# Time Constraints on the Evolution of Southern and Central Palawan Island from Correlation of Miocene Limestone Formations*

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## Abstract

The link between the deformation of southern and central Palawan Island and the deformation of the adjacent offshore wedge is poorly studied. The wedge is a continuation of the Palawan fold and thrust belt and bounds the Borneo-Palawan Trench to the Dangerous Grounds and to Palawan Island. A key parameter for understanding the formation and development of this wedge is the Upper Miocene to Lower Pliocene Tabon Limestone. With an age of ~9 to ~4 Ma, this limestone sequence overlies unconformably the offshore wedge. A detailed biostratigraphic correlation of the Tabon Limestone along the SW Palawan shelf, using well data, combined with detailed investigations onshore southern and central Palawan, revealed a time-and space-transgressive development of these limestones. They are progressively younging towards the West. We infer that the formation of the Tabon Limestone is directly linked with the development of the wedge that tectonically controls the formation of this carbonate platform. This constrains the time for the final phase of the formation of the Palawan thrust belt. After the end of the compression and wedge formation in the lower Early Pliocene the wedge underwent a phase of thermal subsidence.

The beginning of the thrust belt formation is constrained by the so called Nido Limestone, which was deposited after the breakup of the South China Sea (~35 Ma) until the Early Miocene. Age data available from offshore wells give an age of 28 – 25 Ma near the base of the Nido Limestone. While cropping out onshore north Palawan, these limestones were overthrusted by the wedge in southern and central Palawan. Seismic images show a gentle dipping of these carbonates towards the east. It is also visible in the seismic, that these limestones are only slightly affected by the wedge formation.

We can deduce that the wedge did not reach the southern and central Palawan area prior to ~18 Ma. Using the Tabon Limestone, which seals the wedge, as time constraint we state that the development of the wedge in the south Palawan area started in the upper Middle Miocene (~12 Ma) and continued developing towards the west until the upper Late Miocene to Early Pliocene (~5 Ma).

After the wedge propagation stopped, the wedge front collapsed in several places due to gravitational sliding.

Southern and central Palawan was formed in a second pulse of compression and uplift in the Late Pliocene. Investigations on onshore outcrops give indications to a working spleothem since ~1.2 Ma.

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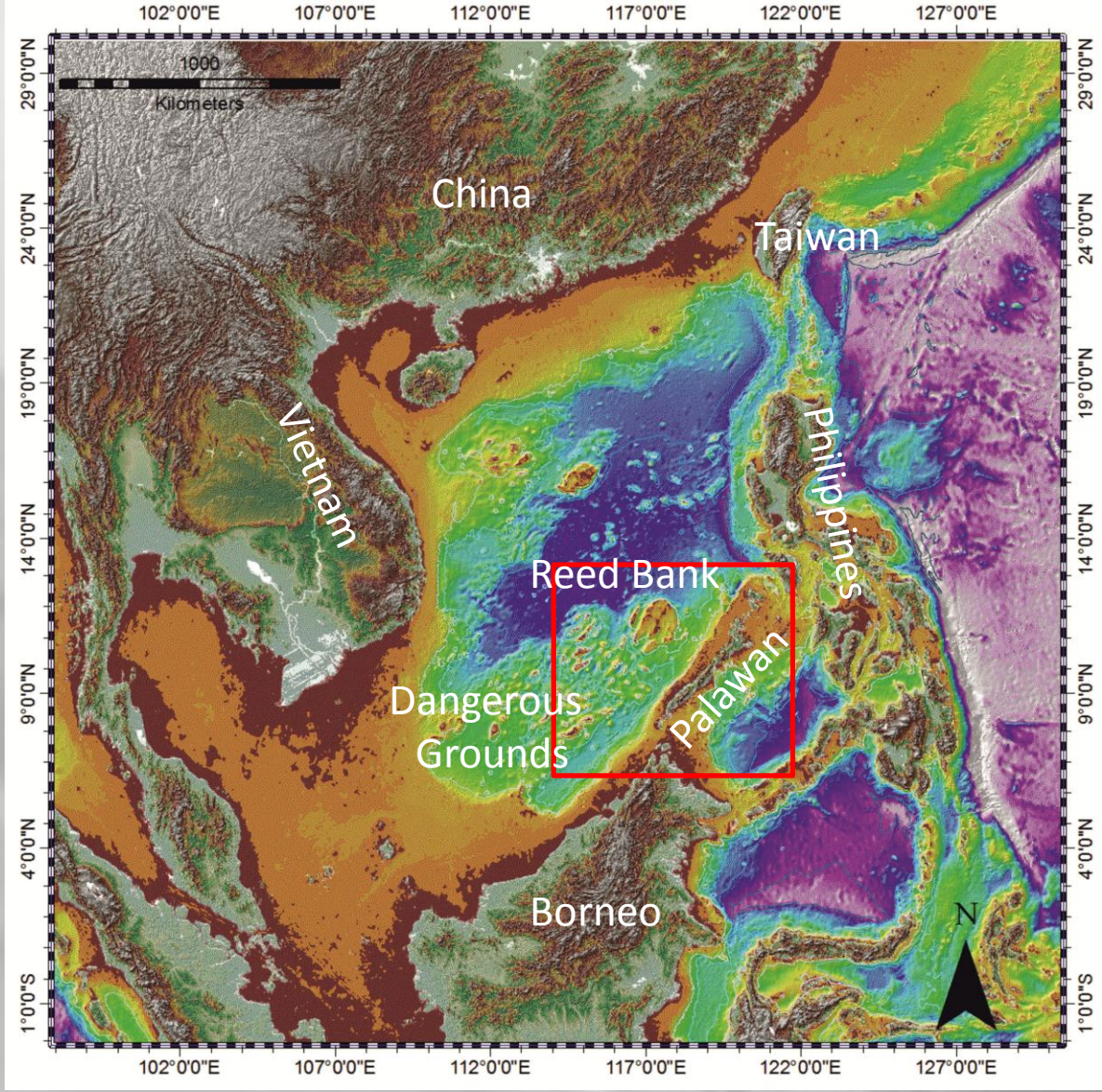
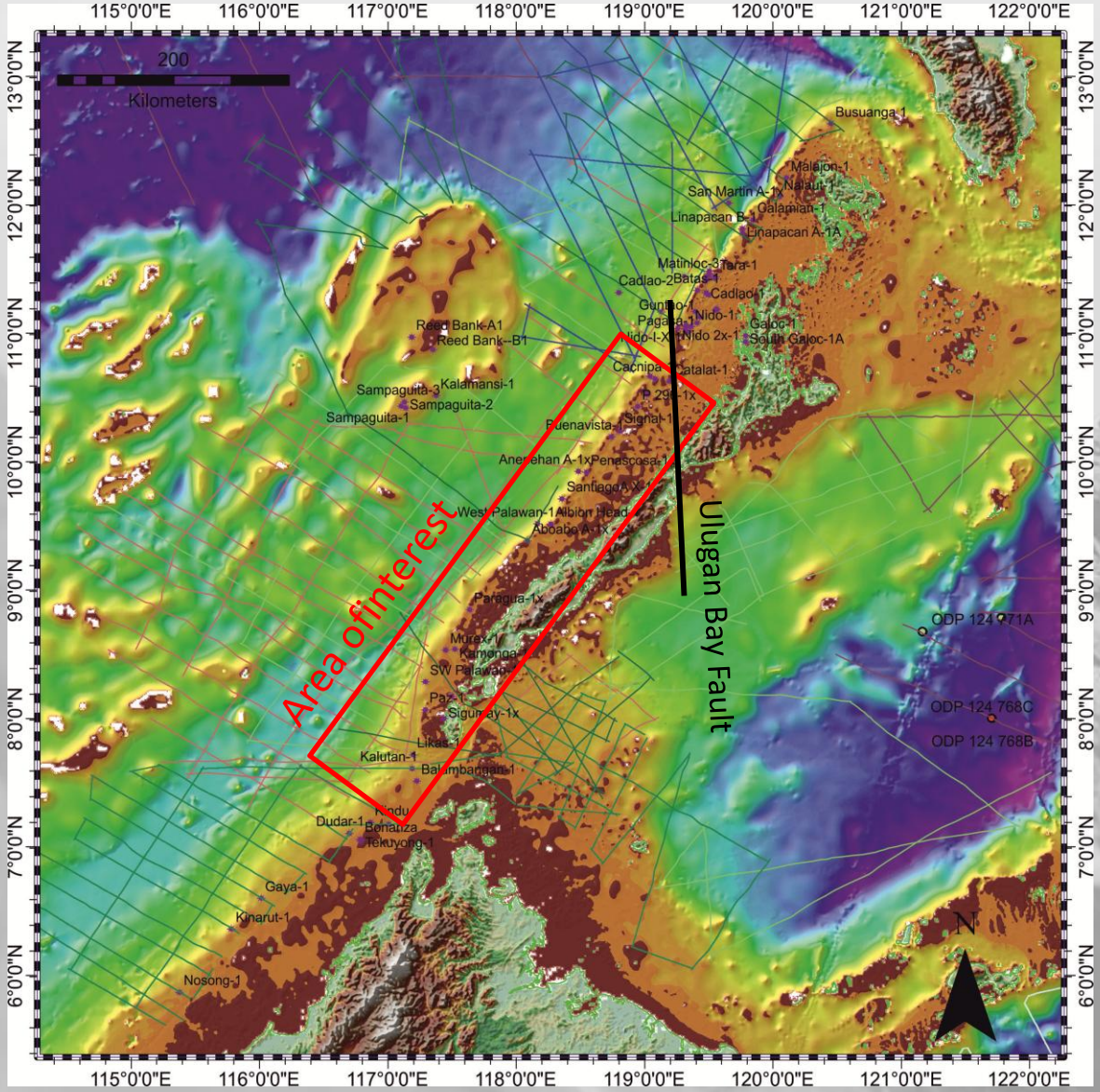
# Overview

