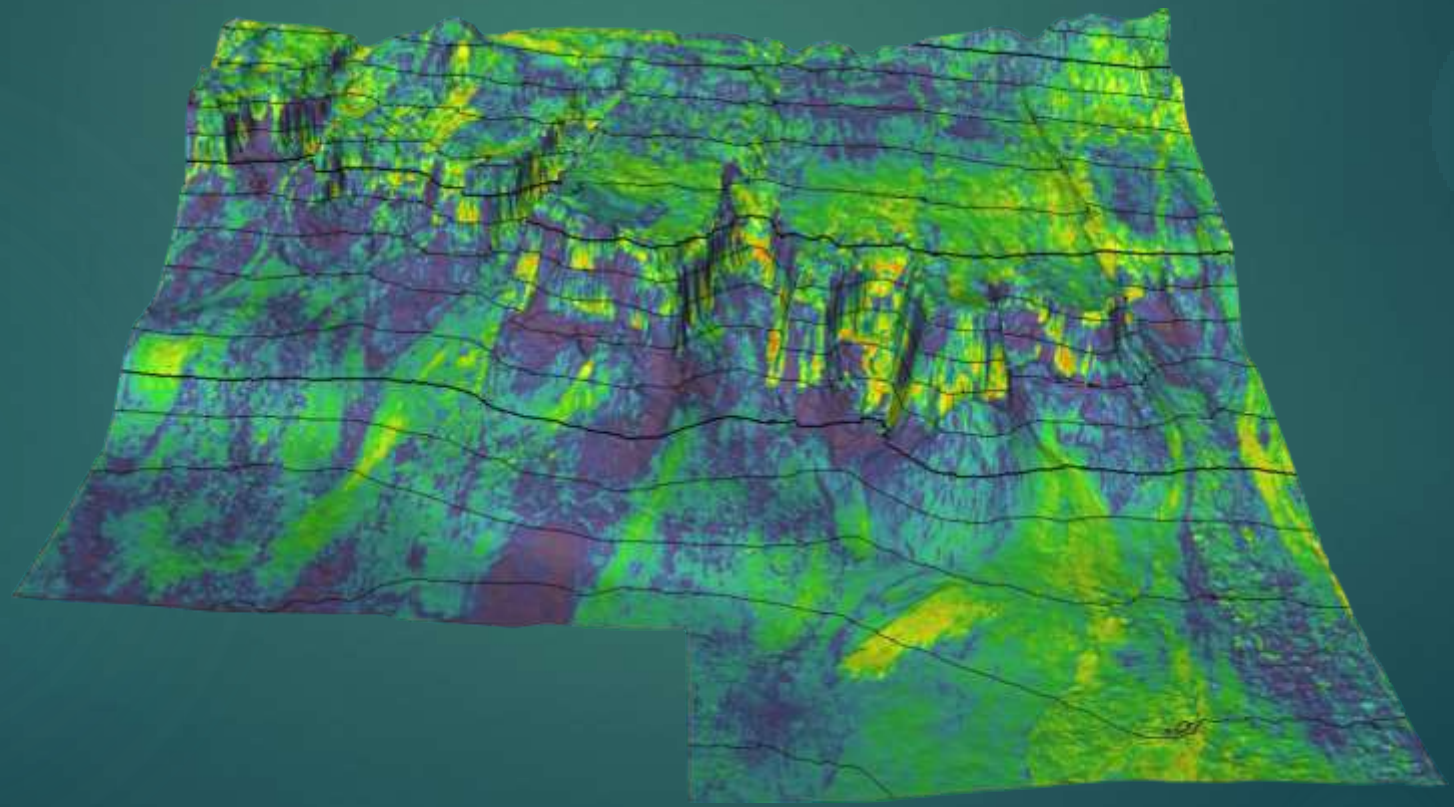
MAX CASSON

MSGBC Basin: Current Analysis, Regional Thoughts & Forward Plan

Supervisors: Prof. Jonathan Redfern, Prof. Mads Huuse, Dr. Luc Bulot



Upper Cretaceous depositional systems, offshore The Gambia Blocks A1&A4

Project Data

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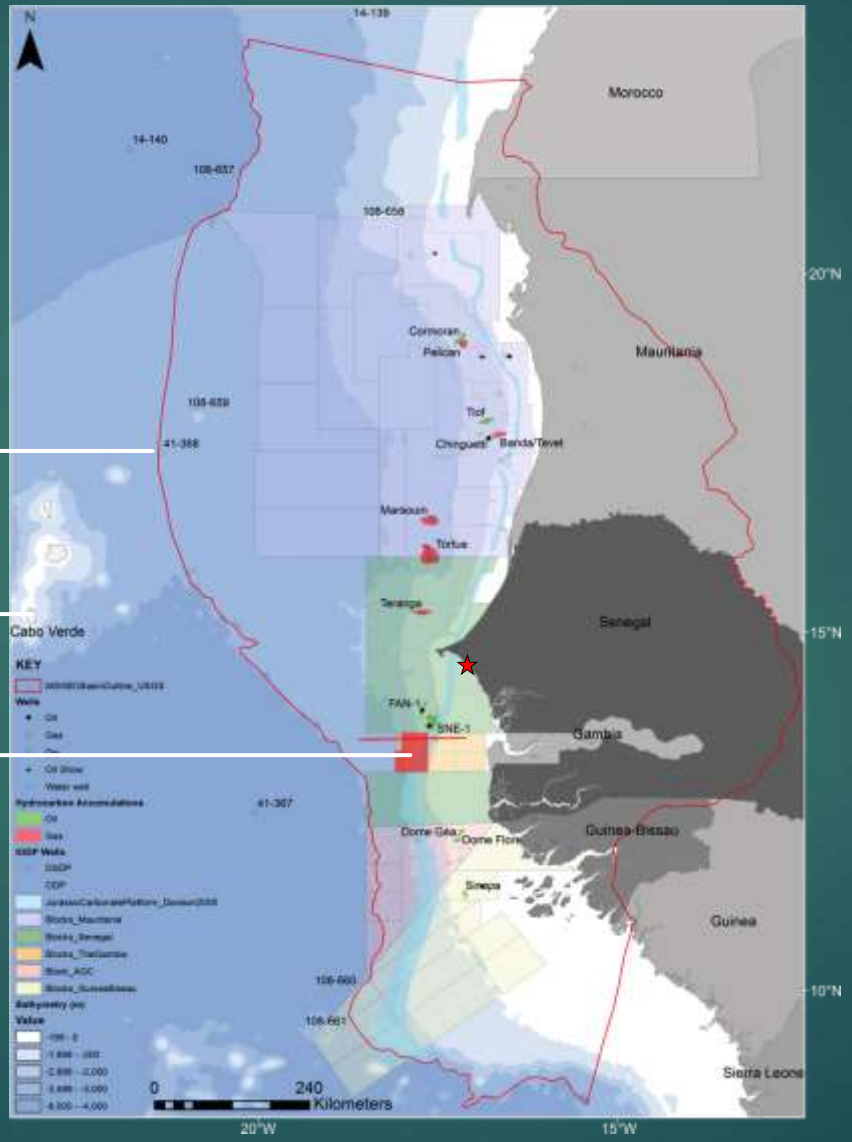
Senegal Cap de Naze / Paki ★
Quarries
Upper Cretaceous sequence

