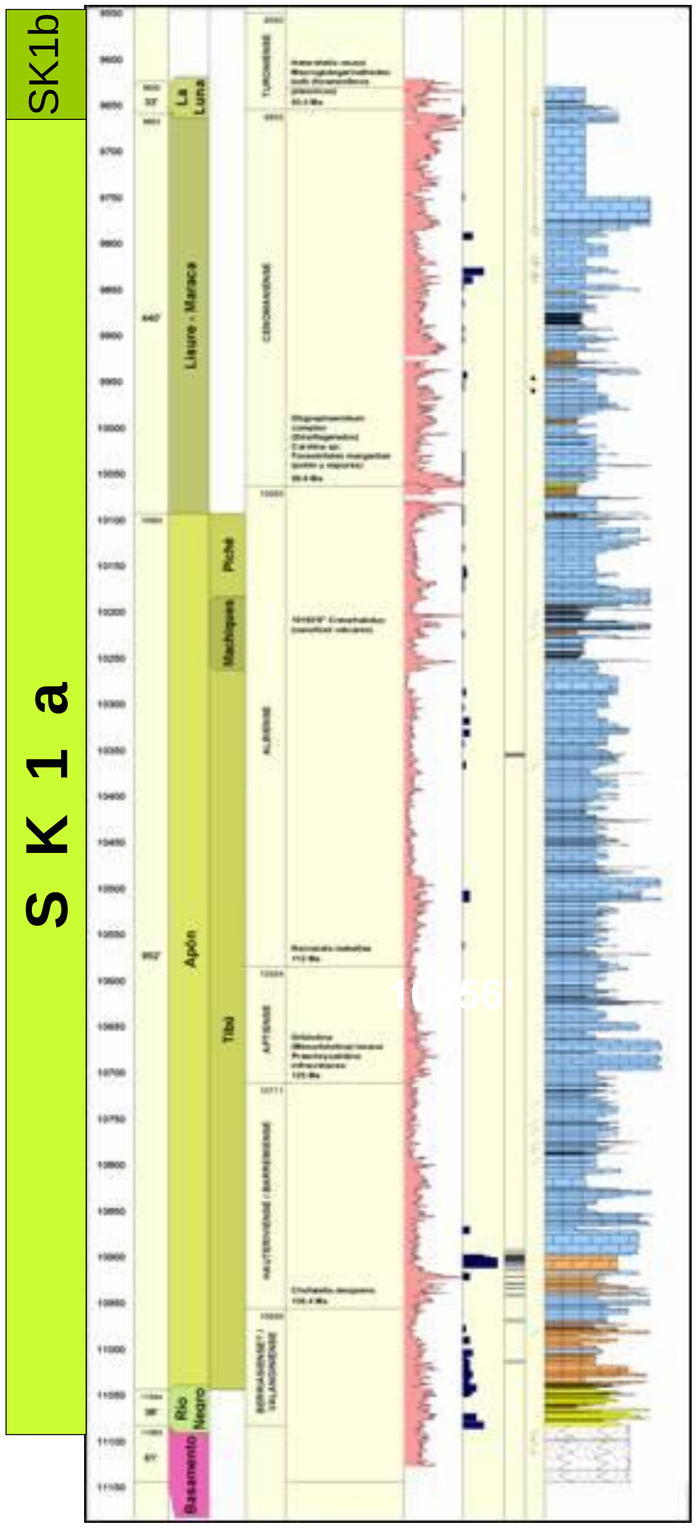
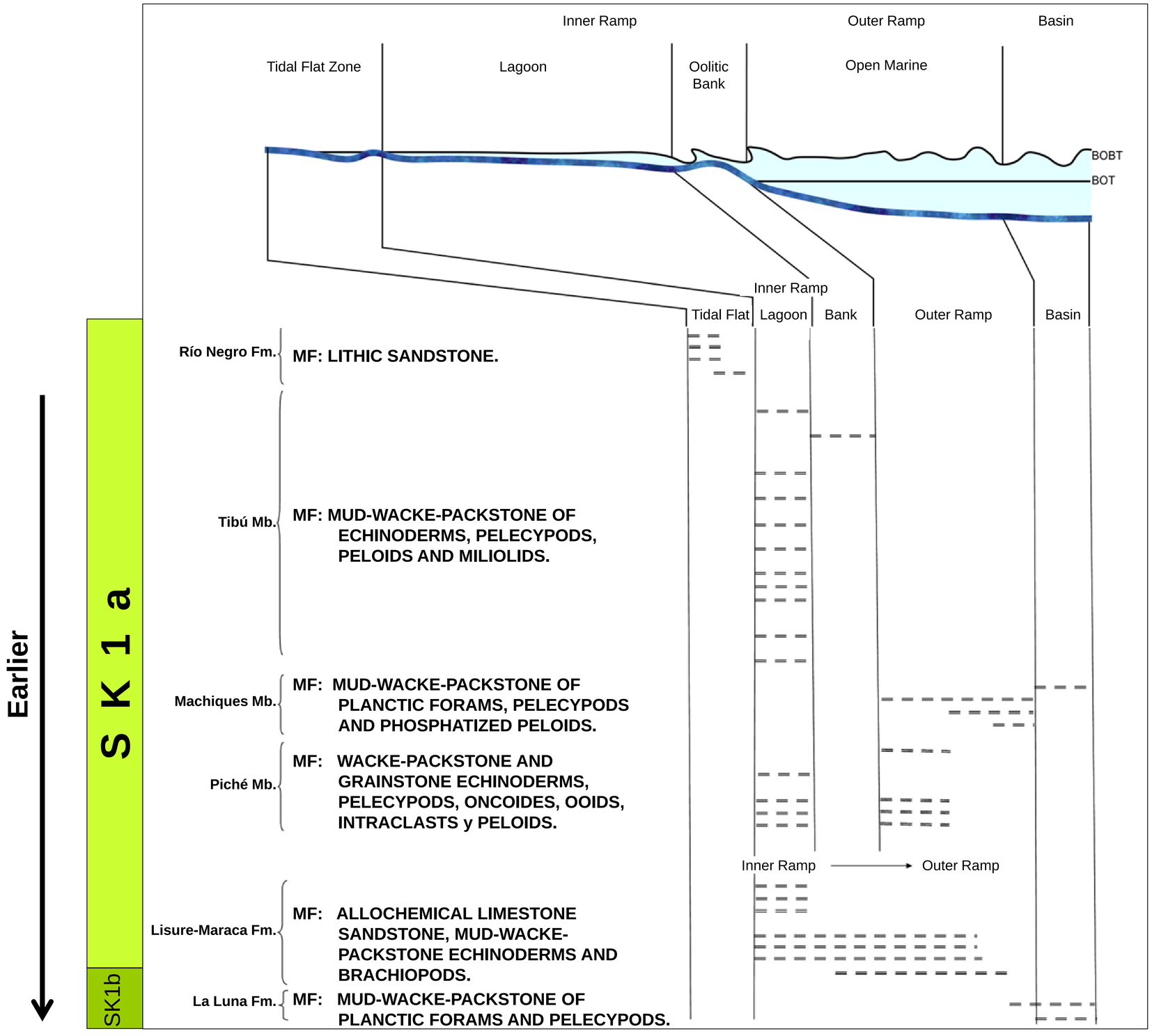


