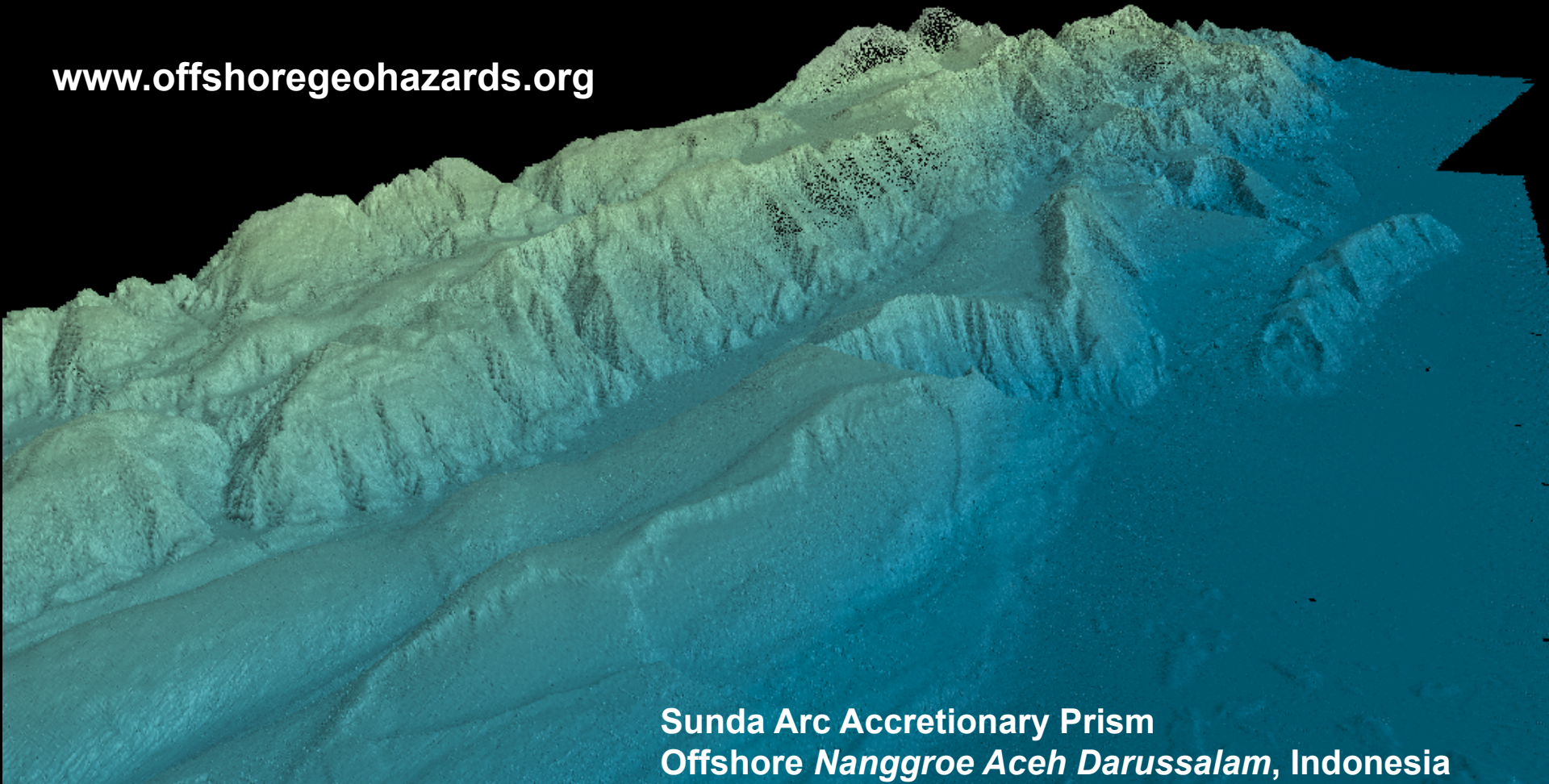


# ***Earthquake and Tsunami Hazard from Submarine Geomorphology***

***Brian G. McAdoo, Vassar College***

***Eugene Morgan and Laurie Baise, Tufts University***

***[www.offshoregeohazards.org](http://www.offshoregeohazards.org)***



***Sunda Arc Accretionary Prism  
Offshore Nanggroe Aceh Darussalam, Indonesia***

