



HOW TO DEFINE THE BASE OF THE SLOPE IN LOW GRADIENT PASSIVE MARGINS ?

BRAZILIAN CONTINENTAL SHELF PROJECT (LEPLAC)

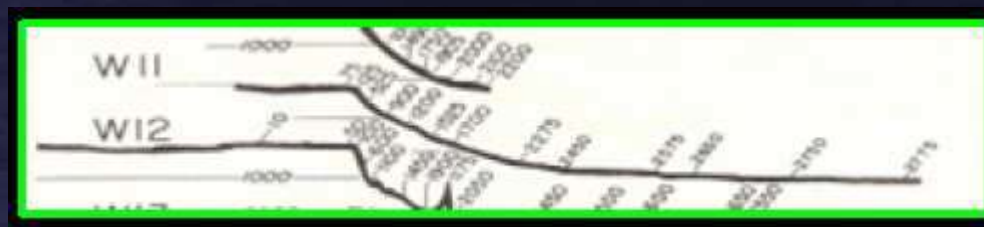
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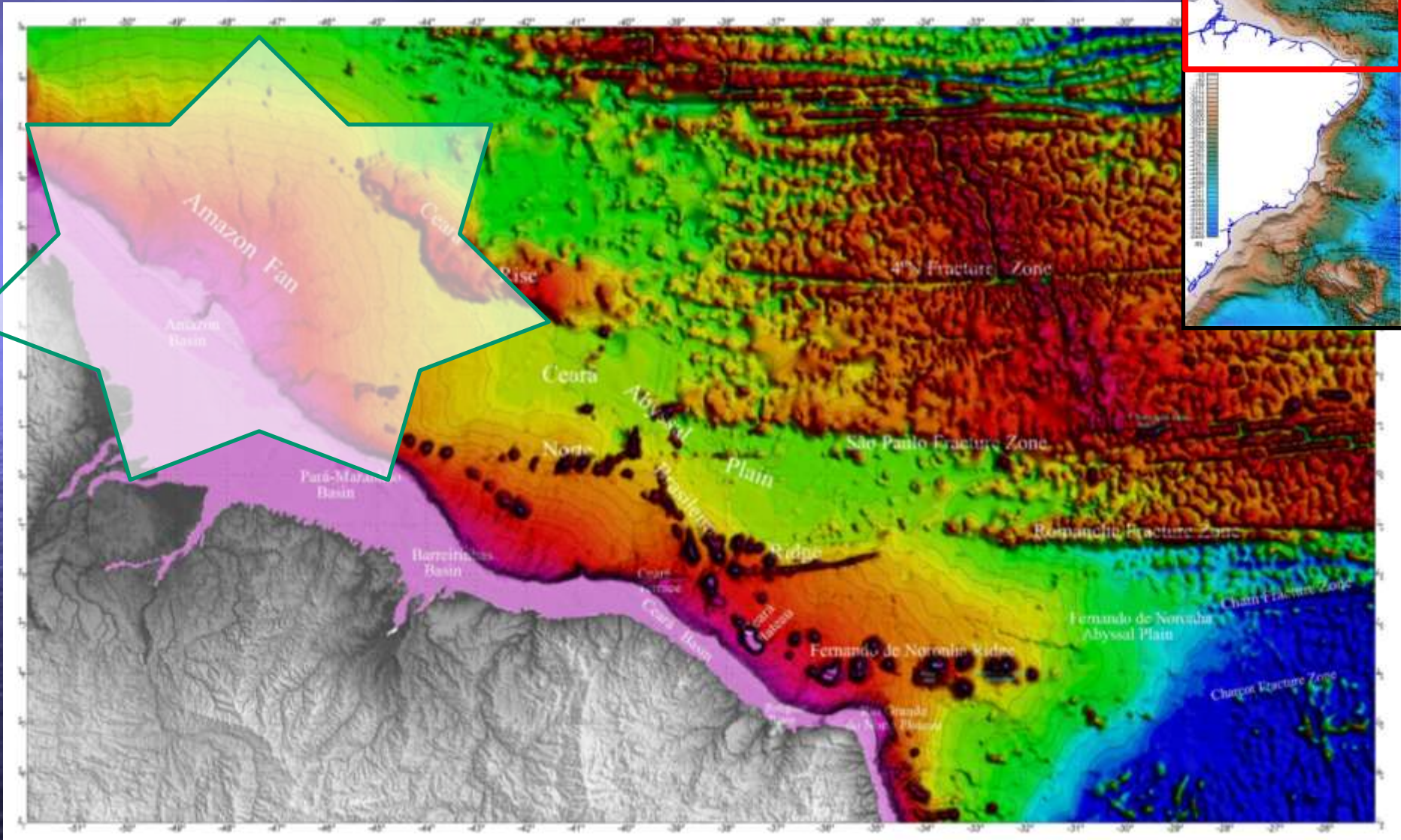


- How to apply art.76 (UNCLOS) and the *Scientifical and Technical Guidelines (STG)*-CLCS/11 in low gradient margins?
- Heezen *et alii* concepts are not applicable – no classic distinction between slope and rise
- Could it be possible to define the base of the slope in the end of the margin, where it reaches the deep ocean floor using the general rule? Evidence to the contrary should be used?





Physiographic Regional Map





THE AMAZON FAN

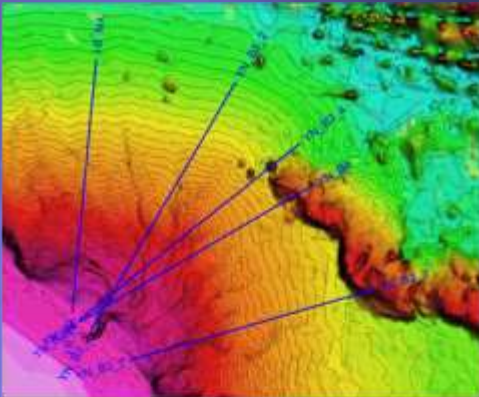
- the third largest fan in the world, reaching 700 km offshore from the shelf break occupying an area of $\approx 375,000 \text{ km}^2$
- natural prolongation of the Brazilian Continental Margin.
- continental slope and rise are affected by the anomalous sedimentation and are an undivided ensemble, starting at the shelf break down to depths of approximately 4,800 m at the boundary with the Demerara Abyssal Plain.
- sediment thickness of about 18 km at its depocenter



