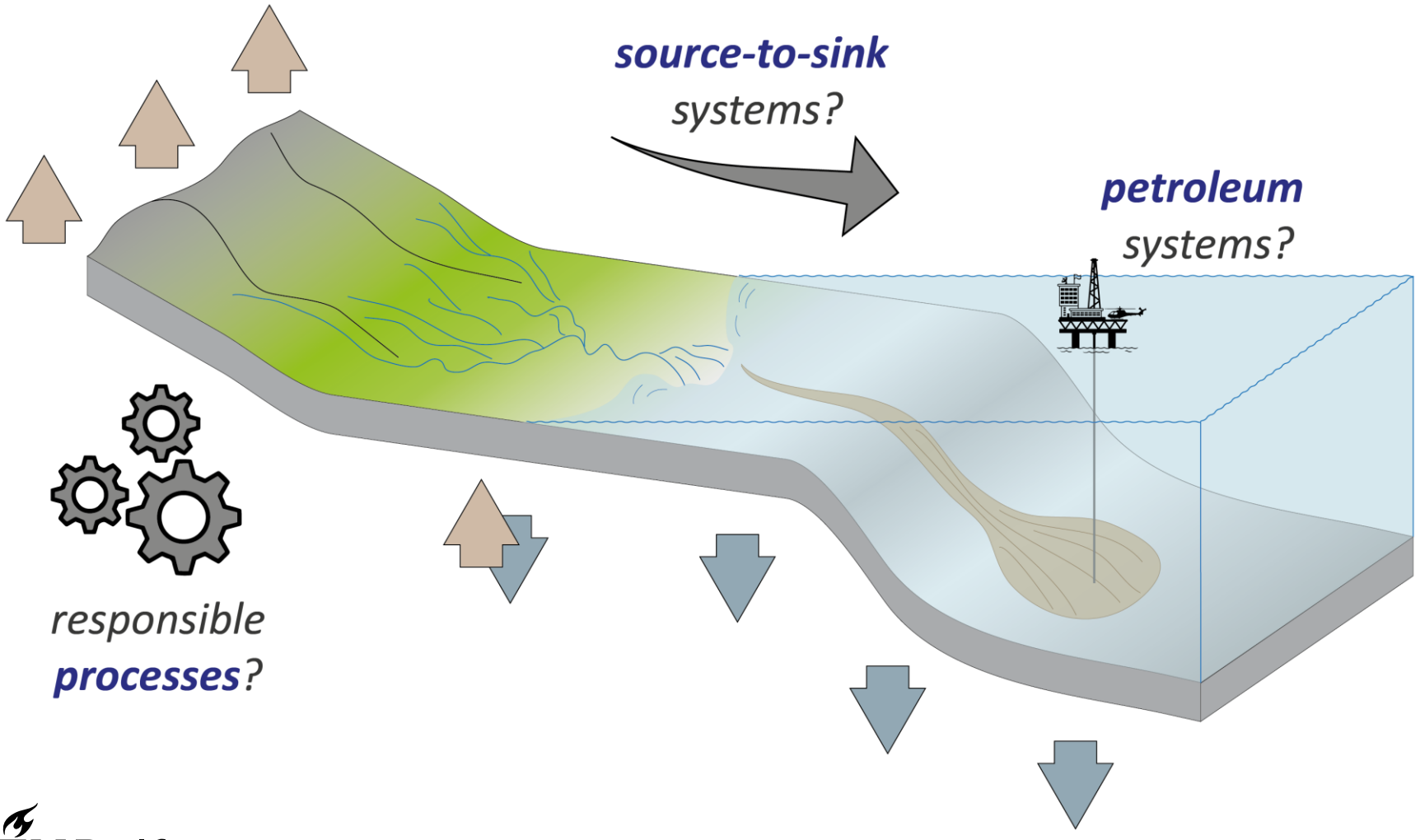
NARG Steering meeting
Manchester | Sept. 2018

TU Delft

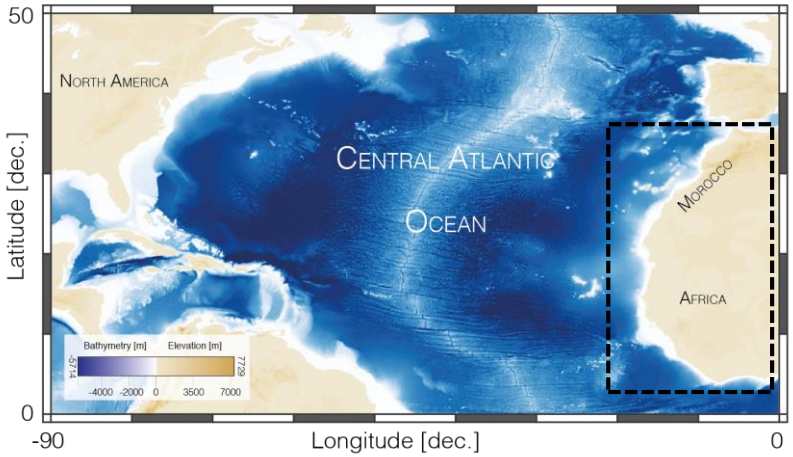
Phanerozoic Vertical Movements in NW Africa

Rémi Charton | Giovanni Bertotti
Jonathan Redfern
Mohamed Gouiza

❶ ••• | Vertical movements in geology



❶ ••• | A sizeable dataset

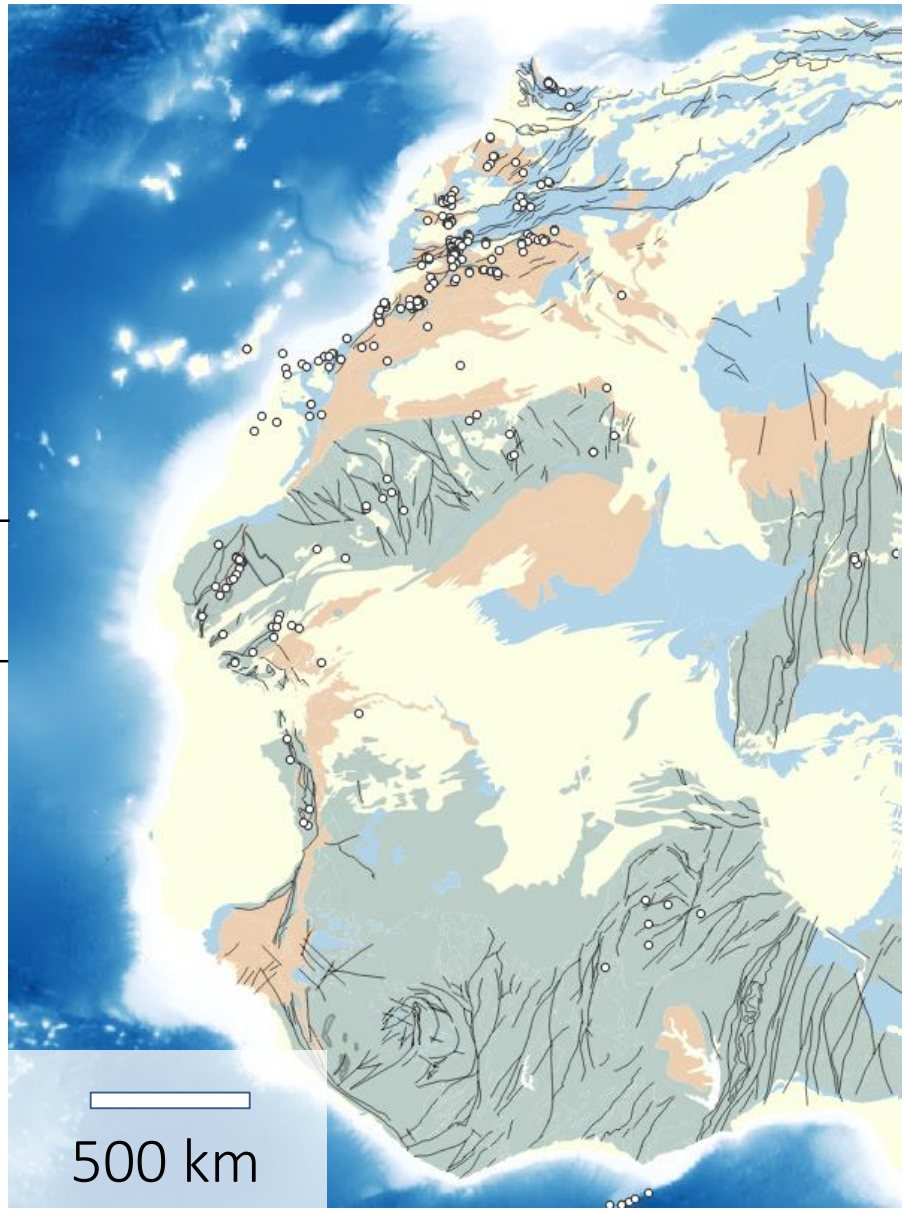


Great exposure

Low-Temperature Thermochronology (LTT)

>1000 cooling ages

Documenting **unexpected** vertical movements



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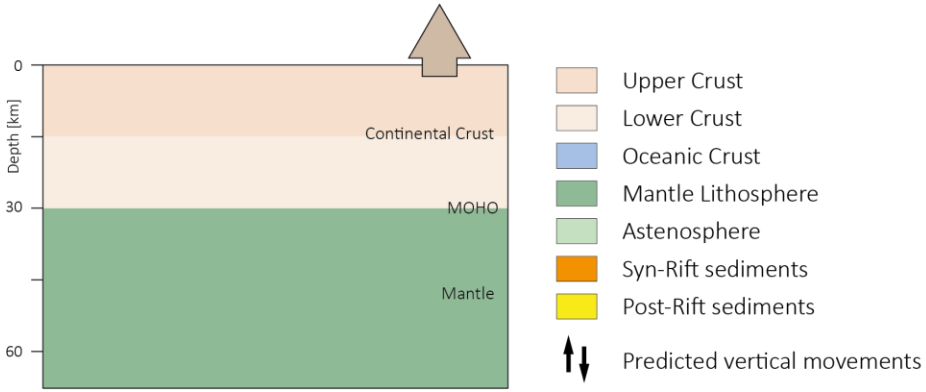
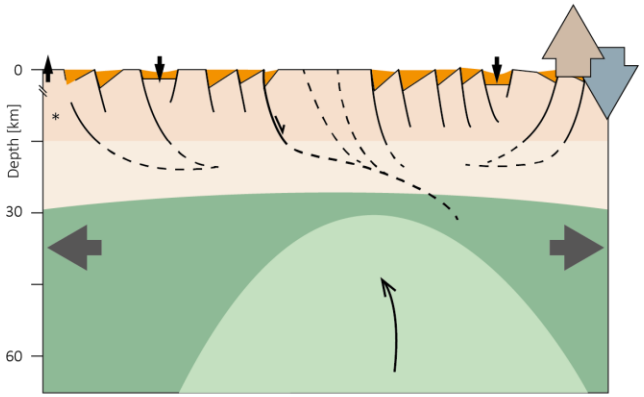
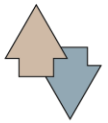
❶ ••• | Unexpected vertical movements?