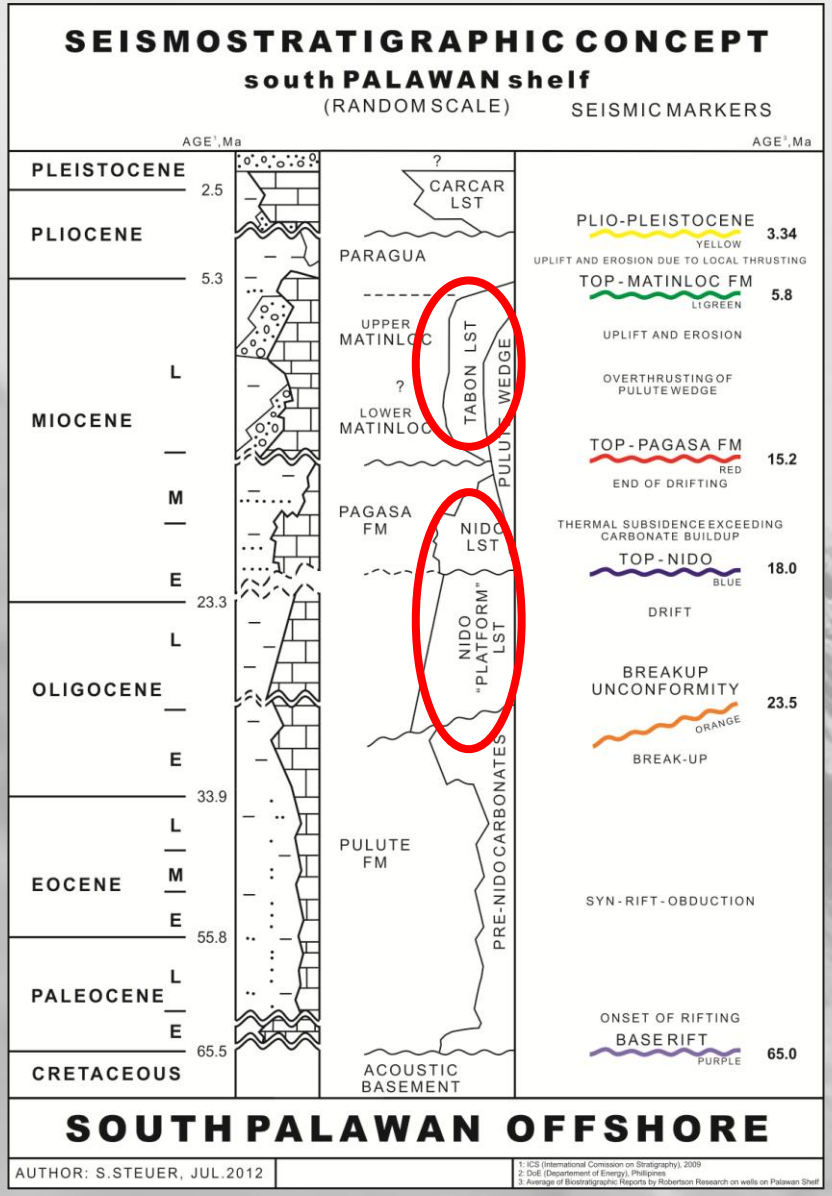


# Database



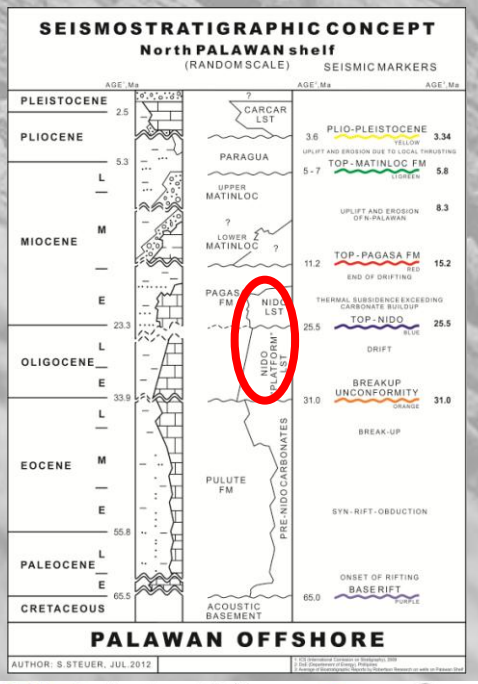

- Set of 2D MCS lines acquired by BGR in the past 30 years
- 32 wells
- Outcrop data onshore Palawan