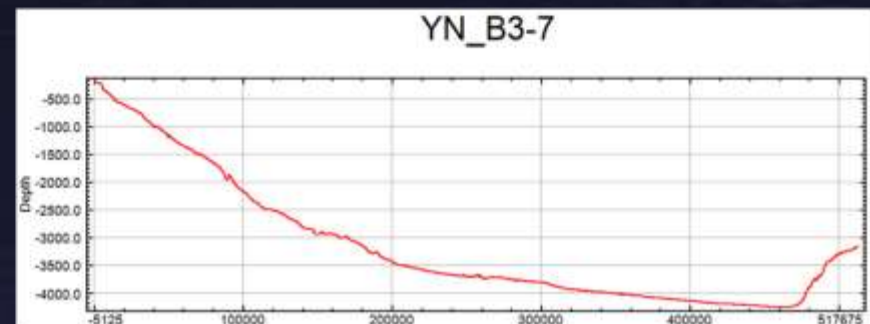
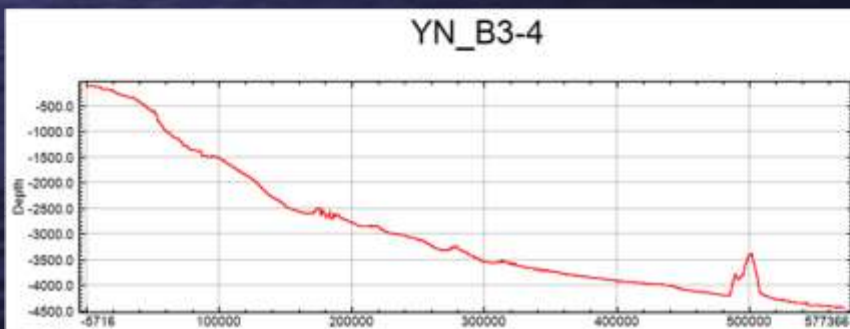
THE AMAZON FAN MORPHOLOGY



The fan surface is smooth and continuous and there is no abrupt and regional breaks.

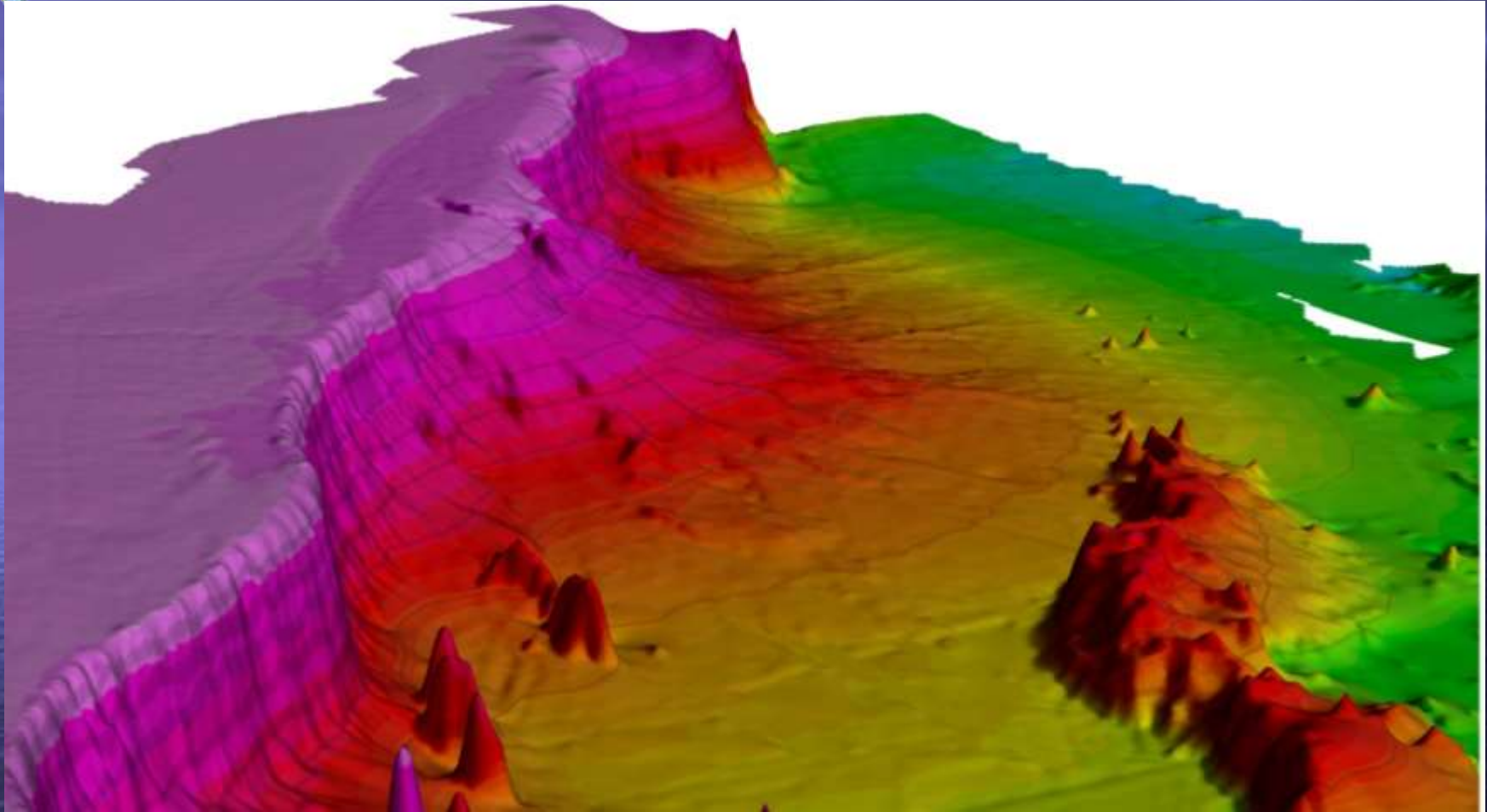


Local changes in the gradient (canyons, channel levees and mass transports).





Amazon Deep Sea Fan “3D” map



Only morphological criterion was not sufficient to determine the base of the slope at the Amazon Fan. So the geological/geophysical evidences should be considered.



UNCLOS -Art 76 - 4. (b) In the absence of evidence to the contrary, the foot of the continental slope shall be determined as the point of maximum change in the gradient at its base.

GENERAL RULE CHAPTER

CLCS/11- 5.1.3 The Commission interprets the determination of the foot of the continental slope by means of the point of maximum change in gradient.... The fundamental requirements posed by this provision are :

- The identification of the region defined as the **base of the continental slope**; and
- The determination of the location of the point of **maximum change in the gradient** at the base of the continental slope .

CLCS/11- 5.1.4 Its implementation will be guided by bathymetric, geomorphologic, geologic and geophysical sources of evidence.