Pre-Rift



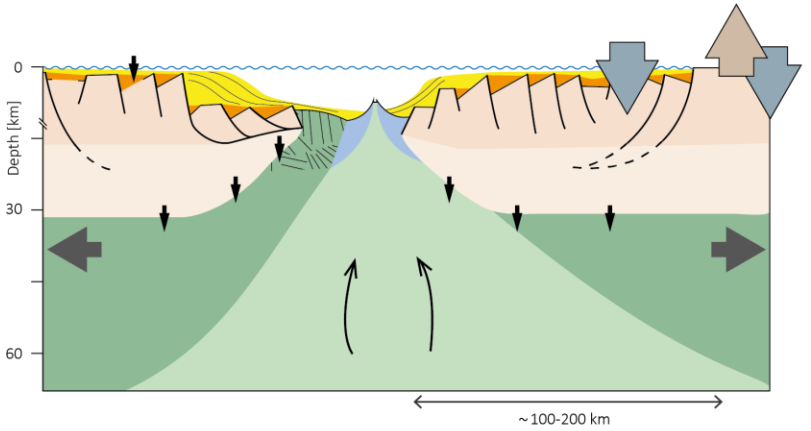
Syn-Rift





Unexpected vertical movements

Post-Rift



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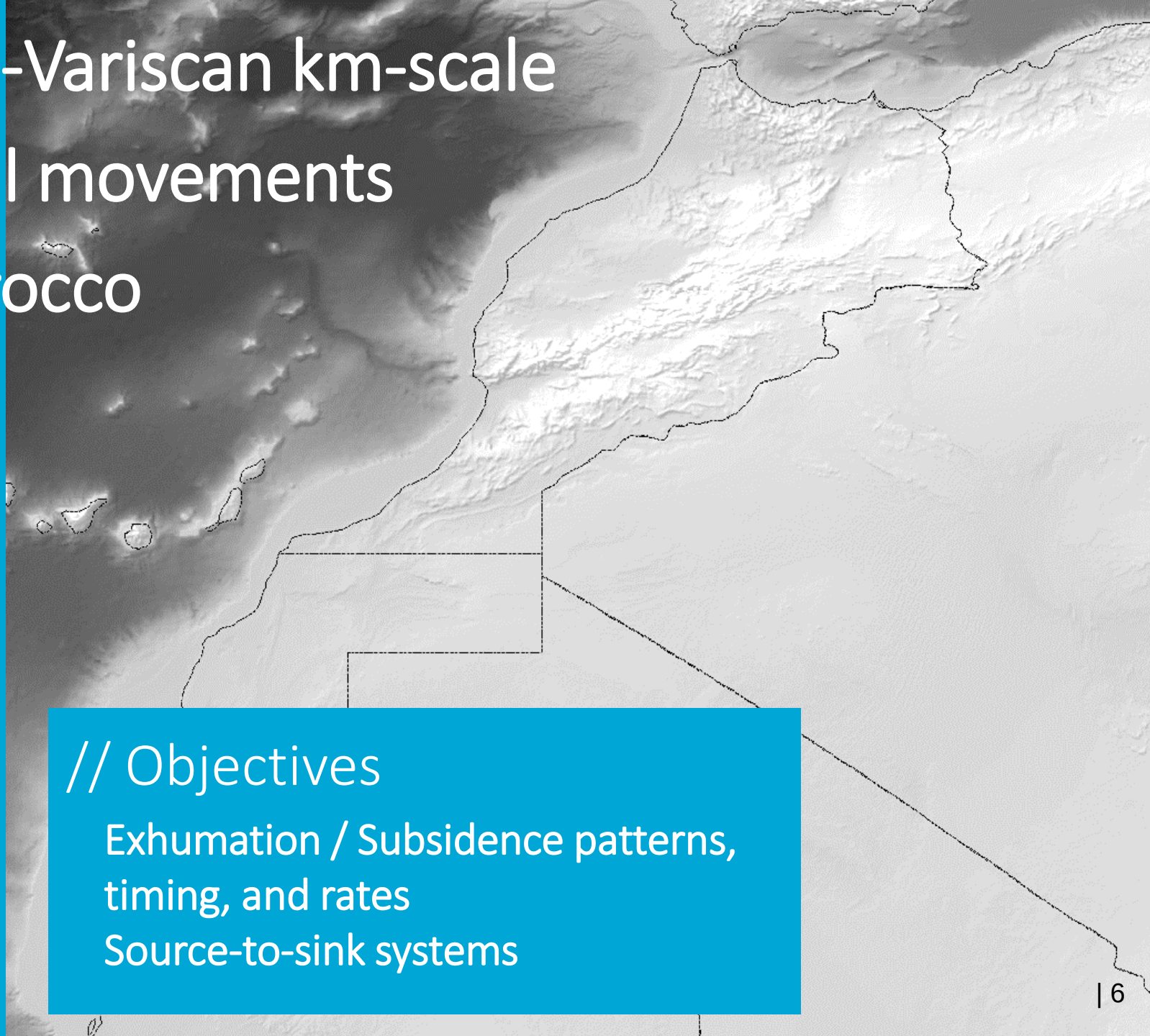
❶ ••• | Agenda