# Main Formations

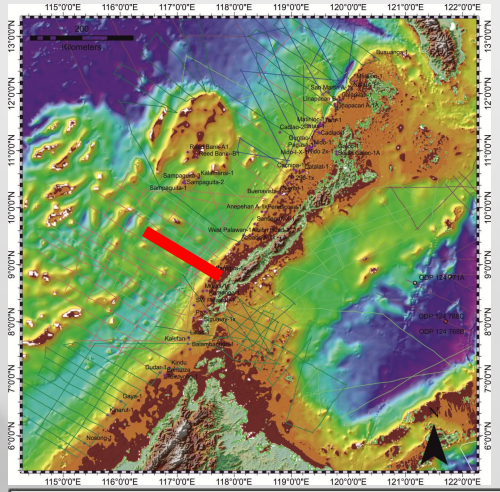



Late Miocene - Pliocene
„Tabon“ Limestone

Oligocene – Early Miocene
„Nido“ Limestone

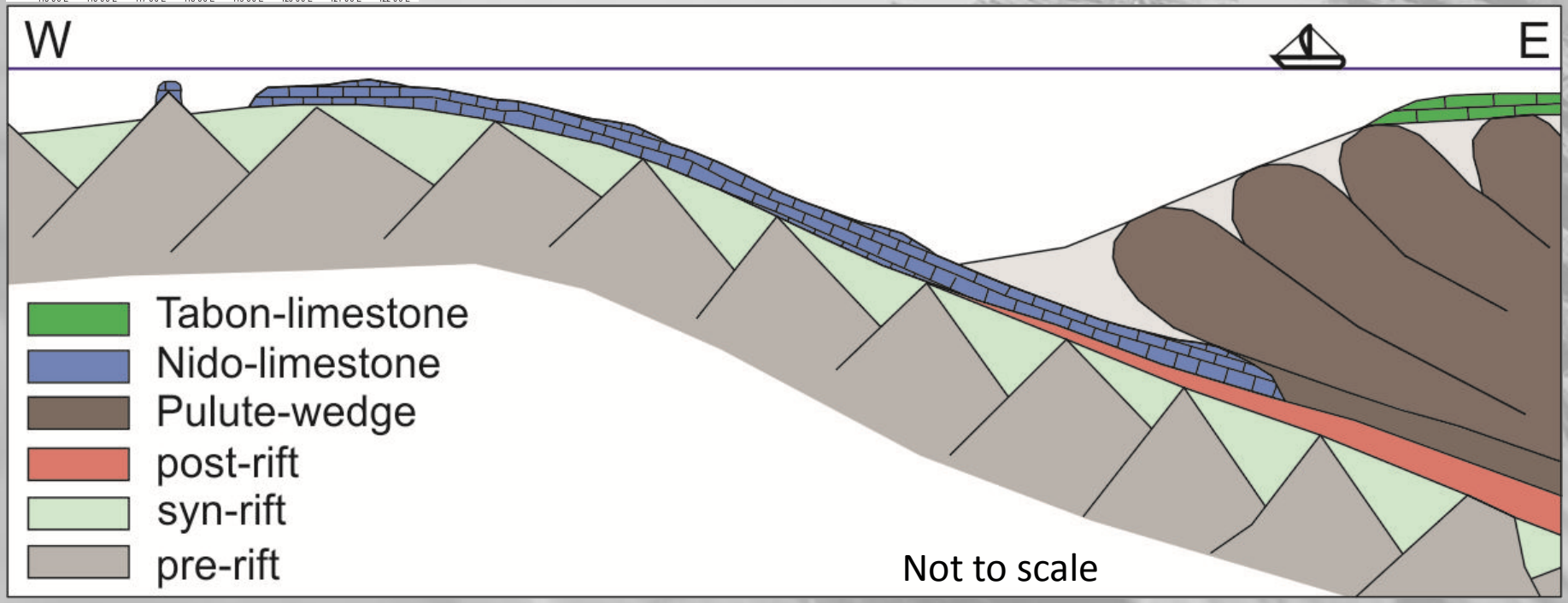


# Why are they significant?



Wedge forms base of South Palawan