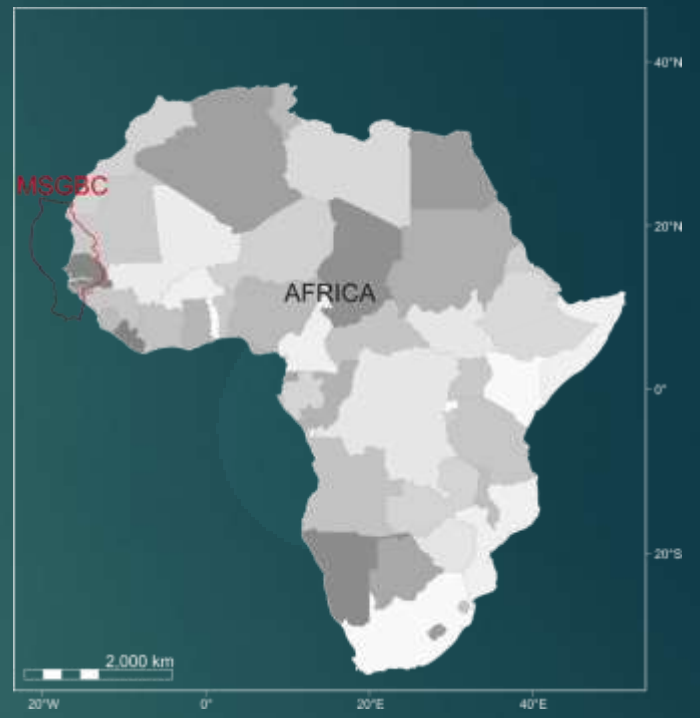
DSDP Well Data

Cape Verde – Maio
Mesozoic sequence

TGS Gambia Blocks A1/A4 3D survey
TGS NWAAM Line-1046 2D

Gravity & Magnetics





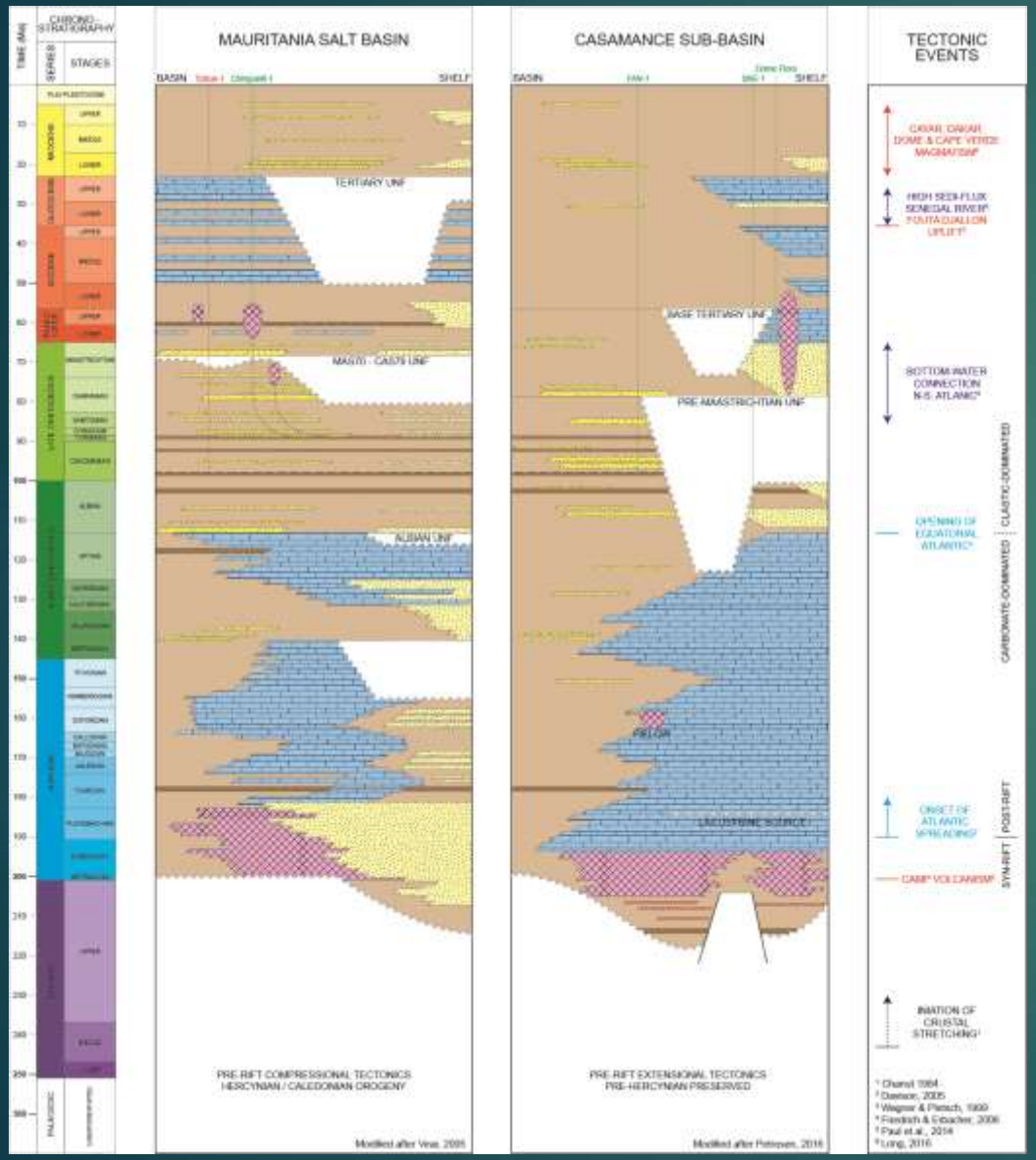
Potential:

TGS NWAAM 2D Survey
Senegal – Guinea

Spectrum Seismic Surveys

Polarcus A2/A5 3D Survey

MSGBC Chrono-Stratigraphy



Questions:

- Regional unconformities diachronous along the margin?
- PMU/Senonian Unf. – cause?
- Control on carbonate/clastic switch + timing
- Timing of sand delivery?
- Upper Jurassic source potential
- Age of salt? Movement history?
- Effect of Tertiary magmatism/uplifts/swells

Cretaceous Global Reconstructions

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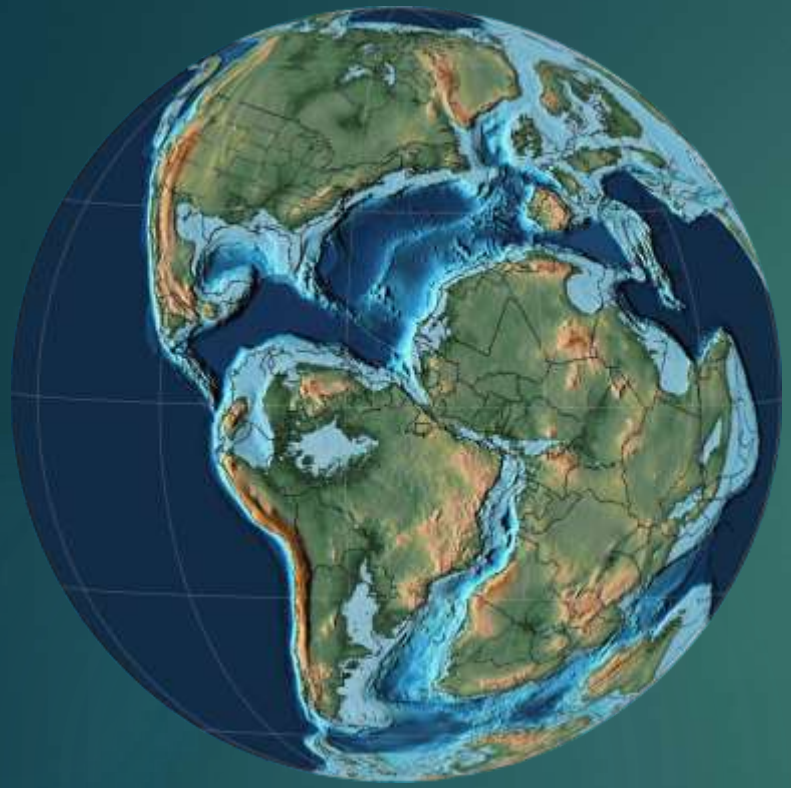