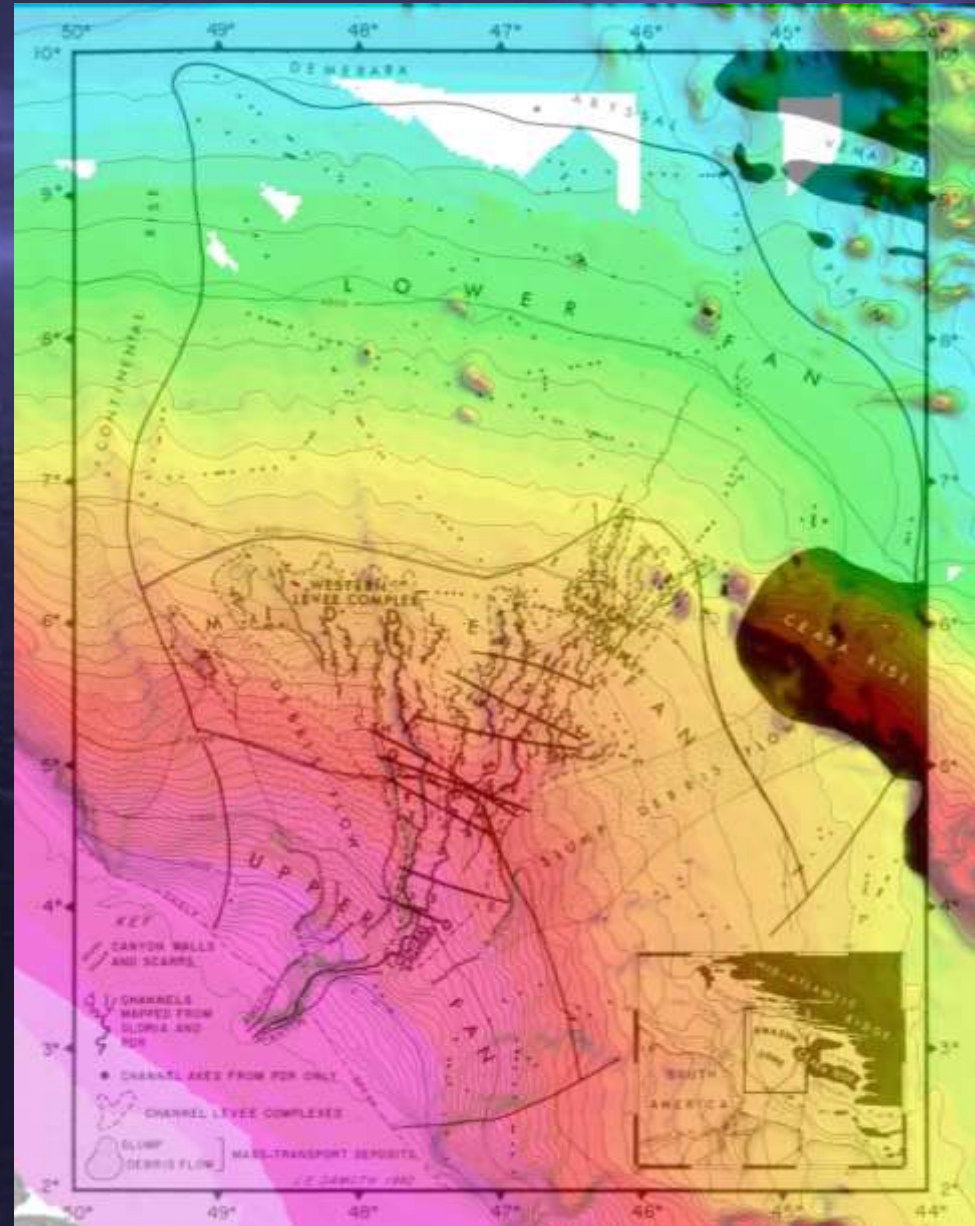
CLCS 11- 5.4.4 For the purpose of identifying the region defined as the base, the Commission defines the continental slope as the outer portion of the continental margin that extends from the shelf edge to the upper part of the rise or to the deep ocean floor **where a rise is not developed**



Amazon Deep Sea Fans Divisions

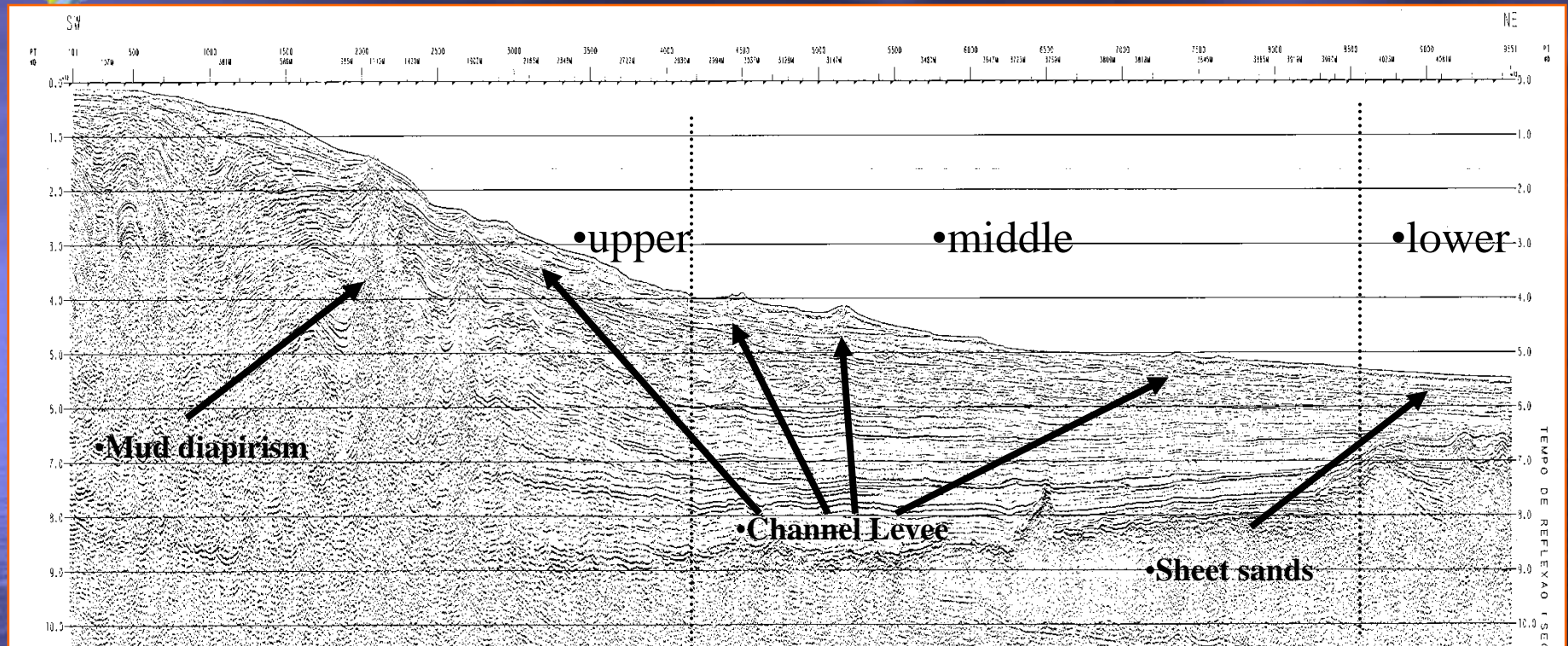


The Amazon Deep Sea Fan is morphologically divided into Upper, Middle and Lower Fan based on broad morphologic and acoustic characteristics (Damuth, 1973 and Damuth *et al.*, 1988). In accordance with Damuth *et al.*, 1988, "these divisions are mainly for descriptive purposes and do not reflect distinctive fan subenvironments of facies associations (as do fan divisions in some published fan models)".