Timing of formation and uplift



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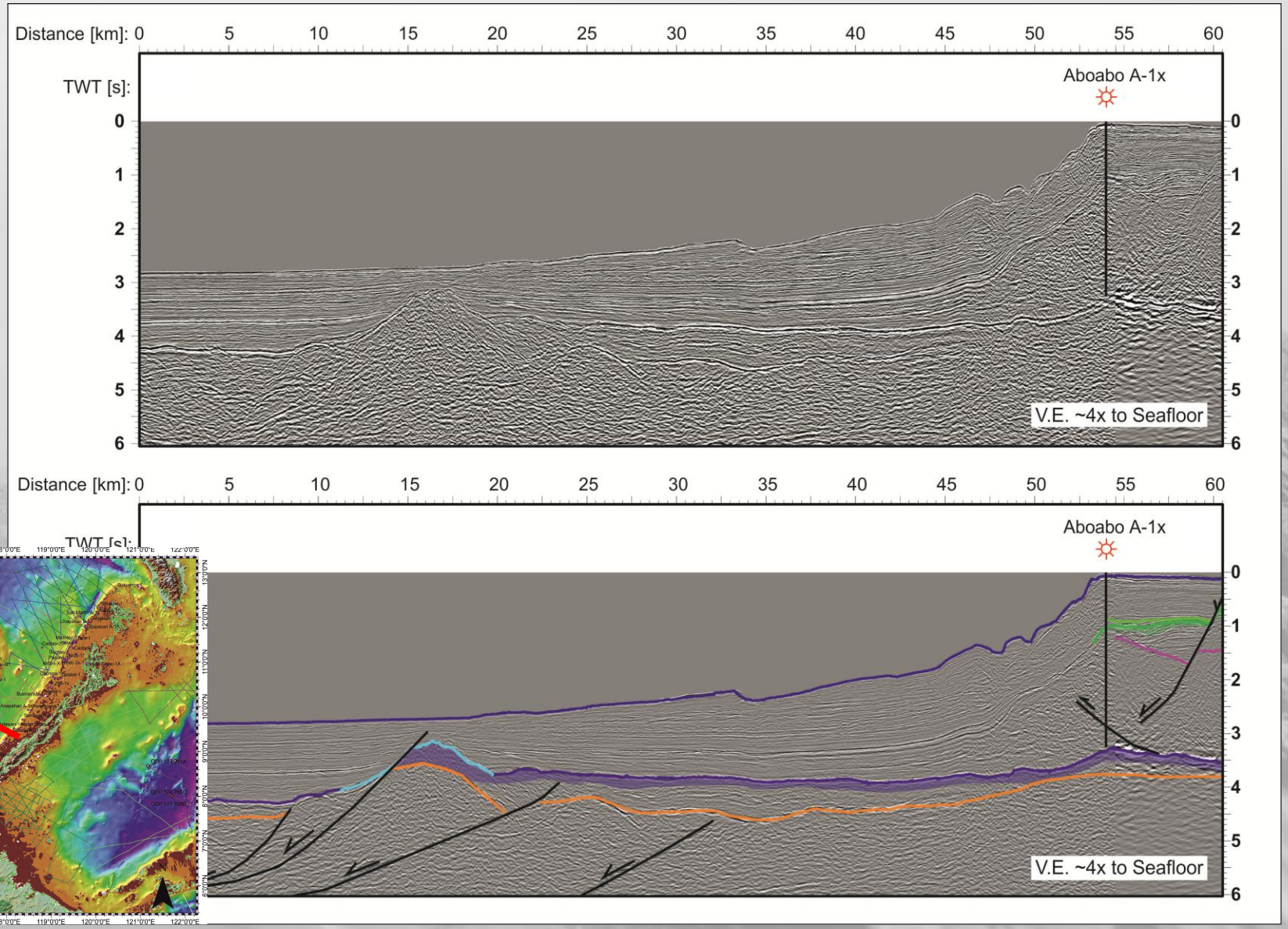
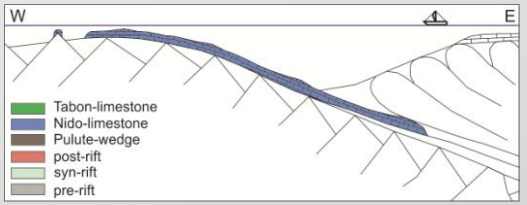
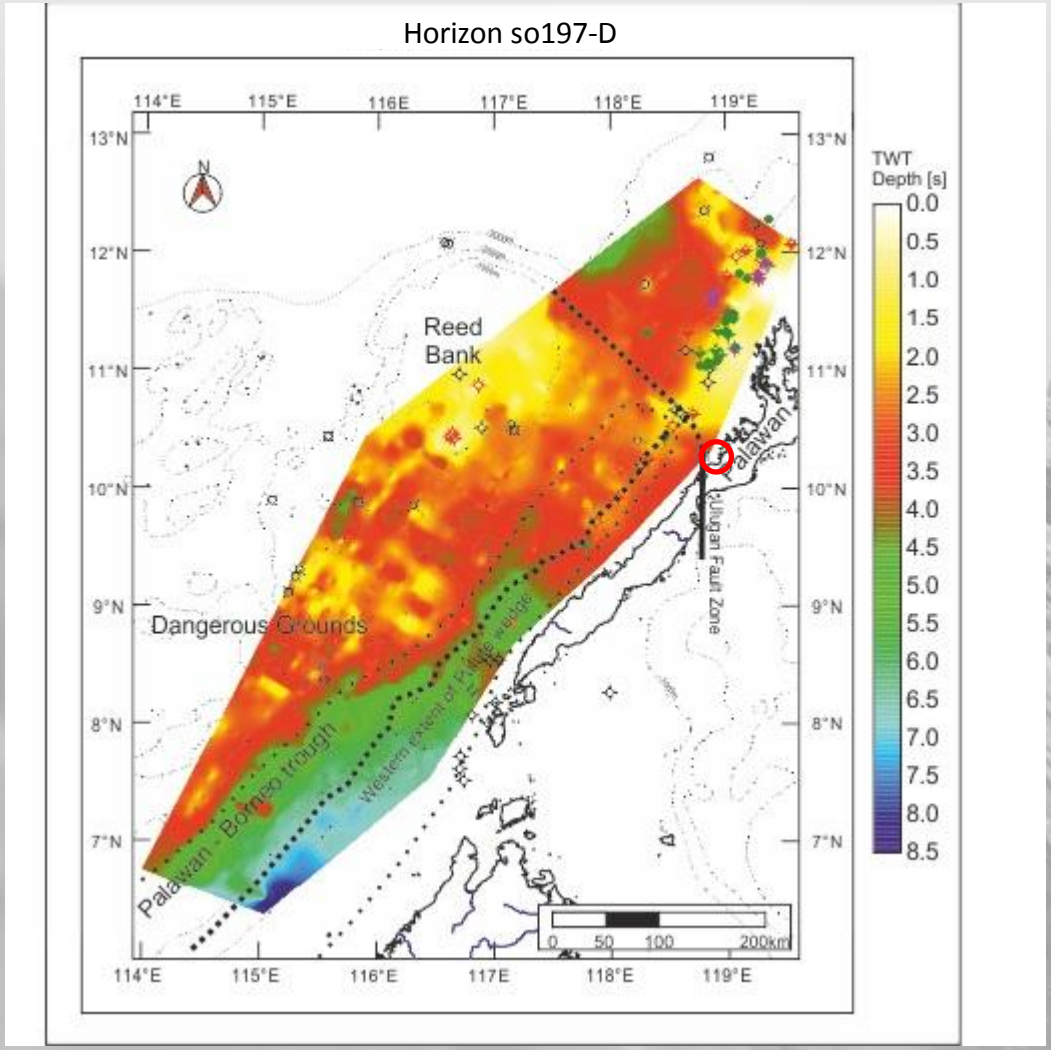