Late Aptian – 115Ma

Rifting along transform margin

Cenomanian – 95Ma

Opening of the Equatorial Atlantic Gateway

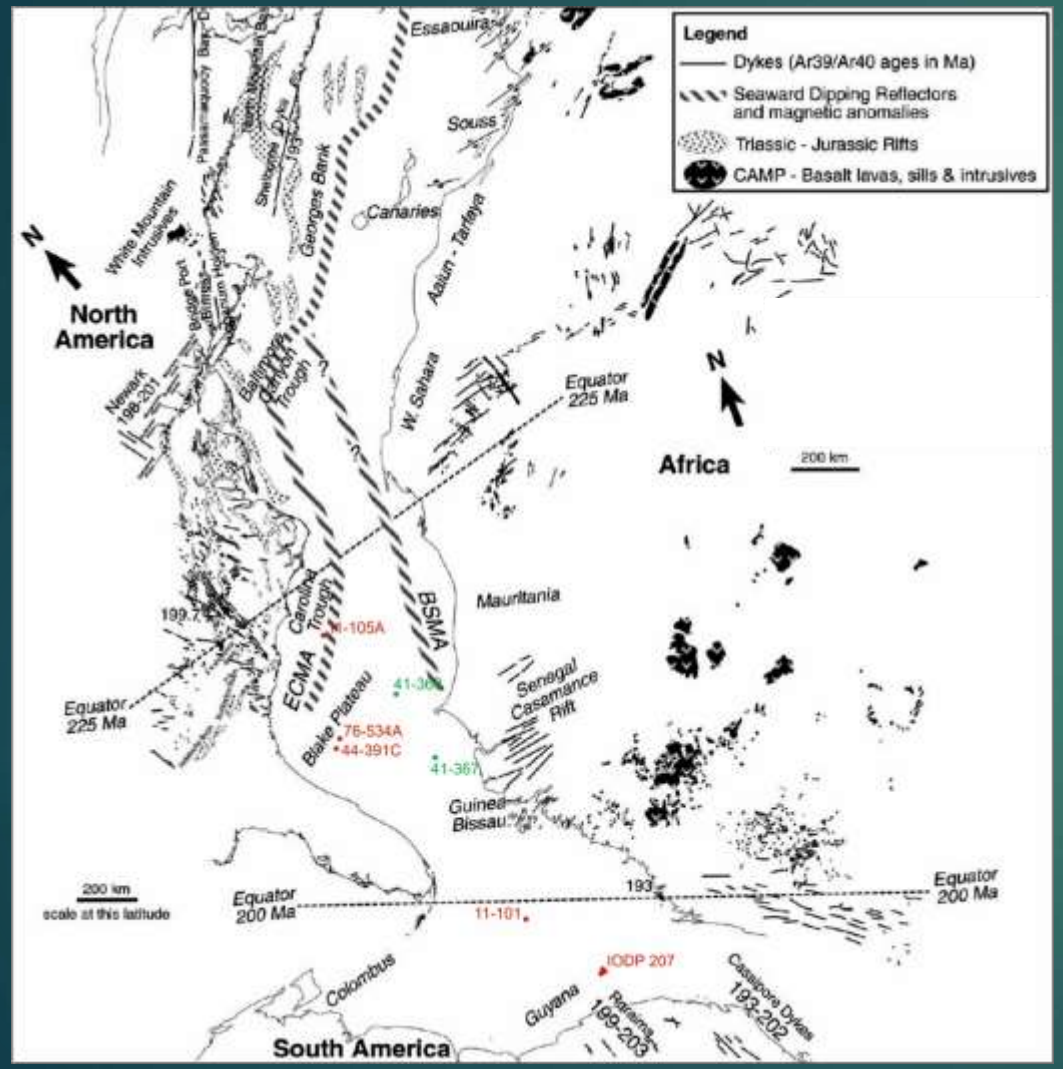
Early Campanian – 80Ma

Atlantic bottom-water circulation

Scotese, GPlates 2016

IODP Core Repository

Bremen, Germany



Jurassic reconstruction, Davison, 2005

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Phase 1 (Aug. 2017) – reconnaissance data collected
Phase 2 (Nov. 2017) – higher resolution biostratigraphy & logging to define key surfaces

Aims:

- Re-evaluation of DSDP 367 & 368 well
- Logging, biostratigraphy & organics analysis
- Biostratigraphic framework for seismic interpretation
- Integrated biostratigraphy

- Central Atlantic Margin-wide re-evaluation: timing, distribution & potential of Jurassic to Cenomanian source rocks (collaboration with Jason Jeremiah)

DSDP 367 key well in the study area:

- Near full succession of Mesozoic stratigraphy
- Proven Late Aptian – Cenomanian black shales
- Older sources ?
- Seismic well tie in the basinal area

DSDP Results: Source Rock Facies

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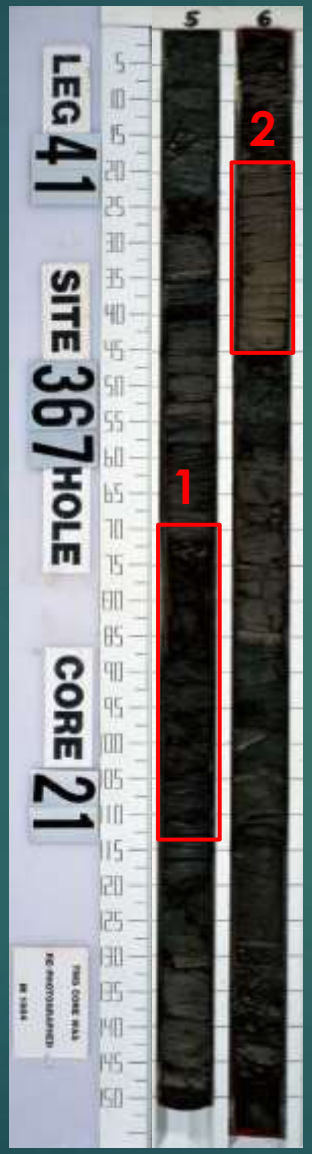
1. Rotten-stone

Black, non-calcareous, sulphur banding, organics, barren of nanno-fossils, type III



earliest Cenomanian – Albian interval

2. Paper Shales

Grey, calcareous, laminated, shelly debris, fossiliferous, high nanno-fossil recovery, marl, type II

?Cenomanian fish preserved on bedding plane

3. Claystone

Full of plant material, non-calcareous, barren of nanno-fossils, argillaceous, frequently oxidised (red) and reduced (green), common silt beds cross-bedded, type II/III

Leg 41 Site 368 Core 63-1

4. Black Shale

Black, laminated, highly organic, carbonaceous OAE-2 equivalent

DSDP Results: Berriasian Unconformity

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Interval – 1087.42m – 1088.07m (3 samples): Late Early Berriasian; Base *Nannoconus steinmannii ssp minor* at 1088.07m

Lower Berriasian Unconformity 1088.10m

Interval 1088.19m – 1088.82m (4 samples): late Early Tithonian; top *Nannoconus infans/compressus* and *Polycostella beckmannii* at 1088.19m.
Base *Nannoconus infans/compressus* at 1088.82m

- late Tithonian missing – J/K boundary
- Significant differences in Jurassic ages to DSDP, pre-Calpionellid work
- Condensed interval, winnowing & bioturbation
- 33-1: laminated black shale – Jurassic source?

Leg 41 Site 367 Core 32-5 working (Left) & archive (right)

IODP Results: Apto-Albian Biostratigraphy

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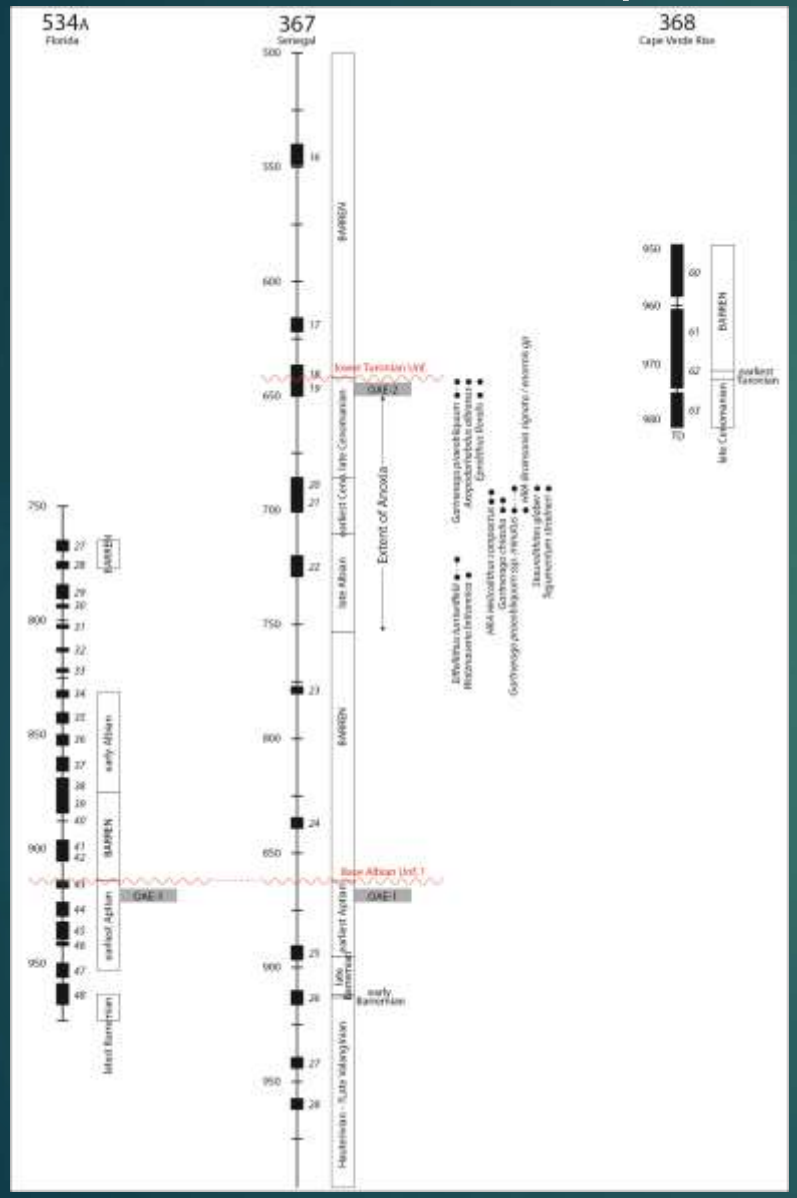