LITOLOGY

- Sandstone
- Shale
- Limestone
- Dolomite Limestone
- Dolomite
- Sandy Limestone
- Mudstone
- Wackestone
- Packstone
- Grainstone
- Floatstone
- Rudstone

MICROFACIES ENVIRONMENTAL DISTRIBUTION IN THE STUDY AREA



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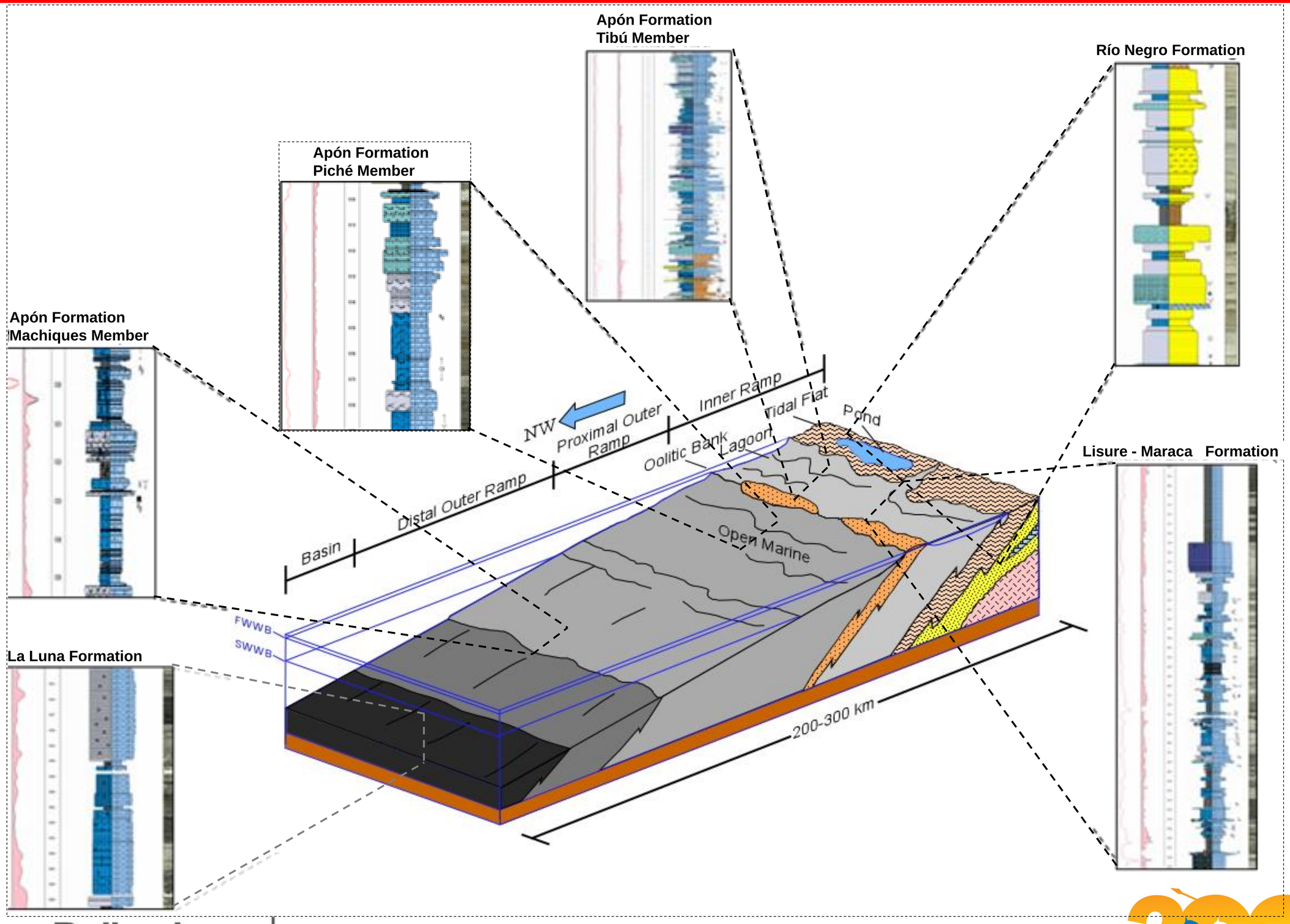
LITOFACIES IN THE CARBONATIC RAMP MODEL