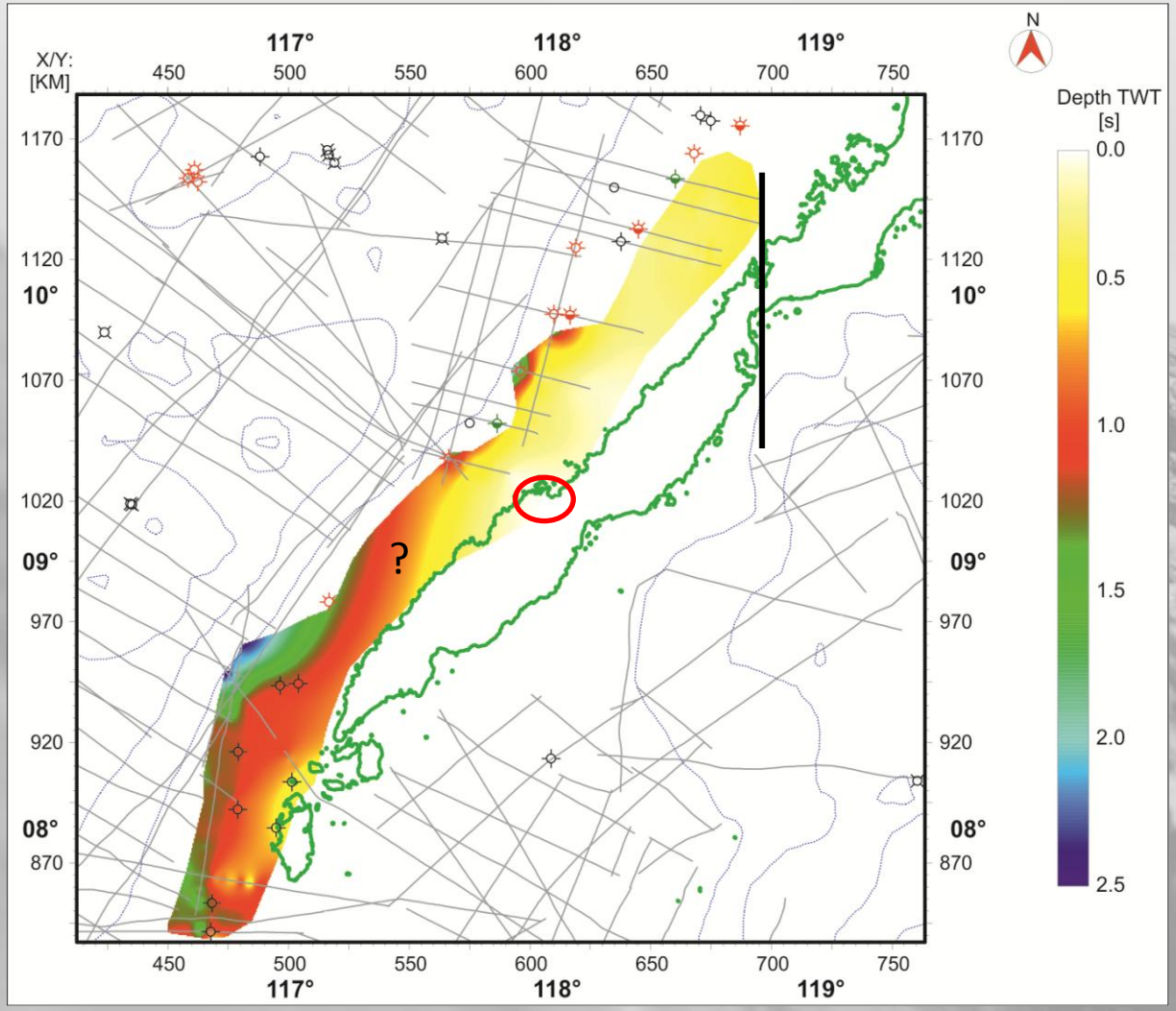
# Oligocene-E. Miocene „Nido“ limestone

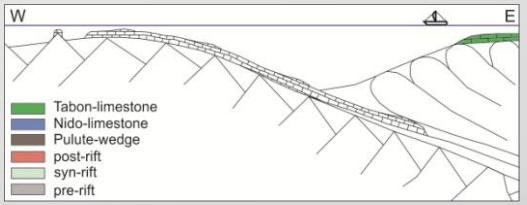



- Two different styles:
  - -Rises towards N-Palawan
  - -Dips downward towards S-Palawan
- Widespread in front of N-Palawan and in the Palawan- Borneo trough
- Patchy in the Dangerous Grounds
- Overthrusted by the S-Palawan wedge

# Late Miocene „Tabon“ limestone




- Restricted to wedge
- Crops out onshore



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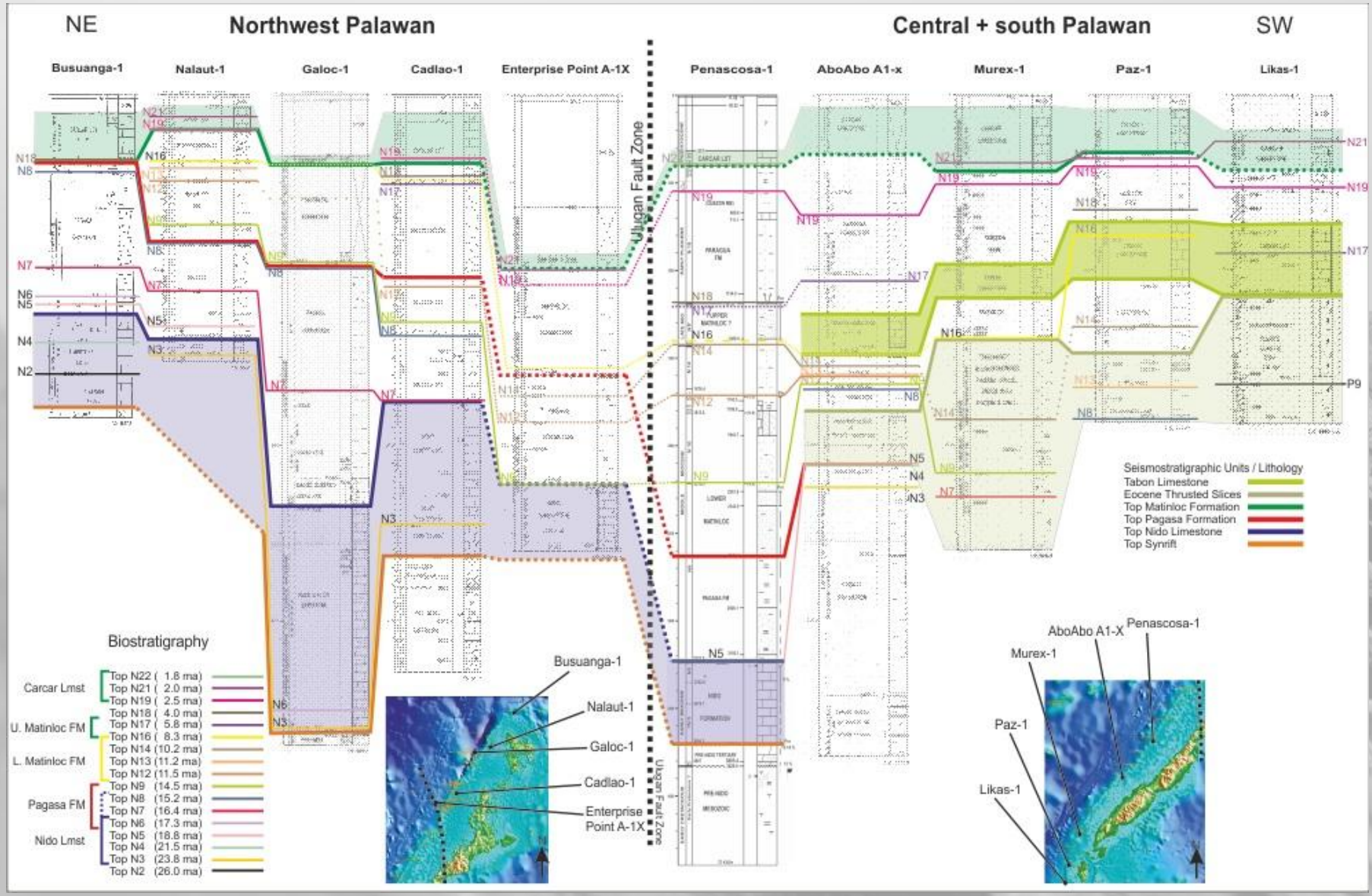
GEOZENTRUM HANNOVER
TOTAL
Ens