LEPLAC seismic profile 501-0024



With the exception of mud diapirs, the same geological processes present in Upper and Middle Fan, with similar intensity and frequency.

The best example of the continuity of processes in the Amazon Upper and Middle Fan are the meandering channel-levee systems associated with a low and continuous gradient.

These processes allow the Upper and Middle Fan to be considered as a single geologic and physiographic unit.



Brazil considerations

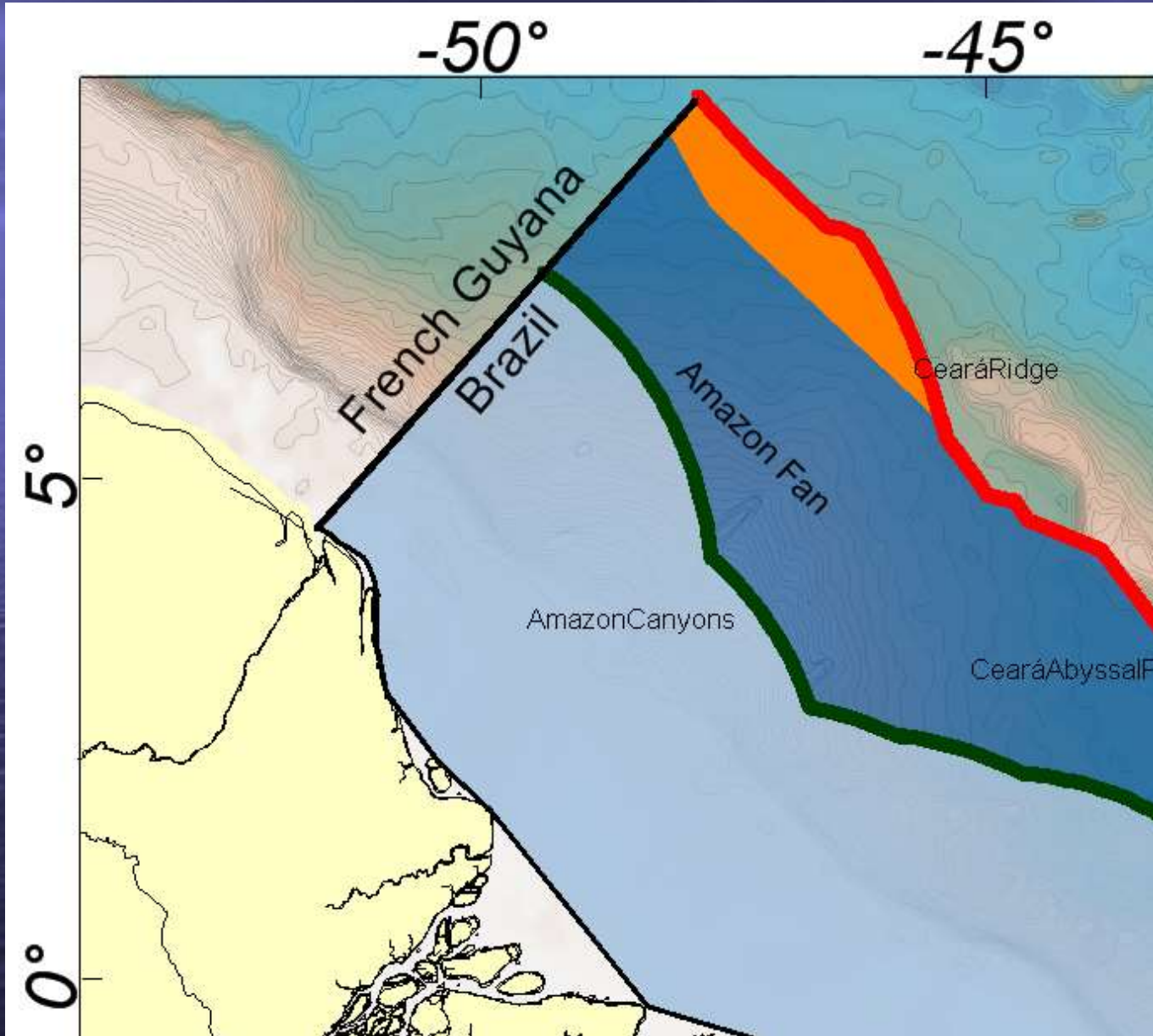
Brazil considers the Upper and Middle Fan as a single geological and physiographic entity analogous to a continental slope, therefore placing the base of the continental slope at the distal end of the Middle Fan, coinciding with the lobe deposition of the channel levee systems.

CLCS considerations

The fan is an integral part of the margin but the base of the slope would be better positioned approximately between the upper and middle fan.



AMAZON DEEP SEA FAN





THE CURRENT APPROACH



Based on the geological processes

item 5.2.1 of CLCS/11 - *Bathymetric and geological data provide the evidence to be used in the geomorphological analysis conducted to identify the region defined as the base of the continental slope...*

- Recently, new studies of the Amazon Fan region made possible the mapping, in details, of the huge areas where Mass Transport Deposits occurs (MTD). These studies have shown that MTD have been recurrent elements at this region from the Middle-Miocene to Recent.
- In regions located to the NW and SE of the Amazon Deep-sea Fan, mass movement processes remobilized thick siliciclastic series (up to 1,000 m) as huge megaslides deposits over areas of up to 90,000 km² (Silva et al., 2010).