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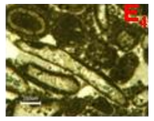
MICROFACIES IN THE CARBONATIC RAMP MODEL

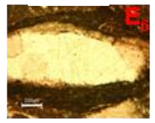
Piché Member

Ooids and Cortoids

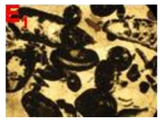


Peloid and Cortoid

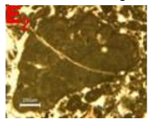
Rodoid



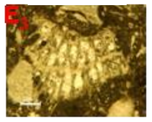
Lituolidae



Green-Blue Algae



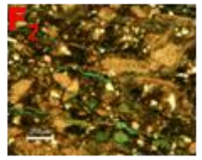
Briozoo



Lisure - Maraca Formation

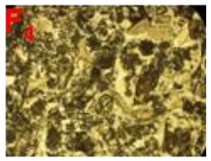
Micritic Sandstone

Glauconite

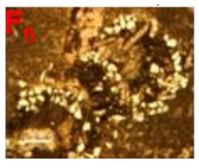


Wackes-Packstone of Echinoderms and Pelecypods

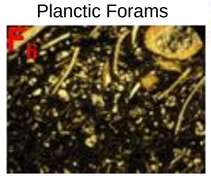
Packstone of Echinoderms and Intraclasts



Cribratina sp.

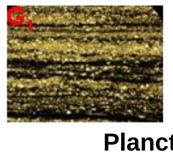


Wackestone of Pelecypods and Planctic Forams

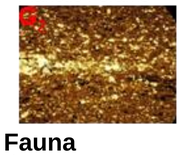


La Luna Formation

Packstone of Planctic Forams

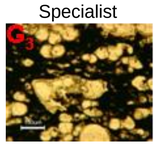


Wackestone of Planctic Forams



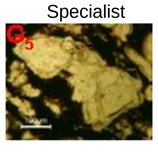
Planctic Fauna

Specialist



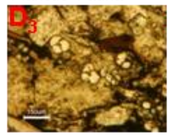
Opportunist

Specialist



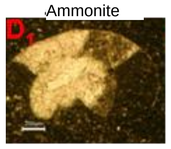
Machiques Member

Planctic Fauna

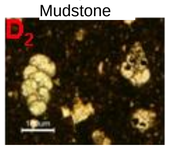


Brachiopod

Ammonite

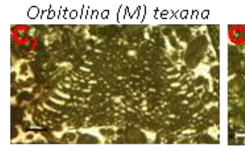


Mudstone

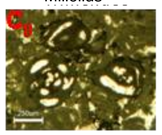


Tibú Member

Orbitolina (M) texana



Miliolids



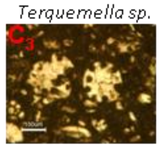
Praechrysalidina infracretacea

Aptian – Albian

Nezzazata isabellae

Late Aptian – Early Albian

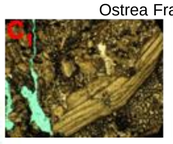
Terquemella sp.

