



# Source to sink: A provenance study of Cretaceous sediments, Senegal NW Africa

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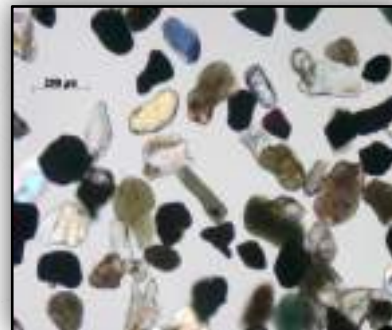
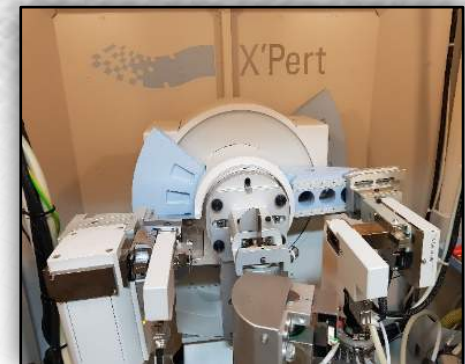
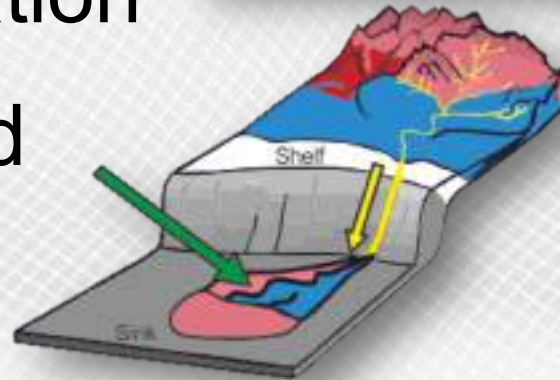
Ian Mounteney: MPhil (year 1 of 2)

Supervisors: Jonathan Redfern, Stefan Schroeder and Giovanni Bertotti and Max Casson



# Presentation:

- Who am I?
- Project location
- Background
- Aims
- Methods
- Initial results
- Next stage...



# My introduction



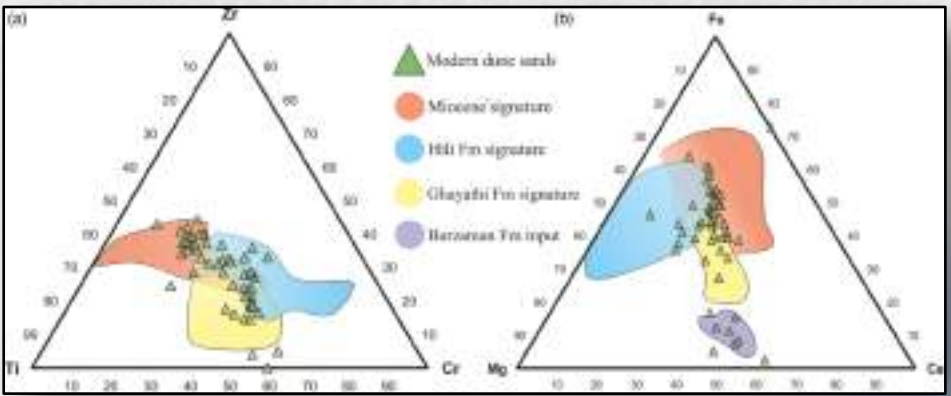
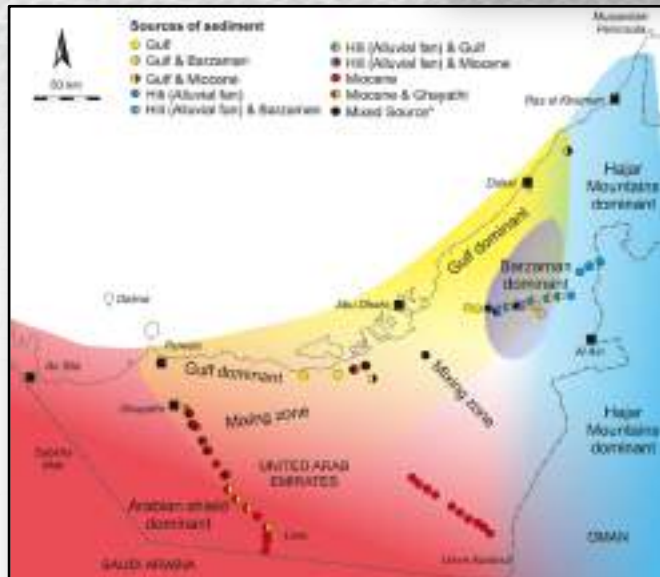
Journal of Geochemical Exploration

Heavy mineral analysis by ICP-AES a tool to aid sediment provenancing

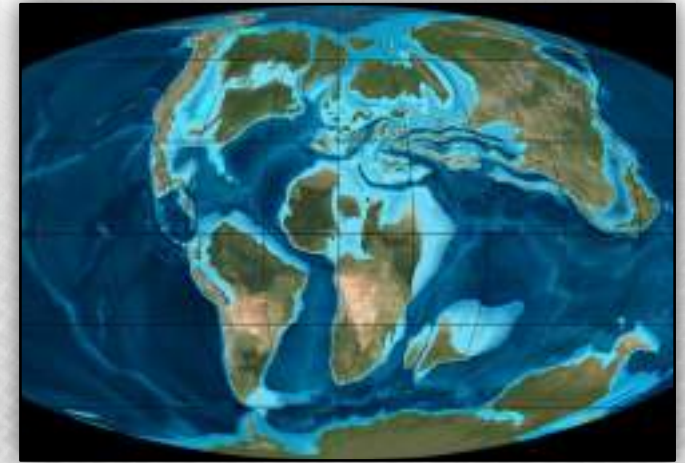
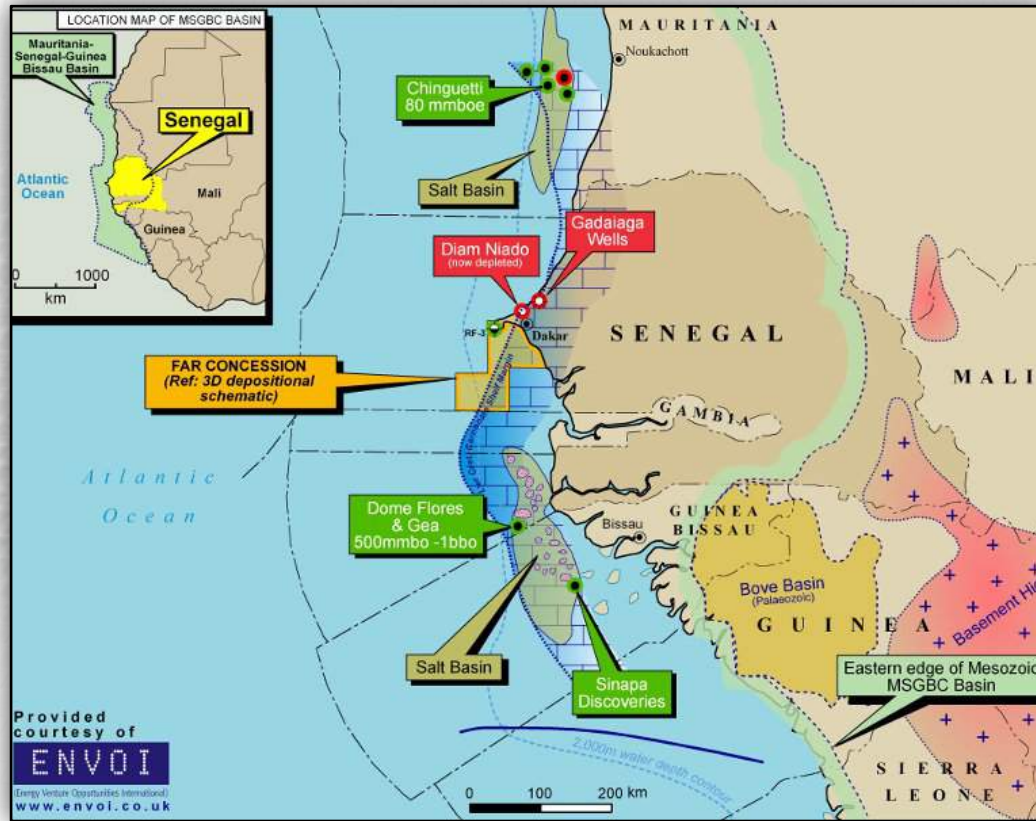
L. Masterson\*, A.E. Barton, A.R. Forrest, M.J. Ward, S.J. Kemp, J.M. Cook

ABSTRACT

Characterisation and provenancing of sediment-sedimented heavy minerals is achieved by conventional techniques a provenance approach is through the identification and discrimination of heavy mineral using a petrological microscope. This can be time consuming, the analysis of heavy minerals by laboratory equipped plasma atomic emission spectrometry offers a faster alternative by determining key elements associated with specific heavy minerals. Here we evaluate potential for determining heavy mineral spectra through ICP-AES using high temperature laser with a hollow cathode tube in a more complete discrimination of mineral signatures. The method was tested in a provenance study of shales south from the Central Ash Mountains. The results are compared with those from traditional optical microscopy. These show good agreement for minerals with specific geochemical signatures, while the overall geochemistry of the heavy mineral concentrates was dependent of potential sediment source. This geochemical approach is capable of processing large numbers of samples rapidly and is robust and accurate technique. A combination of geochemical and mineralogical data produced by these techniques provide a powerful diagnostic tool for studies of heavy mineral signatures to sediment frequently used in mineral provenance, palaeogeographic reconstruction and reservoir characterisation in the petroleum industry.