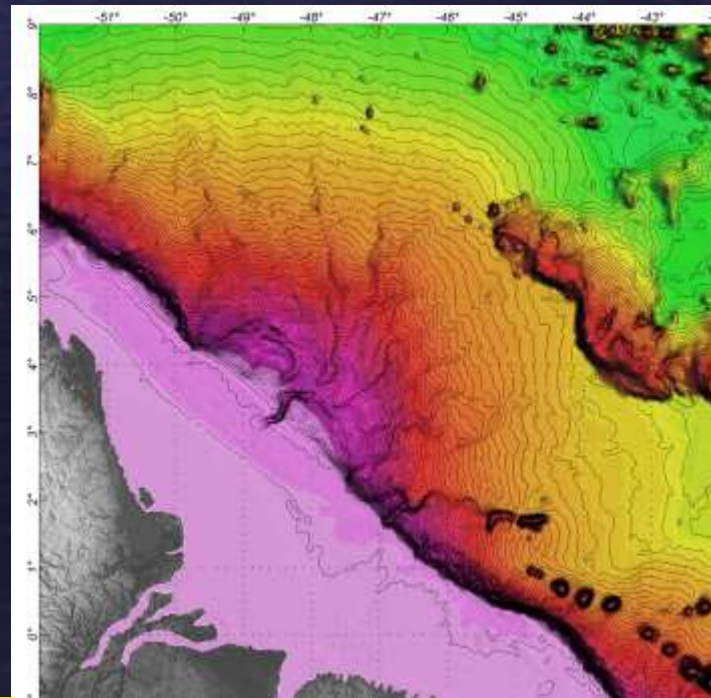
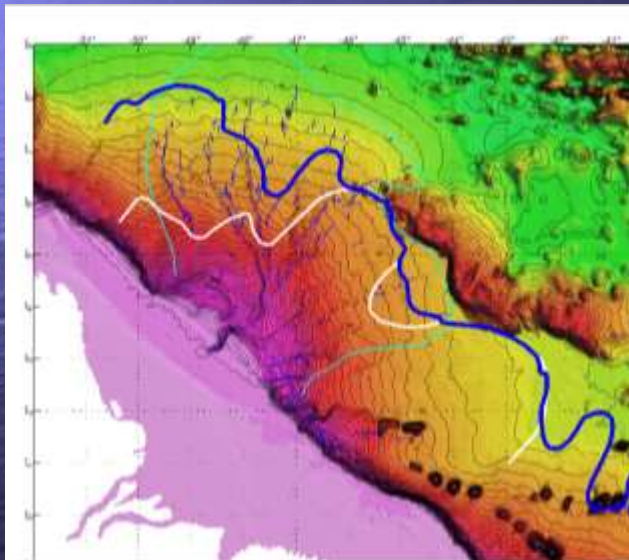


THE BASE OF THE SLOPE - THE AMAZON FAN



- The processes along the Fan are related to down slope process, varying in intensity and frequency;
- The base of slope could be defined at the region of the end of the occurrences of the mass transport deposits (MDT) which are related to a gravitational flow.
- The Amazon Deep Sea fan is a natural component of the Brazilian margin in its totality.

The definition of the BOS and the FOS was not concluded yet.

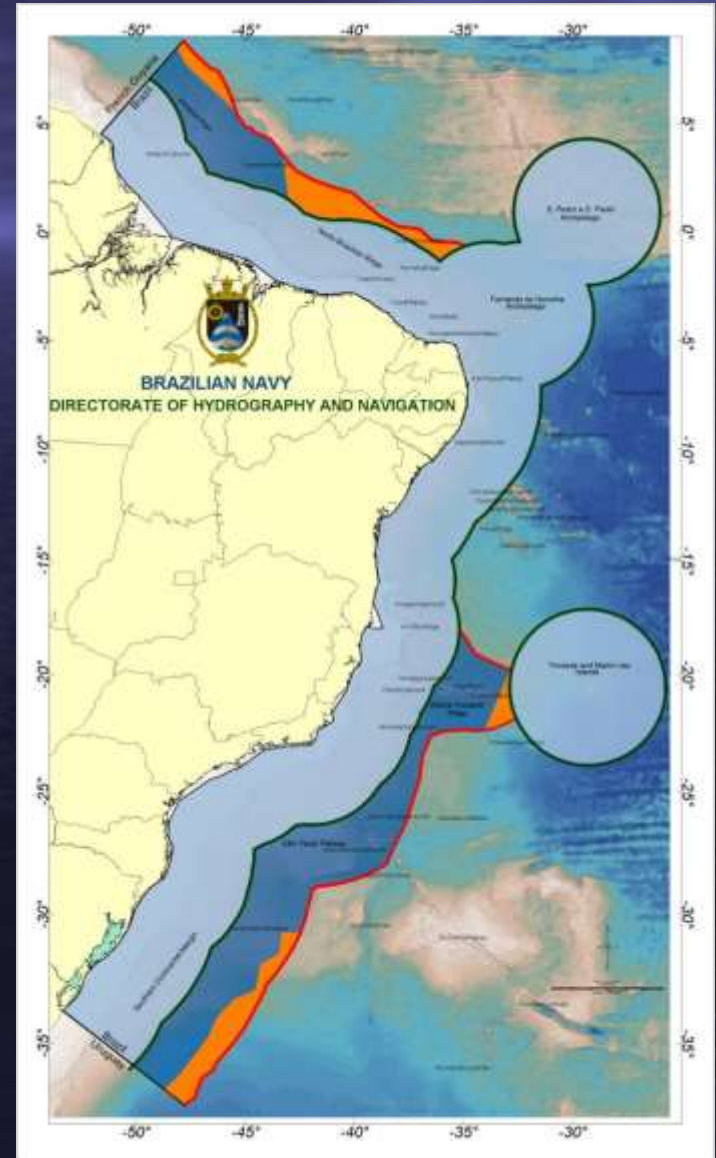
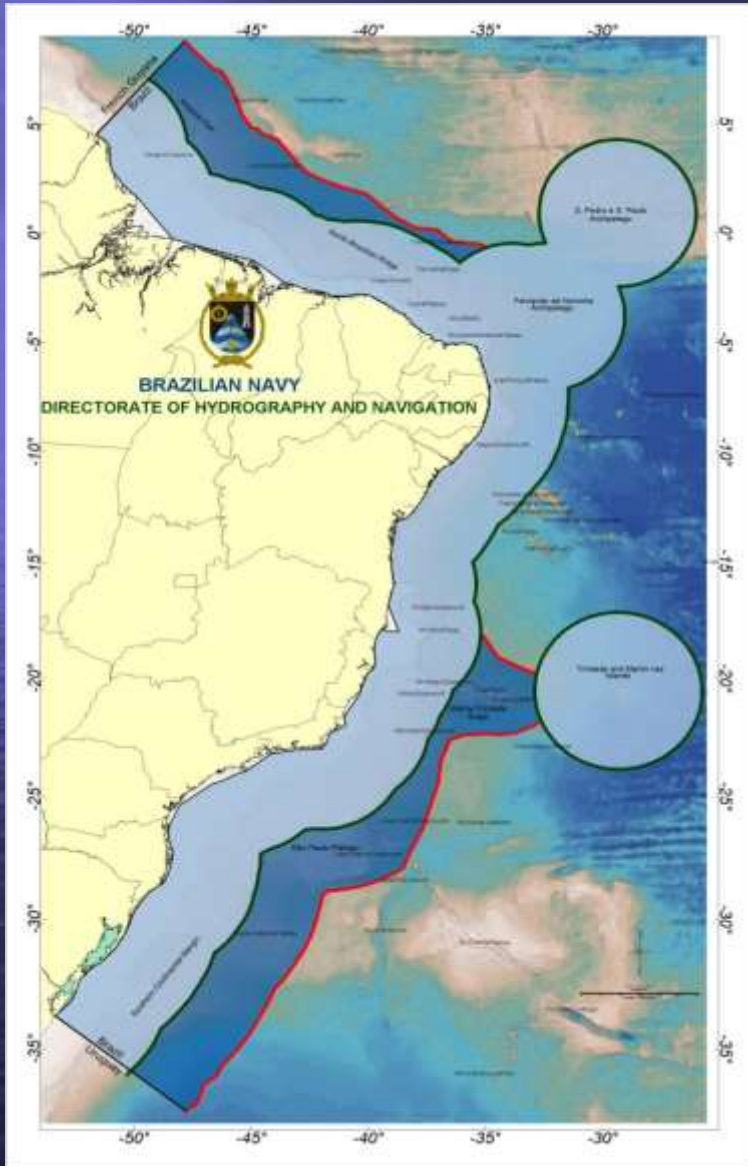