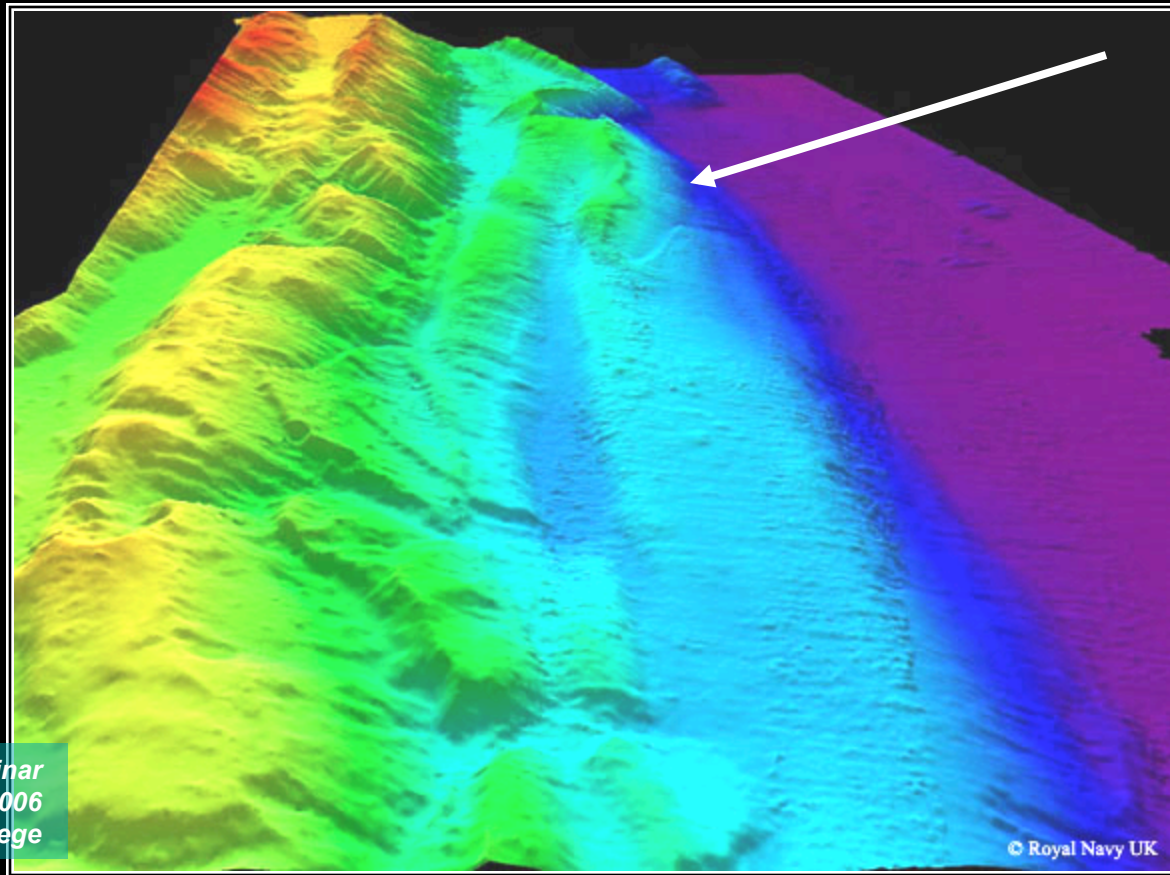


# The Tsunami Times

Sumatra  
**EXTRA**

## EARTHQUAKE SCARS!

*Scene of Devastation*



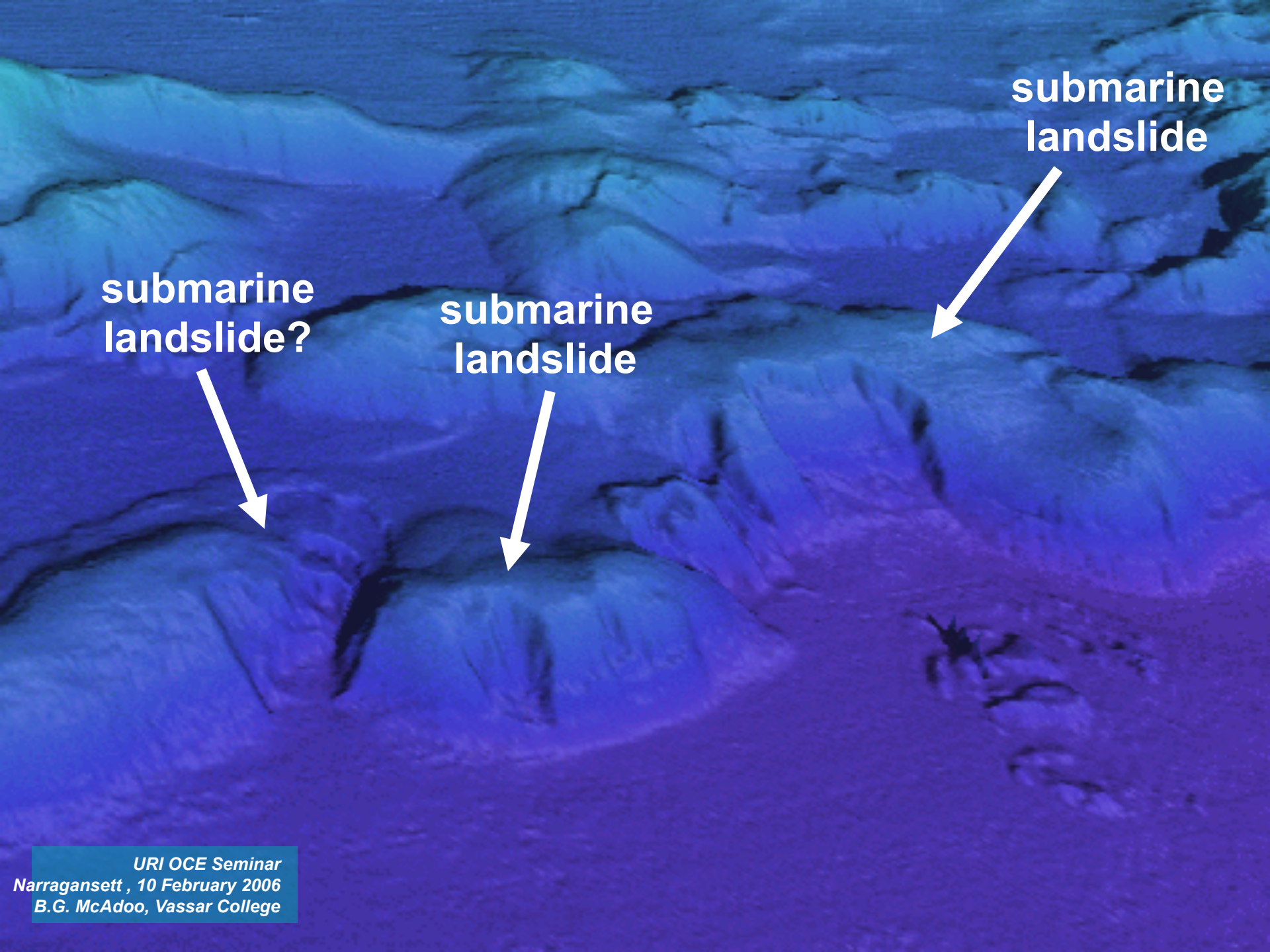
URI OCE Seminar

Narragansett, 10 February 2006

B.G. McAdoo, Vassar College

© Royal Navy UK

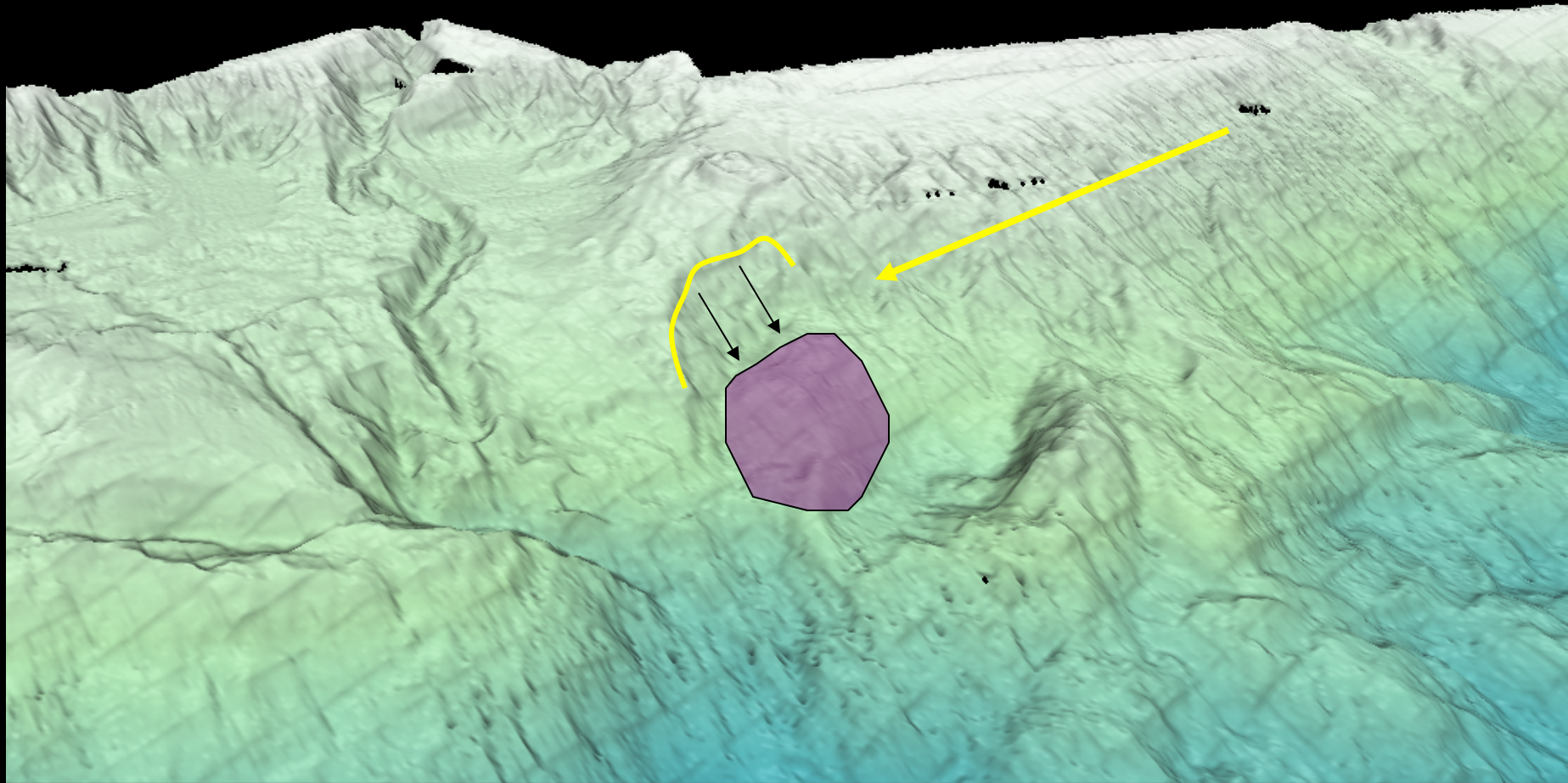




submarine  
landslide

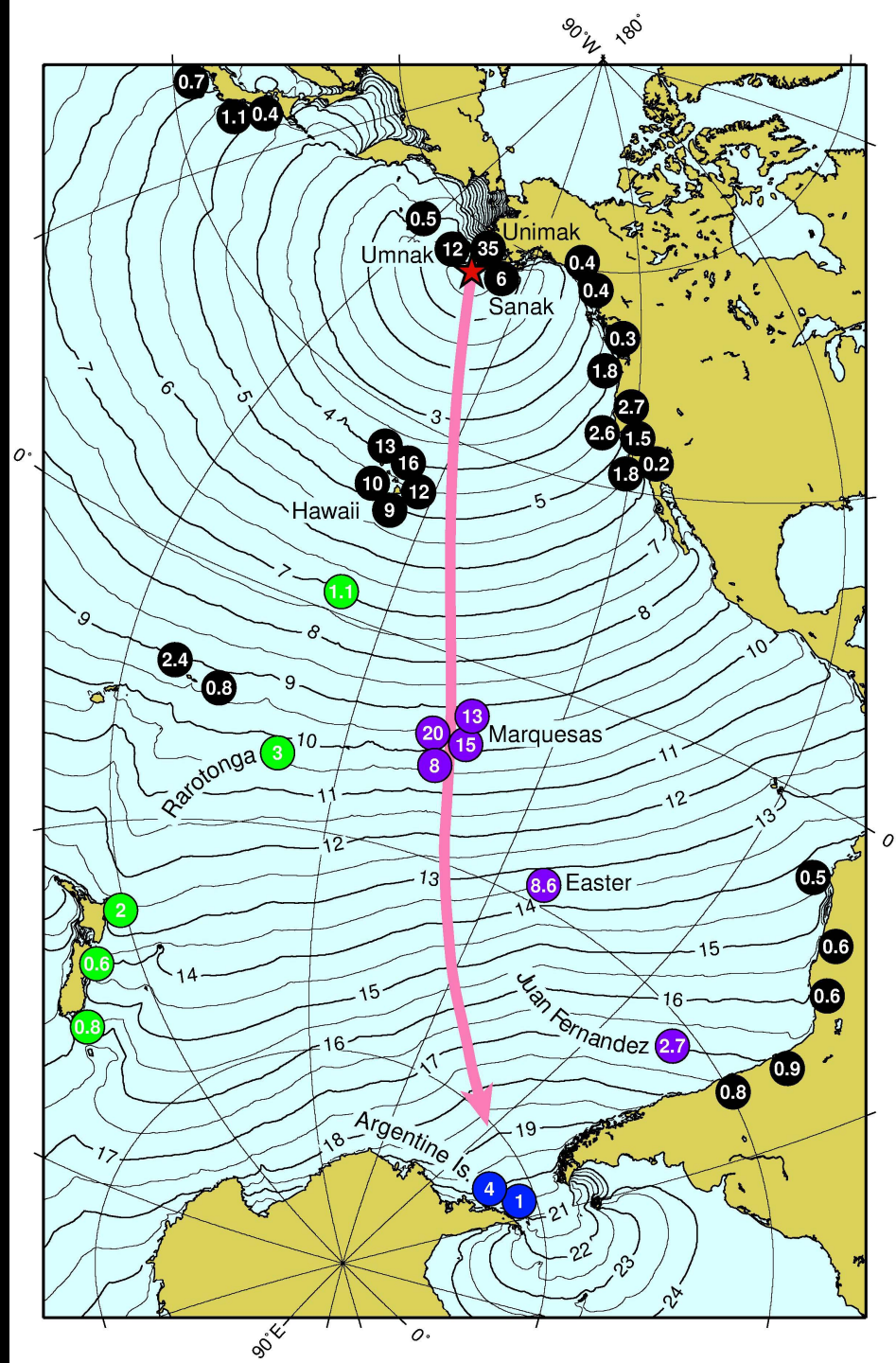
submarine  
landslide?

