Joint ICTP-TWAS Workshop on
Seismic Sources in Central America:
What is the largest earthquake each can produce?
Heredia, Costa Rica, october 30-november 05, 2011

Segmentation of the Boconó Fault from paleoseismic trench results, Mérida Andes, Venezuela

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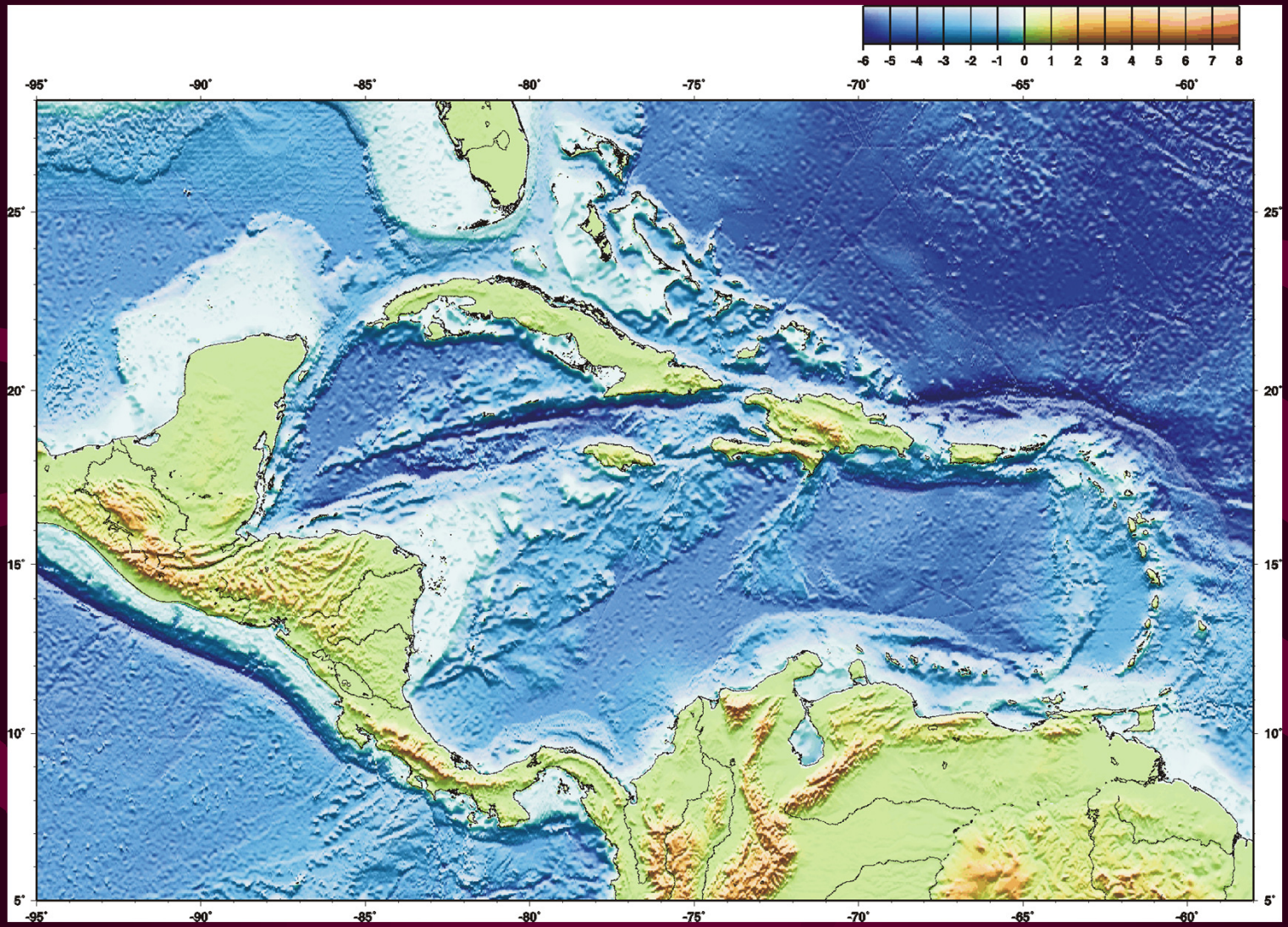
The Southern Caribbean margin in the Plate Tectonics framework