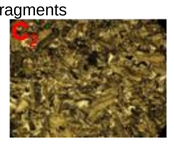


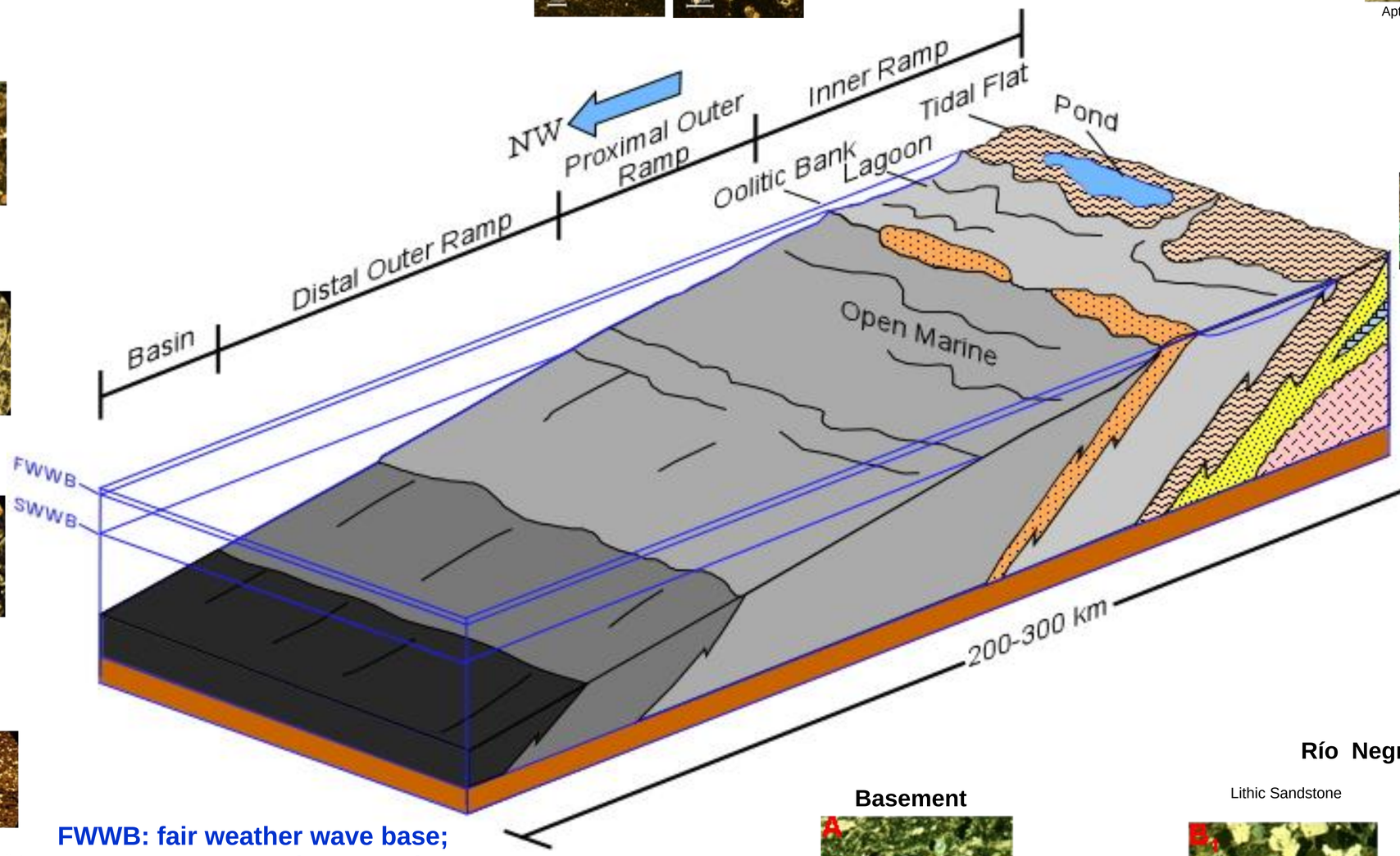
Choffatella decipiens

Barremian – Aptian

Ostrea Fragments

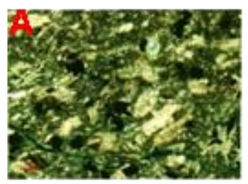






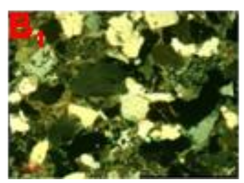
FWWB: fair weather wave base;
SWWB: storm weather wave base