❷ | km-scale vertical movements - Morocco

❸ | Cooling ages and t-T modeling - Mauritania

❹ | Landscape Evolution Modelling - Pilot

// Post-Variscan km-scale vertical movements in Morocco



// Objectives

Exhumation / Subsidence patterns, timing, and rates

Source-to-sink systems

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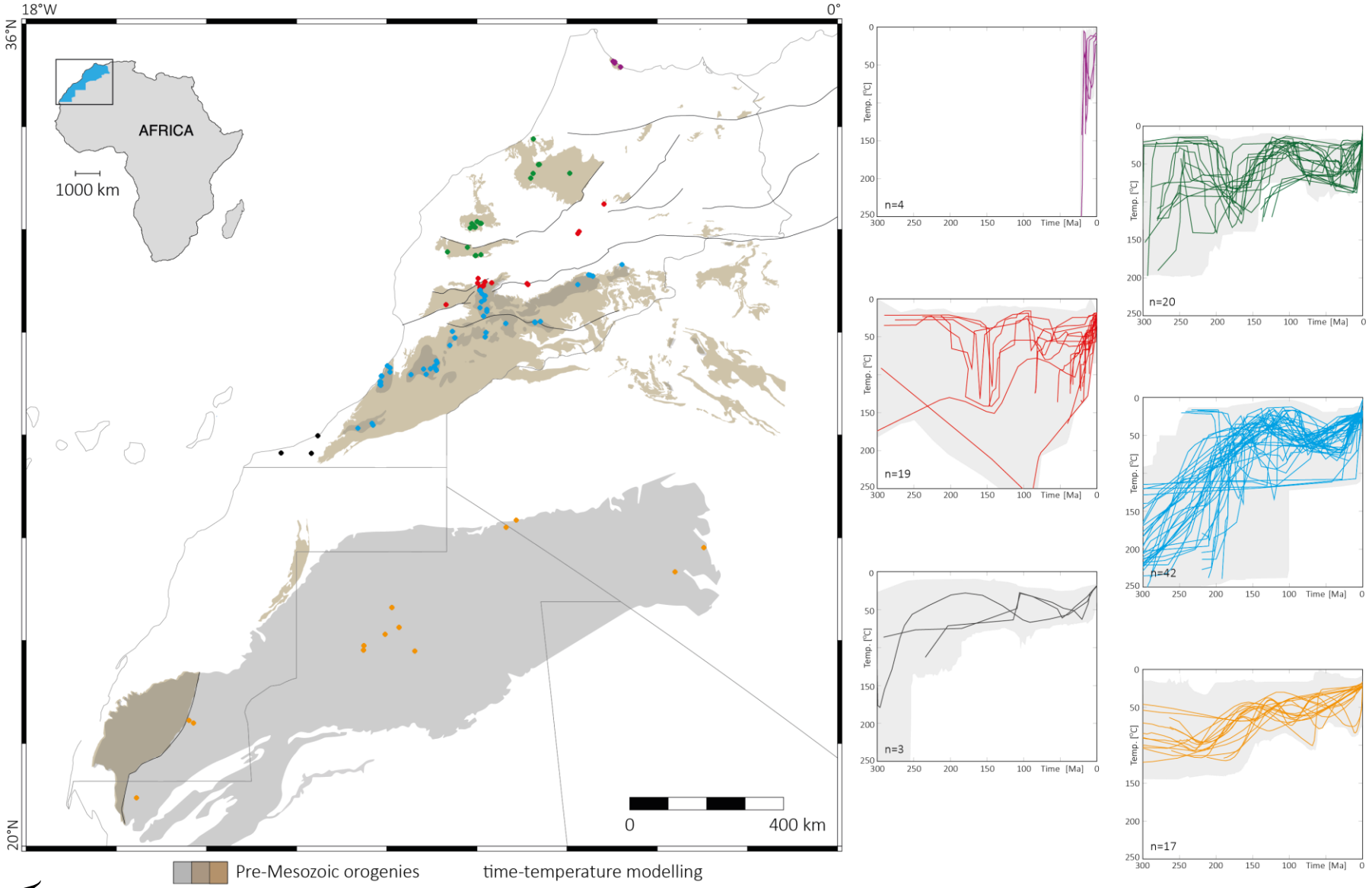
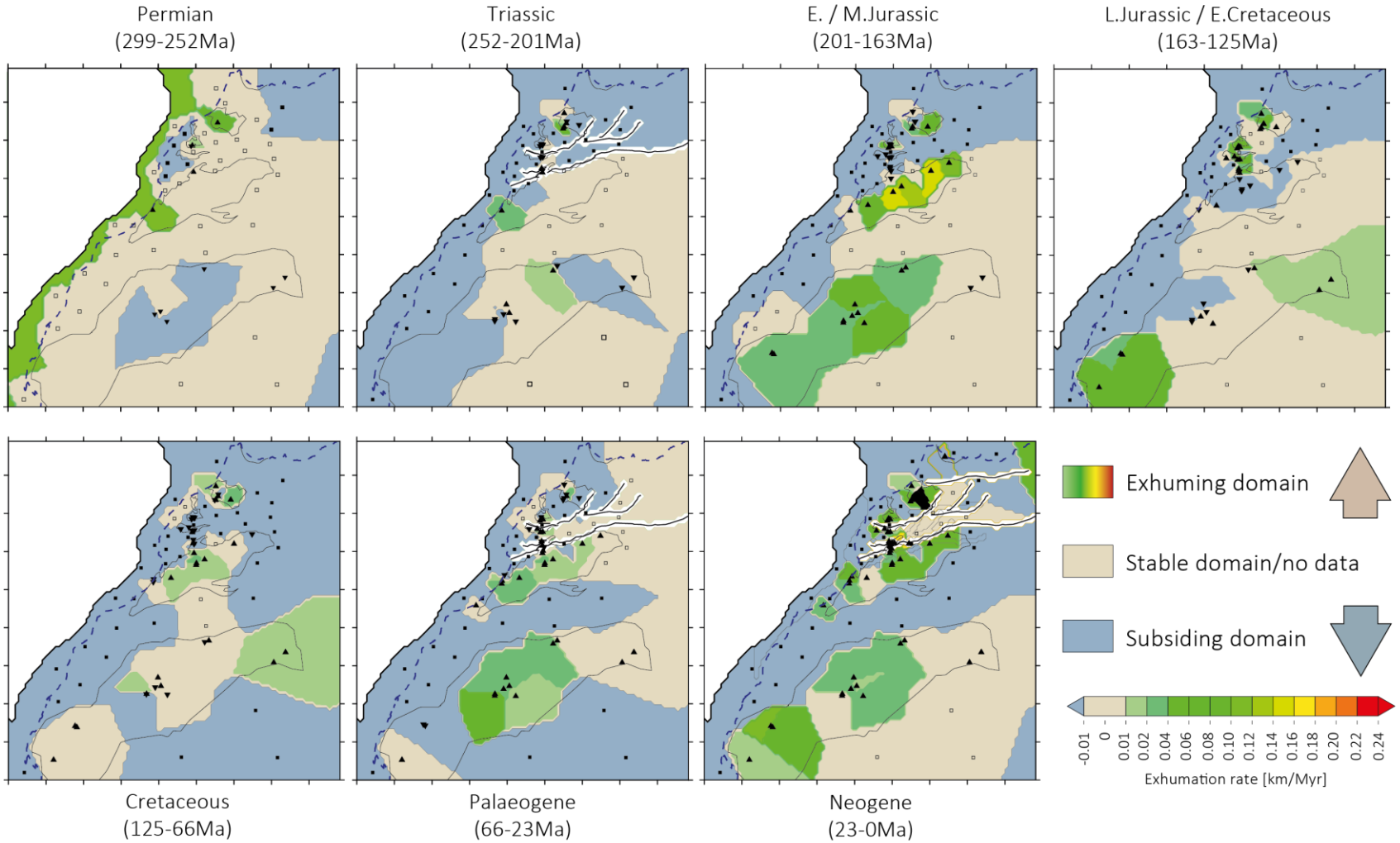
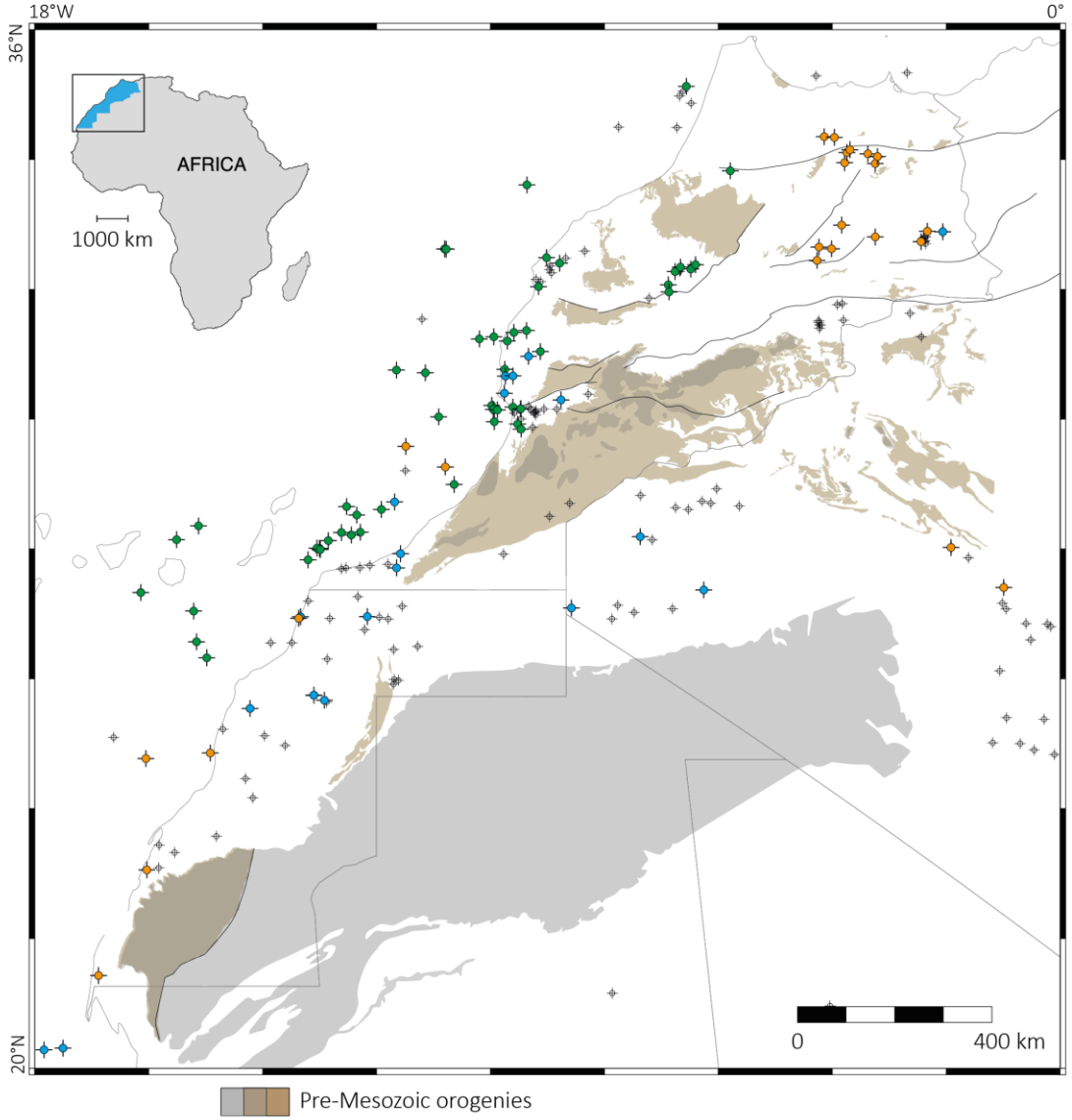
An homogeneous t-T evolution?



2 | Complex exhumation patterns



Pieces for paleo-reconstructions



Well database

- Original report
- Literature
- Limited data
- No data

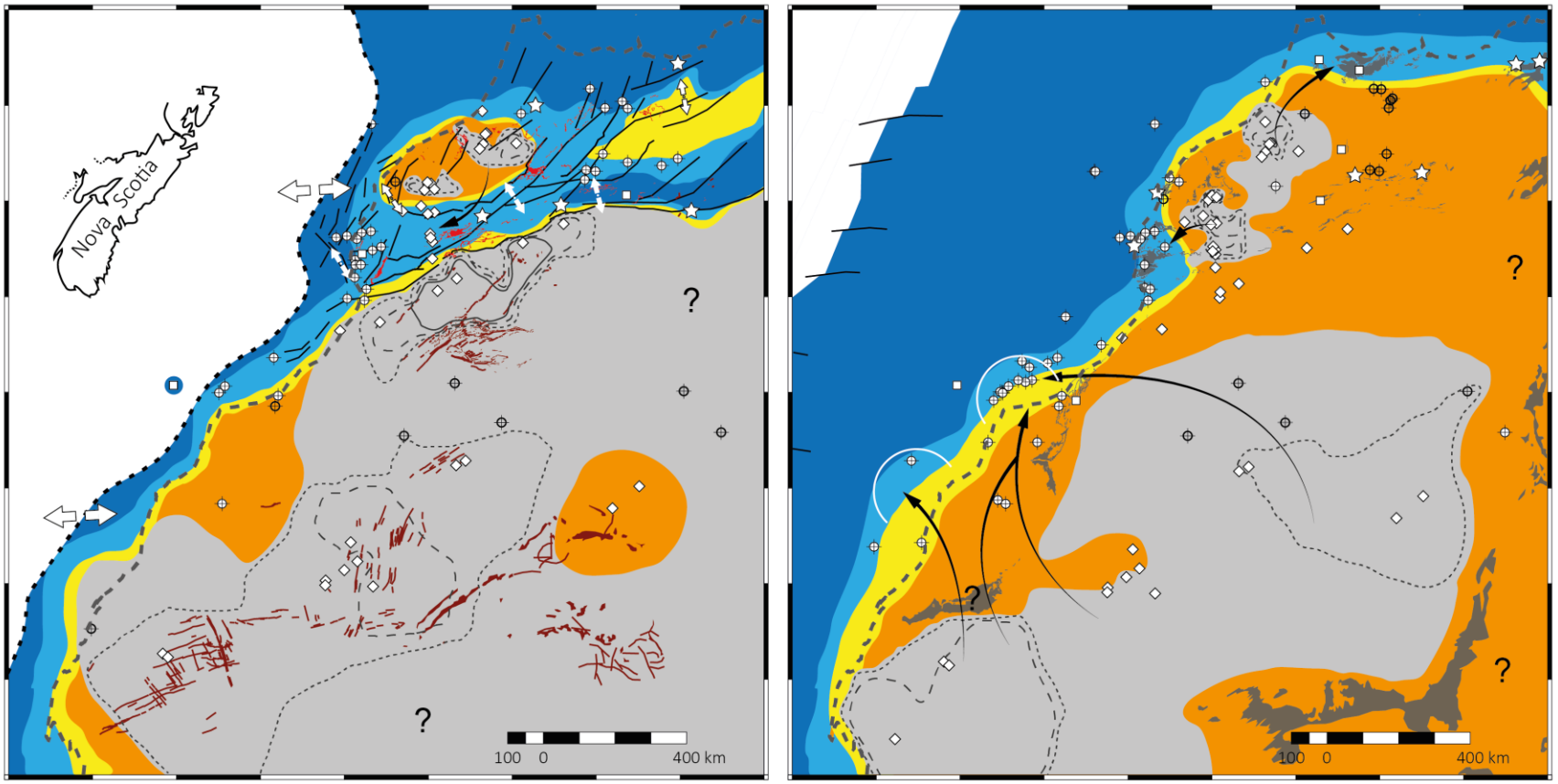
+ outcrop data
+ fossil data
+ paleoreconstruction
+ provencance
…
+ geo 'fantasy'

=

Source-to-sink maps

Early Jurassic
201-174 Ma
syn- to post-rift

(early) Early Cretaceous
145-125 Ma
post-rift



Source area
Outcrops
Basalts/sills

Terrestrial
Transitional
Shallow marine
Marine

// Low-T thermochronology and first t-T modelling in the Mauritanides

Research leads
Mohamed Gouiza
& Giovanni Bertotti

// Senegal Campaign

// Objectives

Identify exhumation / subsidence
Key to better understand
source-to-sink / petroleum systems