BRAZILIAN CONTINENTAL SHELF PROJECT



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BRAZILIAN CONTINENTAL MARGIN

Amazon Deep Sea Fan



Norte Brasileira Ridge



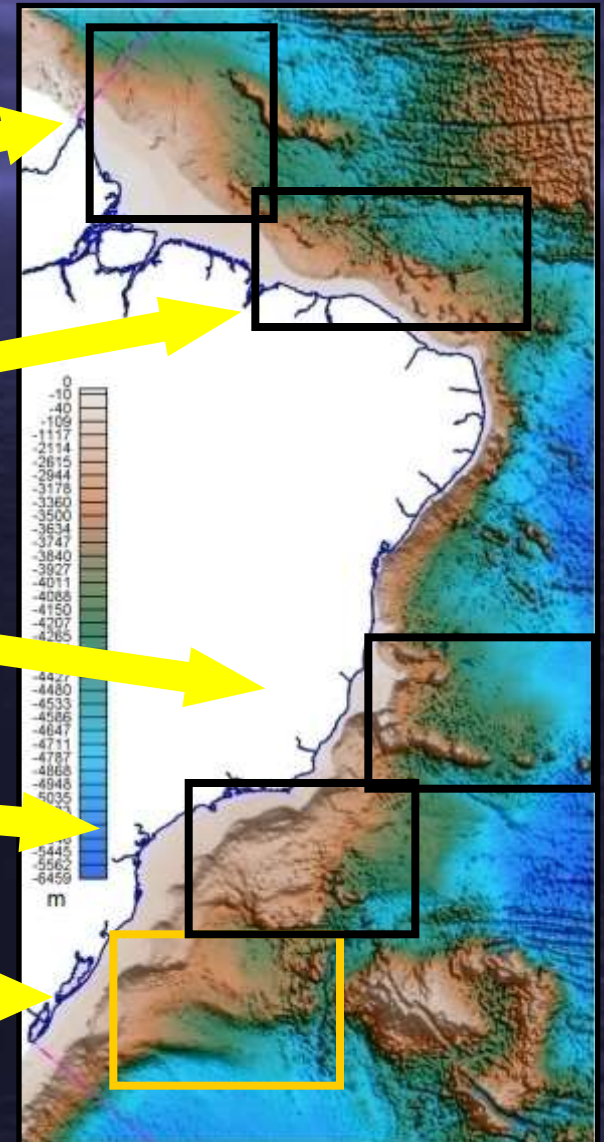
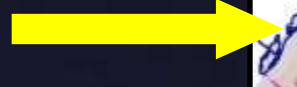
Vitoria Trindade Ridge