Fuente: http://www.ig.utexas.edu/research/projects/caribbean

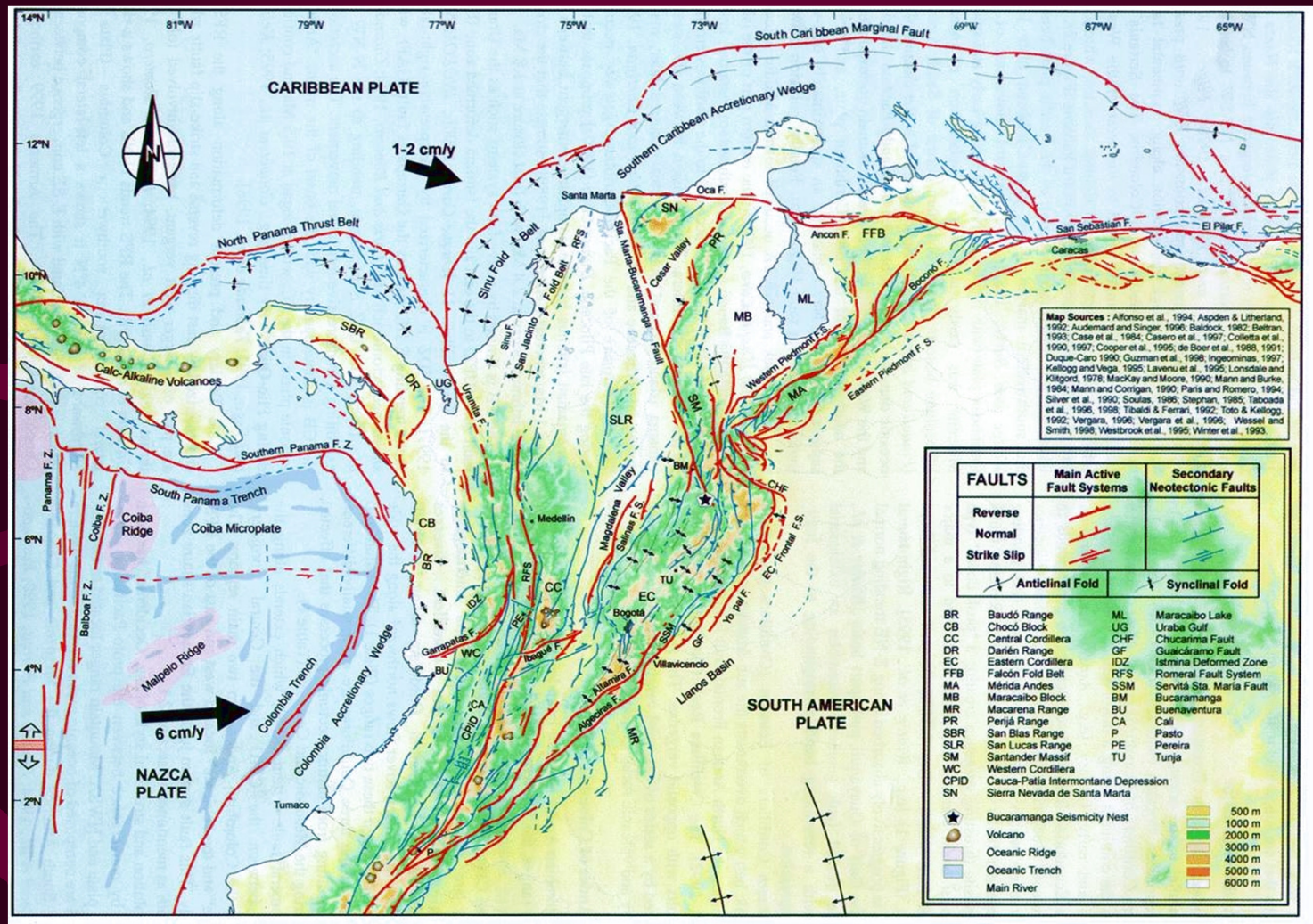
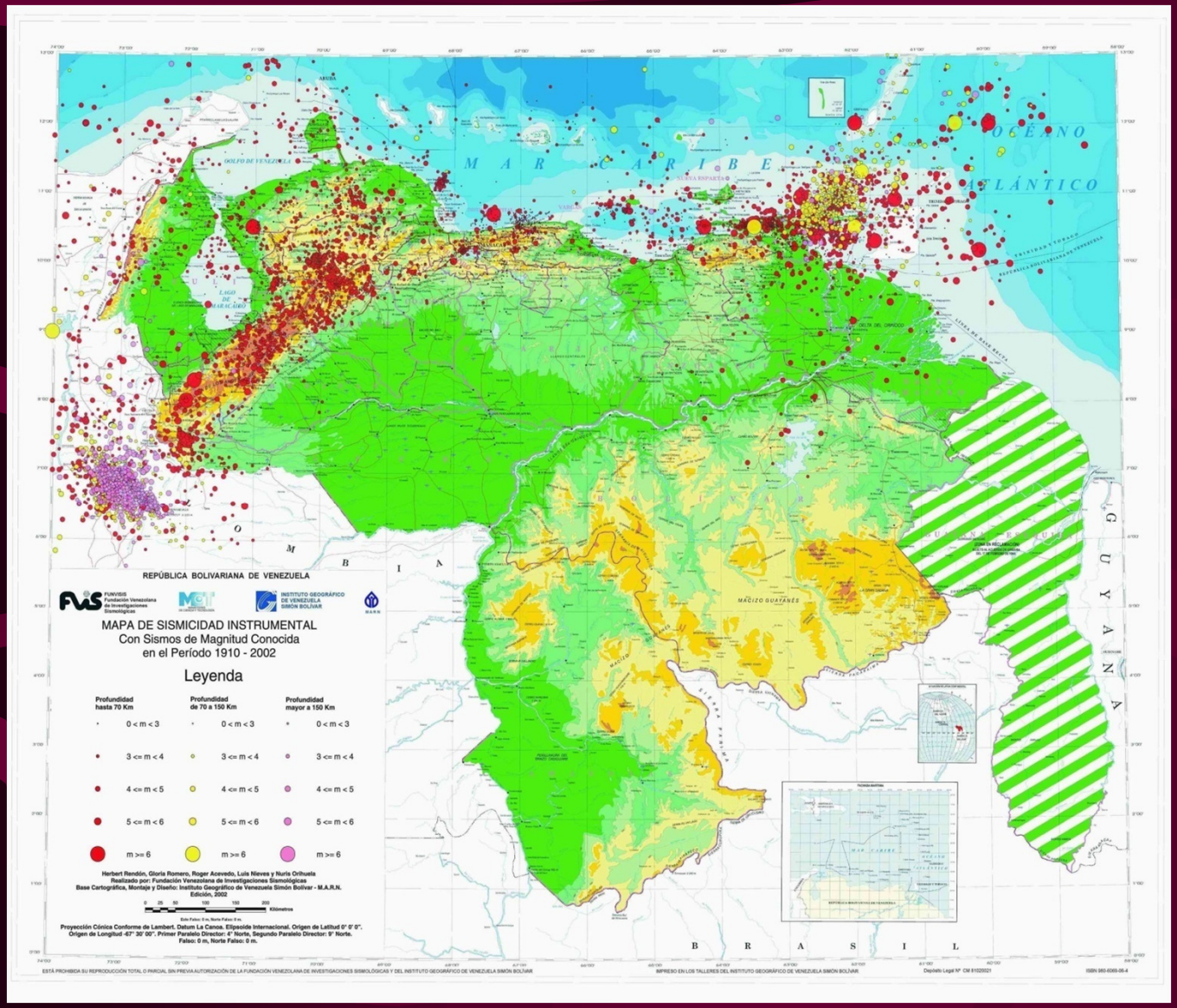