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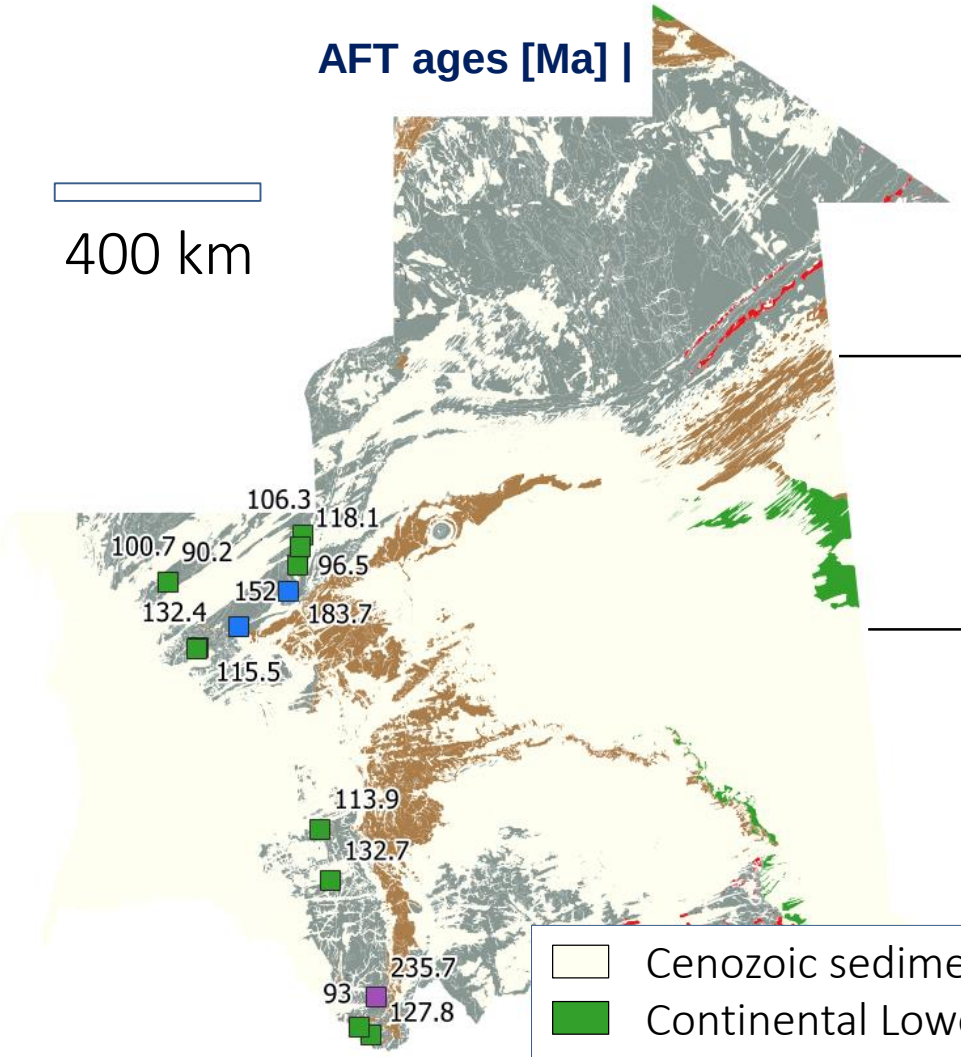
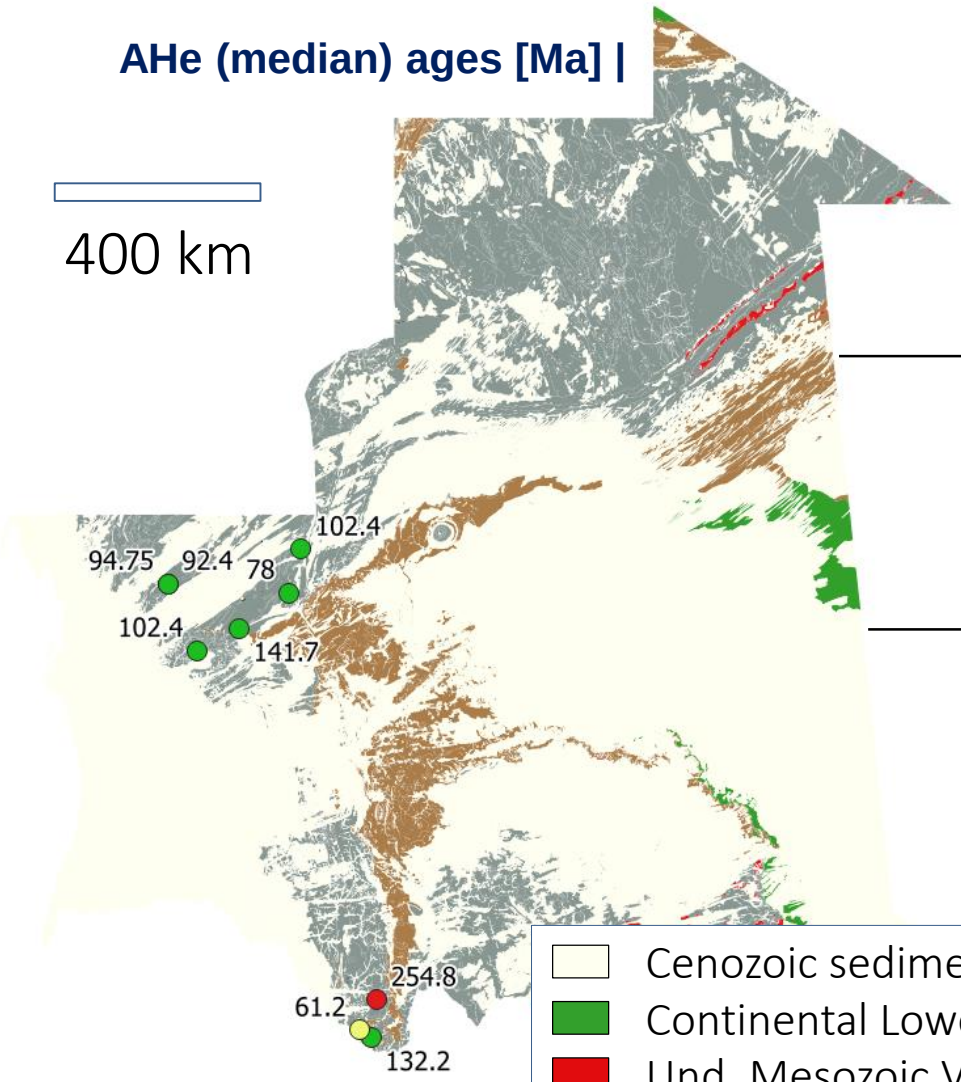
Mauritanides dataset – Fission track



Cretaceous cooling

Continuous since the Triassic?

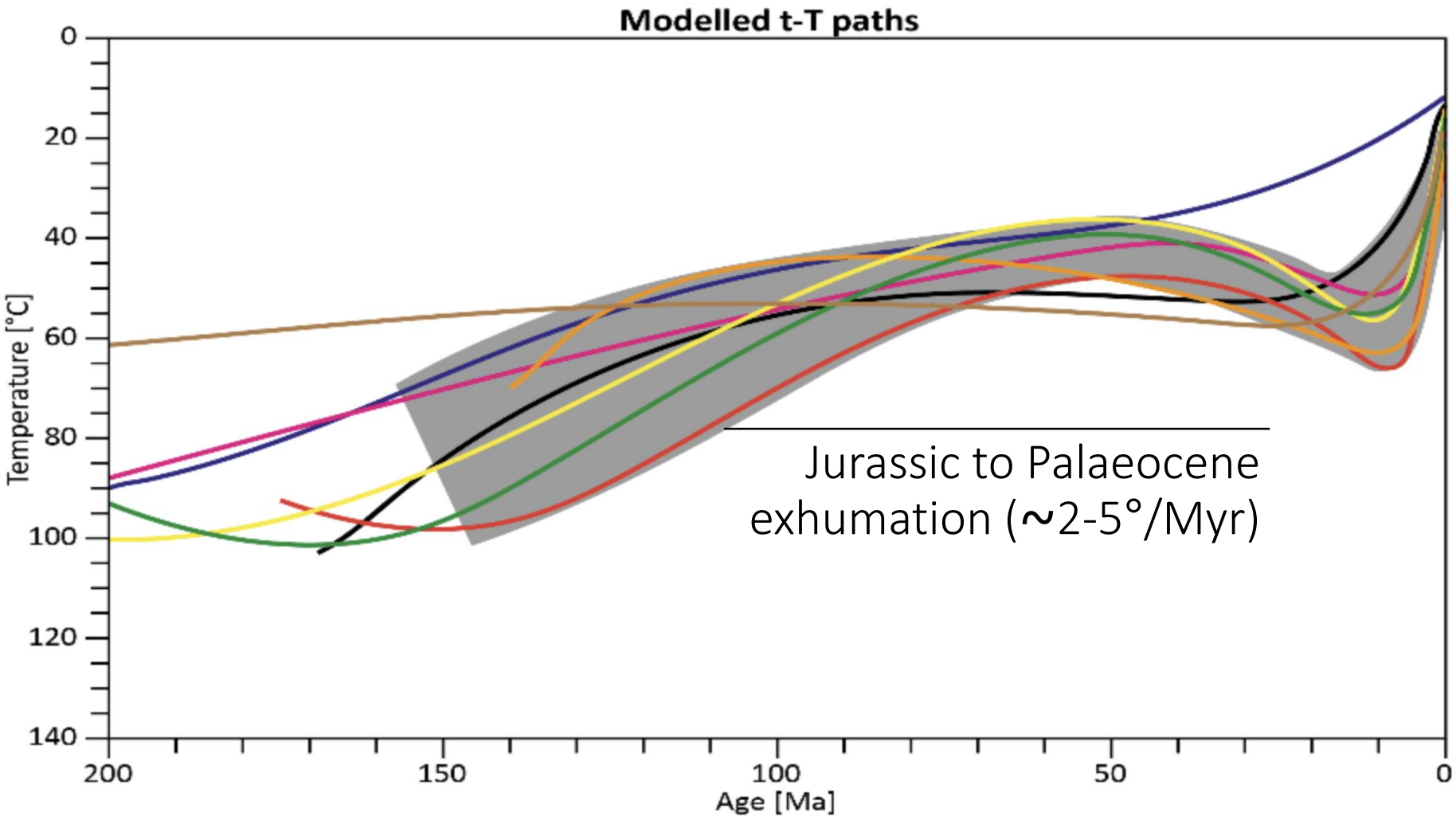
Mauritanides dataset – Helium dating



Cretaceous cooling

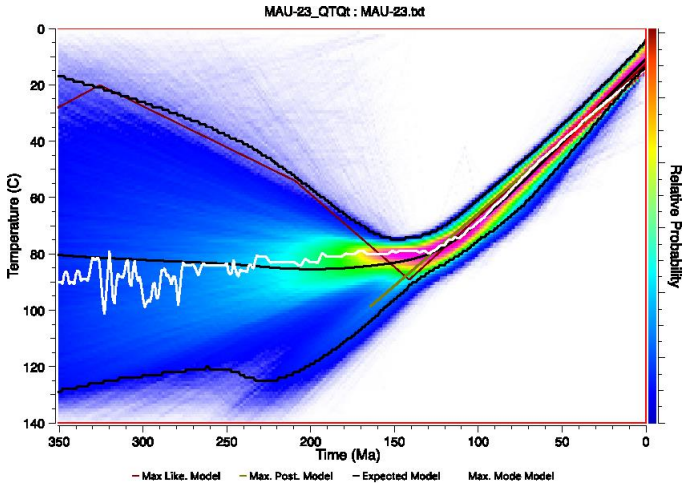
Cooling ends in the late Cretaceous-early Cenozoic