submarine  
landslide





**April 1, 1946**  
**Aleutians**  
**M = 7.1**  
**Max runup 35 m**

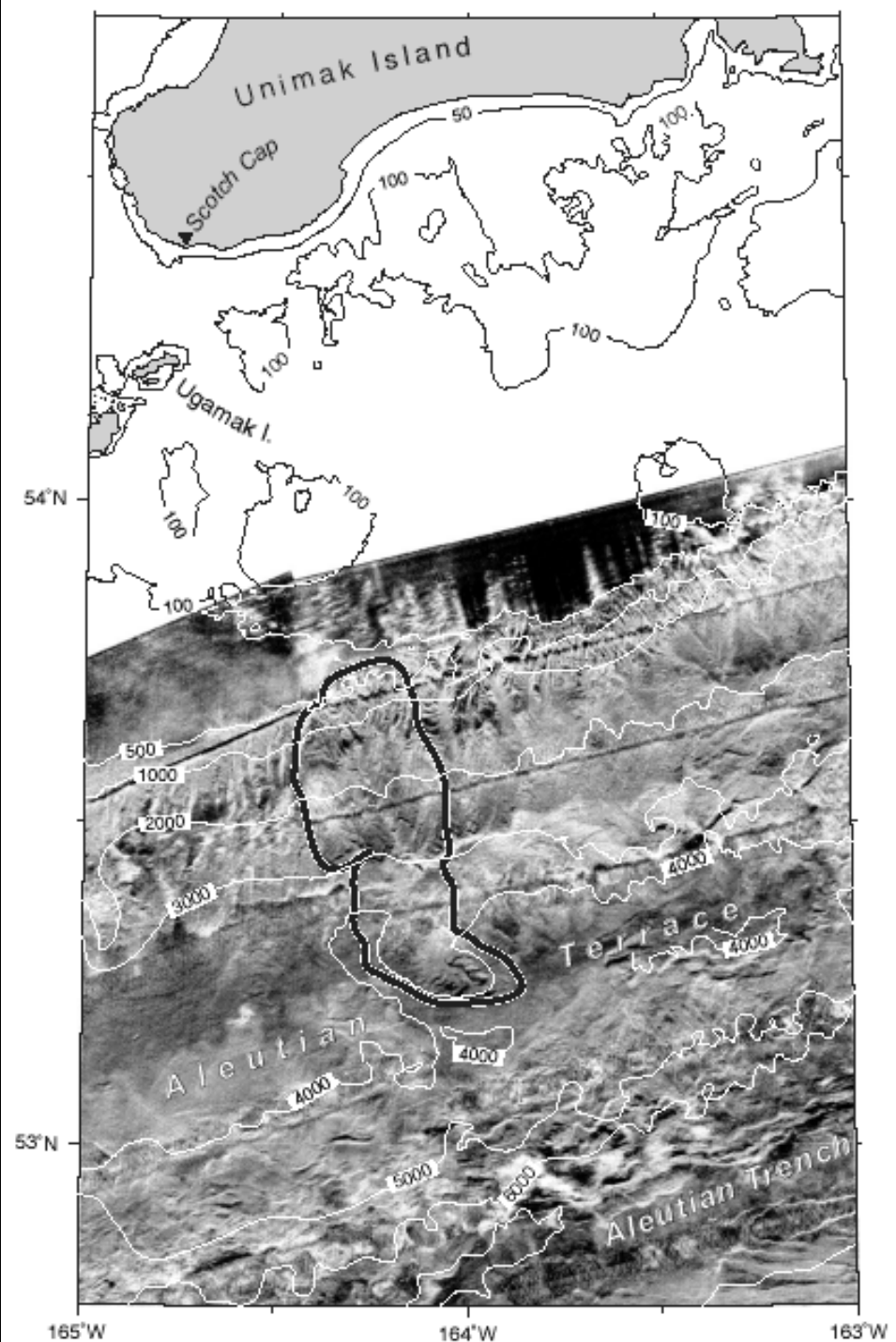




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**Figure from Gerard Fryer,  
SOEST**



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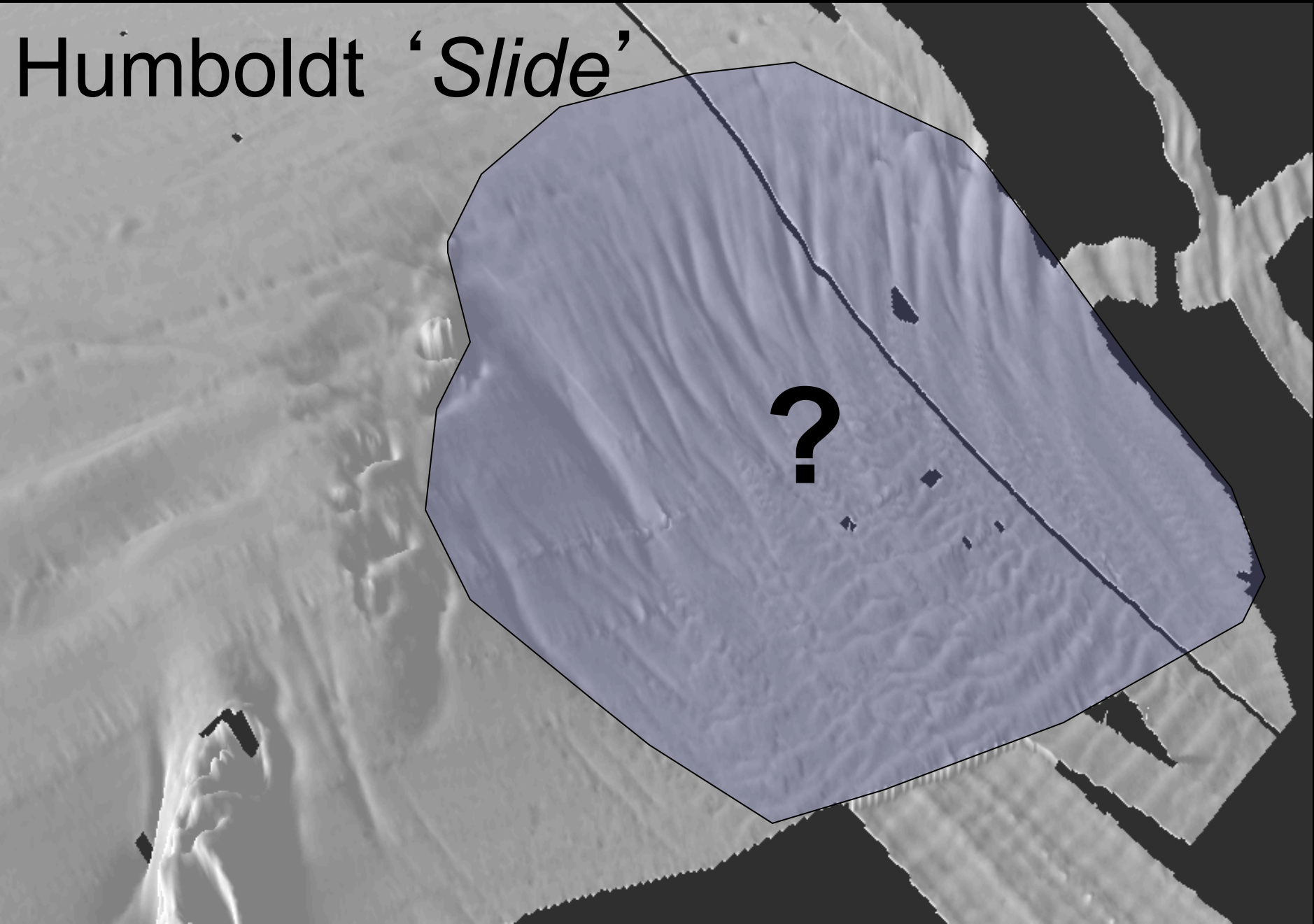
Narragansett, 10 February 2006