Basement

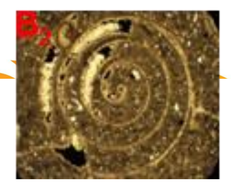


Río Negro Formation

Lithic Sandstone



Gastropod *Actaeonellidae*



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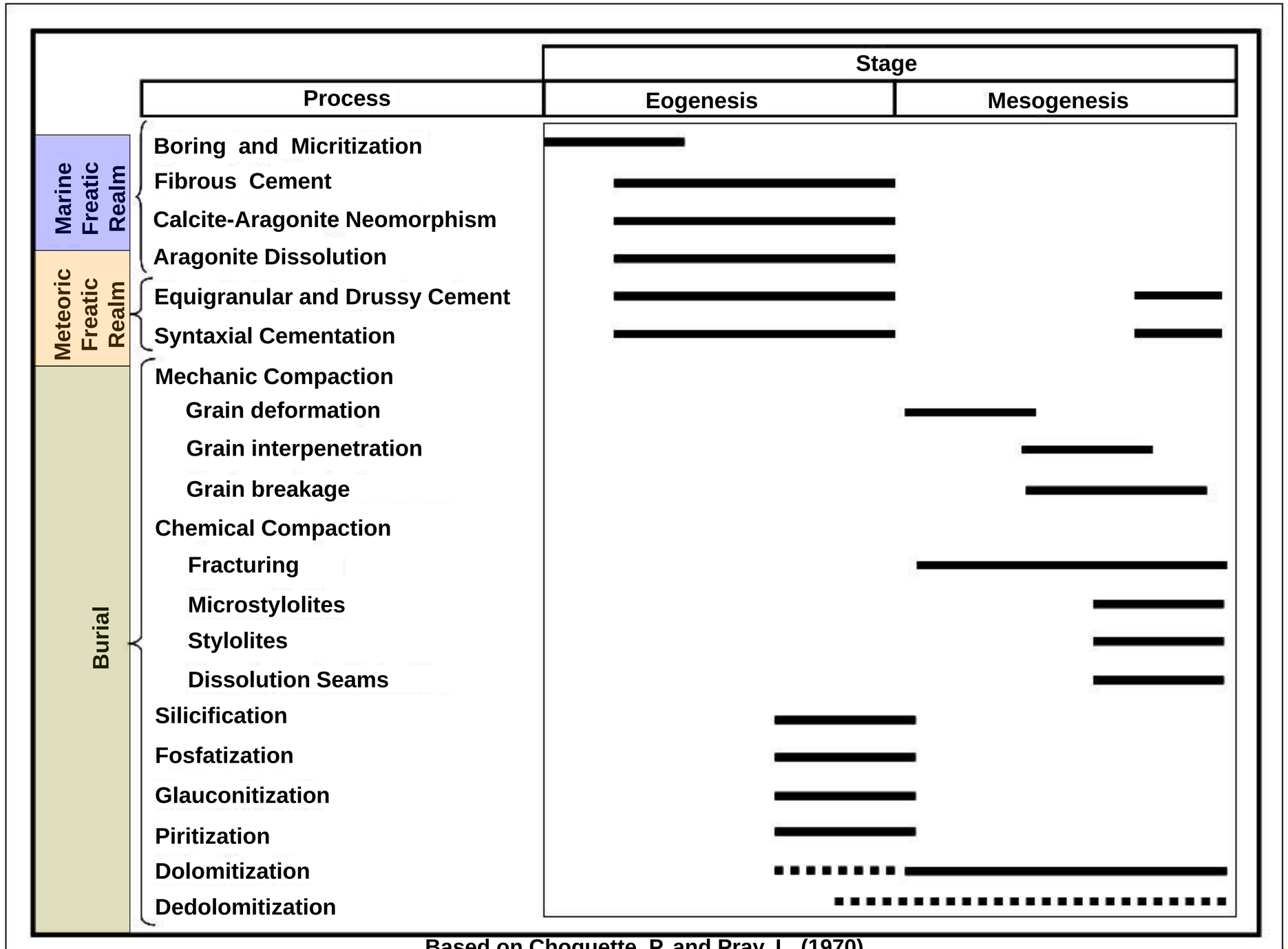
POST DEPOSITIONAL STAGES: DIAGENESIS



Based on Choquette, P. and Pray, L. (1970)

ISOTOPES ANALYSIS : $\delta^{13}C$ and $\delta^{18}O$ at WELL-1

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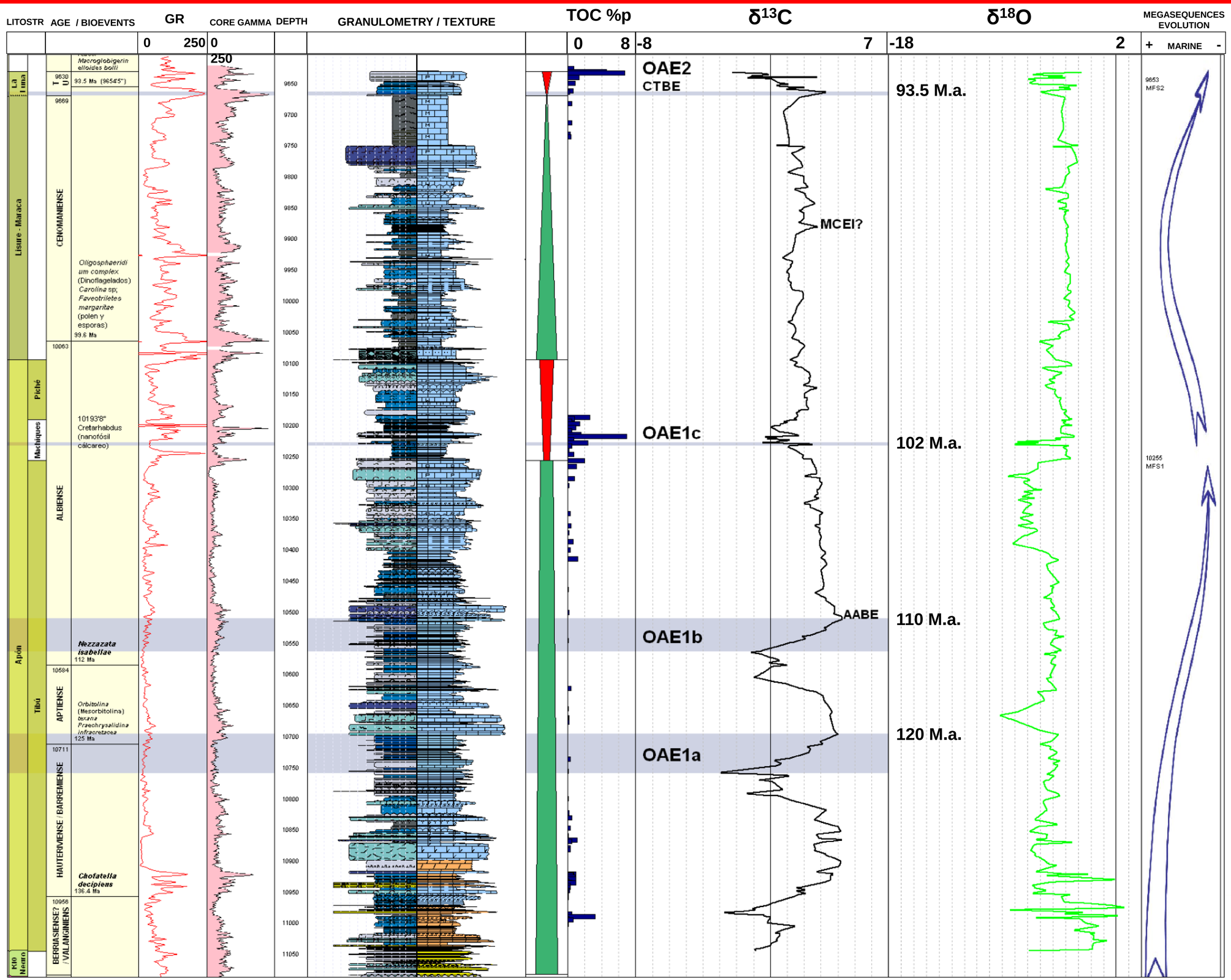
GRANULOMETRY