••❸• | First t-T modelling results in the area

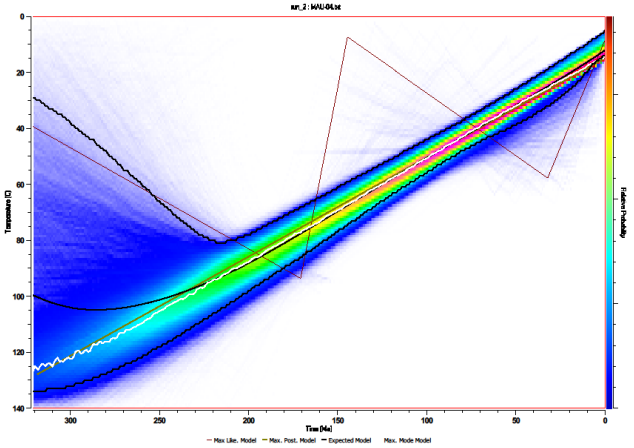


••❸• | First t-T modelling results in the area

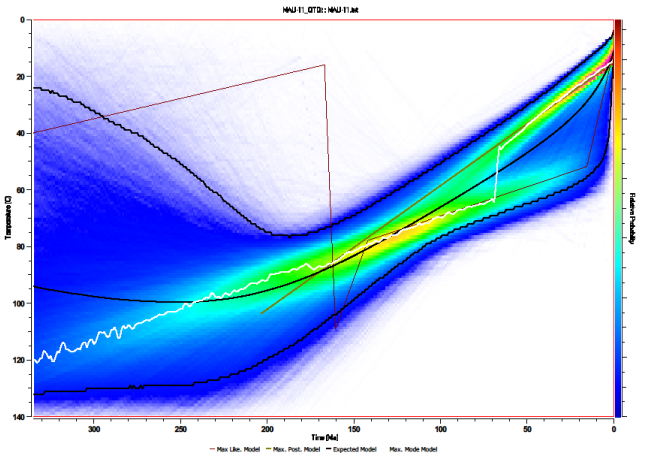
NW |



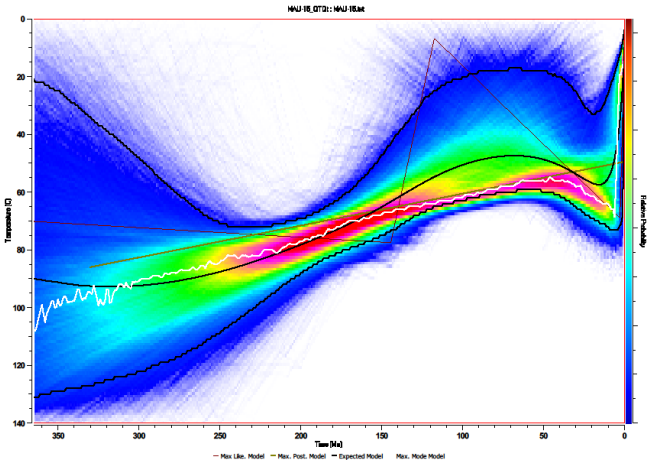
NE |



Central |

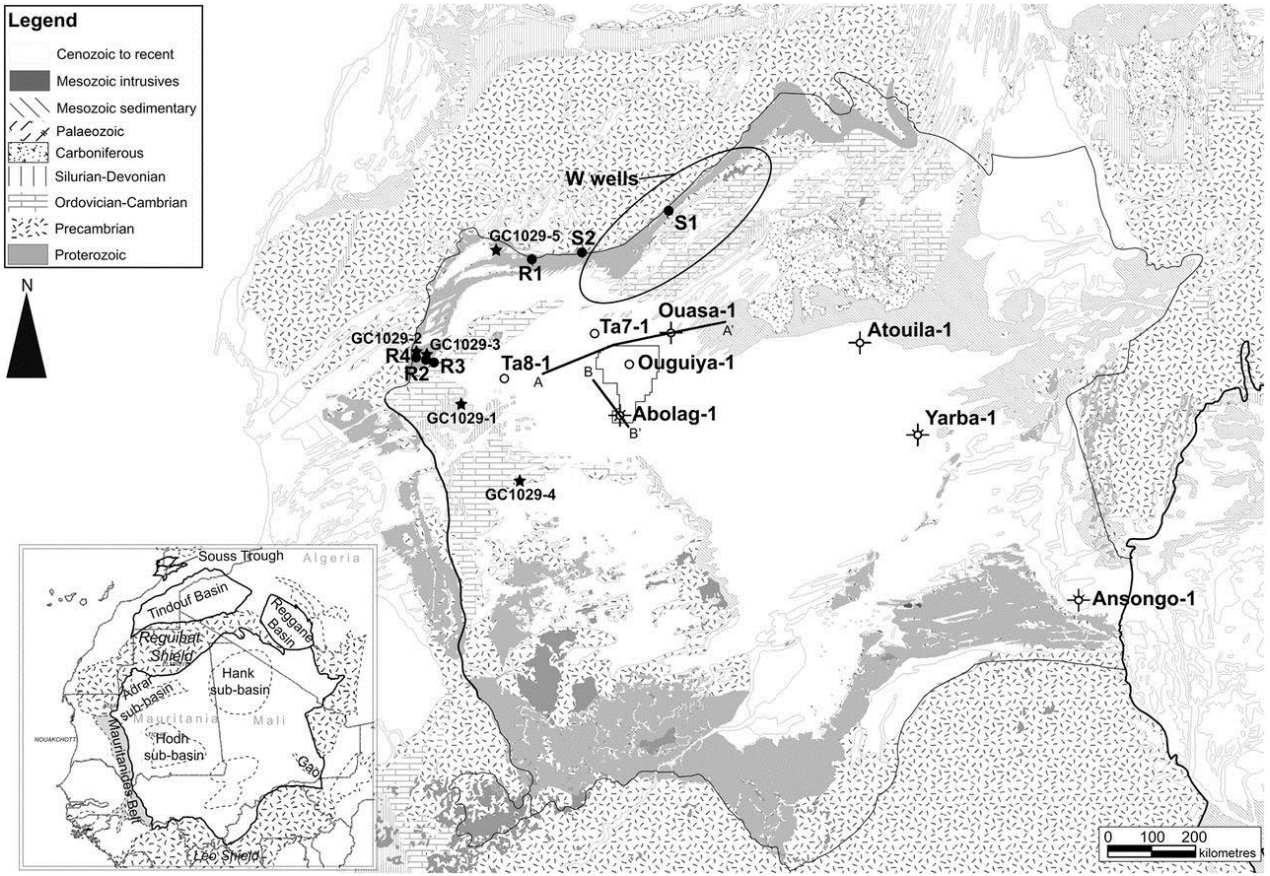


S |



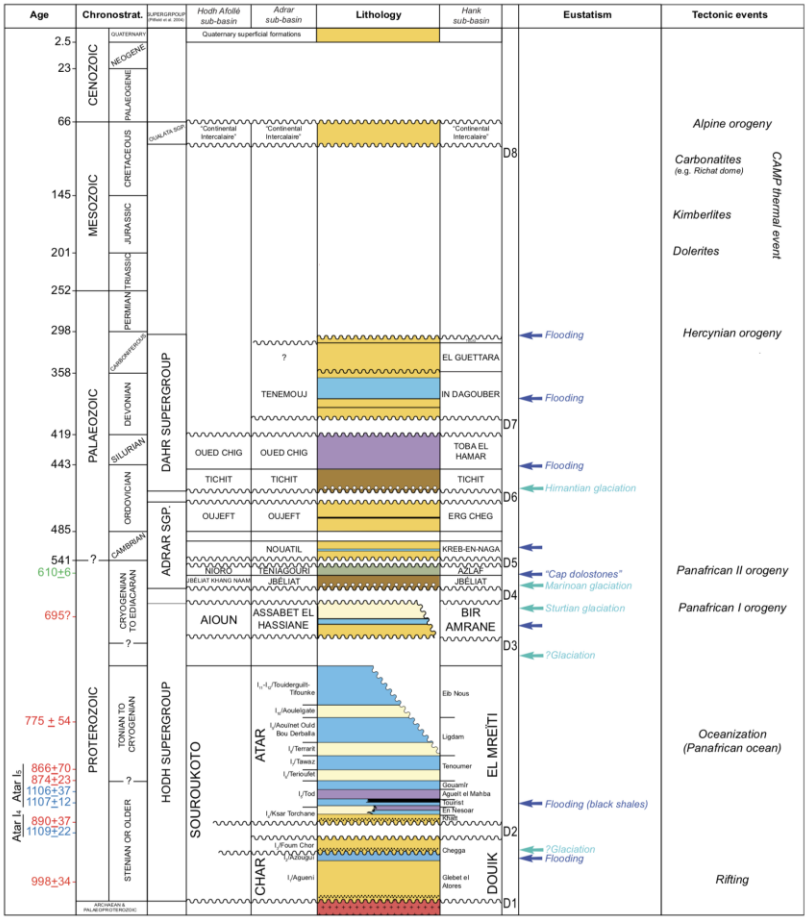
••❸• | Implications for the Taoudeni basin