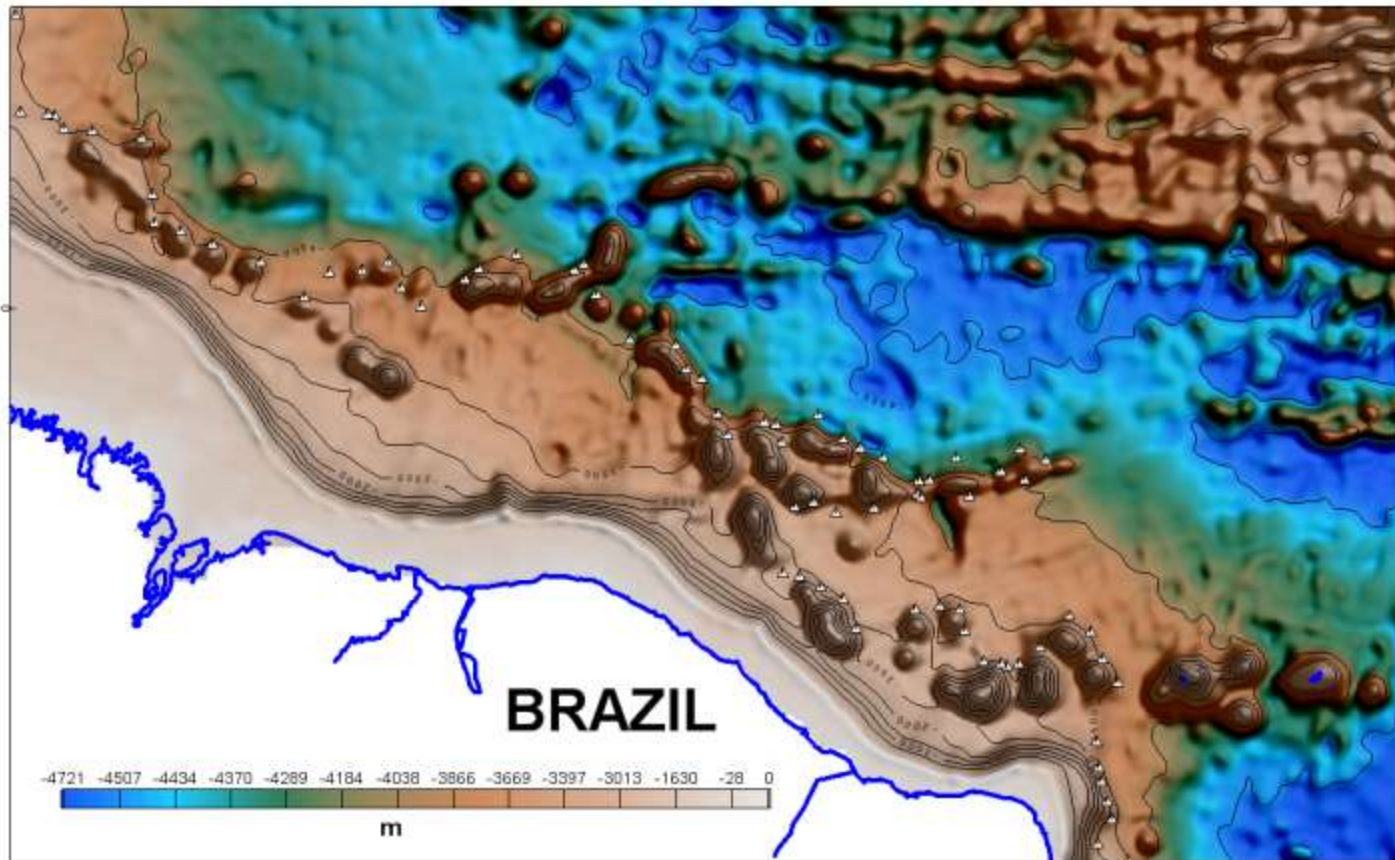
São Paulo Plateau



Southern Margin



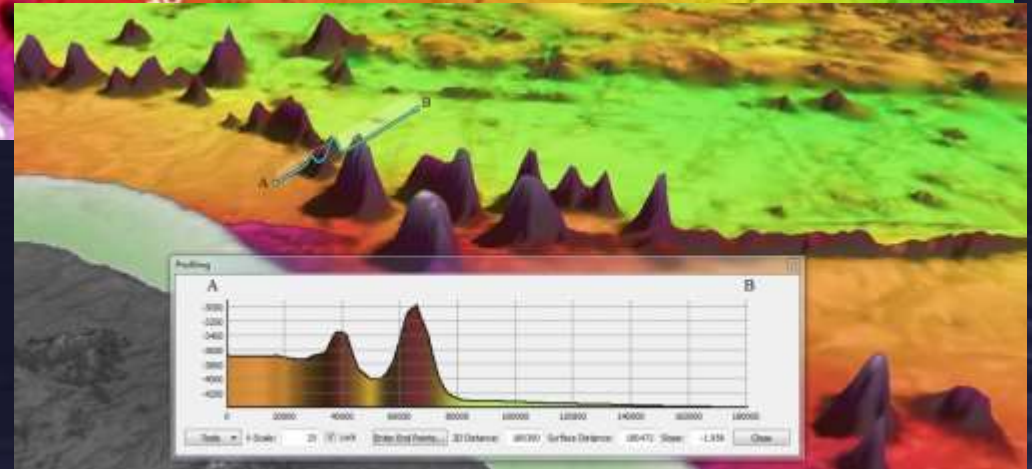
NORTE BRASILEIRA RIDGE



BRAZILIAN EQUATORIAL MARGIN
NORTE BRASILEIRA RIDGE REGION BATHYMETRIC MAP
(with Foot of Slope points)

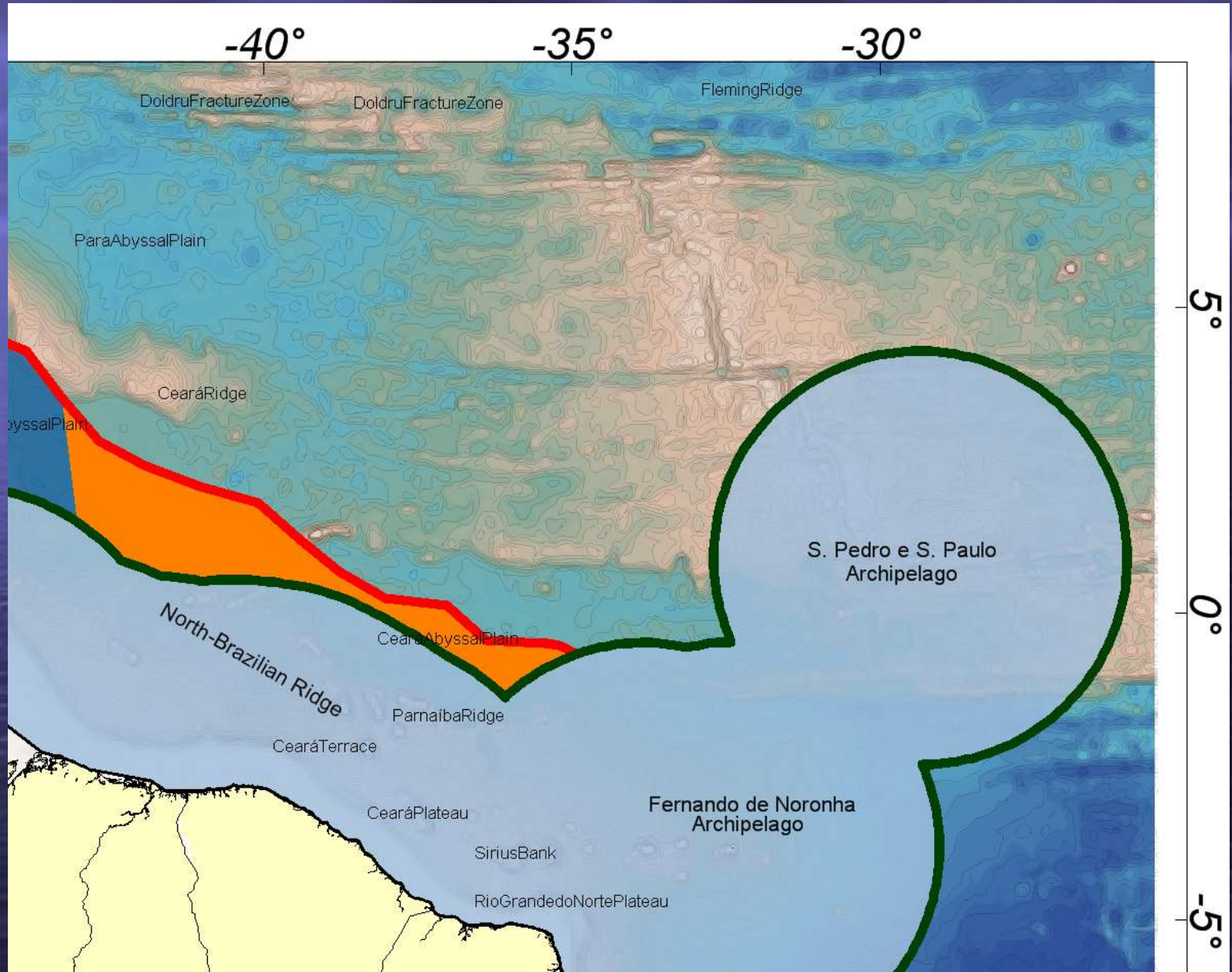


New data (2009-2010)