Observations:

- Facies consistent either side of the Atlantic – regional
- Nanno-fossil dates – forthcoming zonations
- most of the Aptian absent
- Non-calcareous, barren unit
- late Albian – Cenomanian source rock facies – anoxia throughout this thick interval not limited to OAE-2
- OAE-2 equivalent late Cenomanian

Interpretations:

- Base Albian uncf. observed in 534A, suspected in 367 between cores 26-27
- early Albian & Turonian barren units, full of plant material represent clastic deltaic progradations on the shelf – reservoir generation
- Send samples for palynology – some units oxidised
- Albian – Cenomanian flooding event

1. Build an integrated biostratigraphic / sequence strat. framework
2. Improve accuracy of seismic & tectono-stratigraphic interpretation

The Gambia: Albian Delta Evolution

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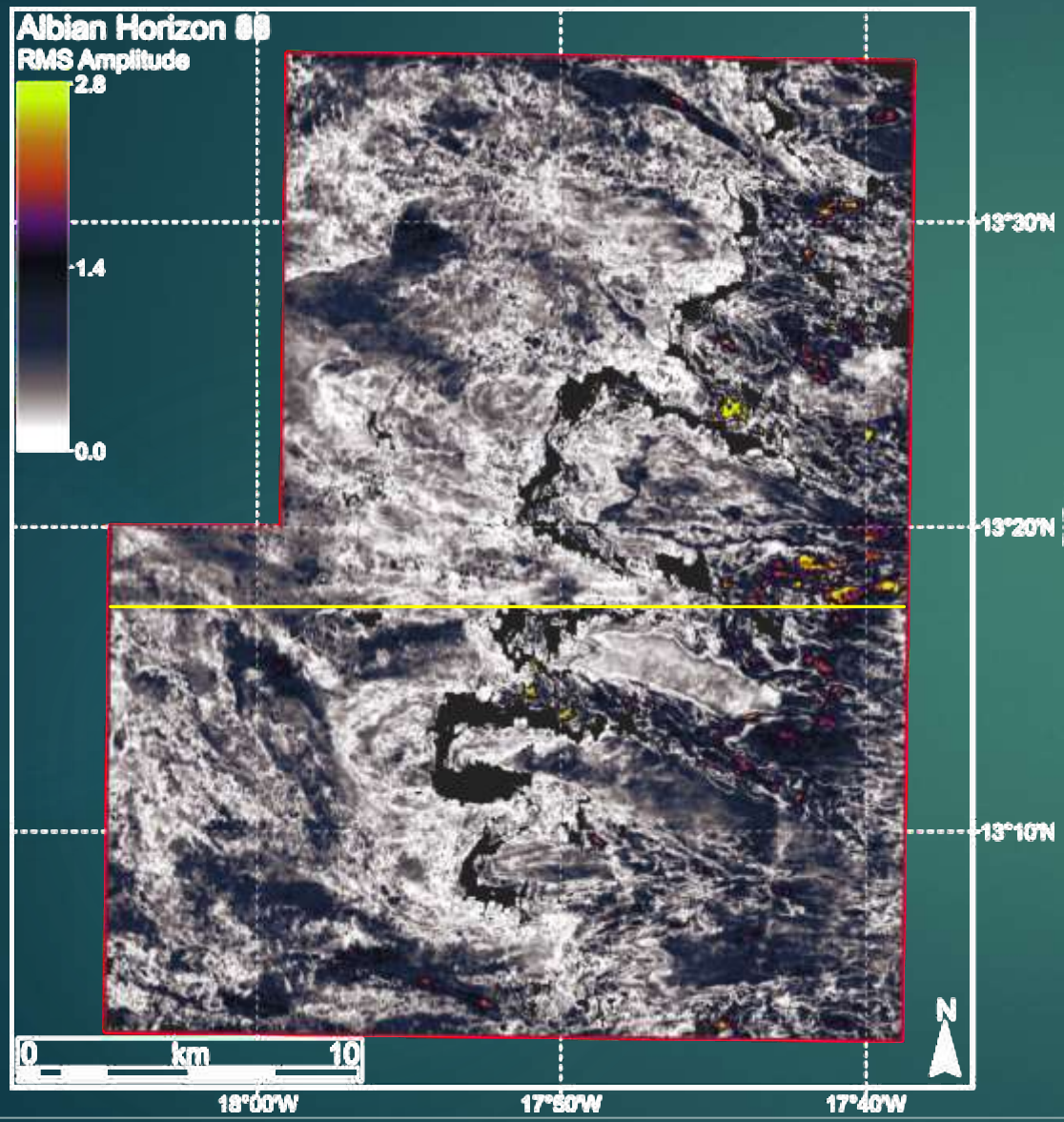