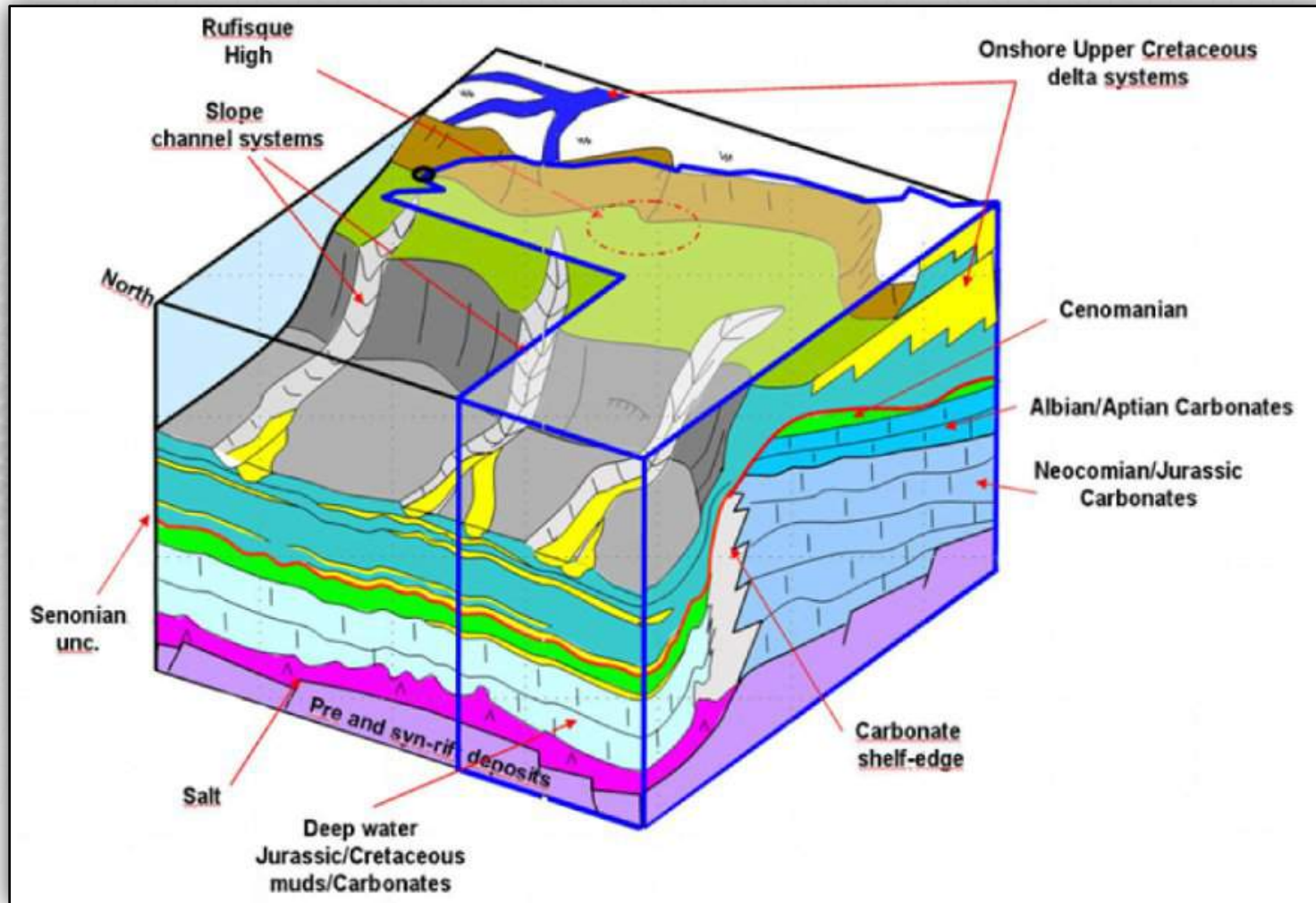
# Location



Paleogeographic reconstruction 90 Ma  
(<http://scienceviews.com/photo/library/SIA3584.html>).

“To build a regional tectonic-stratigraphic framework, integrating well data from across Senegal”

# Source to sink



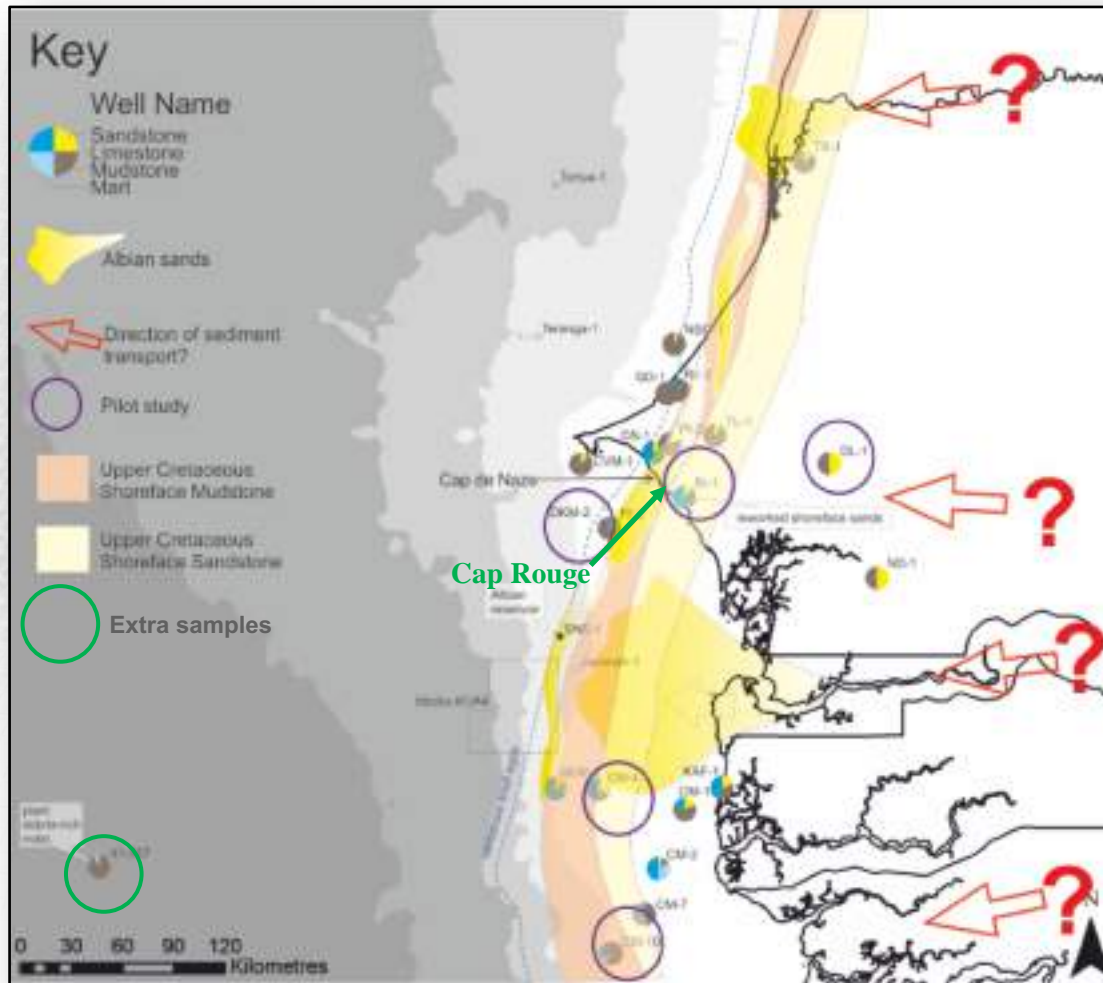
<https://www.geoexpro.com/articles/2015/01/senegal-revisited>