# Well correlation



# Age of „Nido“ platform limestone

## Top:

North:
Range: 20 – 16 Ma
Average: 19 Ma

Upper Early Miocene

South:
18 Ma

Slightly younger than in the North

**Age before overthrusting**

## Base:

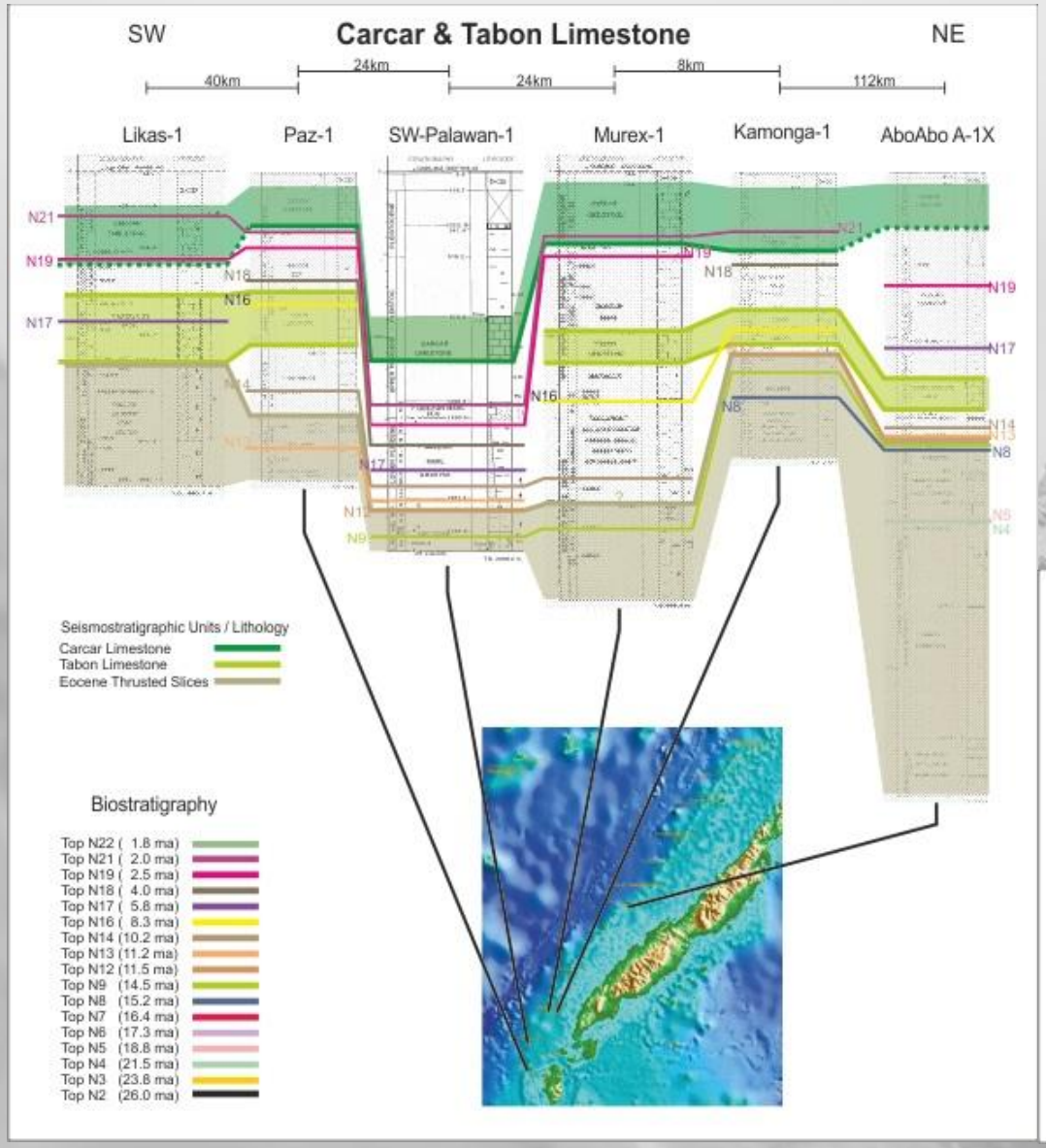
North:
Range: 30 – 27 Ma

upper Early Oligocene – lower Late Oligocene