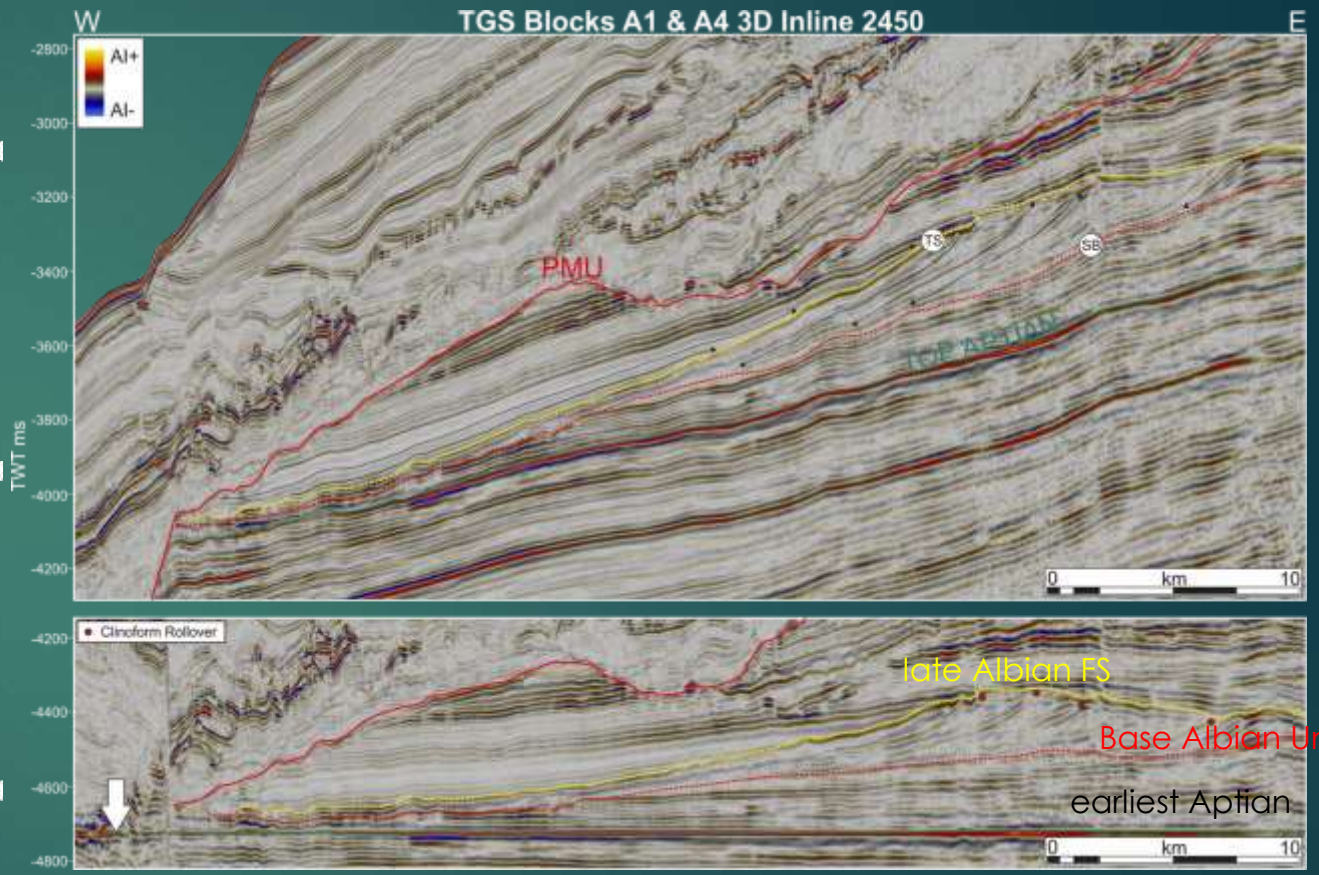

Forward Plan

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Well & Fieldwork Data

IODP Core Repository Bremen — November 2017

Cape Verde Fieldwork — January 2017

Cap de Naze & Paki Fieldwork — November 2017

Write-Up — Mid-2018

Evolution of Depositional Systems, offshore The Gambia — On-going

Abstract submitted: AAPG ACE 2018

Interpretations from regional study applied to 3D seismic, The Gambia

Cap de Naze, Senegal Fieldwork

23rd November to 2nd December 2017

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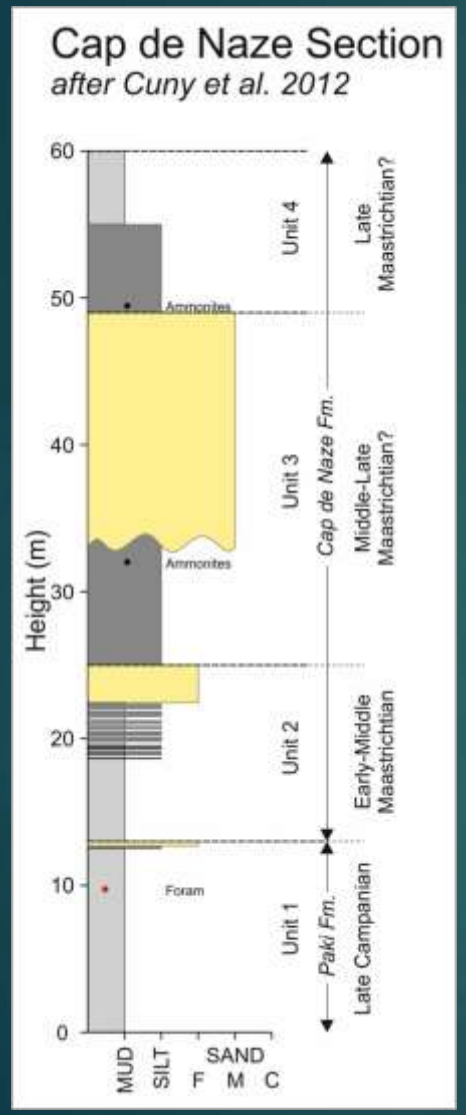

- **Aims:** sequential logs along strike, collect biostrat. & reservoir samples
- Photograph cliff-face using drone
- Proximal data point in biostratigraphic framework – correlate to DSDP wells
- Improve sequence strat. & depositional environments