# Aims

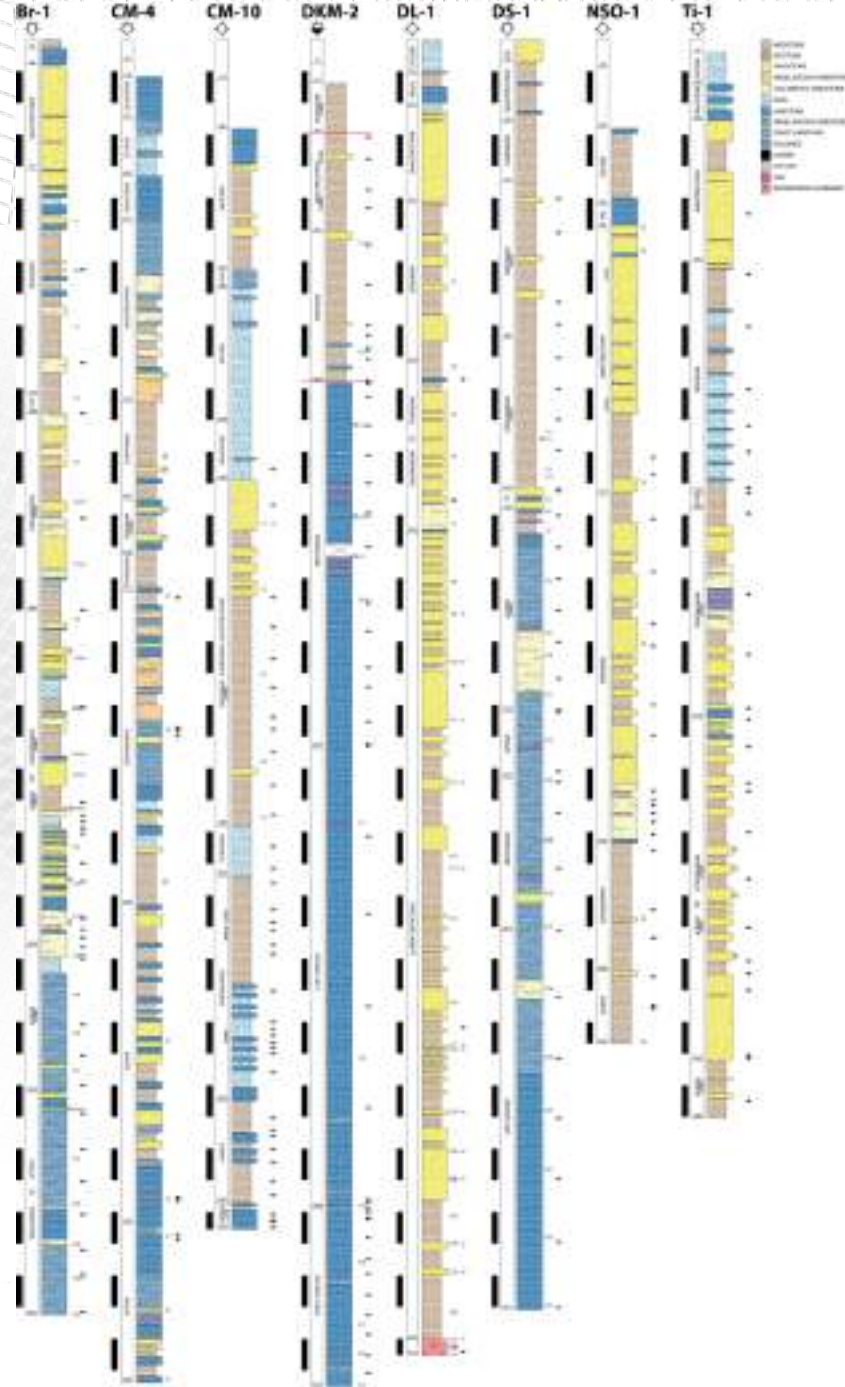
- Investigate sediment distribution in offshore and onshore basins, Senegal, NW Africa.
- Evaluate the Cretaceous stratigraphy and refine our prediction of sand delivery.
- \*Examine and contrast modern-day sand delivery.



# First stage sampling

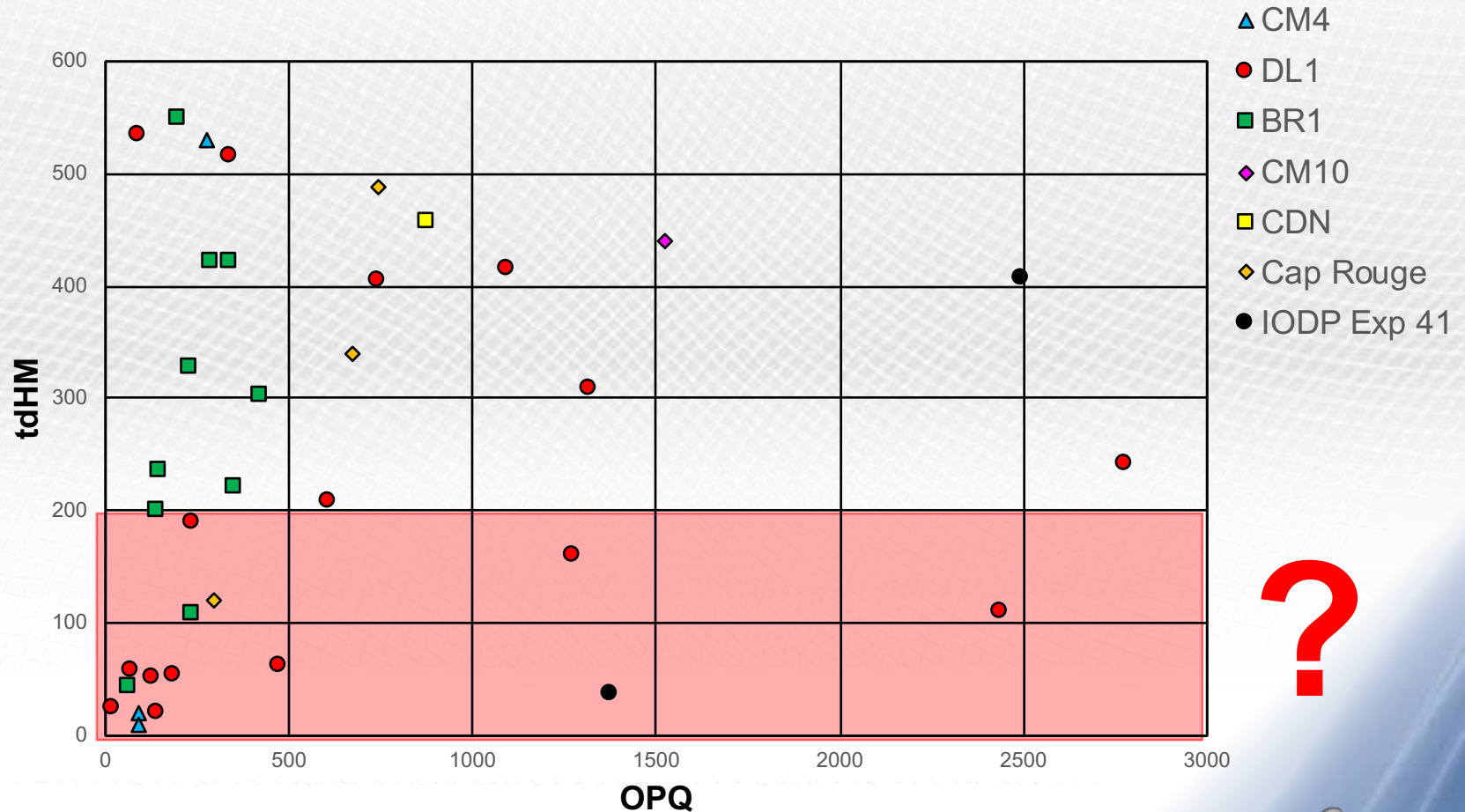


Albian (113-100 Ma) sands and Upper Cretaceous shoreface facies.  
(Max Casson, PhD & Bonilla Andrango, MSc).