- Clay - Silt
- V. Fine - Fine
- Medium - Coarse
- V. Coarse S.
- A.f f
- A.m pack m
- A.g g
- A. mg grain mg
- bc gran Float
- B/C Guija Rud
- B/C guijo
- B/C canto

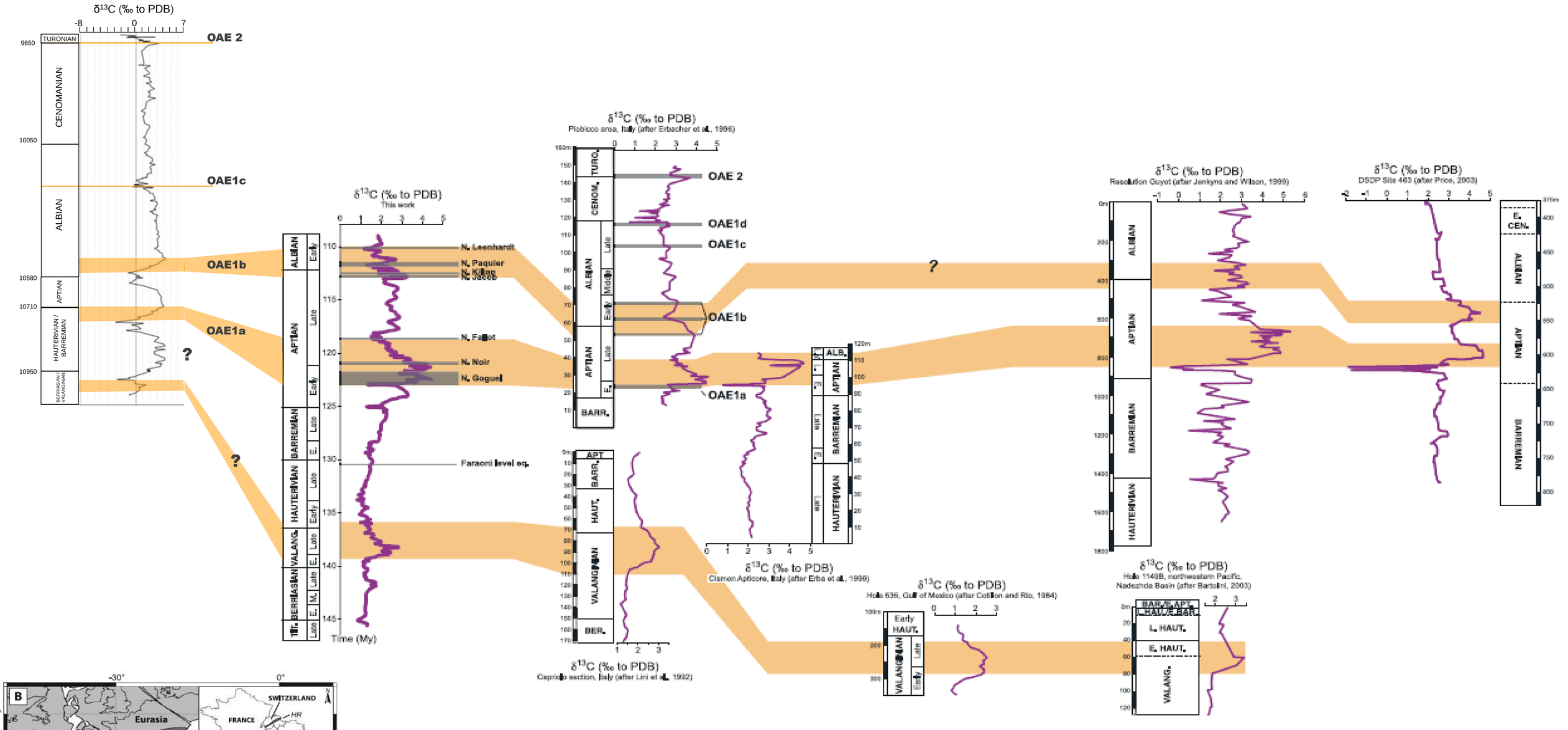
LITOLOGY

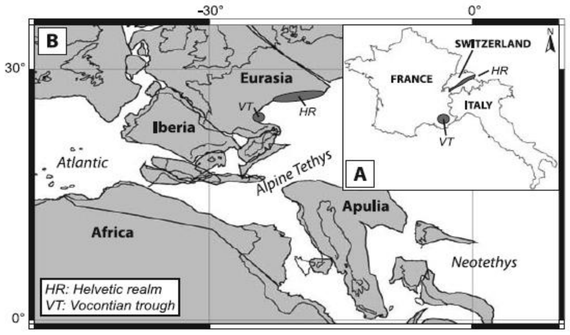
- Sandstone
- Shale
- Limestone
- Dolomite Limestone
- Dolomite
- Sandy Limestone
- Mudstone
- Wackestone
- Packstone