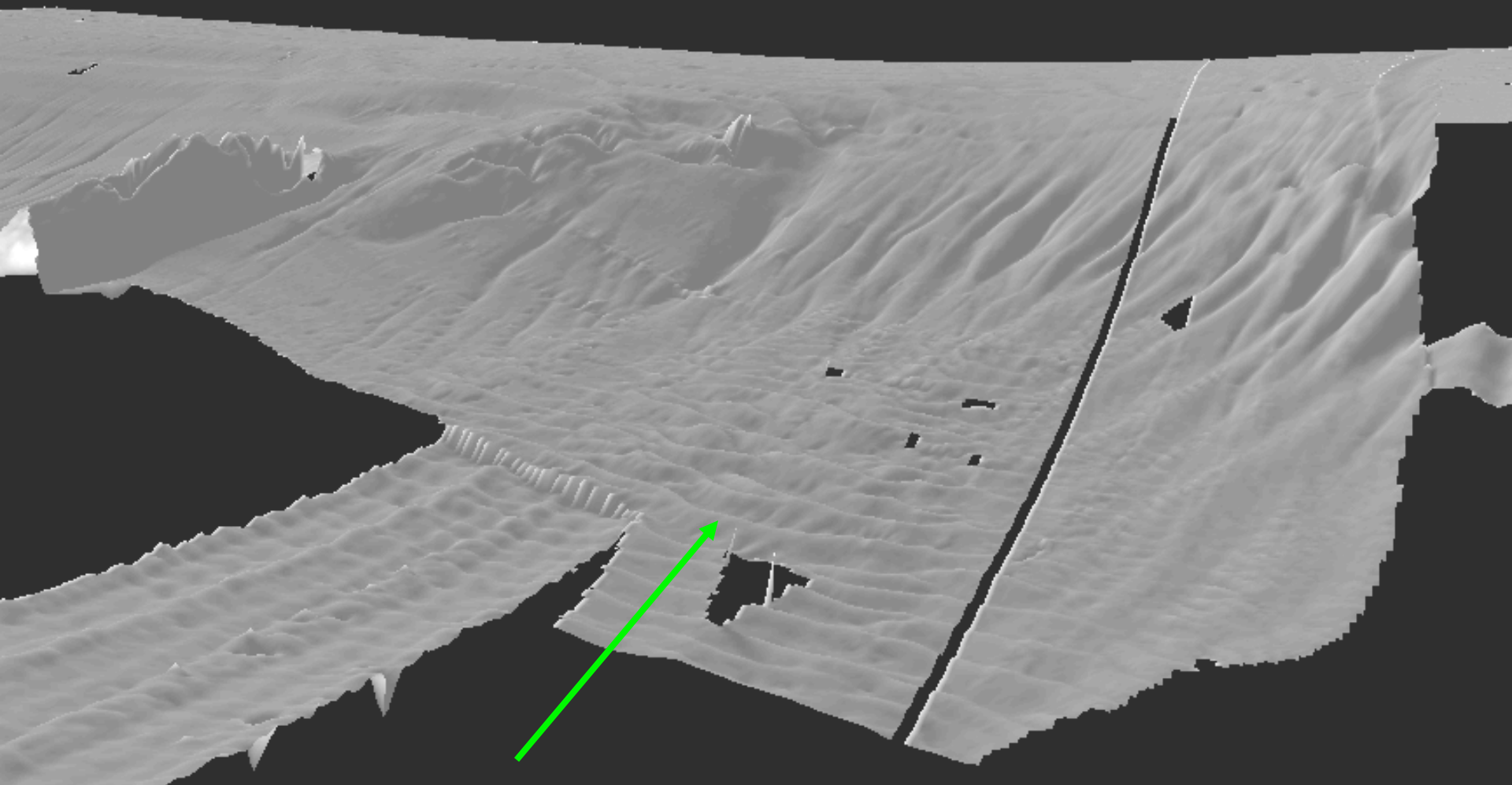
B.G. McAdoo, Vassar College



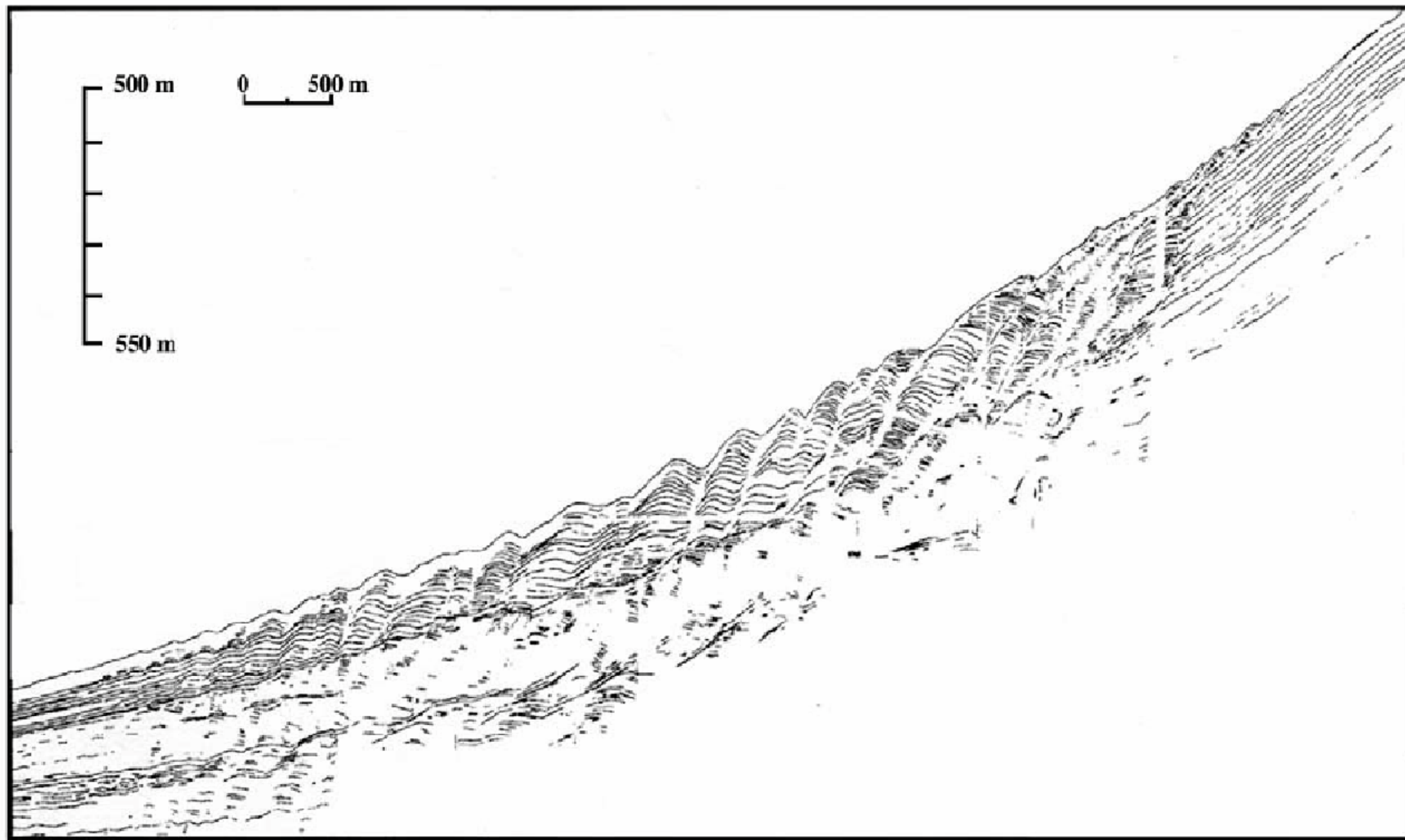


# Humboldt *'Slide'*

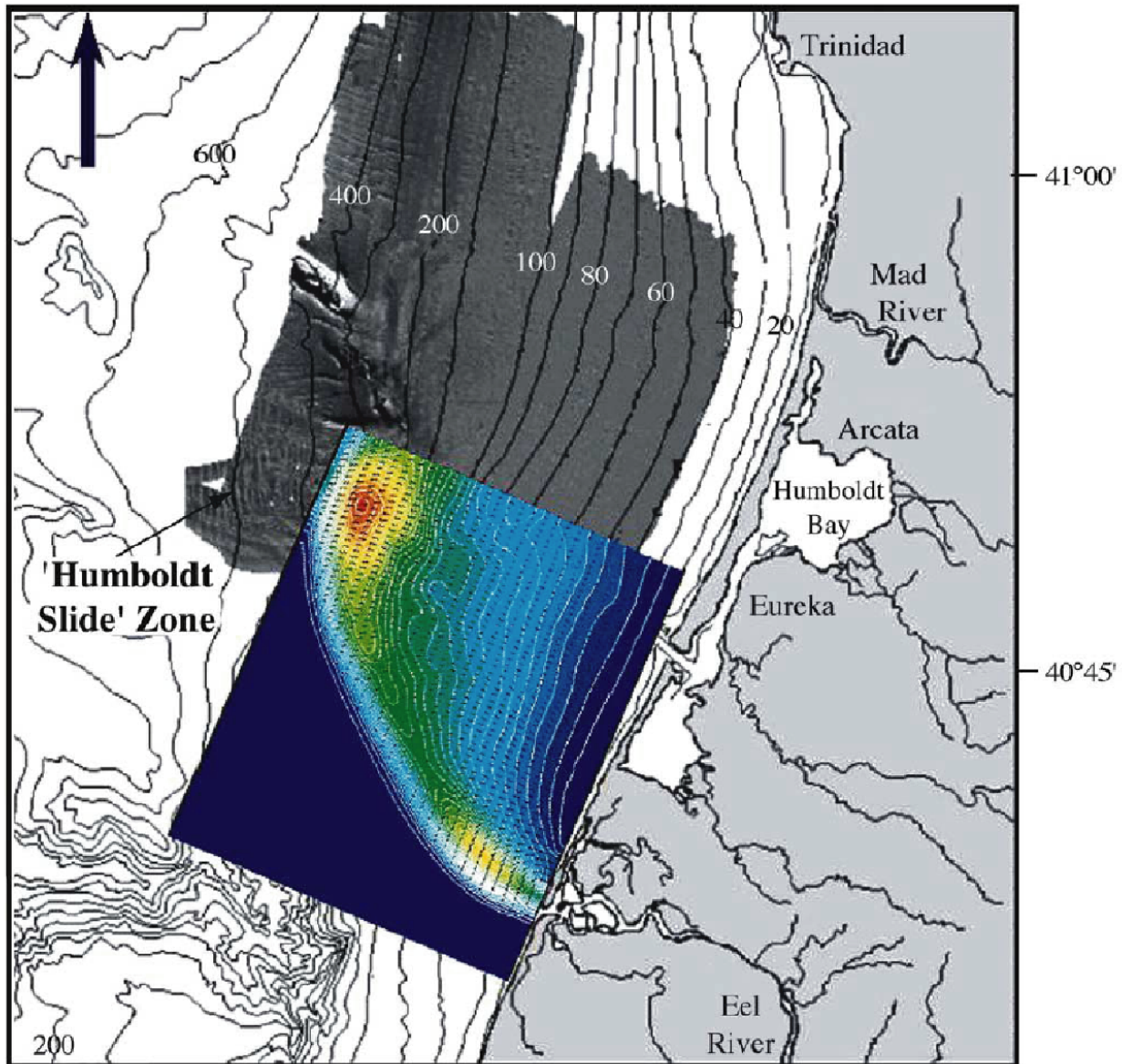






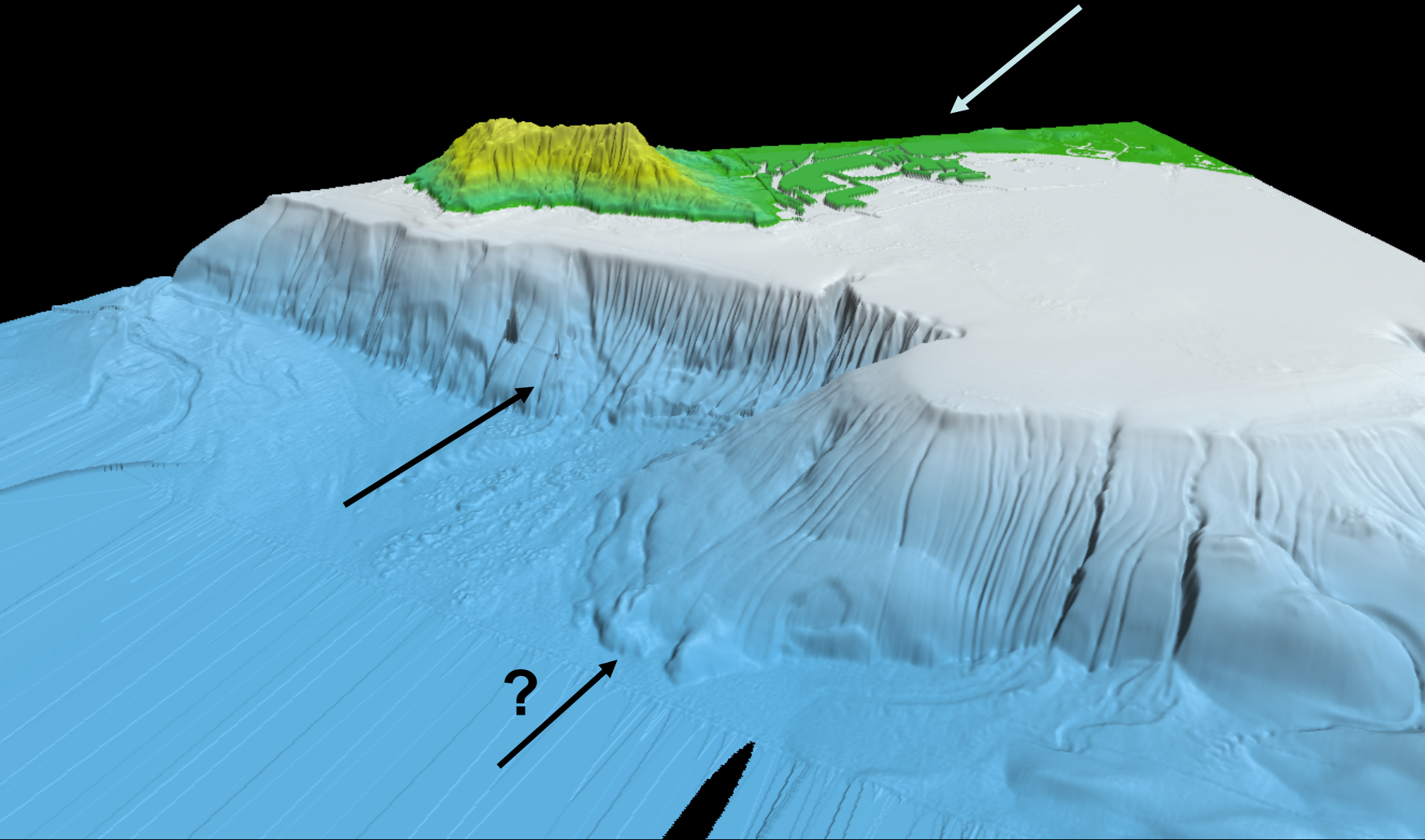


From Lee et al., 2002





Long Beach, California  