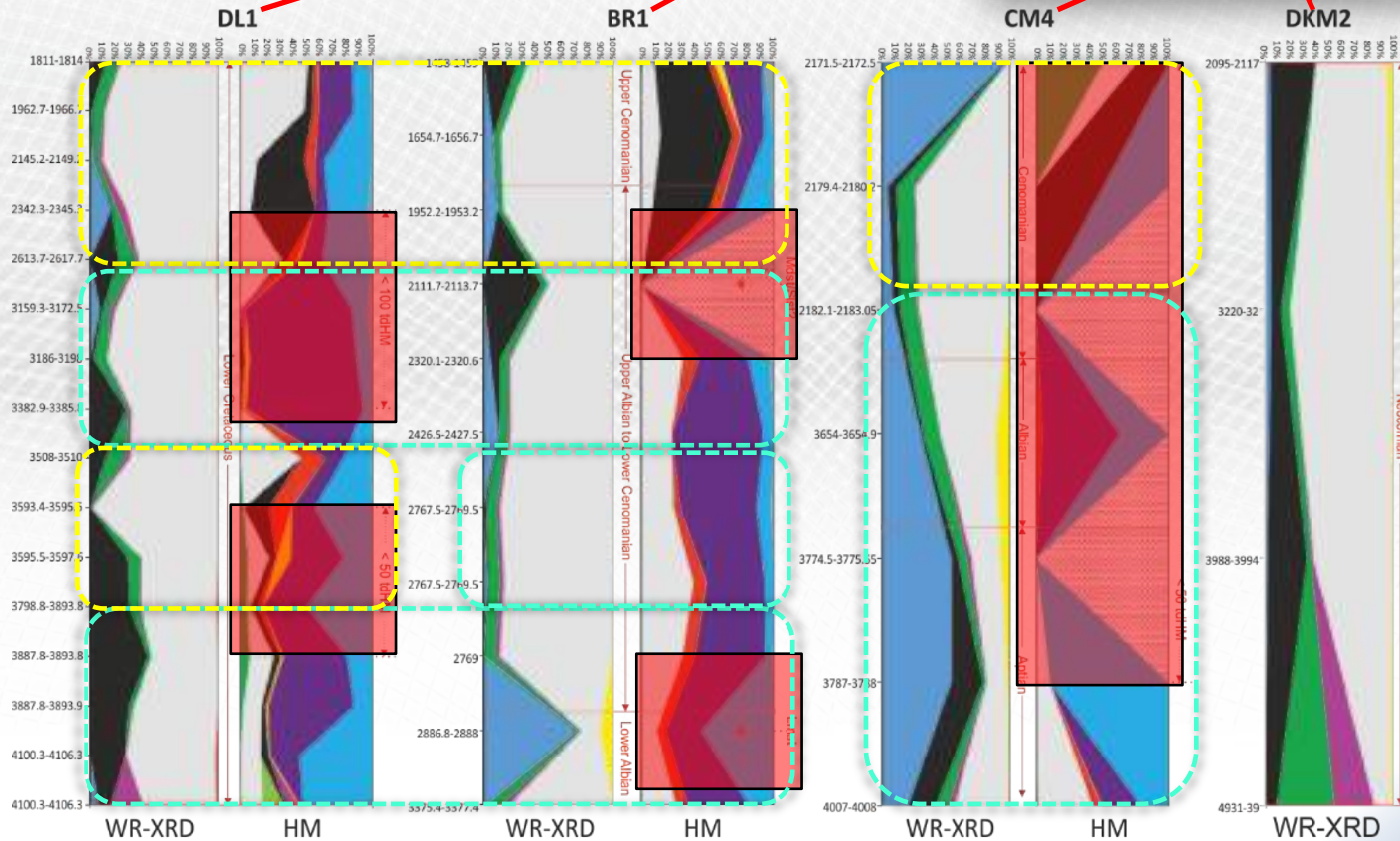
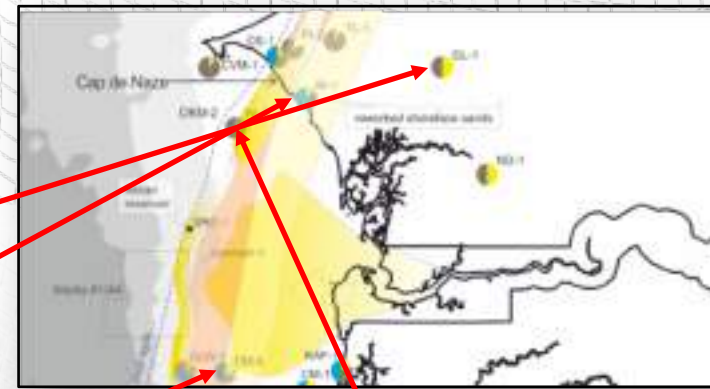




# Statistical identification of *td*/HM



# Preliminary results



**Whole-rock XRD**

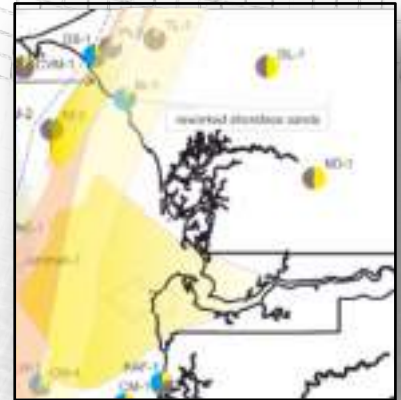
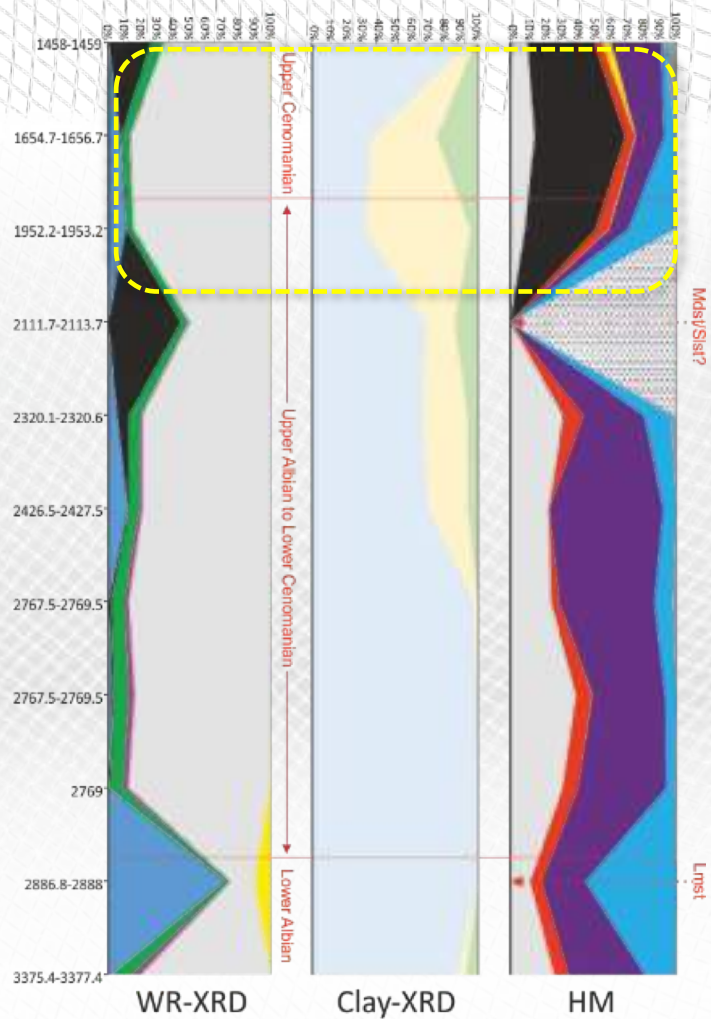
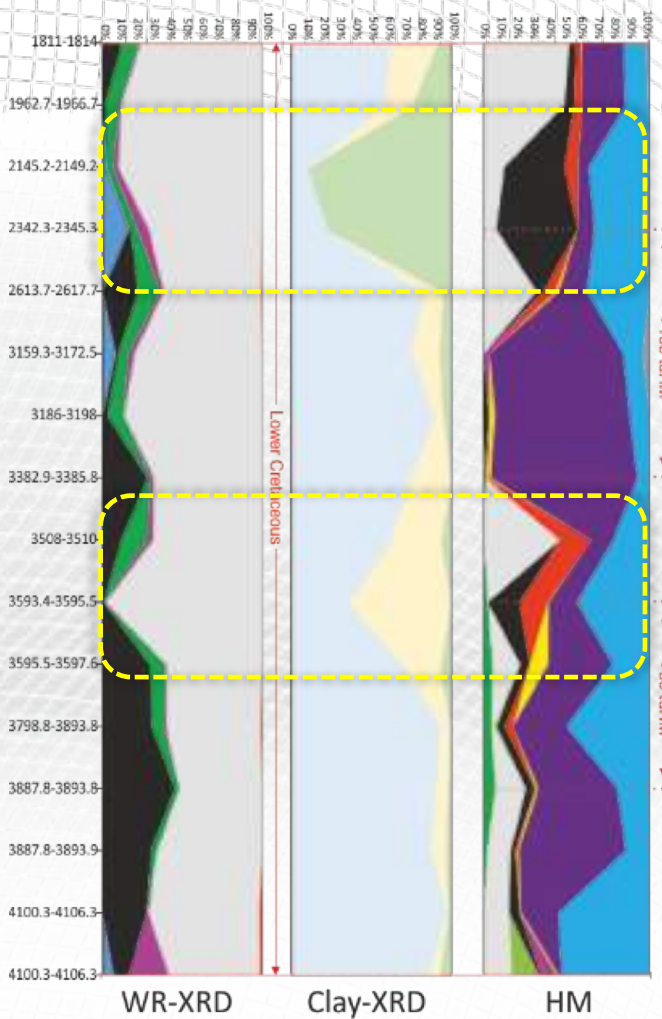
■ Carbonate	■ Clay	■ Feldspar	■ K-feldspar
■ Quartz	■ Sulphides	■ Fe-Oxides	