Geological map | *Martin-Monge et al., 2016*



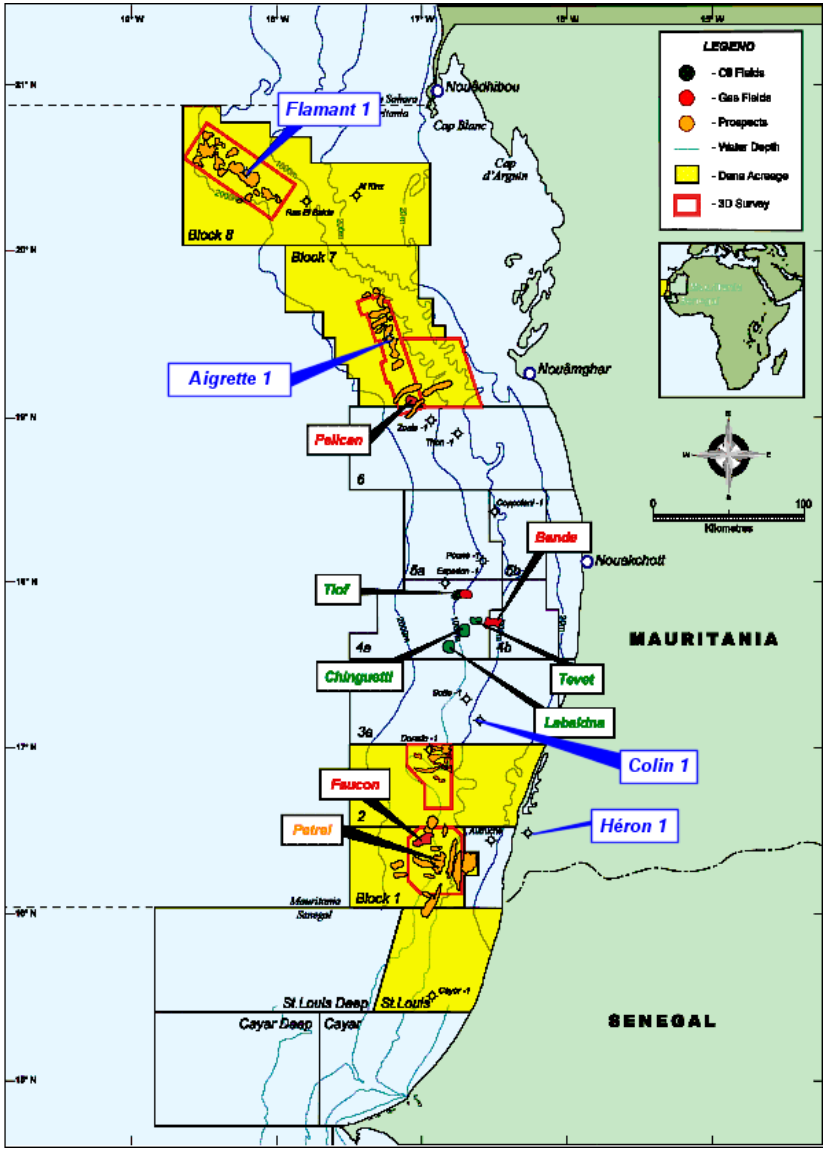
••❸• | Implications for the Taoudeni basin

Taoudeni Stratigraphy | *Martin-Monge et al., 2016*



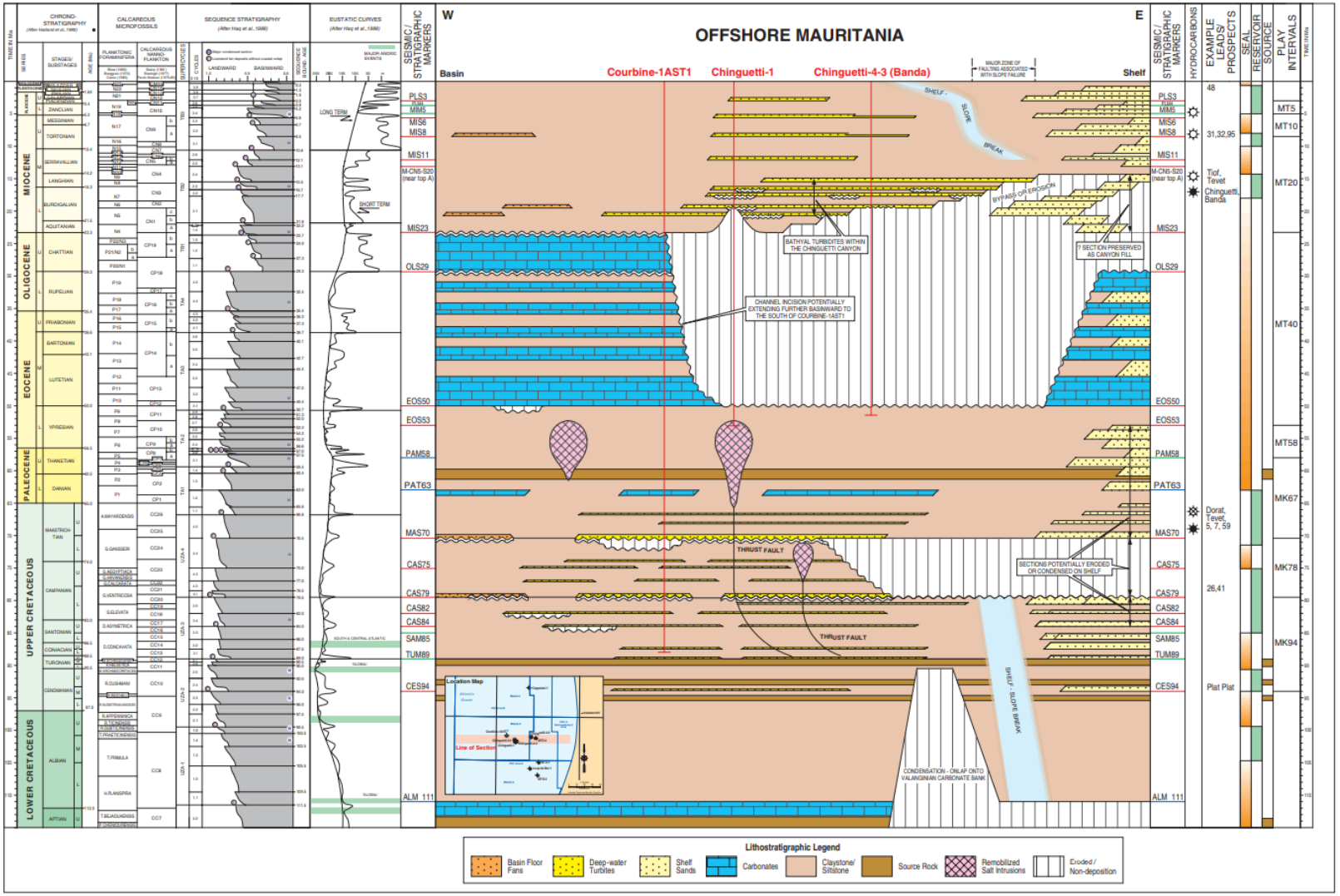
Implications for the Mauritanian basin

Offshore blocks and fields | *unknown source*



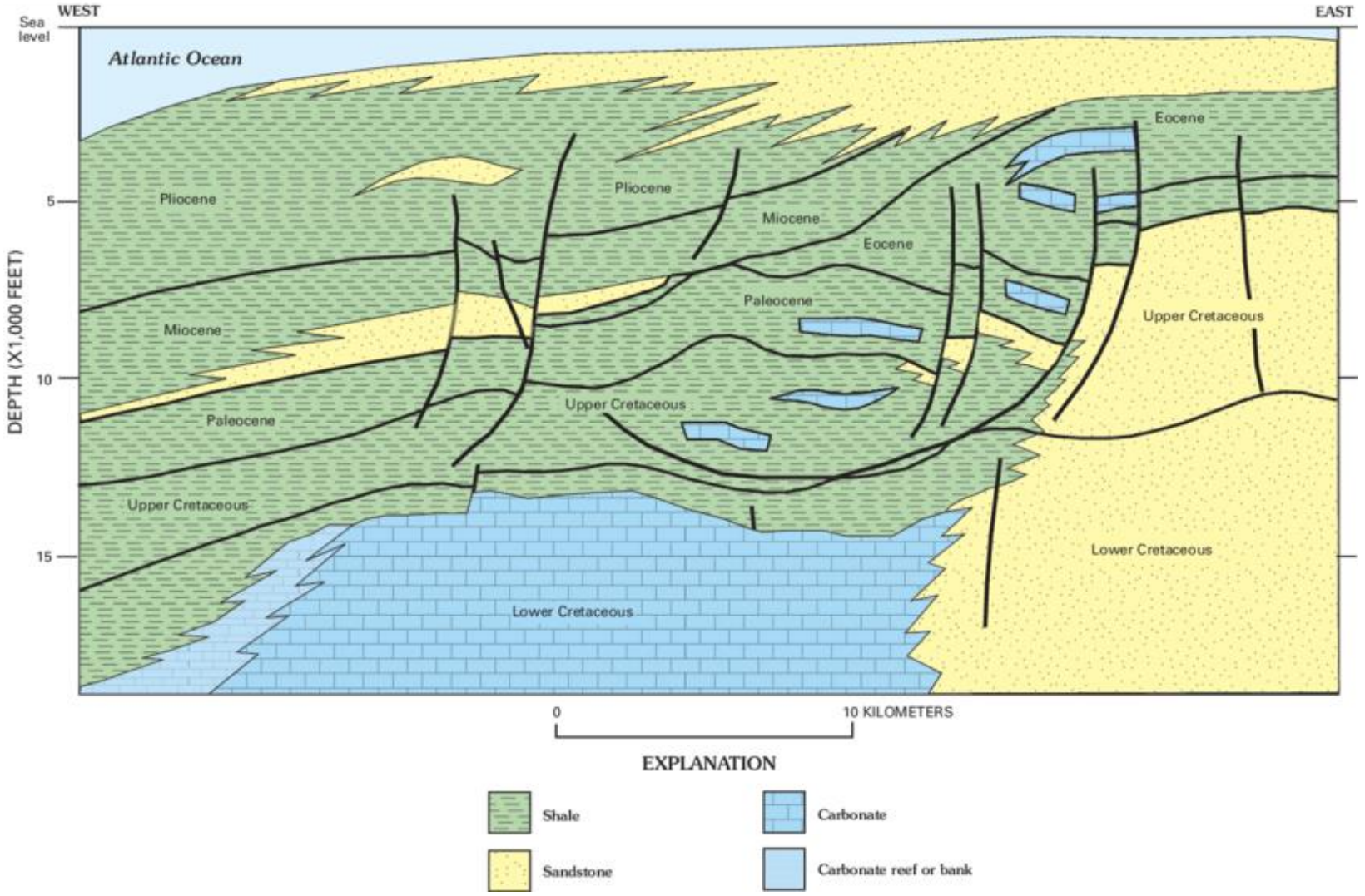
••❸• | Implications for the Mauritanian basin