20 minutes....



# Seafloor geomorphology of convergent margins: Implications for Cascadia seismic hazard

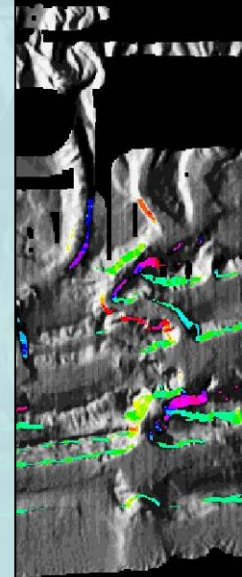
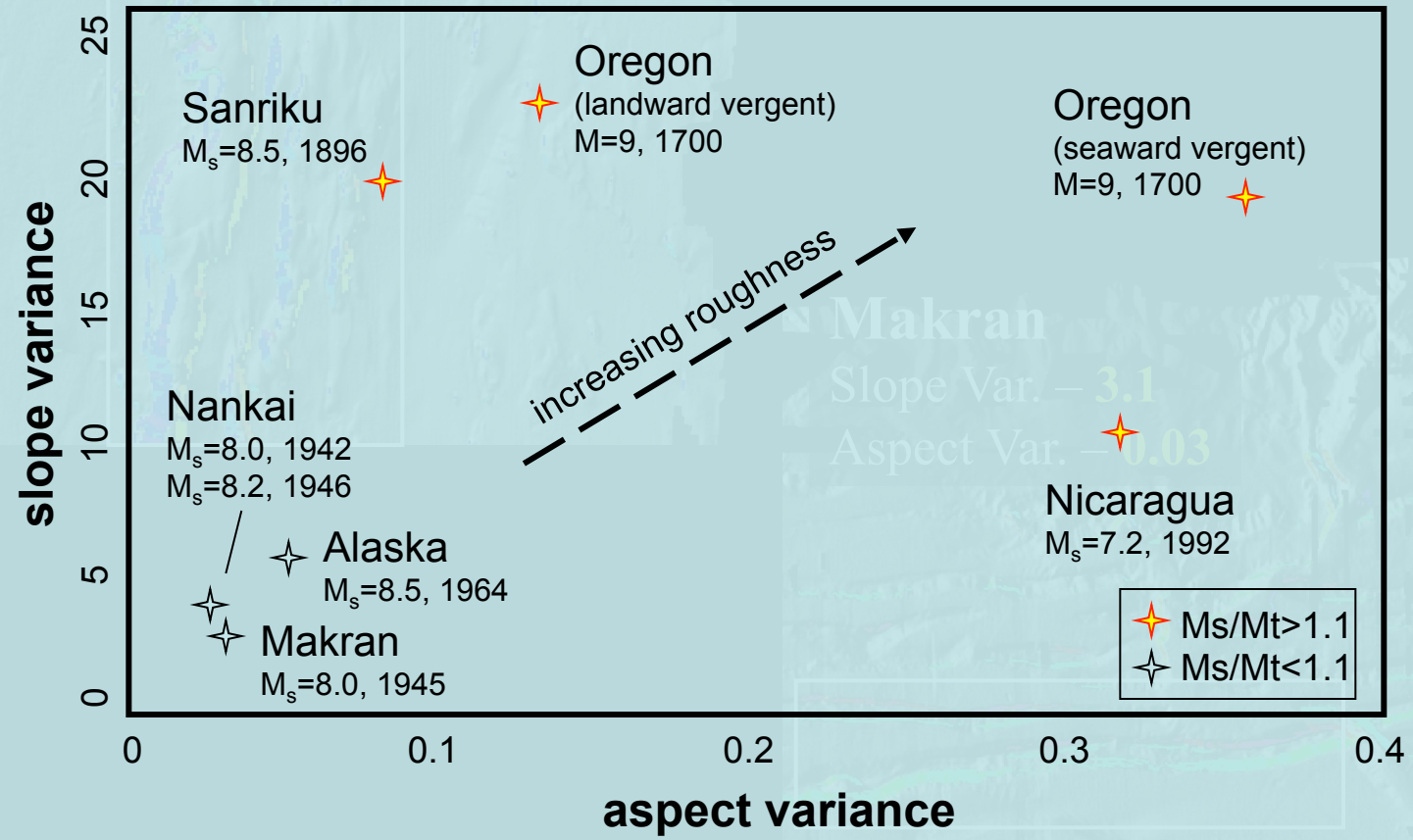
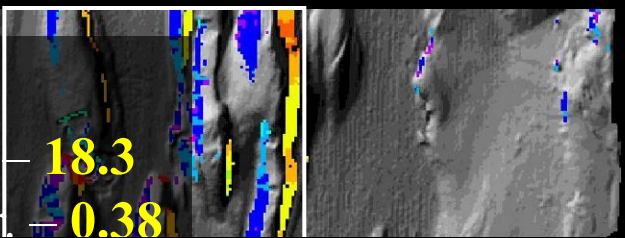
Brian G. McAdoo, Mark K. Capone, and Justin Minder