**Heavy minerals (HM)**

■ Am	■ Ap	■ Ep	■ Grt	■ Ky	■ Rt	■ St
■ Tur	■ Zrn	■ Other	■ Non-tdHM			

# DL1

# BR1



**Whole-rock XRD**

- Carbonate
- Clay
- Feldspar
- K-feldspar
- Quartz
- Sulphides
- Fe-Oxides

**<2 μm Clay XRD**

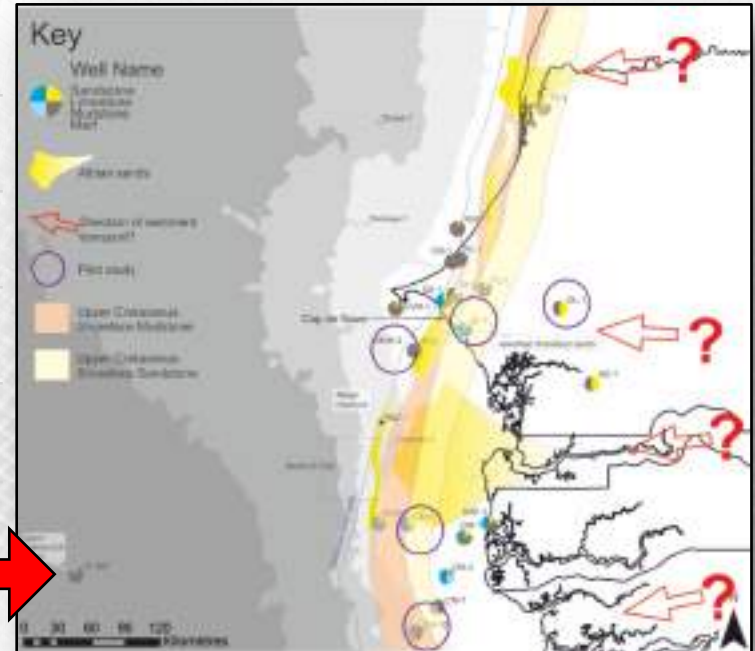
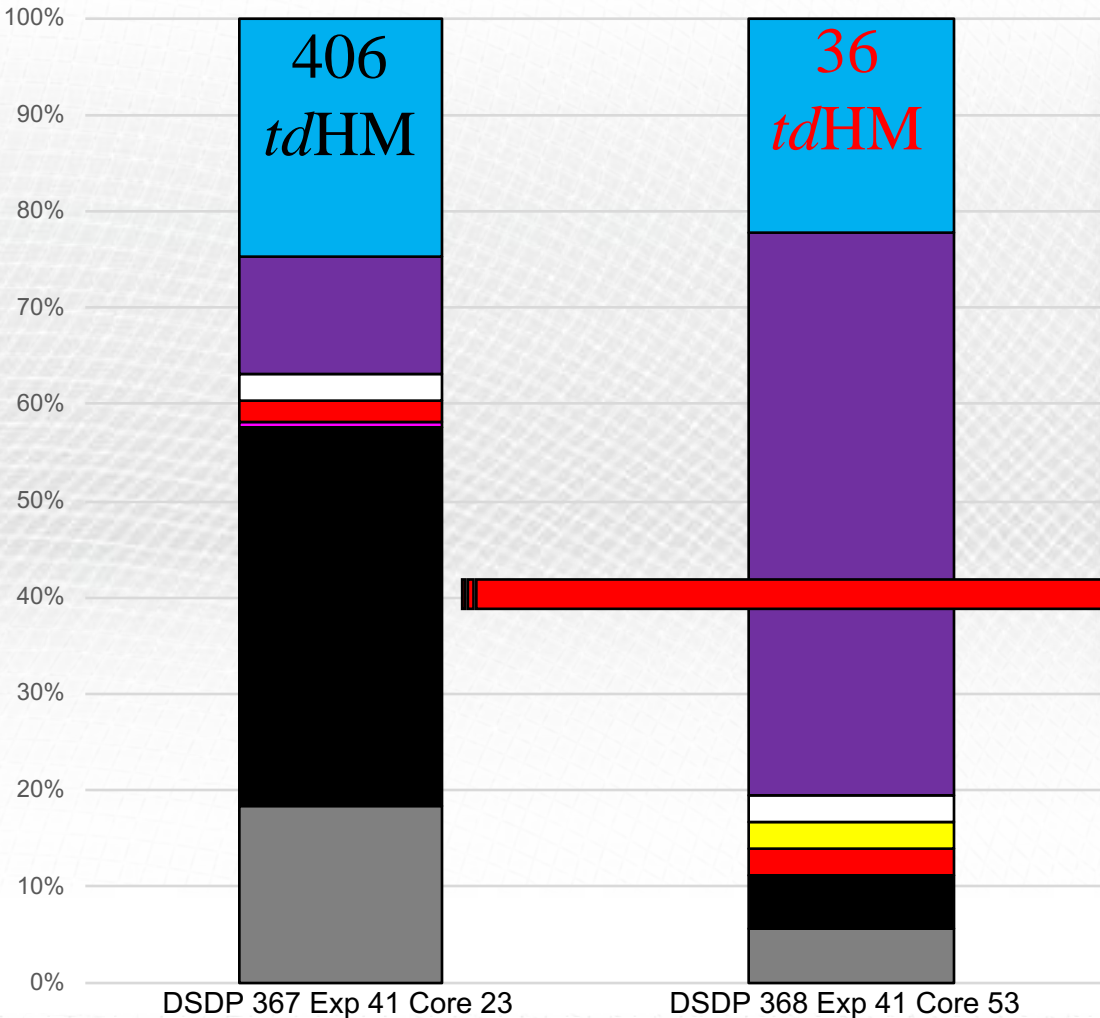
- Illite
- Kaolinite
- Chlorite
- Smectite

**Heavy minerals (HM)**

- Am
- Ap
- Ep
- Grt
- Ky
- Rt
- St
- Tur
- Zrn
- Other
- Non-tdHM

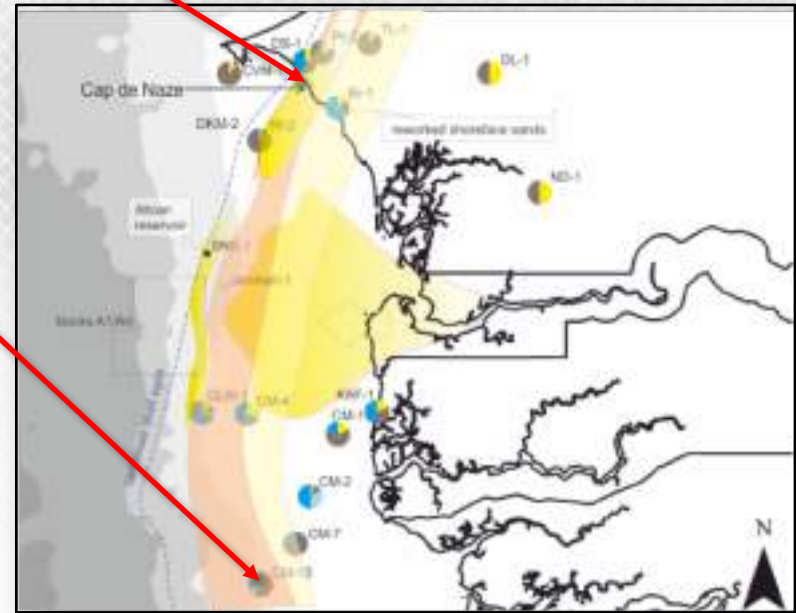
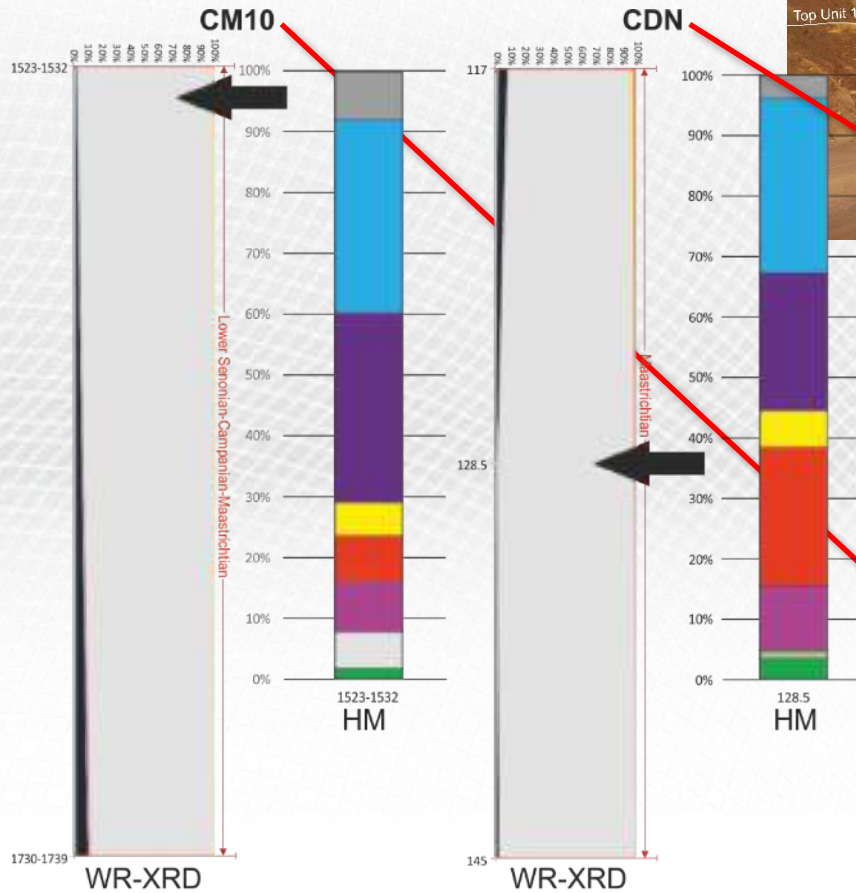