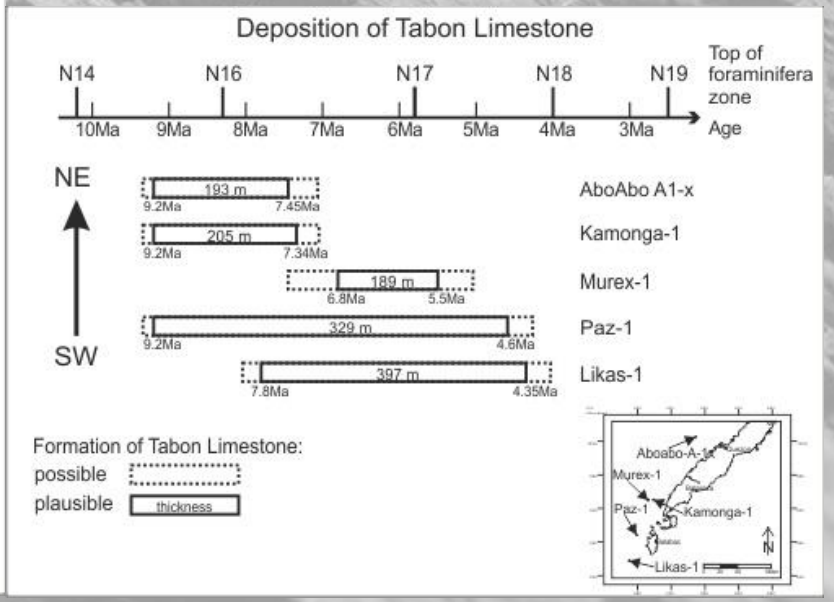
South:
Range 23.5 – 24 Ma

Upper Late Oligocene

# Late Miocene „Tabon“ limestone




Development is time- and space- transgressive



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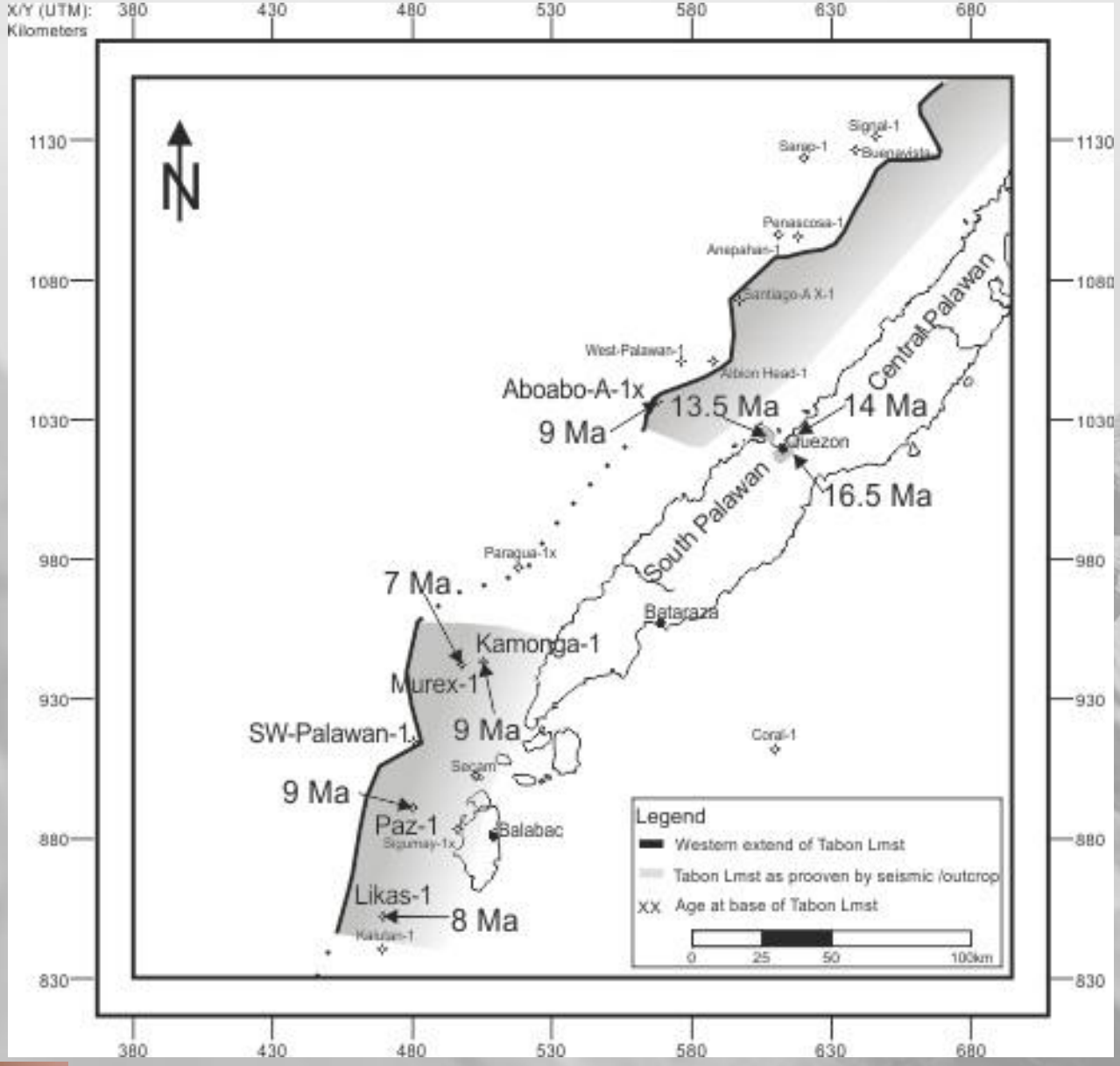
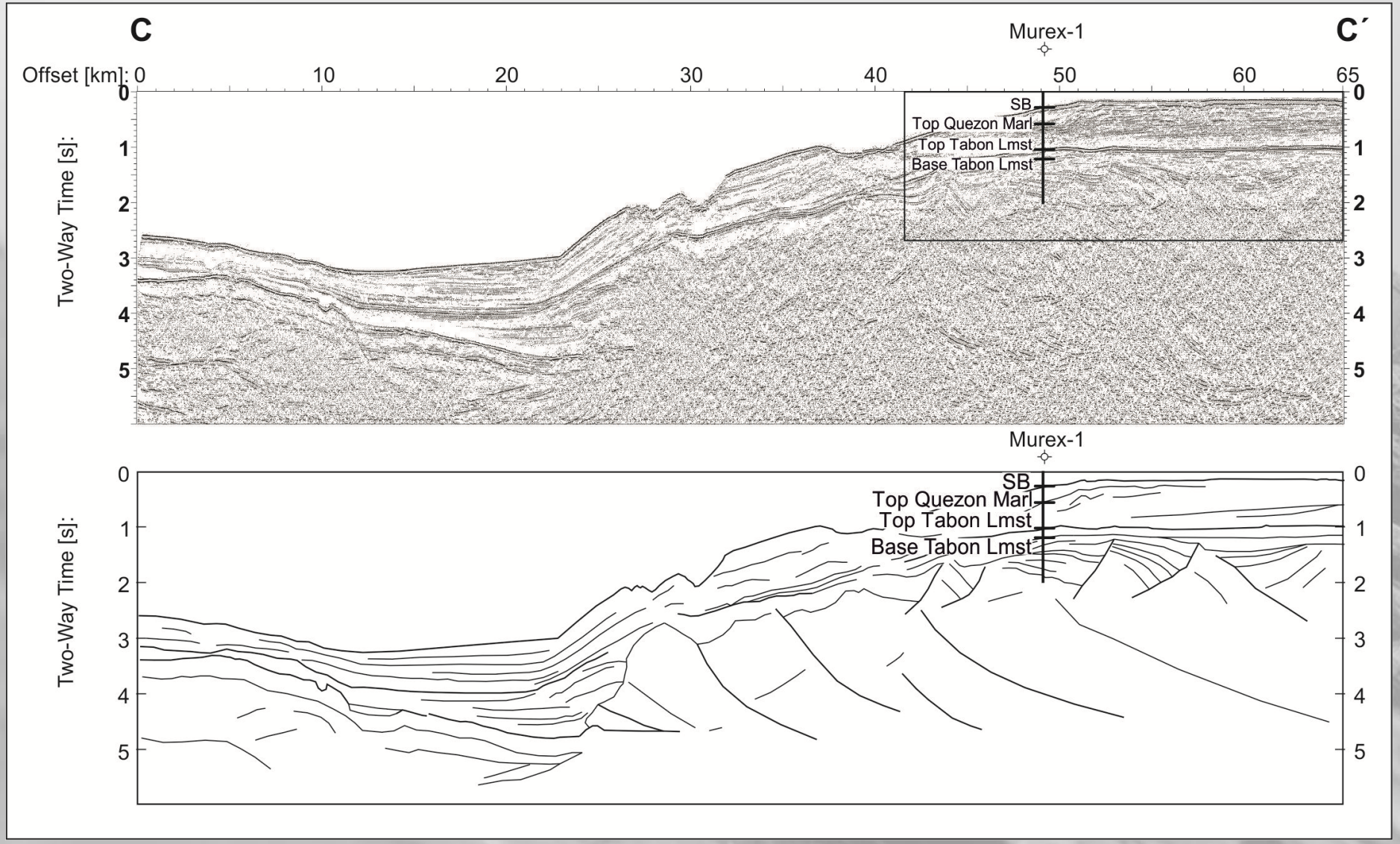