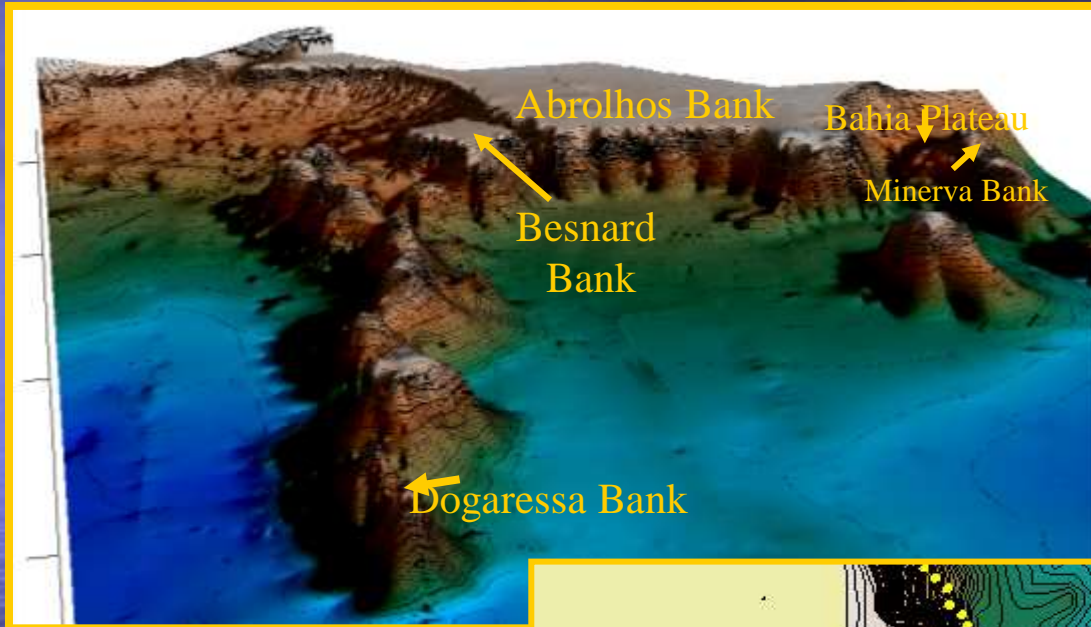




NORTE BRASILEIRA RIDGE

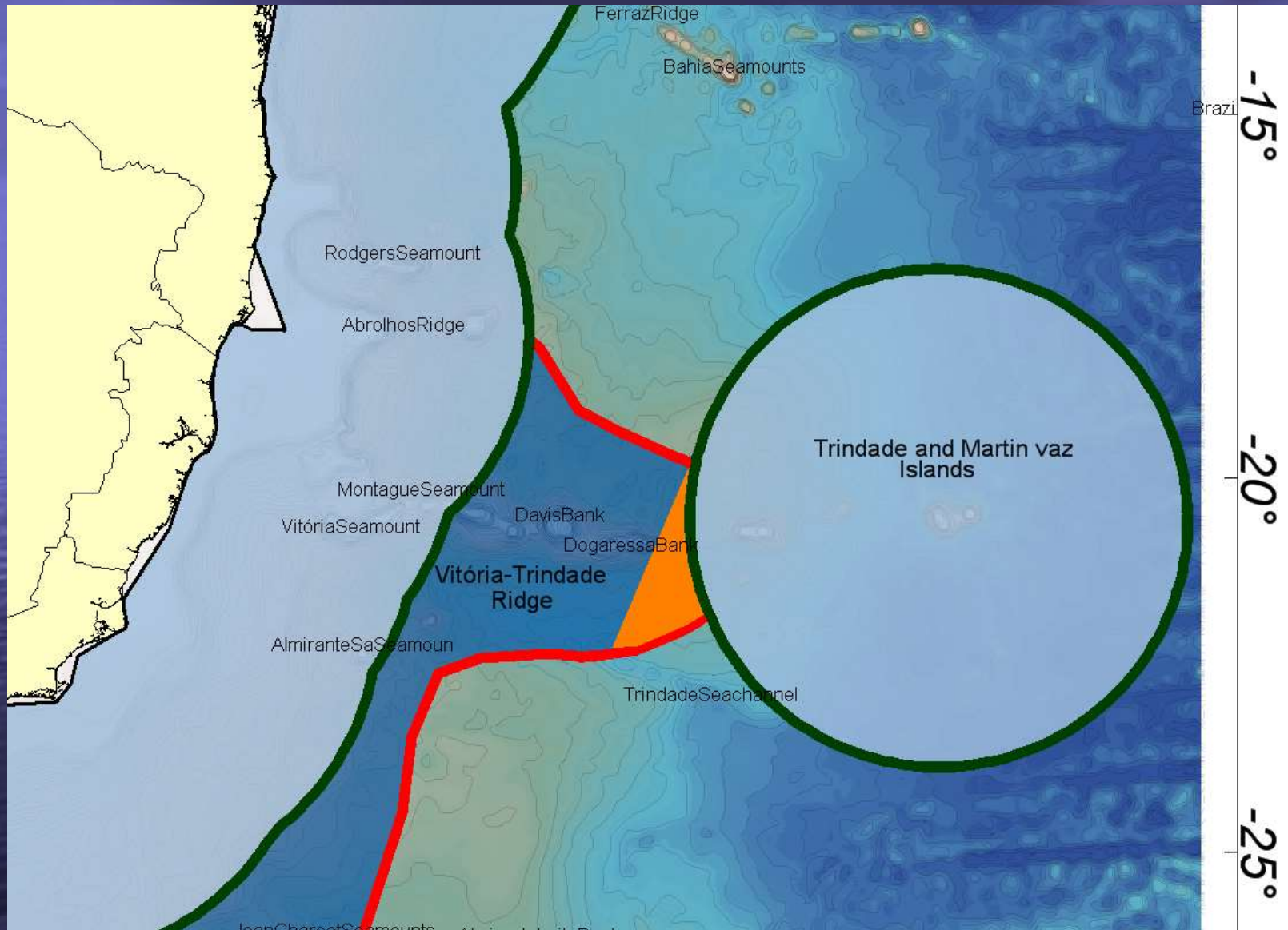


VITORIA TRINDADE RIDGE





VITORIA TRINDADE RIDGE





THANKS