- Grainstone
- Floatstone
- Rudstone



GLOBAL CORRELATION OF $\delta^{13}C$ ISOTOPS with the WELL-1

Venezuelan Gulf | *Northern Tethys* | *Central Tethys* | *Western Atlantic* | *Pacific realm*





Modified from Föllmi *et al.* (2006)

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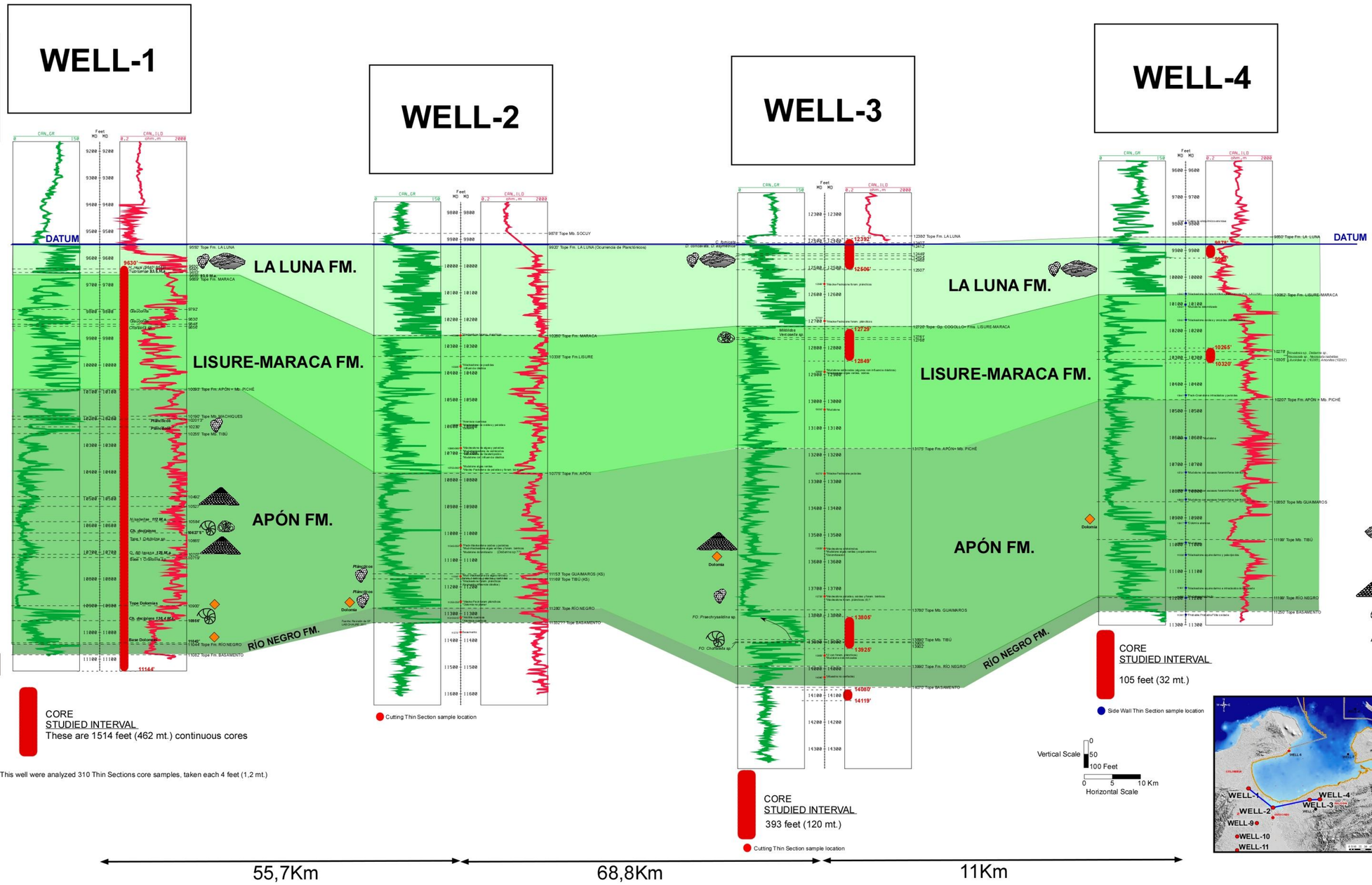
W-E LITHOSTRATIGRAPHIC CORRELATION: SK1 SEQUENCE