**Tectonics, 2004**

**Oregon**

Slope Var. — **18.3**

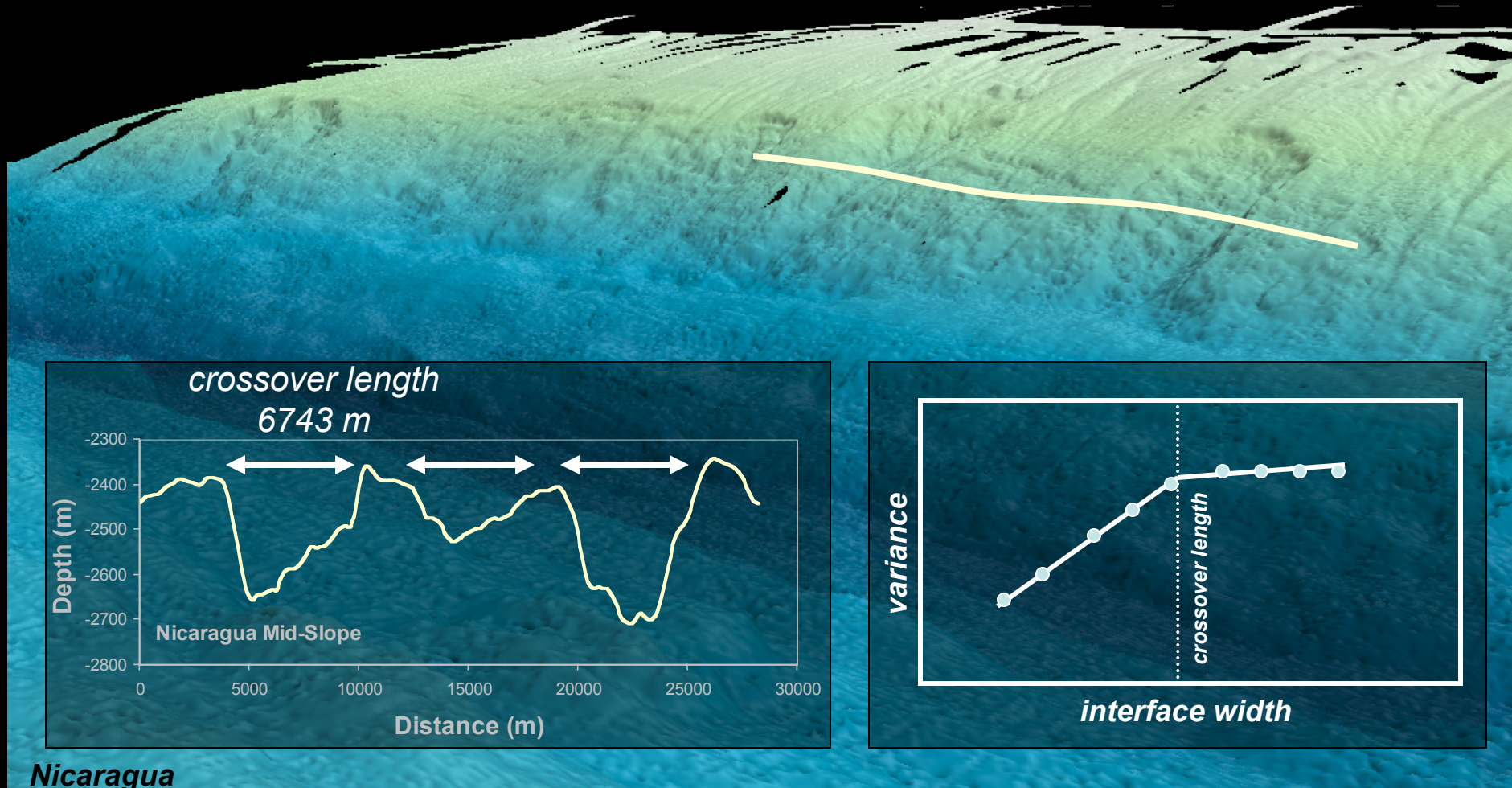
Aspect Var. — **0.38**



colors correspond  
to aspect



# What is the scale of the roughness elements?



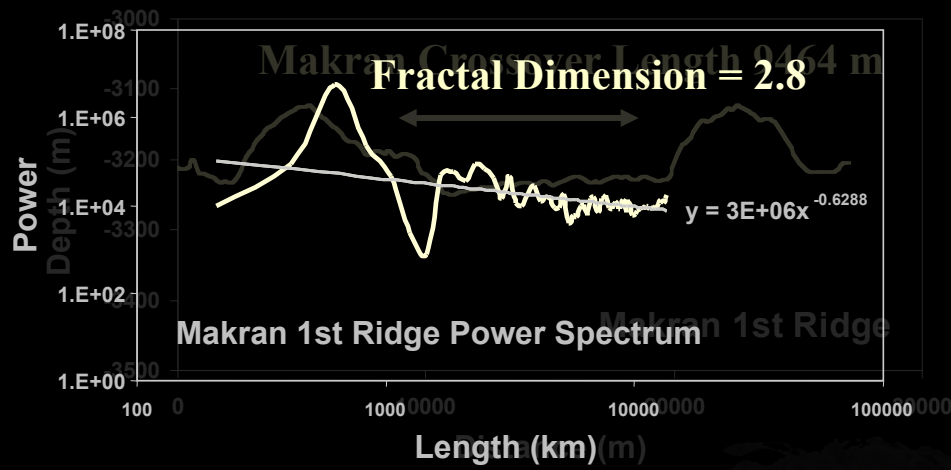
Nicaragua

Fractal dimension, D

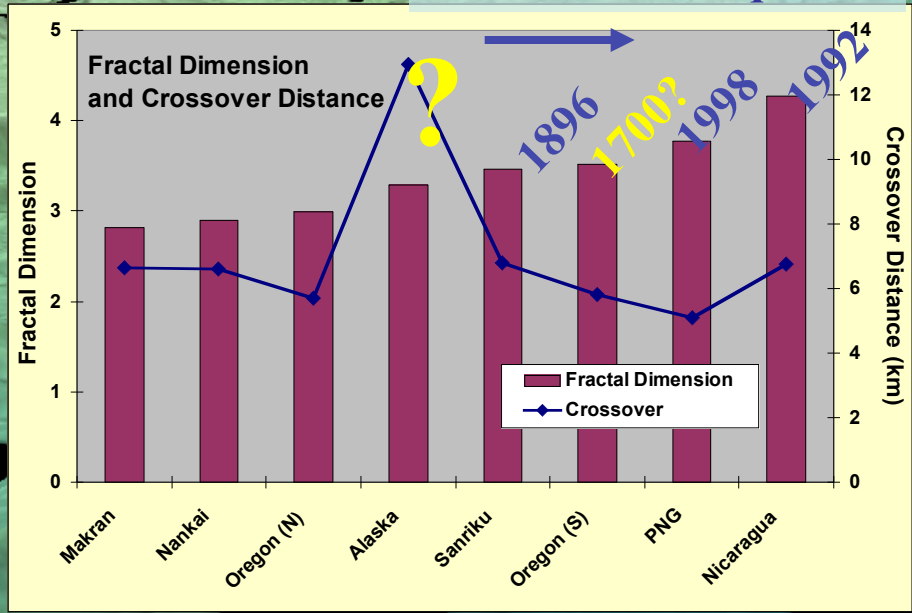
$$D = 0.5[(2H+1)-5]$$

$$S_2(f) = r^{-(2H+1)} S_1(f/r) - \text{power spectral density}$$

Where H is a coefficient that relates smoothness of distance/elevation, and r is the scaling factor related to the sampling length.



**Tsunami Earthquakes**



**Makran Accretionary Prism, Offshore Pakistan**



es?