Cape Verde Fieldwork

8th – 31st January 2018

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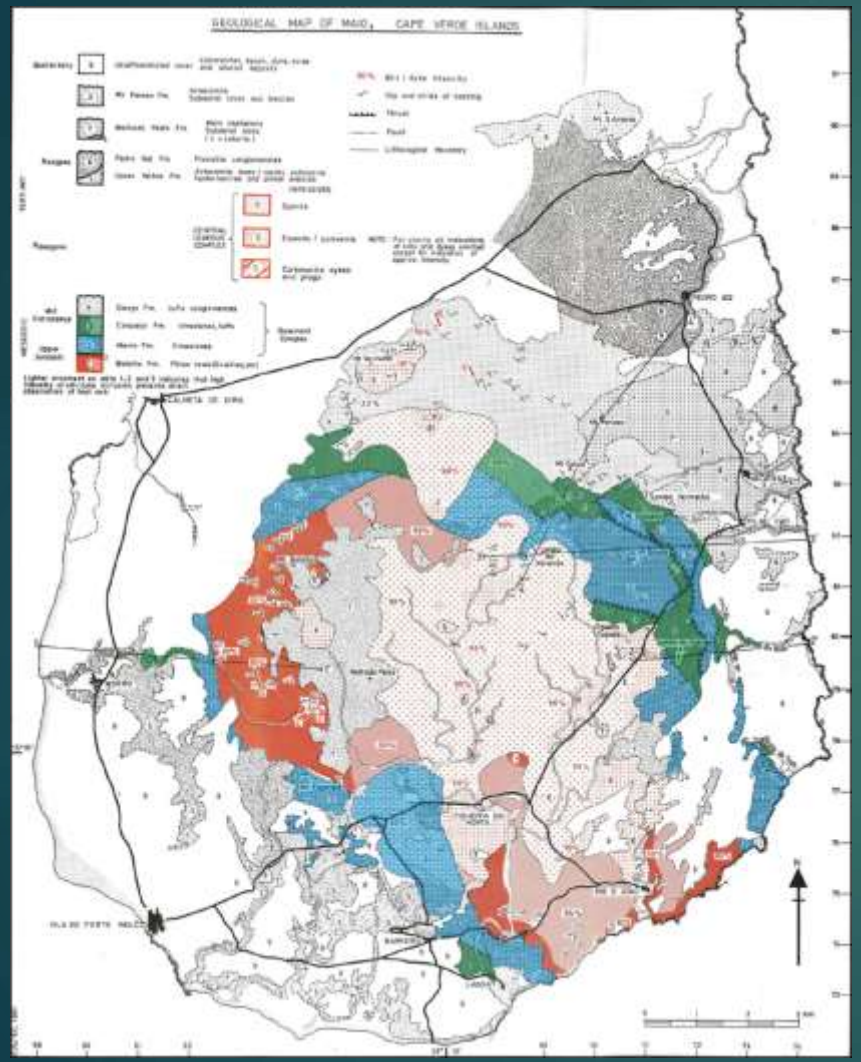
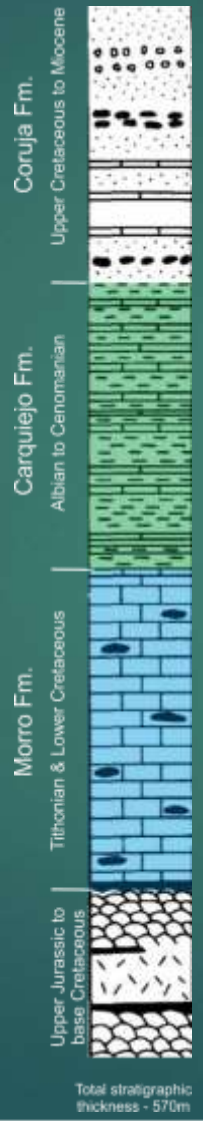


Geological map of Maio, Stillman et al. 1982



History:

- Original study – Stahlecker, 1934
- Re-visited by Robertson (Edinburgh Uni) 1970's to improve geological mapping & history

Geology:

- Central igneous complex
- Jur. deep water chalks, 'White Limestones' equivalent
- mid-Cret. Atlantic anoxic black shale facies
- Interbedded with distal calc-/terrigenious turbidites
- Uplift during Miocene

Aims:

- Logging of sections to improve understanding of depositional environment
- Biostratigraphic sampling
- Correlate to DSDP wells