Plate 1. Neotectonic map of the northern Andes.

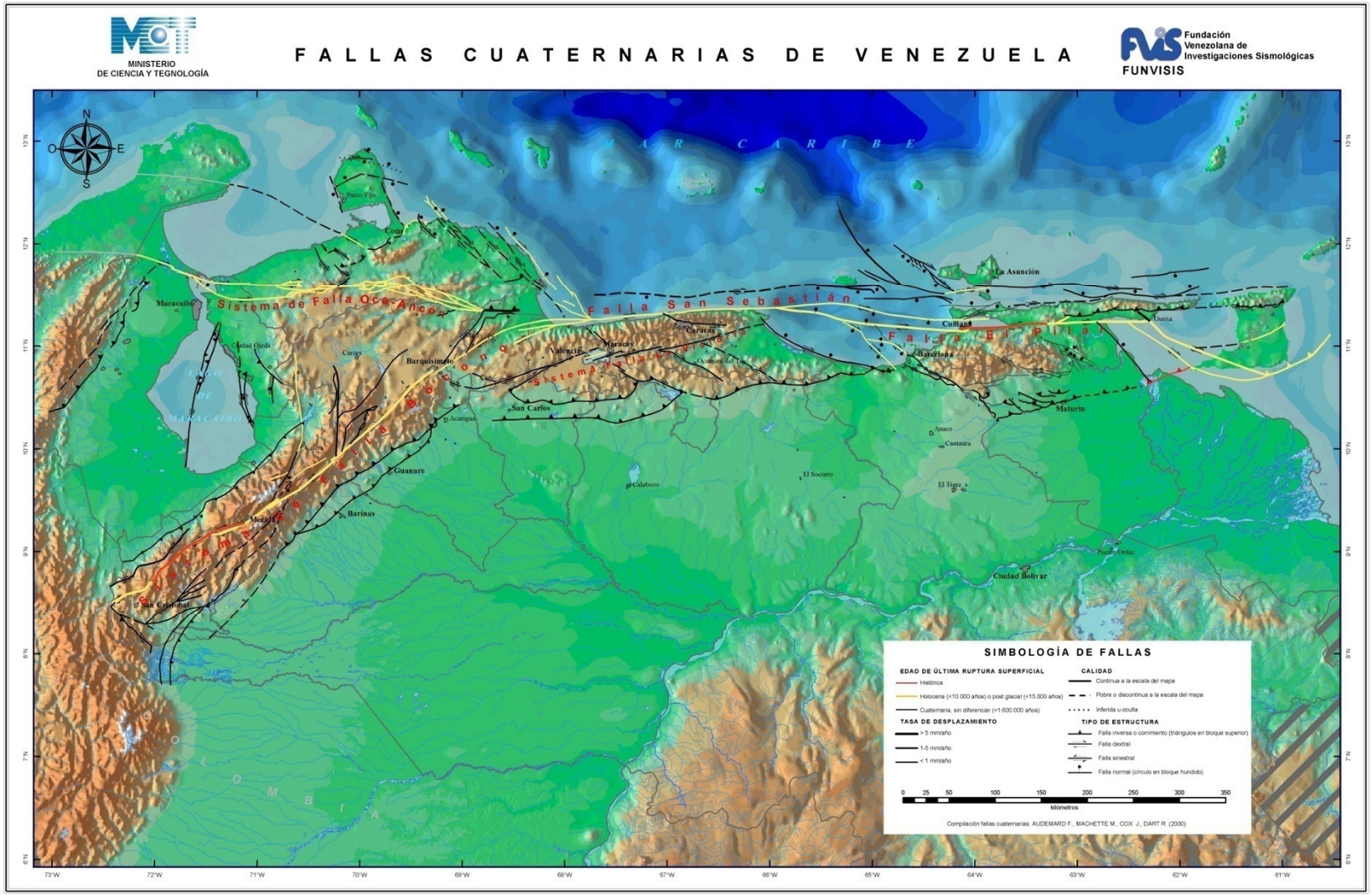
(Taboada et al., 2000)



Instrumental Seismicity 1910-2002

¿ What is responsible for it?