# DSDP Exp 41 (367 and 368)



■ Ap ■ Grt ■ Ky ■ Rt ■ St ■ Tn ■ Tur ■ Zm

# Cap de Naze



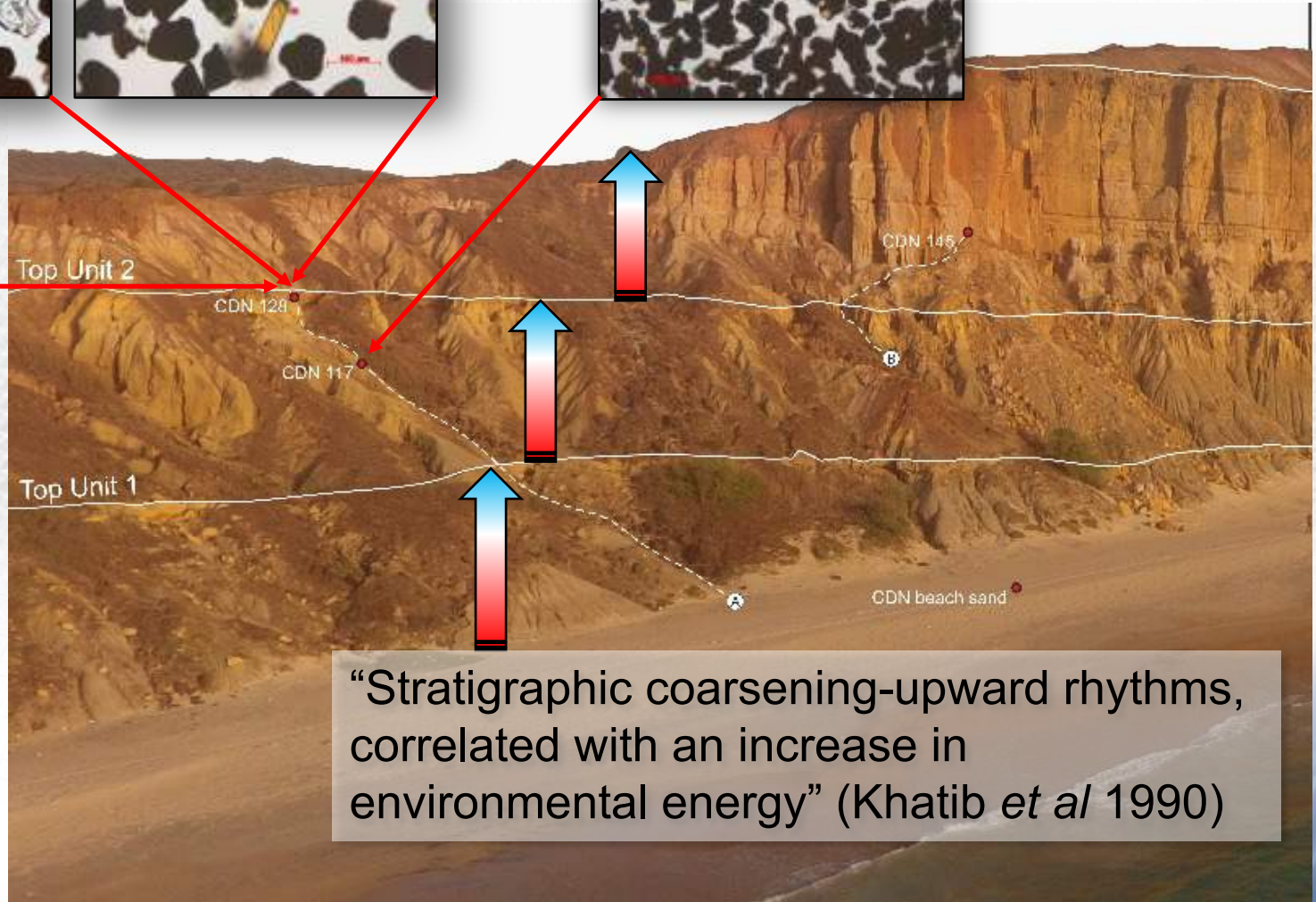
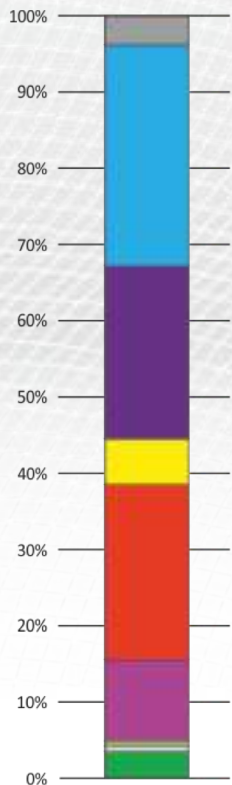
Whole-rock XRD

Carbonate	Clay	Feldspar	K-feldspar
Quartz	Sulphides	Fe-Oxides	

Heavy minerals (HM)

Am	Ap	Ep	Grt	Ky	Rt	St
Tur	Zrn	Other	Non-tdHM			



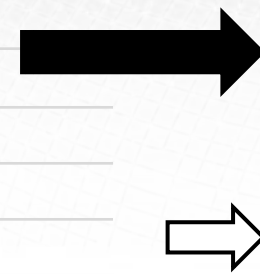
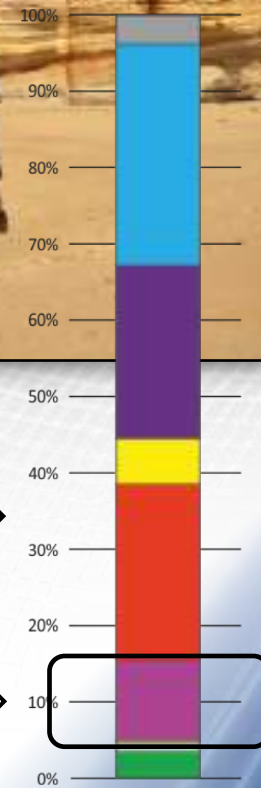
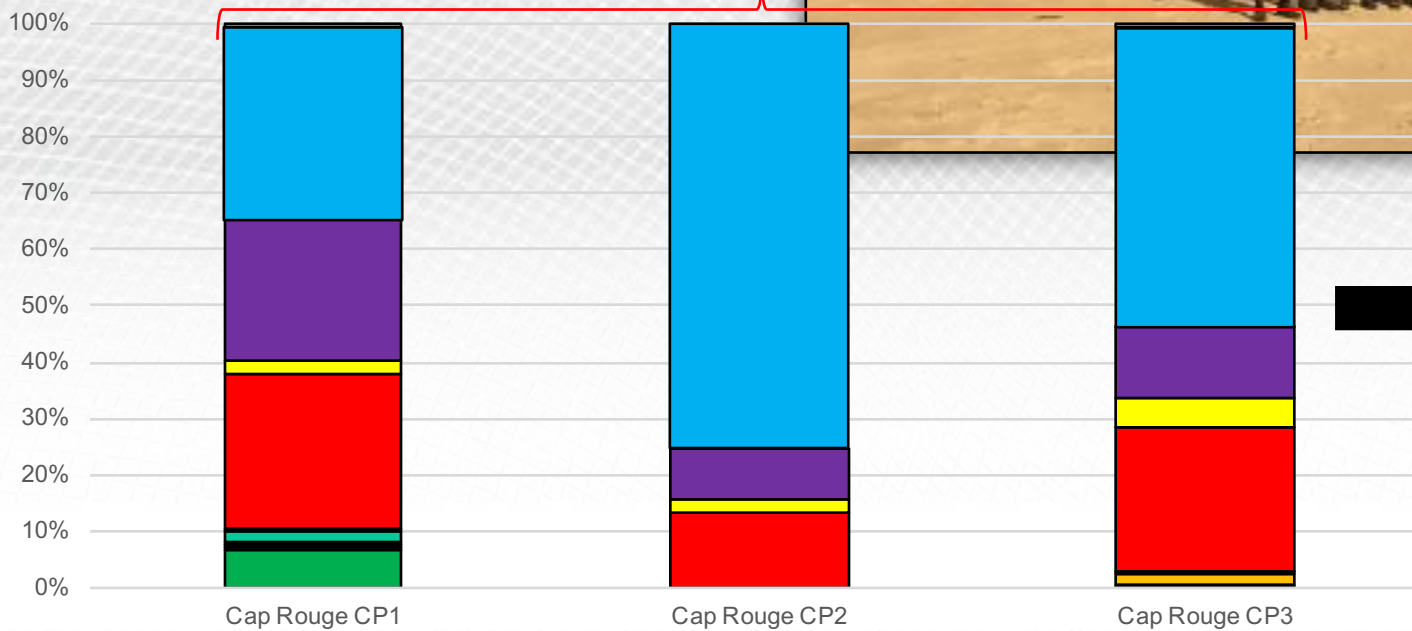
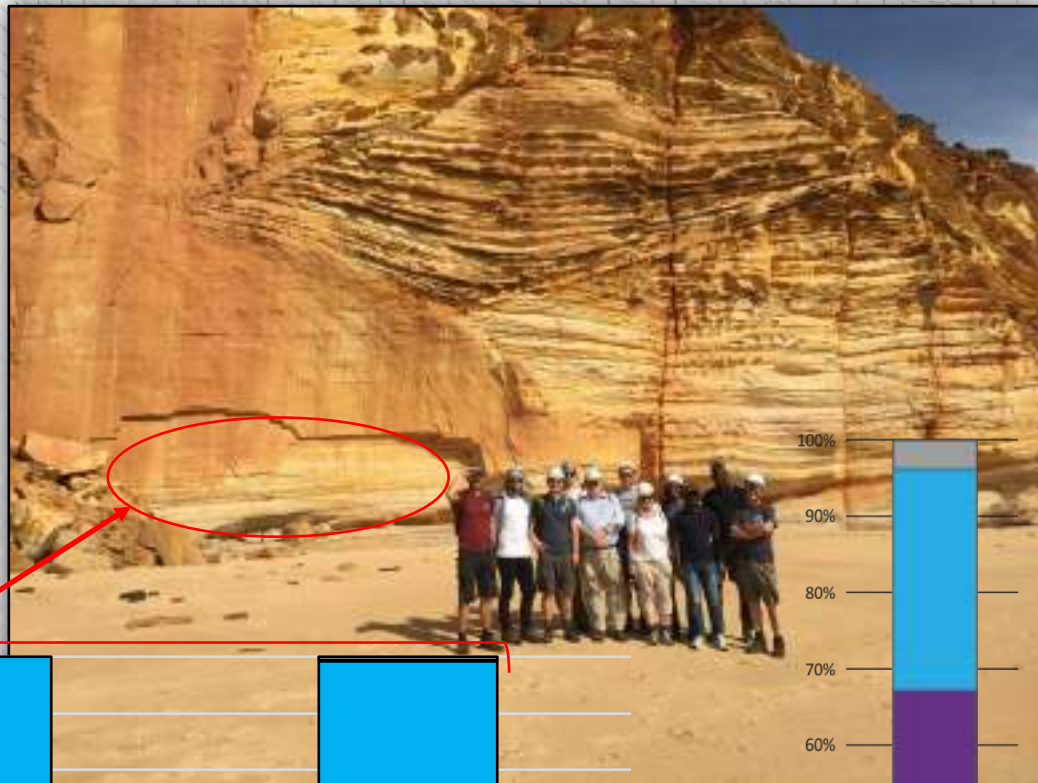