NW

E

PERIOD	EPOCH	STAGE	2nd Order Sequences	3rd Order Sequences	FORMATION
CRETACEOUS	LATE	Maastrichtian/ Campanian	SK2		COLÓN
		Turonian/ Campanian	SK1	SK1b	LA LUNA
		Cenomanian			LISURE-MARACA
	EARLY	Albian		SK1a	APÓN
		Aptian			
		Barremian/ Hauterivian			
		Berrias-Valang			RÍO NEGRO
PERMIC		BASEMENT			



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N-S LITHOSTRATIGRAPHIC CORRELATION: SK1 SEQUENCE

SW

NE

WELL-11

WELL-10

WELL-9

WELL-1

PERIOD	EPOCH	STAGE	2nd Order Sequences	3rd Order Sequences	FORMATION
CRETACEOUS	LATE	Campanian	SK2		COLÓN
		Turonian/ Santonian			LA LUNA
		Cenomanian		SK1b	
	EARLY	Albian	SK1		MARACA / LISURE
		Aptian		SK1a	APÓN
		Lower Aptian/ Barremian			RIO NEGRO
PERMIC			BASEMENT		

LA LUNA FM.

MARACA FM.

LISURE FM.

APÓN FM.

RÍO NEGRO FM.

LISURE-MARACA FM.

DATUM

CORE
STUDIED INTERVAL
1666 feet (508 mt.)

CORE
STUDIED INTERVAL
1695 feet (517 mt.)

CORE
STUDIED INTERVAL
1179 feet (359 mt.)

CORE
STUDIED INTERVAL
These are 1514 feet (462 mt.) continuous cores

- Specialist Planctic Foram
- Opportunist Planctic Foram
- *Orbitoline*
- Miliolid
- *Choffatella*
- Dolomite

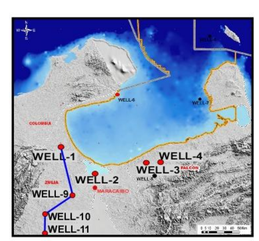
● This well were analyzed 310 Thin Sections core samples, taken each 4 feet (1,2 mt.)

Vertical Scale 0 50 100 Feet

Horizontal Scale 0 5 10 Km

26,3Km | 42,2Km | 65Km

FORMATION	3rd Order Sequences	2nd Order Sequences	STAGE	EPOCH	PERIOD
COLÓN		SK2	Maastrichtian/ Campanian	LATE	CRETACEOUS
LISURE-MARACA / LA LUNA		SK1b	Turonian/ Campanian		
			Cenomanian		
APÓN		SK1a	Albian	EARLY	
			Aptian		
			Barremian/ Hauterivian		
RIO NEGRO			Berrias-Valang		
BASEMENT			PERMIC		



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1813·2013 CAMPAÑA ADMIRABLE

CONCLUSIONS

- We determined 14 microfacies associated with various sub-environments, based on skeletal particles of benthic and planctic invertebrate micro and macrofauna, as well as no skeletal carbonatic particles.

- Cogollo Gp. is made up of sediments from inner to outer carbonatic ramp and includes: 1) Muddy/Grain supported limestones, 2) Dolomites and 3) Siliciclastic. The first, lithotype is along the whole column while; the second, is restricted to the base of the Apón Fm.: and the third, to the Río Negro Fm. and the Lisure-Maraca Fm., which couldn't be differentiated because they share compositional characteristic elements of both units: glauconite, siliciclastics and bivalve fragments.

- From diagenetic point of view, Cogollo Group´s carbonates show physical and chemical processes: micritization, dissolution, cementation, mechanical and chemical compaction, neomorphism, dolomitization, replacement and fractures.

CONCLUSIONS

- Two main transgressive events were established:

  Machiques Mb. outer distal ramp: MFS1 and La Luna Formation, where the planctonics progress, indicating a deepening in anoxic environment of middle neritic-upper bathial paleobathymetry: MFS2.

- MFS were confirmed from the $\delta^{13}C$ isotopic analysis, which shows from the top to the base:

  1) Cenomanian-Turonian boundary, assigned to the OAE2, which correspond to the La Luna Fm., who calibrate and has good match with the biostratigraphic analysis of planctics foraminifera.

  2) Anoxic Event called OAE1c (Machiques Event).

  Additionally, in the lower part of the isotopic curve occur two positive excursions: OAE1b which indicates the Aptian-Albian limit and, the Early Aptian associated to the anoxic event OAE1a.

- For Cretaceous age in Gulf of Venezuela a sedimentological model of **Homoclinal Carbonatic Ramp with Gentle Slope** was defined.