Coastal basin stratigraphy | *Vear, 2005*



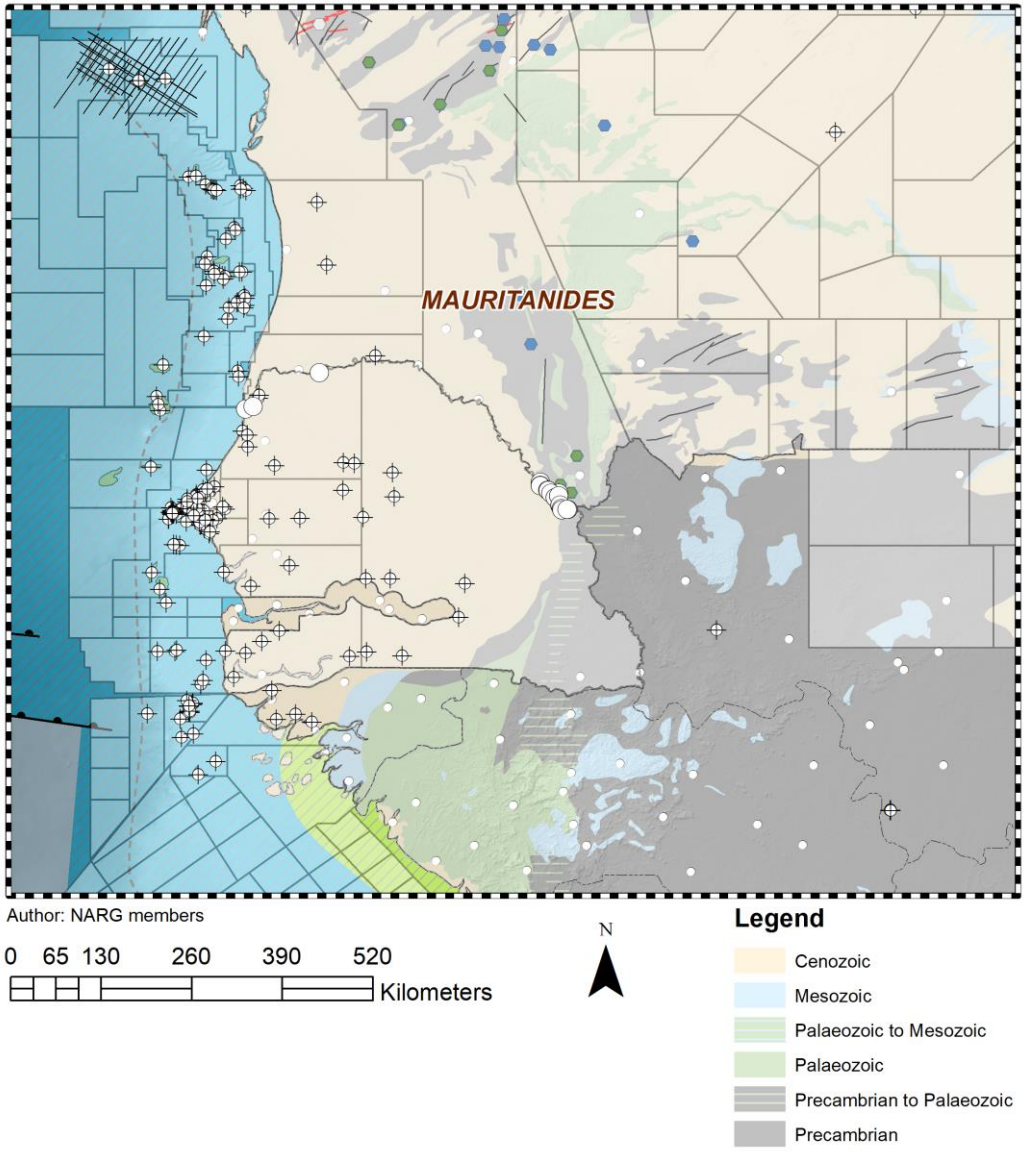
••❸• | Implications for the Mauritanian basin

Coastal basin schematic cross-section | *Brownfield and Charpentier, 2003*



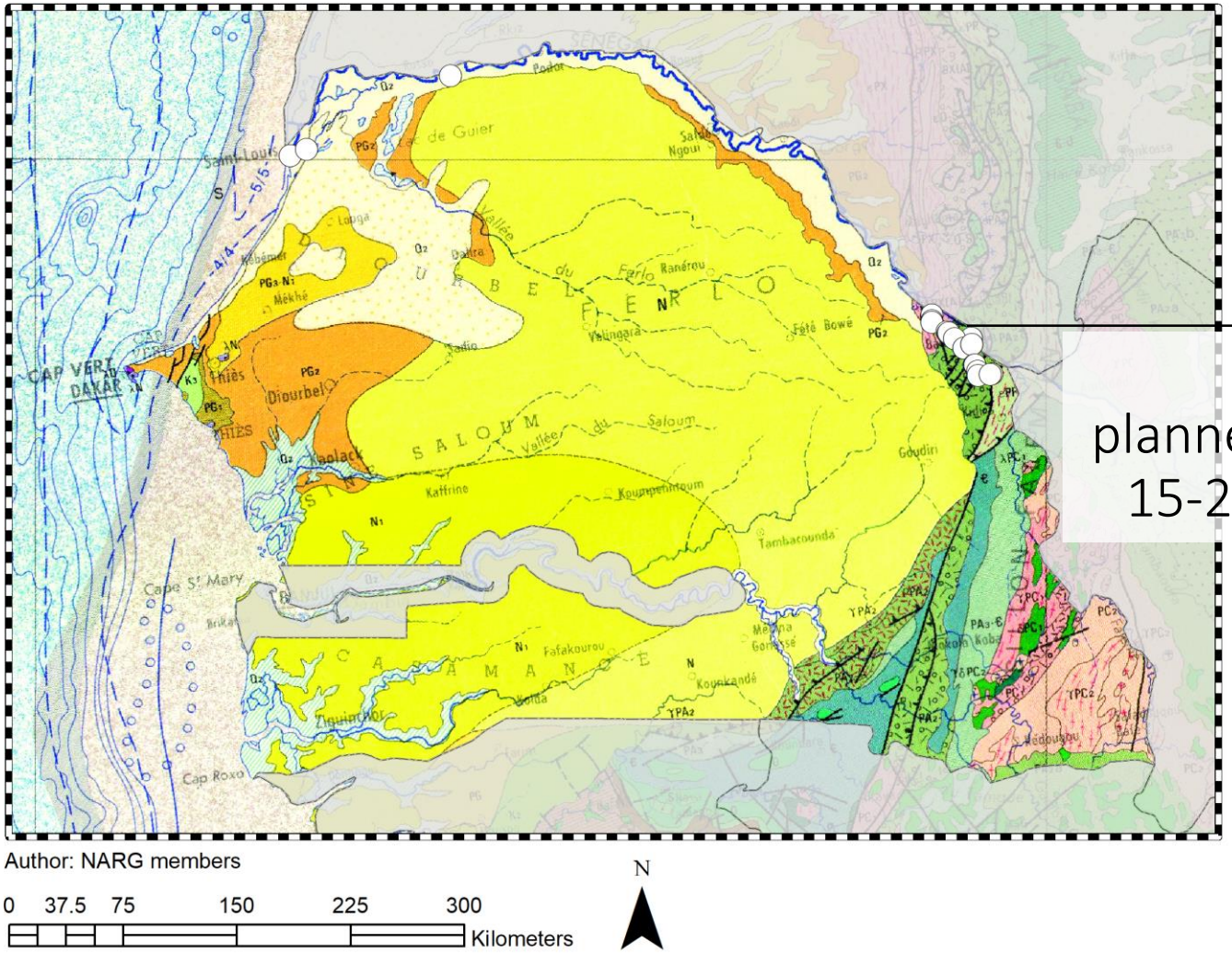
Preparations for next campaign: Senegal

Senegal LTT targets | *NARG geodatabase*



••❸• | Preparations for next campaign: Senegal

Senegal LTT targets | *NARG geodatabase*



Fieldwork planned for the 15-20 October

// Landscape Evolution Modelling (Pilot) pyBADLANDS

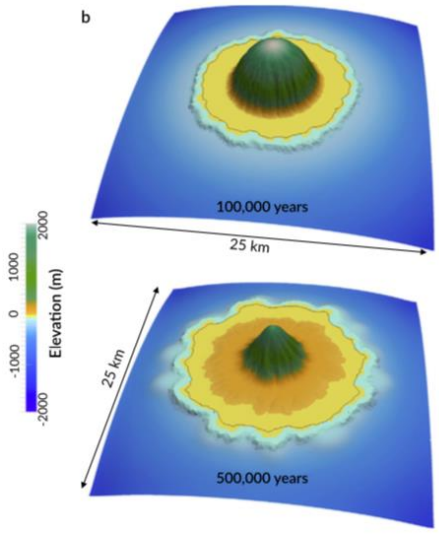
// Objectives

Sediment routing / budget
Exhumation triggering mechanism(s)
First order altimetry / stratigraphy