Cape Verde Chrono-Stratigraphy

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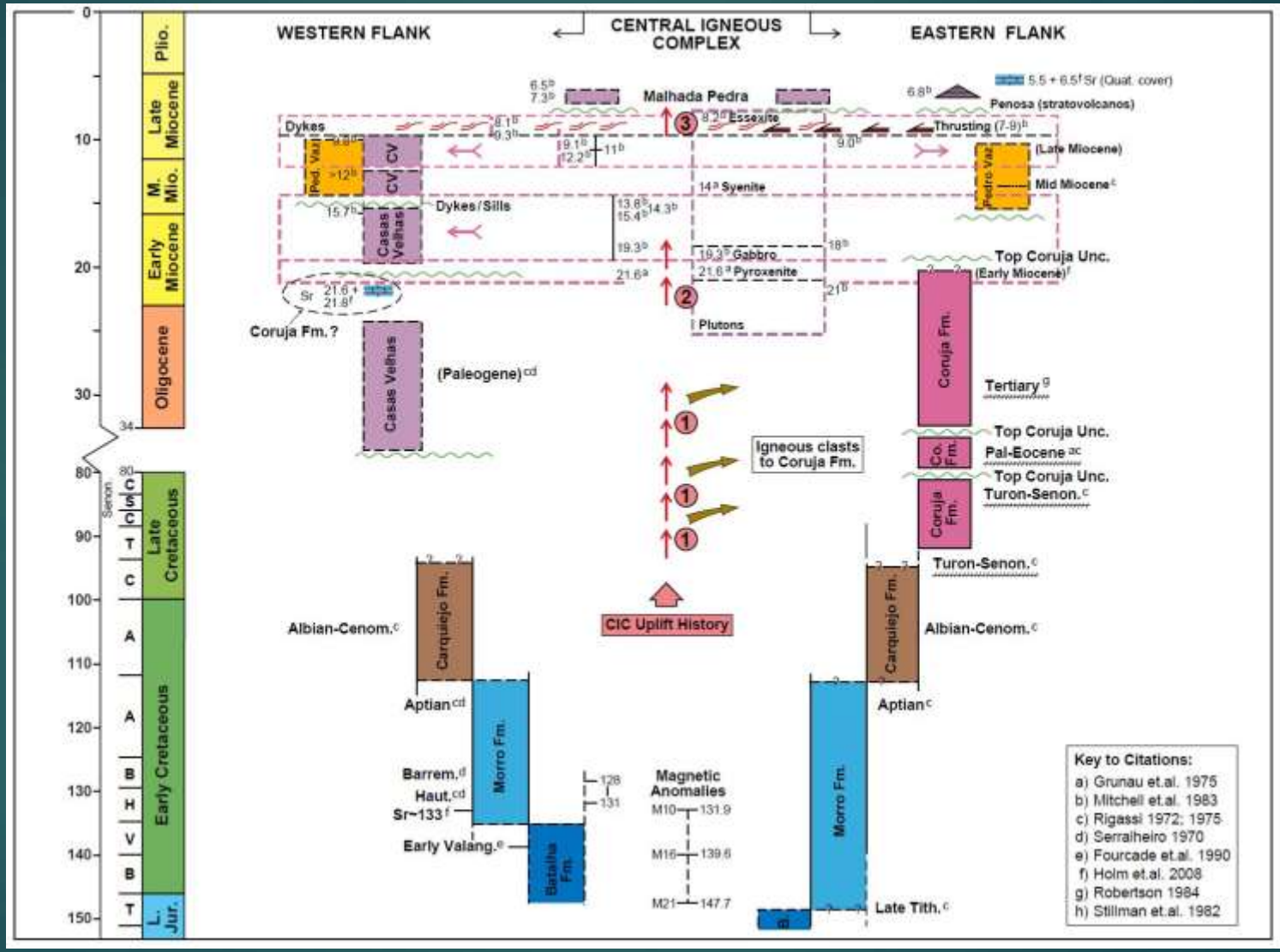
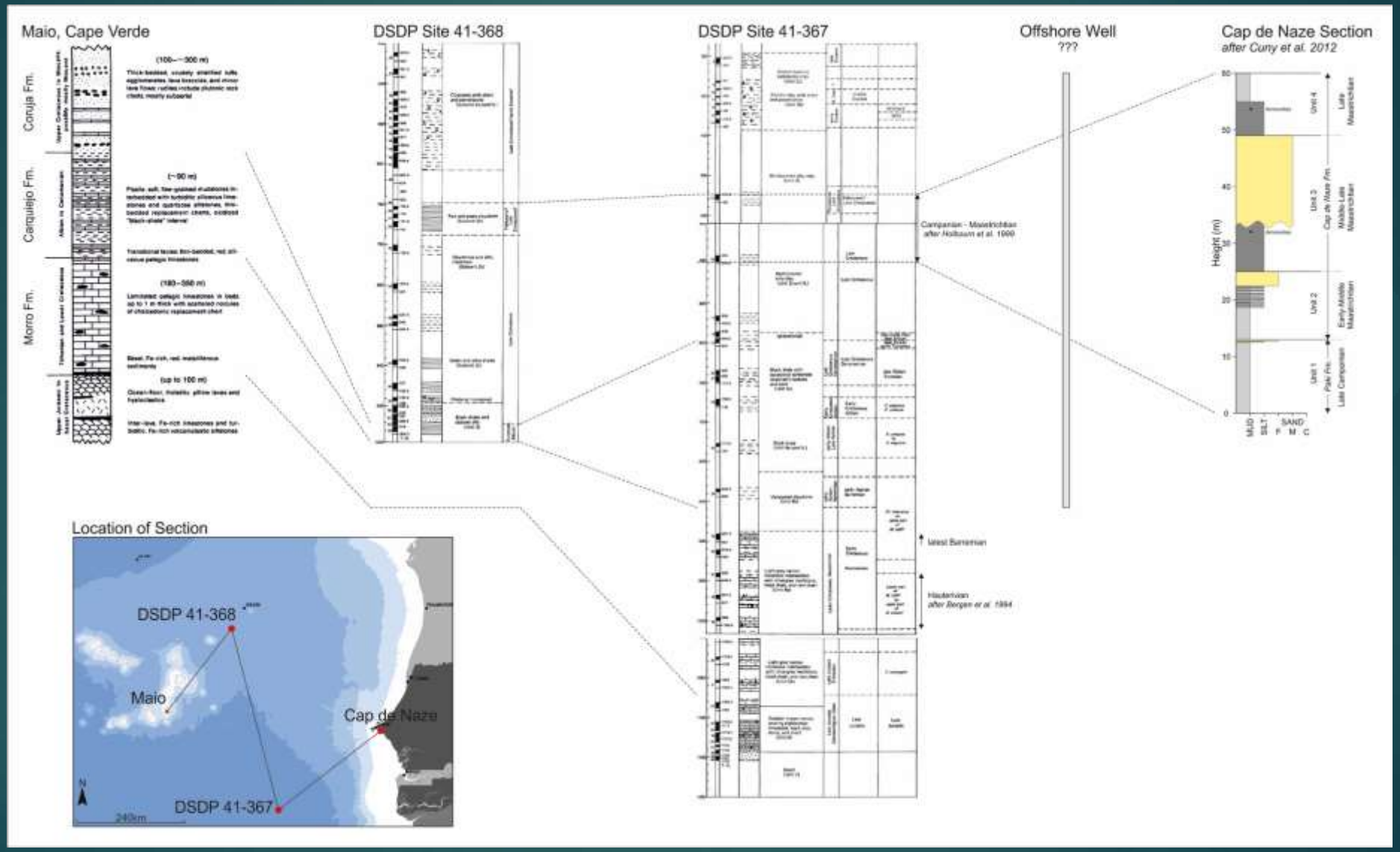


Maio Chrono-Stratigraphy – Lawrence, 2016

Stratigraphic Correlation



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