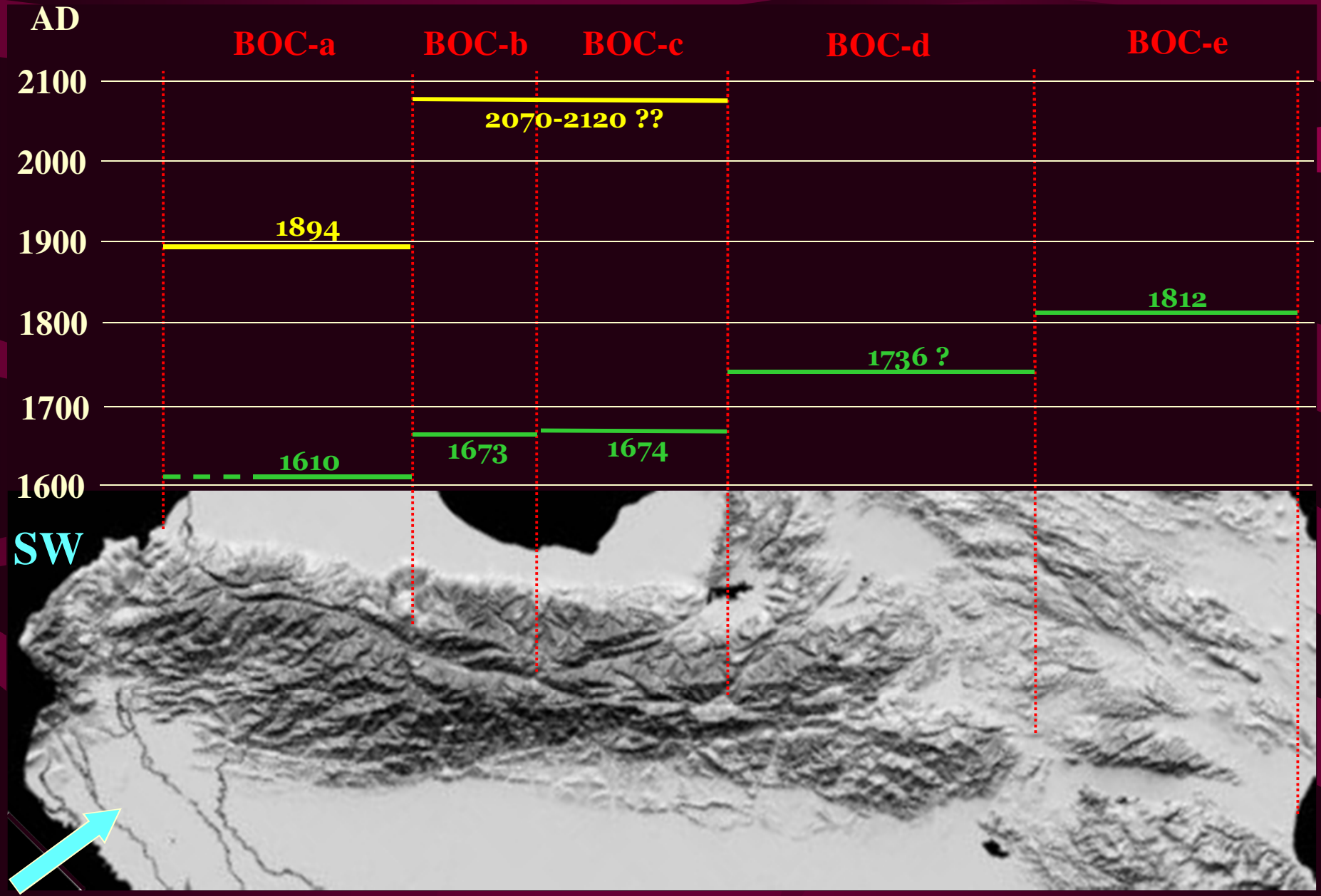
Seismogenic Fauts of Venezuela