pyBADLANDS

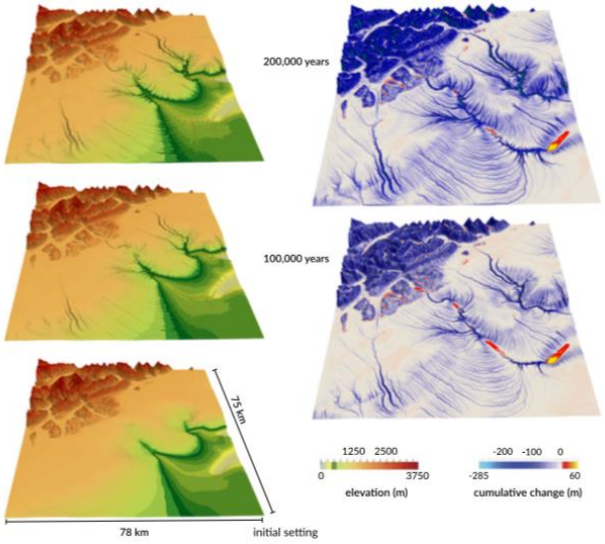
python BAsin anD LANdscape DynamicS

Generic models



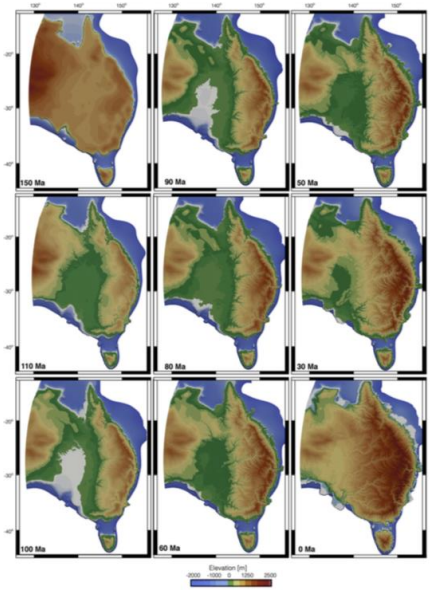
Salles and Hardiman, 2016

Regional models

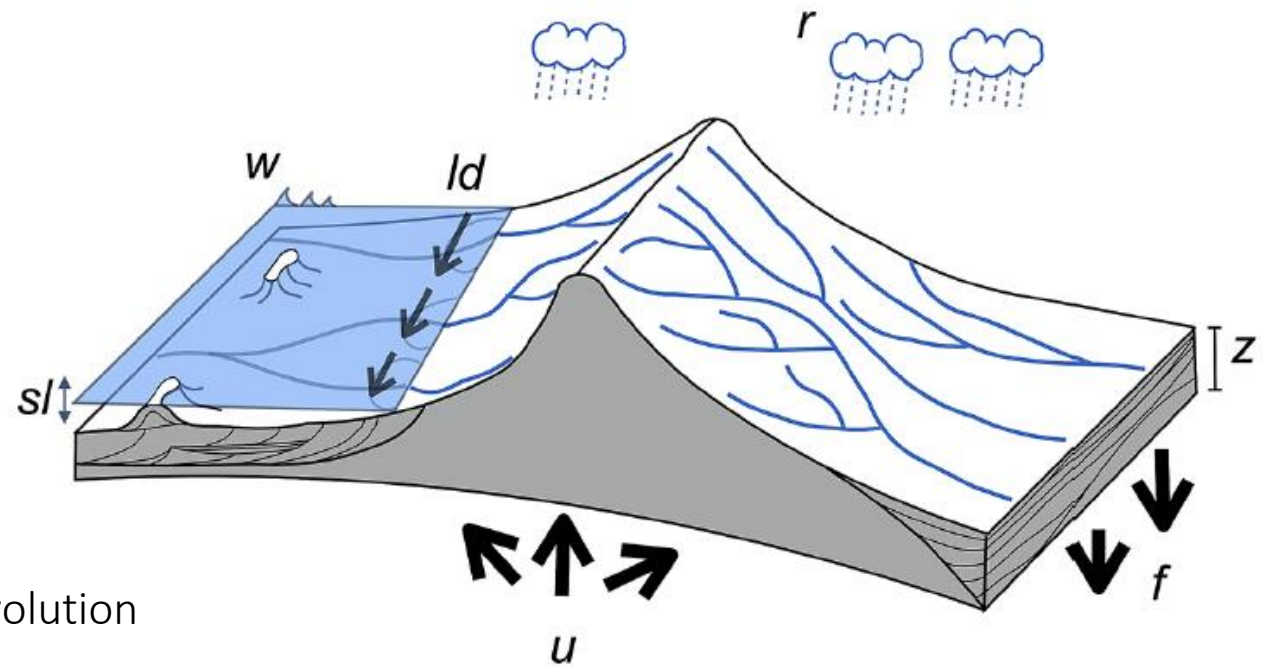


Salles, 2016

Continental-scale models



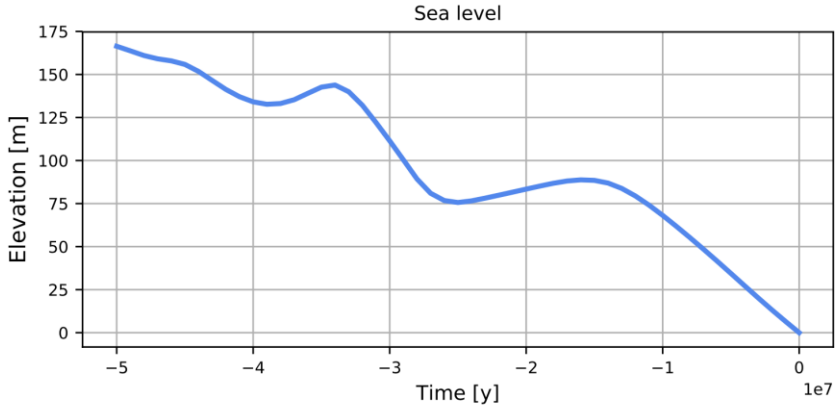
Salles et al, 2017

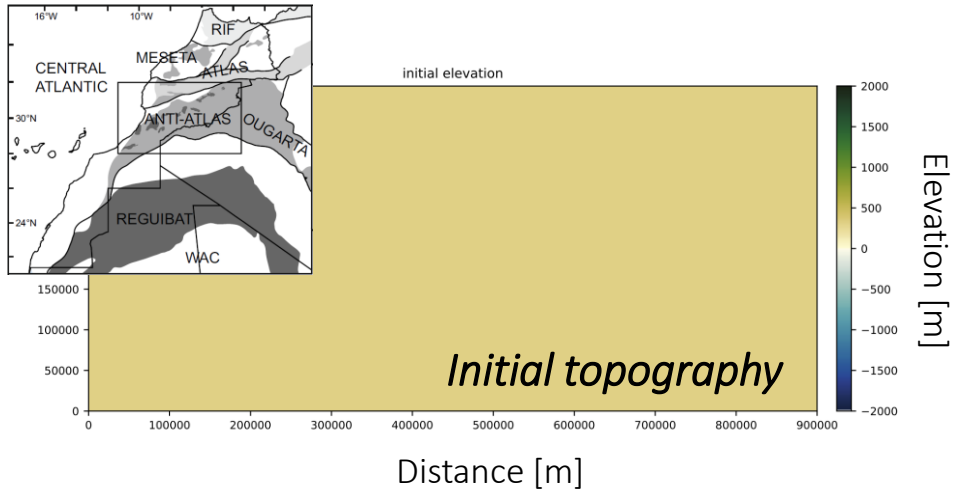


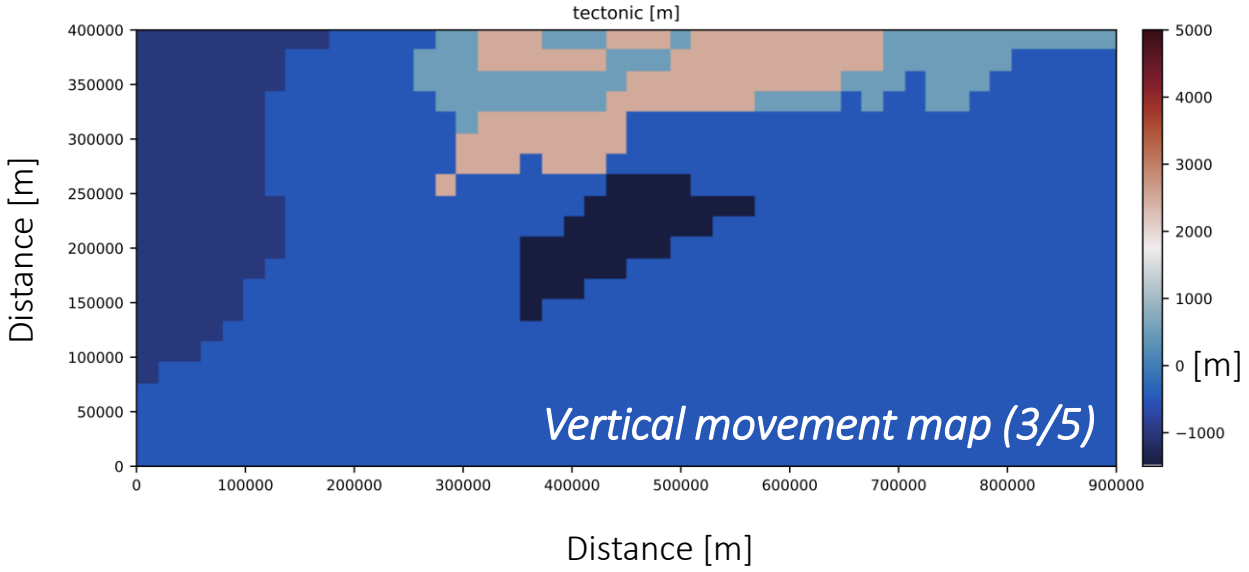
z = surface evolution
r = rainfall
sl = sea level
u = tectonic uplift
f = flexural isostasy
ld = longshore drift
w = waves

Salles et al., 2018

●●●❹ | Pilot: design







Simulation parameters

Start | 250 Ma

End | 0 Ma

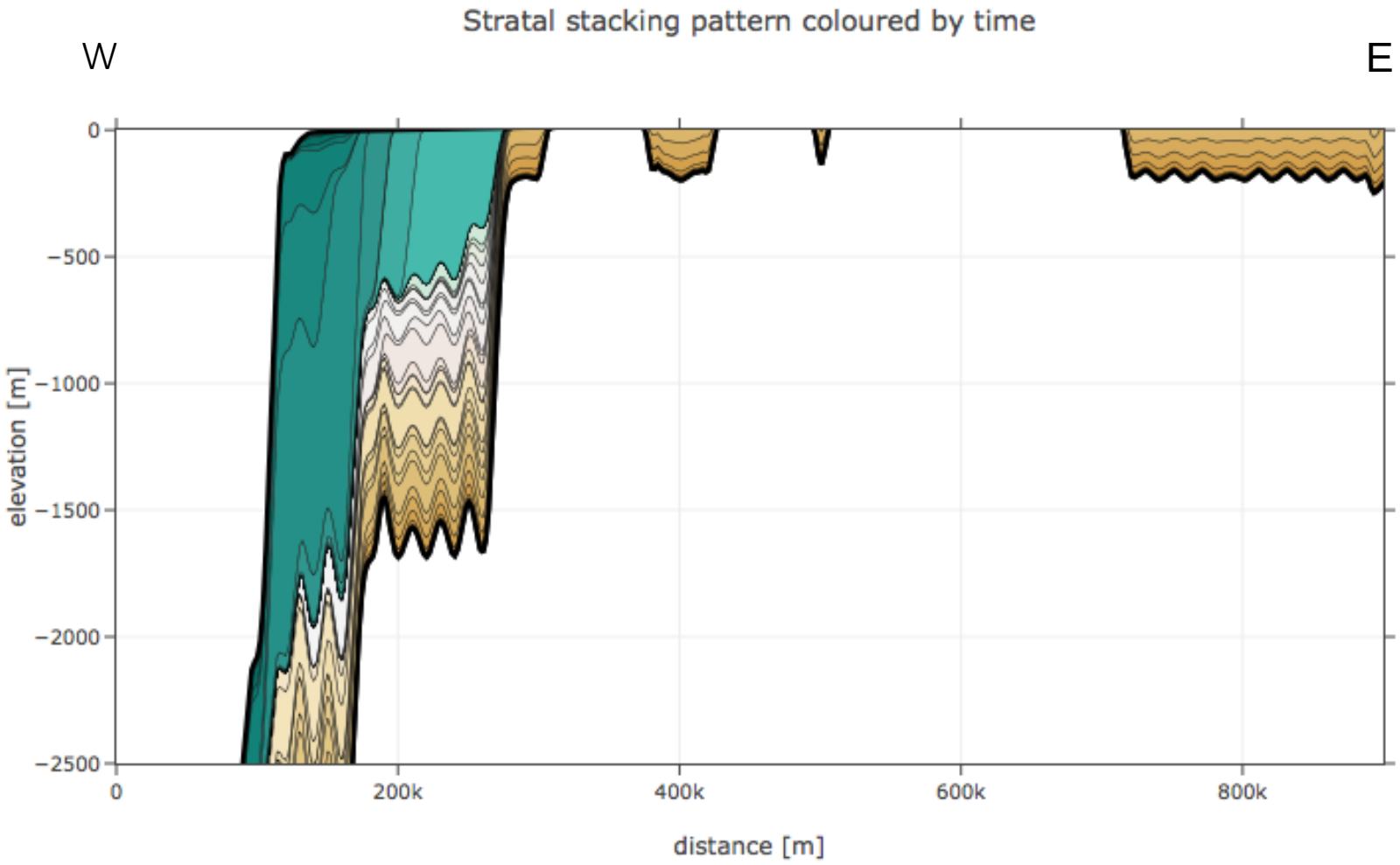
Time step | 100 ka

Boundaries | slope

Rainfall | constant (1 mm/a)

Erodibility | constant

••• ❹ | Pilot: preliminary results



Thank you

Project

TU Delft Delft University of Technology

MANCHESTER 1824 The University of Manchester

Research group

North Africa Research Group
www.narg.org.uk

Special thanks

ONHYM
المكتب الوطني للهيدروكاربورات و المعادن
OFFICE NATIONAL DES HYDROCARBURES ET DES MINES

| Extra

PHANEROZOIC VERTICAL MOVEMENTS IN MOROCCO

TU Delft

NARG ISES

RÉMI J. G. CHARTON