“Stratigraphic coarsening-upward rhythms, correlated with an increase in environmental energy” (Khatib *et al* 1990)

Heavy minerals (HM)

Am	Ap	Ep	Grt	Ky	Rt	St
Tur	Zrn	Other	Non-tdHM			

# Cap Rouge

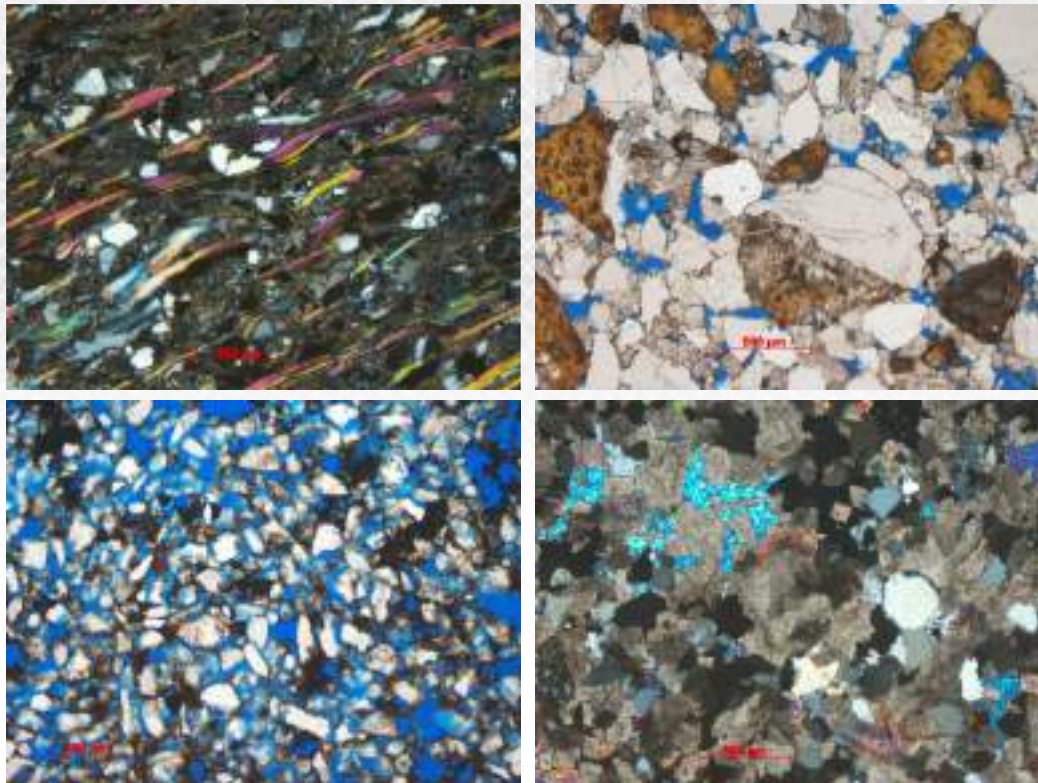


■ Am 
 ■ Ap 
 ■ Cpx 
 ■ Ep 
 ■ Gphane 
 ■ Grt 
 ■ Ky 
 ■ Rt 
 ■ St 
 ■ Tur 
 ■ Zm 
 ■ Other

# Stage one recap

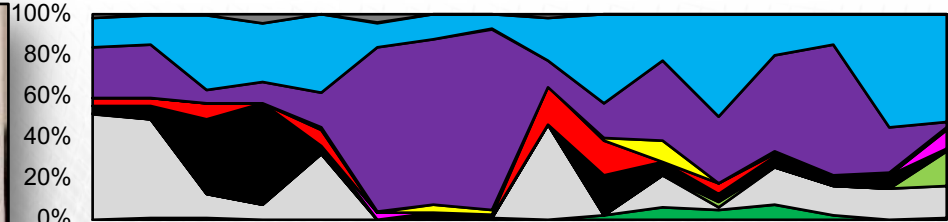
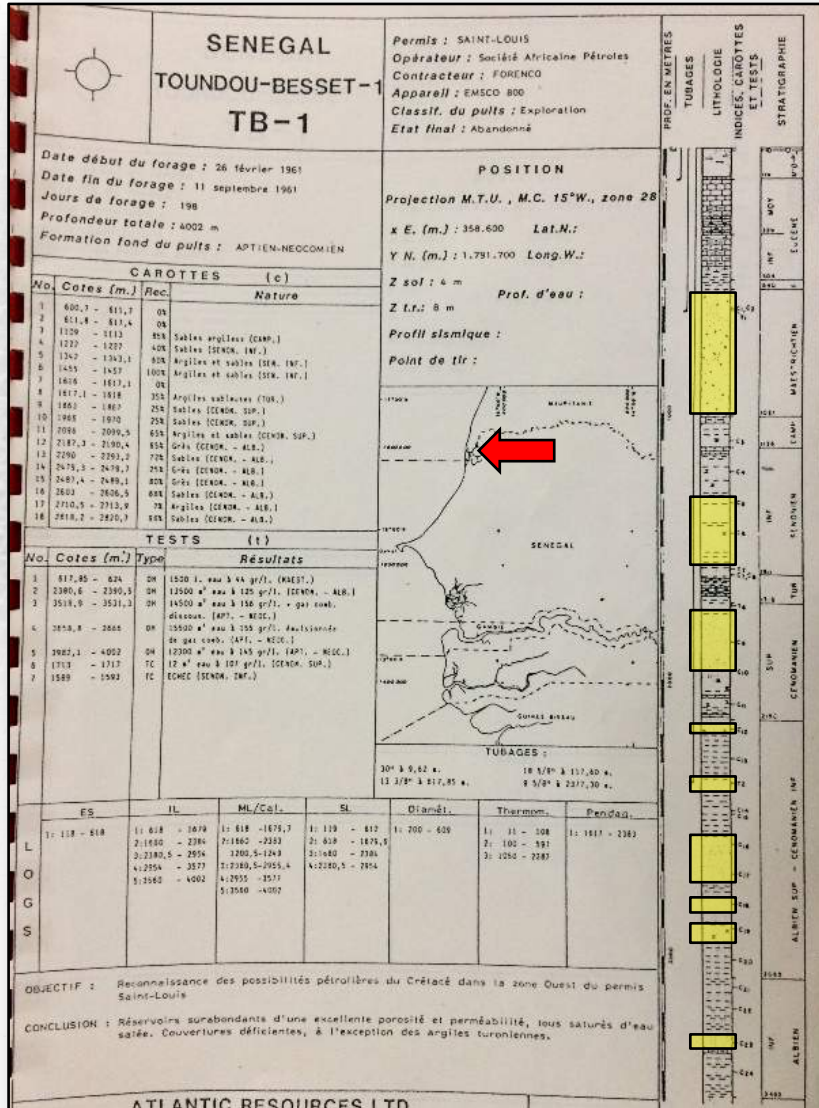
Stage 1 (to complete...):