First deposition in the east

Youngest carbonates in the west

# Connection between „Tabon“ limestone and the wedge



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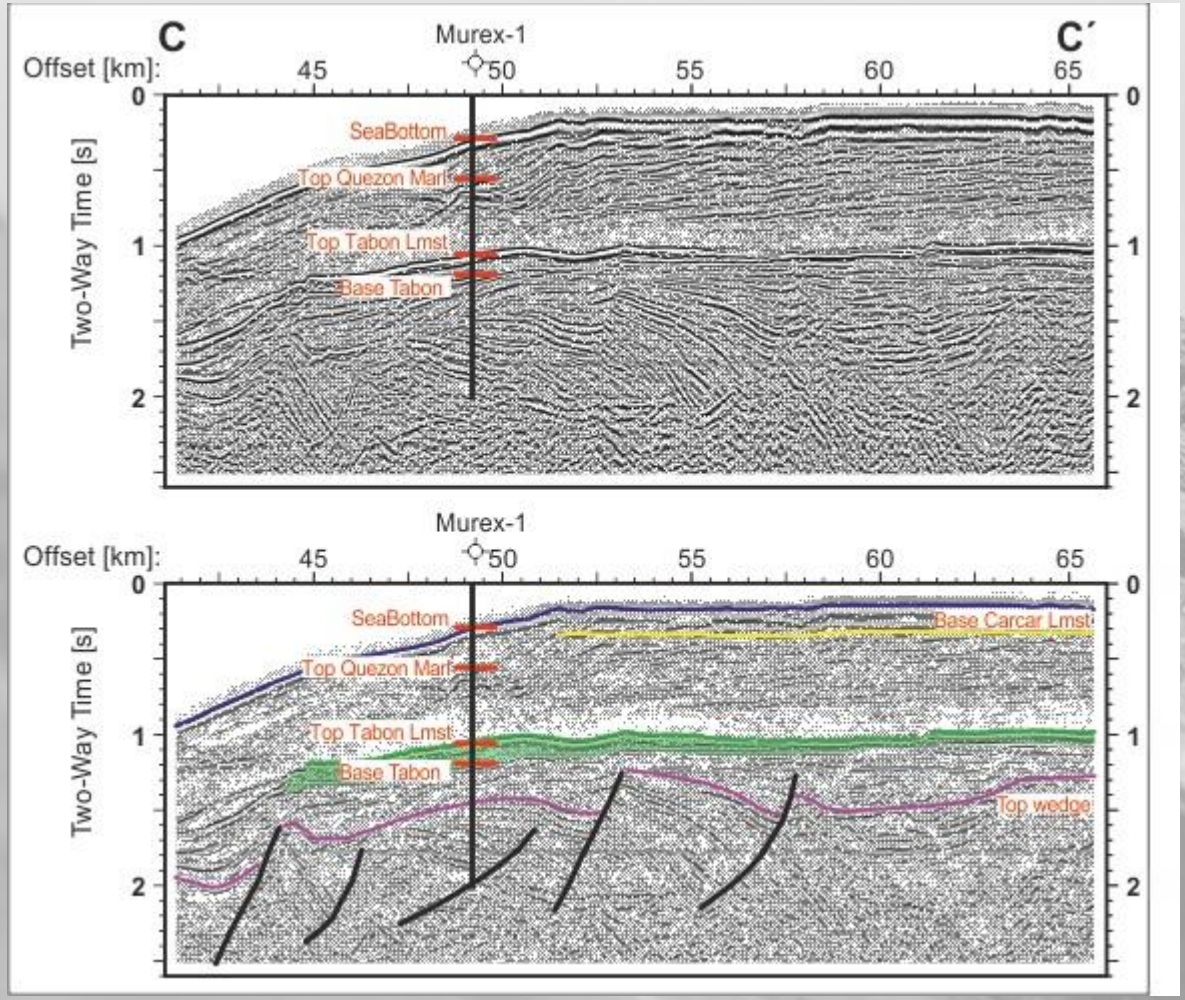
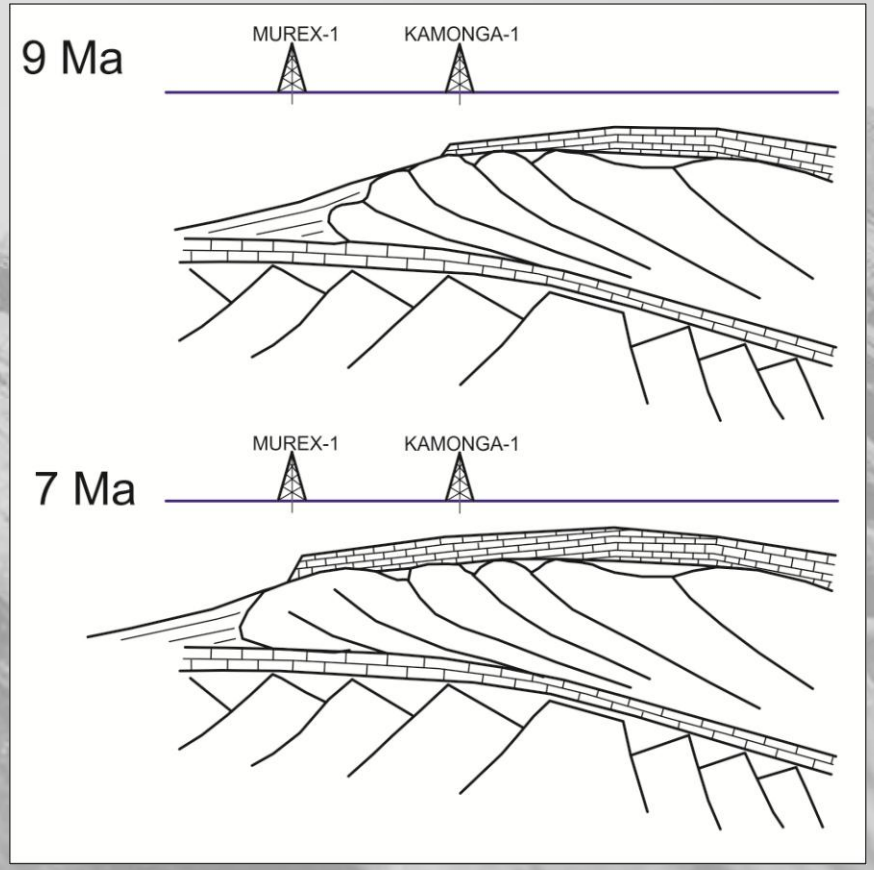



- Tabon Limestone is not affected by thrusting
- Prograding uplift by the wedge controlls limestone deposition
- Rising sealevel provides space for further development of the carbonates
- Locally subaerial exposure
- End of Tabon deposition:
  - Slow retreat
  - Rapid drowningatwedge front

# Results

- „Nido“ and „Tabon“ Limestone provide time constraints for the development of South-Palawan
- Wedge was not present in the area of the SW-Palawan shelf before ~18 Ma
- First uplift in the east (now onshore Palawan Island) at ~16 Ma
- Wedge development continued until ~7 Ma
- Thermal subsidence since ~7 Ma
- Rapid drowning of the Tabon Limestone in several places at ~5 Ma due to gravitational collapse at the wedge front

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# Thank you for your attention

St. Pauls / „Nido“ Limestone nearSabang / Palawan