# Afen Slide

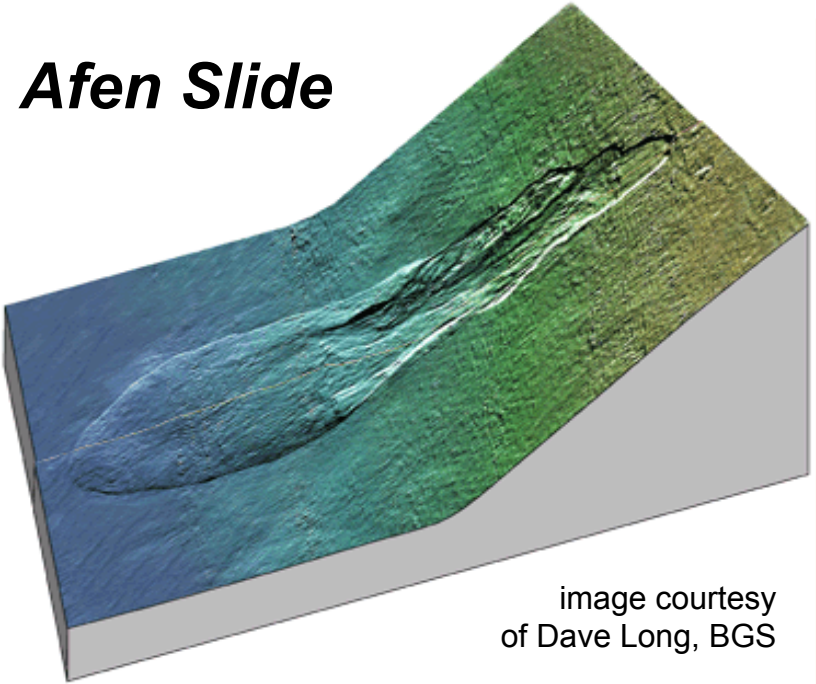
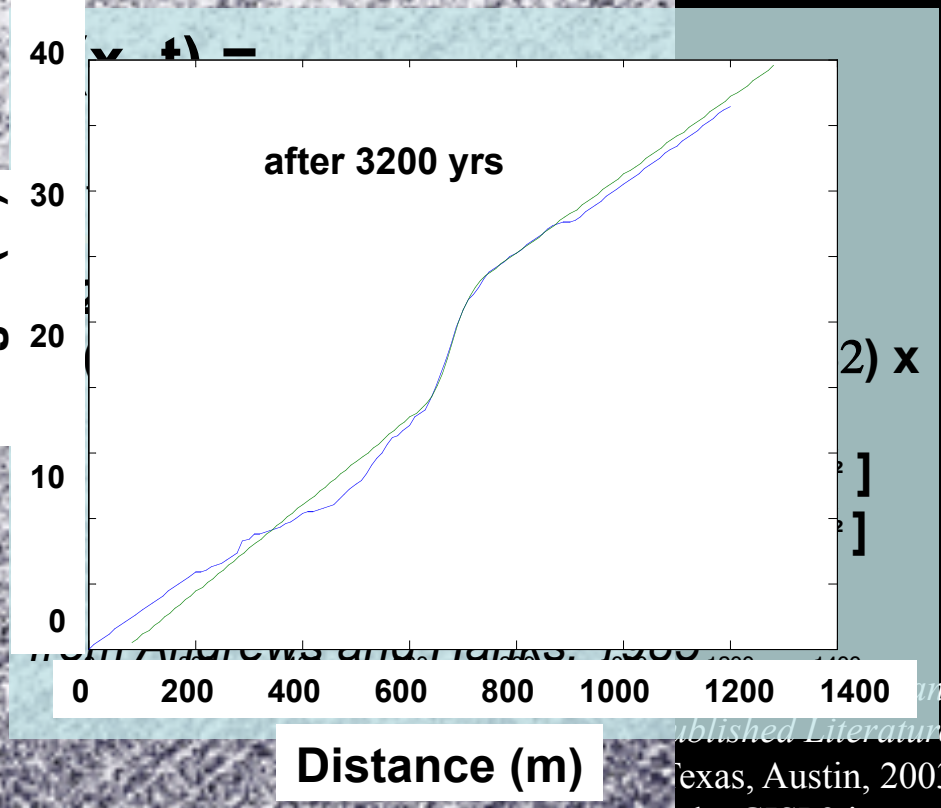
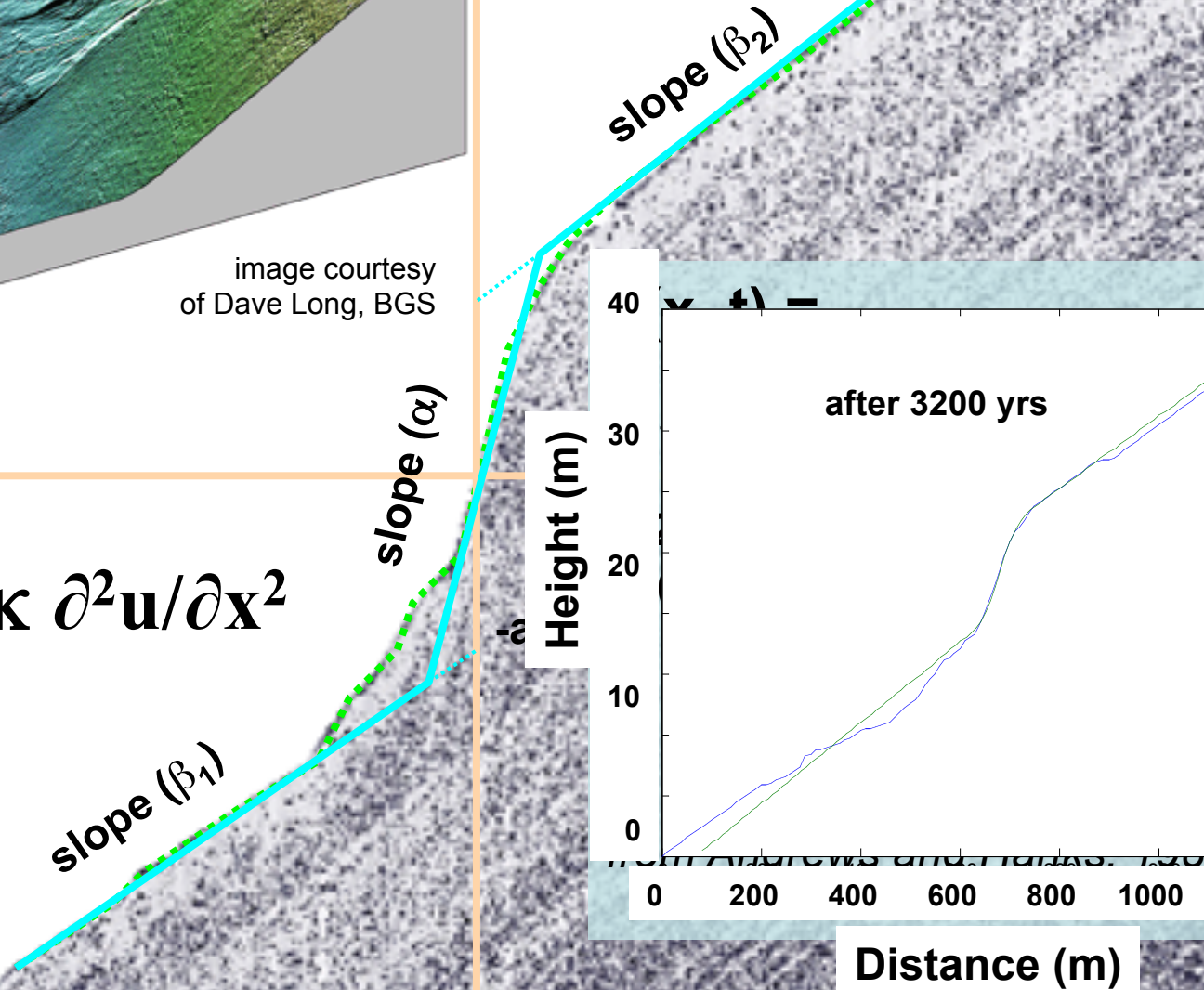


image courtesy of Dave Long, BGS

$$\frac{\partial u}{\partial t} = \kappa \frac{\partial^2 u}{\partial x^2}$$



and  
 Published Literature,  
 Texas, Austin, 2003.  
 the GISP2 ice core

# Lan

tsunami

wave

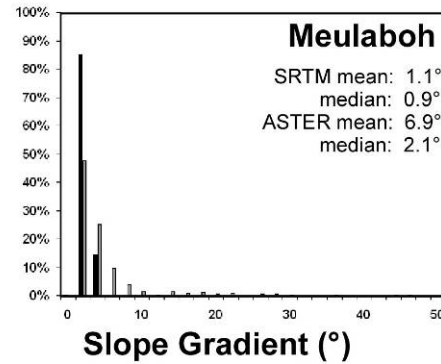
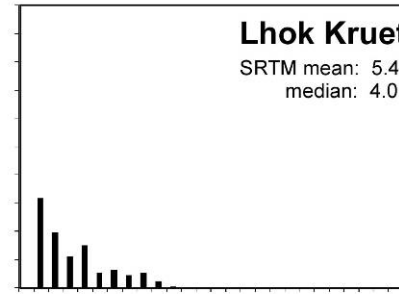
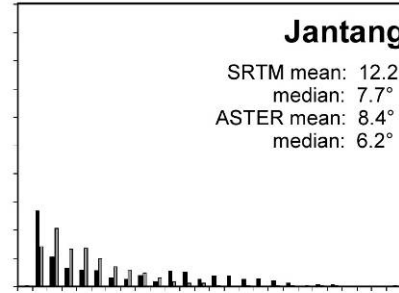
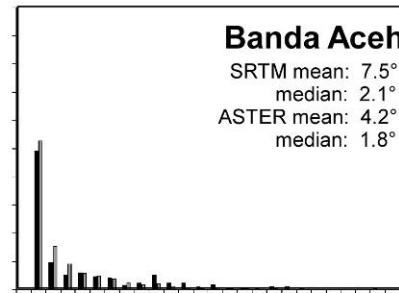
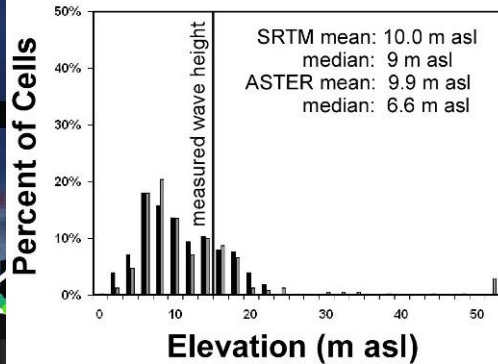
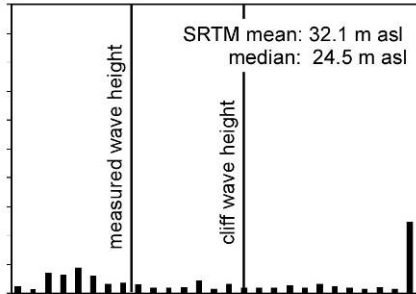
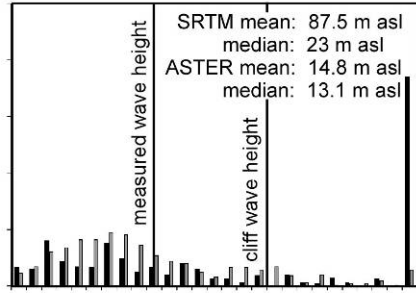
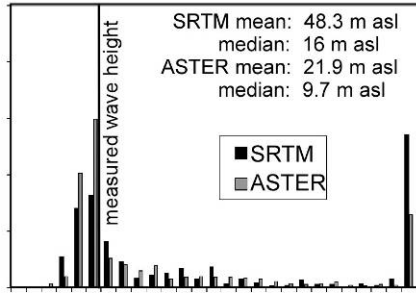
present SL

4°54'23"N

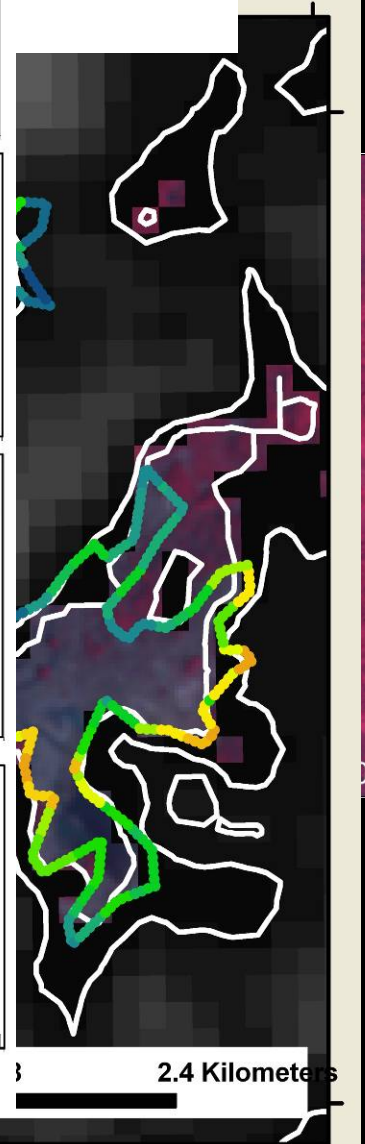
4°52'30"N

95°24'23"E

95°26'15"