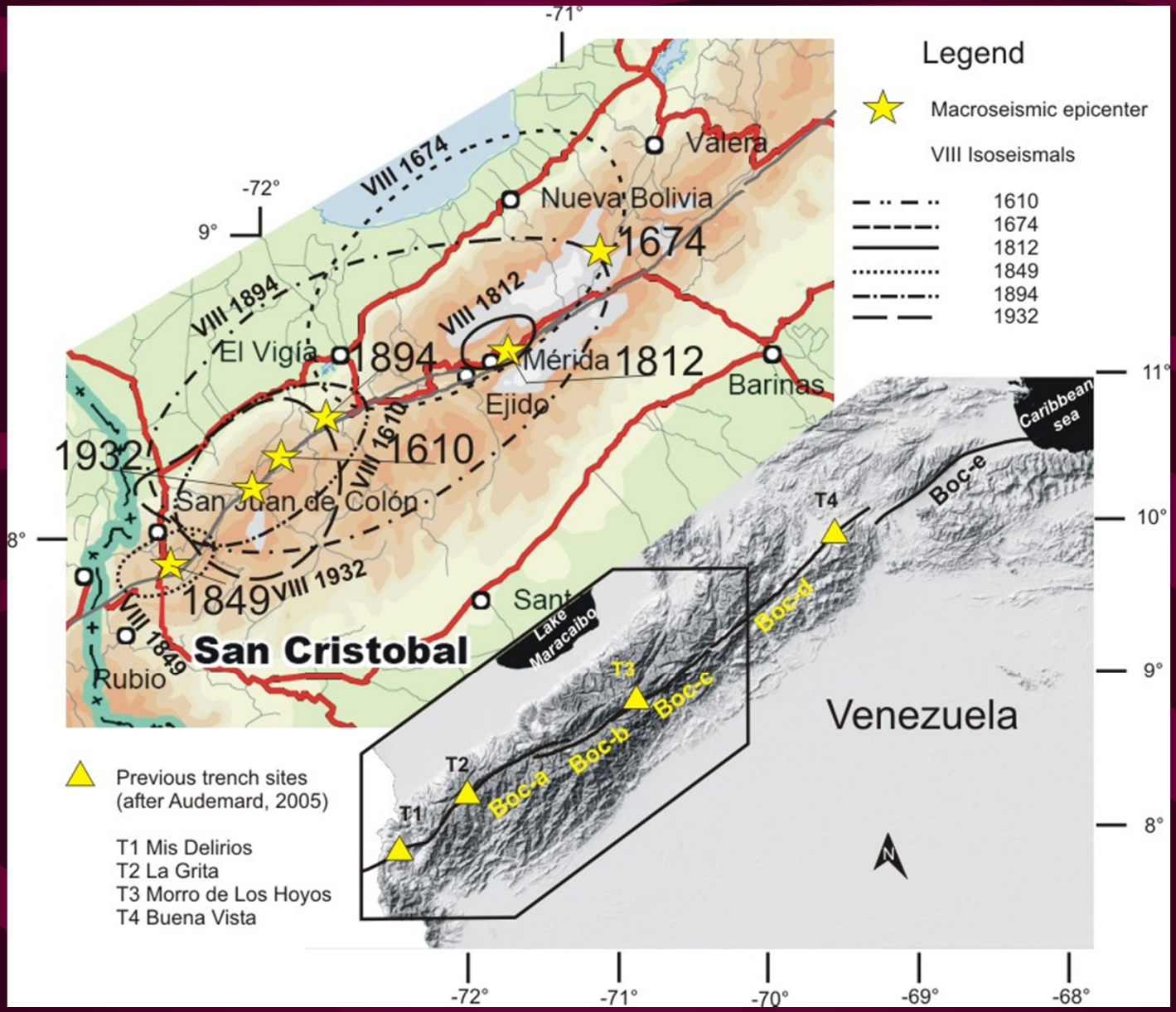
Fuente: http://www.ig.ul[illegible]