- QFL on stage 1 samples

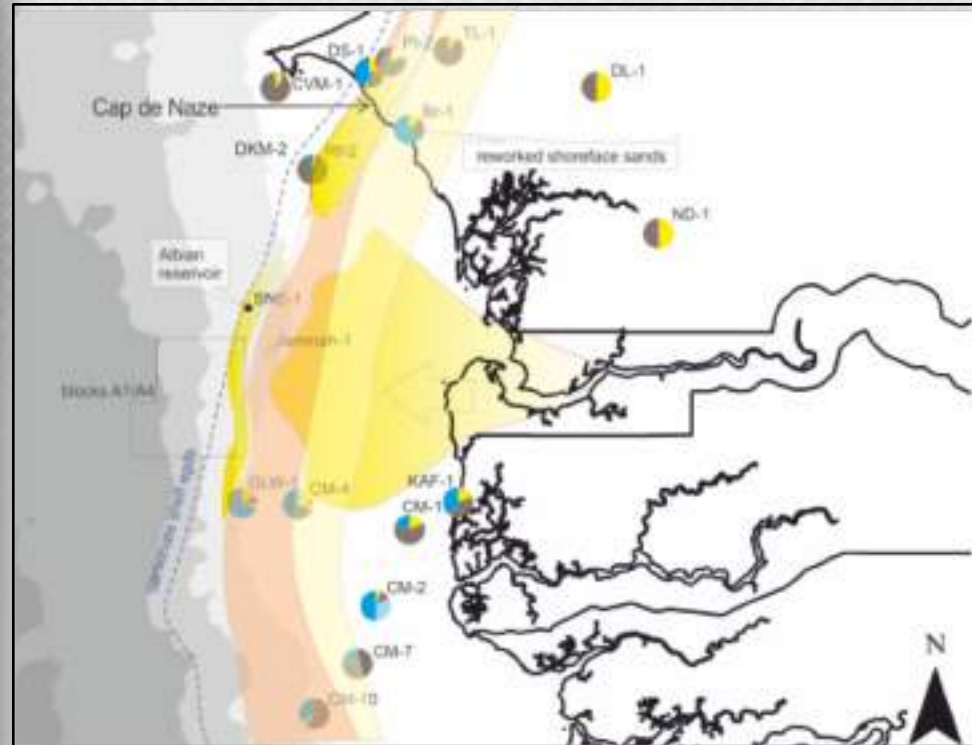


# Planning ahead

DL1



Am Ap Ep Grt Ky Rt St Tur Zm Other



North Africa Research Group

www.narg.org.uk



# Further sampling

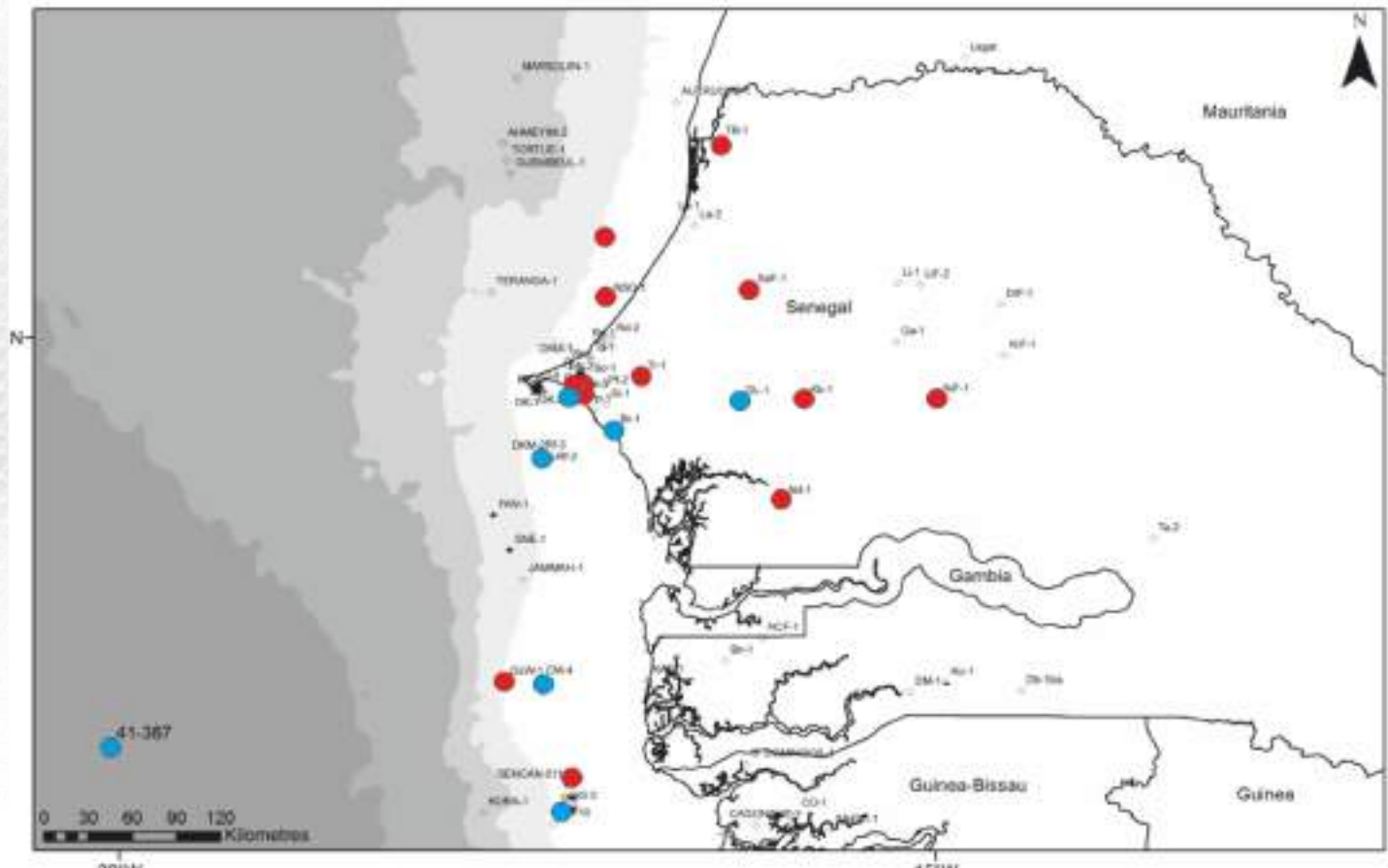
Nd-1	NiF-1	NSO-1	SaF-1	TB-1	Co-1	DS-1	CM-7	DN-2	TI-1	Si-1	Kb-1	GLW-1
Depths	Depths	Depths	Depths	Depths	Depths	Depths	Depths	Depths	Depths	Depths	Depths	Depths
310-370	300-395	750	320-390	600-700	850-850	0-65	250-400	250-310	258-300	0-230	0-48	2230
430-500	410-460	850	490-510	800-850	900-1010	1420-1440	1100-1190	360-420	420-710	230-520	217-437	
600-680	500-600	1250	600-660	900-950	1200-1300	1830-2020	1400-1420	700-800	1530-1610	520-730	600-700	
740-810	675-700	1520-1600	810-880	1330-1400	1500-1515	2690-2710	1710-1730	1300-1400	1960-2030	730-884	860-960	
1050-1110		1820-1900	1080-1120	1450-1500	1550-1585	2930-3000	2120-2135		2220-2260		1100-1180	
1150-1200		2250-2310	1240-1300	1800-1900	~1810		2210-2230		2600-2710		1400	
1603-1640			1320-1400	2130-2190	2000-2150				2800-2920		1600-1640	
1950-2040			1630-1700	2350-2400	2300-2330				3270-3330		1940-2030	
2300-2330				2600-2650	2590-2630						2300	
2800-2865				2700-2750	2850-2920							
3120-3160				2800-2860								
				2900-2950								
				3290-3310								



## Key

Miocene	Unspecified Cretaceous
Eocene	
Paleocene	
Maastrichtian	
Campanian	
Senonian	
Turonian	
Cenomanian	
Albian	
Aptian	
Neocomian	
Jurassic	



# Sampling locations



-  Stage 1 sampling
-  Stage 2 sampling

# WITH THANKS

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