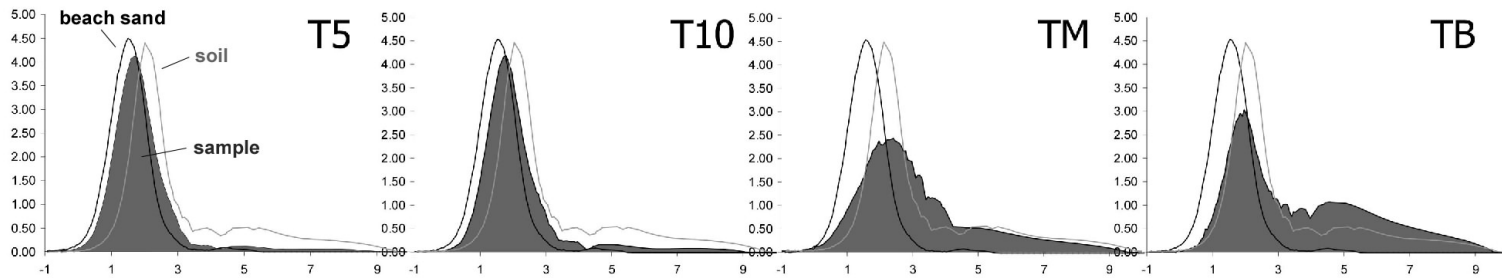
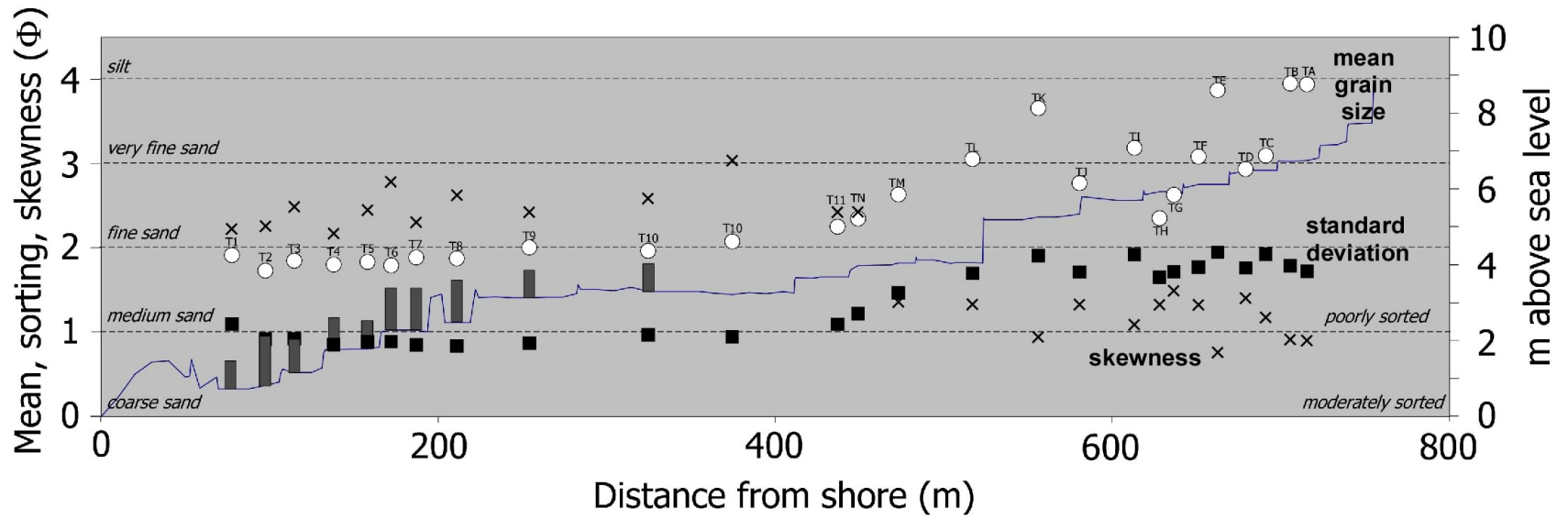
slope gradient  
 inundation limit

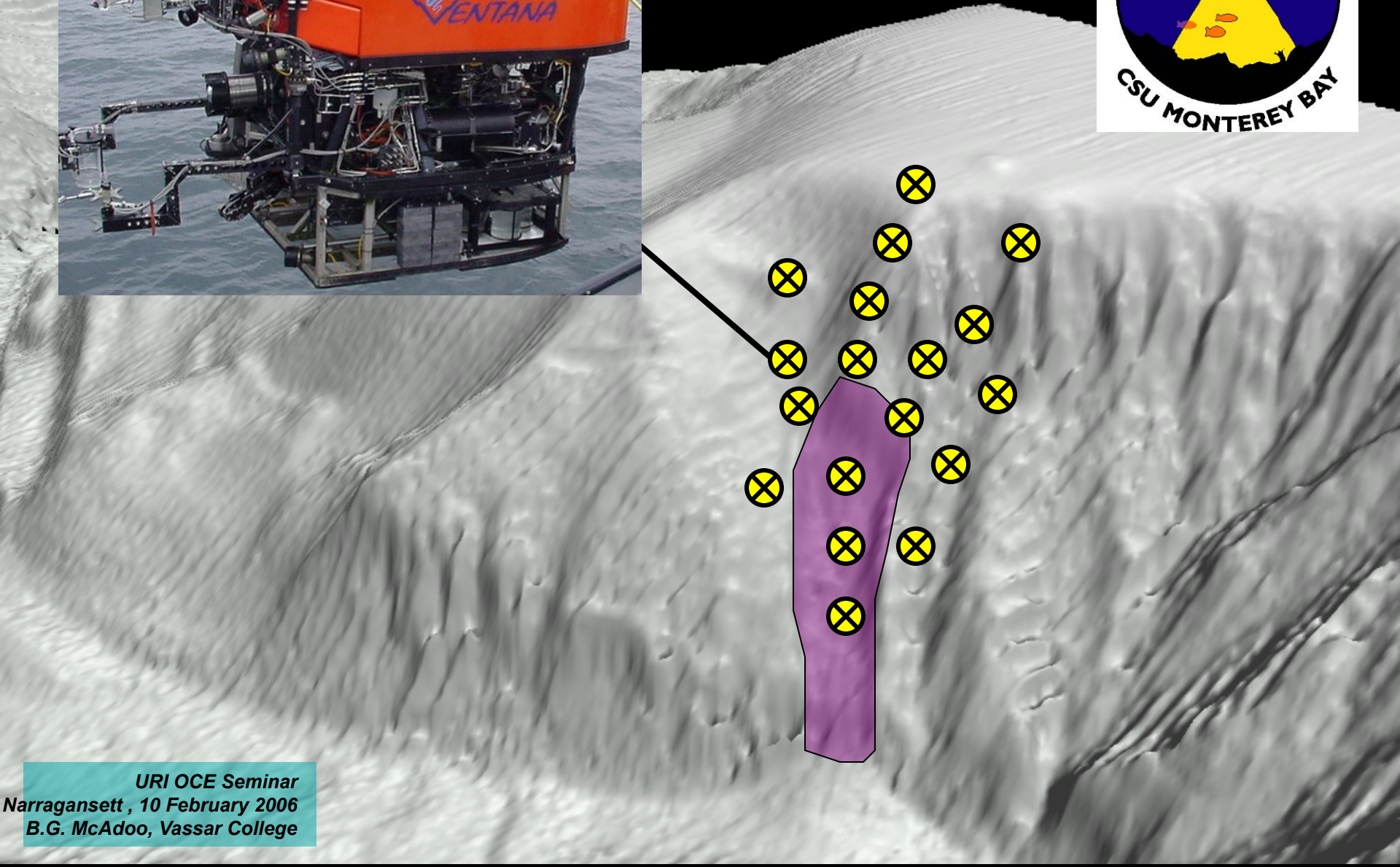
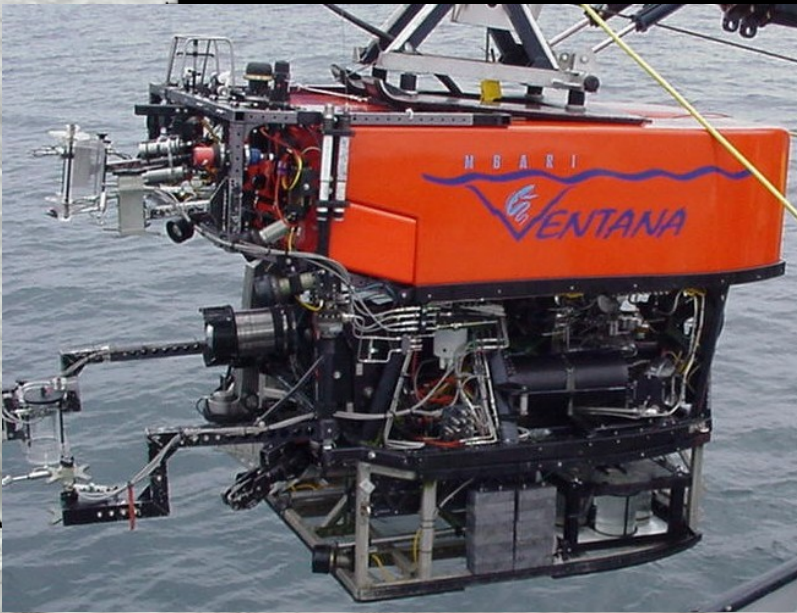


005



# 2006 West Java Tsunami





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