Boconó Fault

Time-space distribution of major historical earthquakes



Historical earthquakes in the Mérida Andes

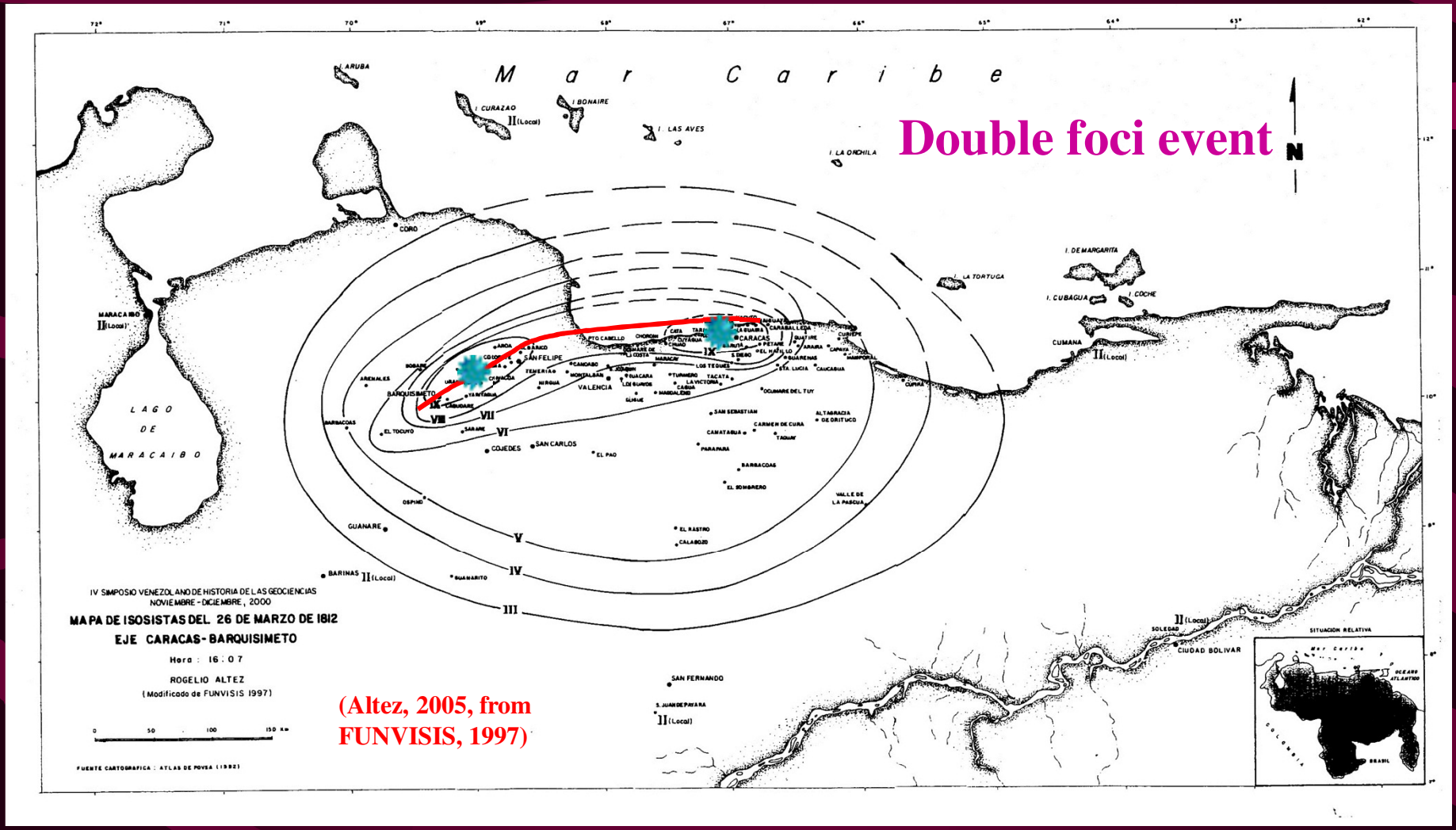


Note: length of VIII isoseismal approximates rupture length

Historical earthquakes in the Mérida Andes

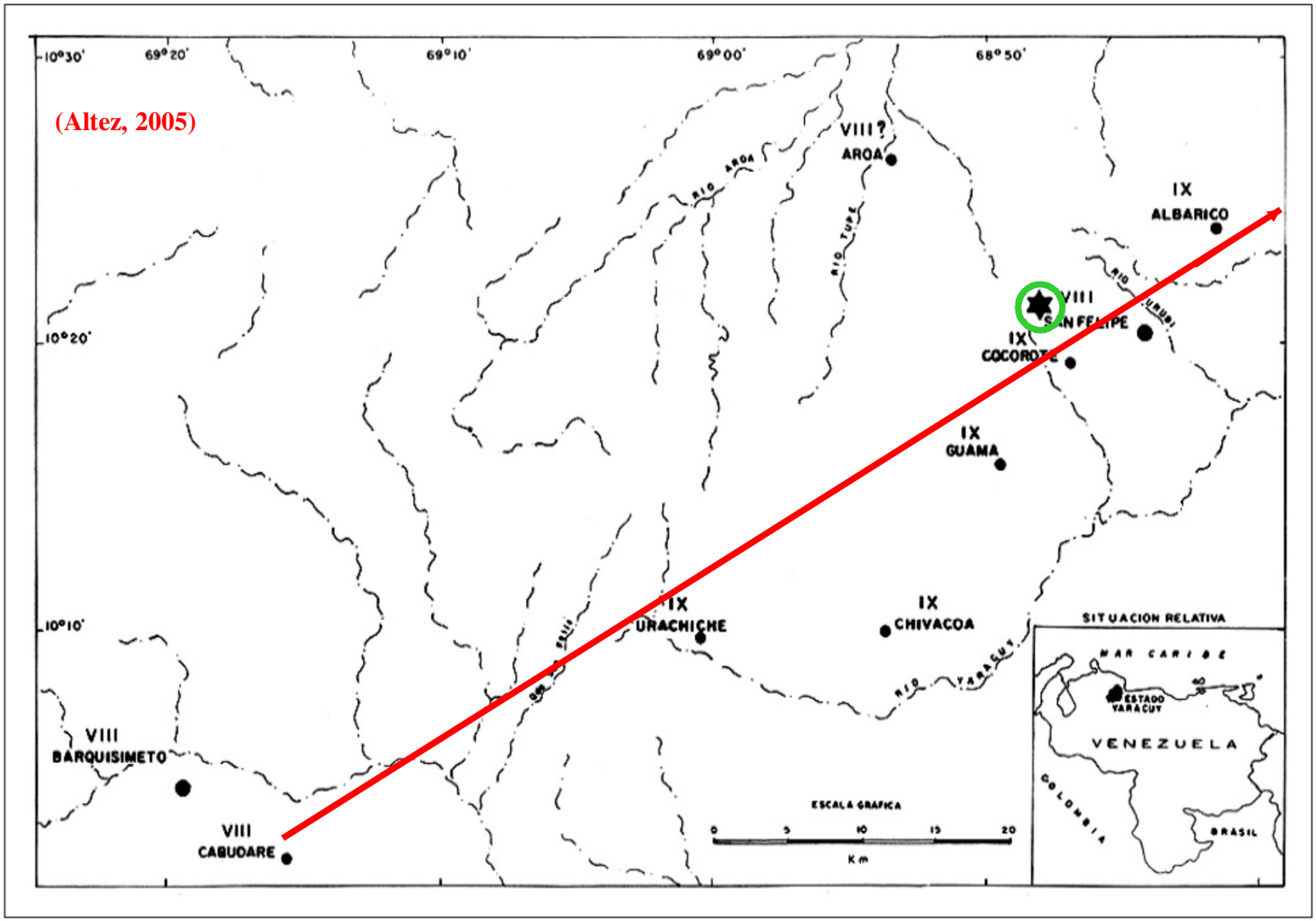
Event	After Palme et al. (2005)				After other authors		
	Long. (W)	Lat. (N)	Mag. (Mw)	N° Intensity reports	Epicenter (Long/Lat)	Magnitude	References
1610	71.65	8.45	7.60 ± 0.63	4	71.8/8.3 71.8/8.3	**7.3 MI** **7.2 Ms** **7.1-7.3 Ms**	Fiedler (1961) Cluff and Hansen (1969) Ferrer and Laffaille (1998) Audemard (1998)
1674	70.80	8.95	7.40 ± 0.63	4	70.64/9.3 70.9/8.9	**6.8 MI**	Grases (1980) Palme and Altez (2002)
1812	71.05	8.65	6.00 ± 0.63	11	71.3/8.5 71.05/8.65 aprox.	7.1 mC **5.1-5.4 MI**	Fiedler (1961) Laffaille and Ferrer (2003)
1849	72.25	8.05	6.35 ± 0.63	4	72.3/7.3 72.2/7.9 72.2/7.9	6.0 MI 6.6 mC 6.7 MI	Fiedler (1961) Fiedler (1961) Cluff and Hansen (1969) Ramírez (1975)
1894	71.70	8.70	7.56 ± 0.33	32	71.7/8.5 71.69/8.55	**7.1 MI** **7.0 mC** **7.1-7.3 Ms** **7.1-7.4 MI**	Fiedler (1961) Fiedler (1961) Audemard (1998) Rengifo and Laffaille (2000)
1932	72.00	8.30	6.50 ± 0.31	44	71.75/8.25 71.9/8.2 71.88/8.29 71.7/8.3 72.03/8.15	**6.75 Ms** **6.5 MI** **6.75 Ms** **6.75 MI** **6.5-6.7**	Gutenberg and Richter (1954) Fiedler (1961) Dewey (1972) Ramírez (1975) Escobar and Rengifo (2003)

Historical earthquakes in the Yaracuy depression



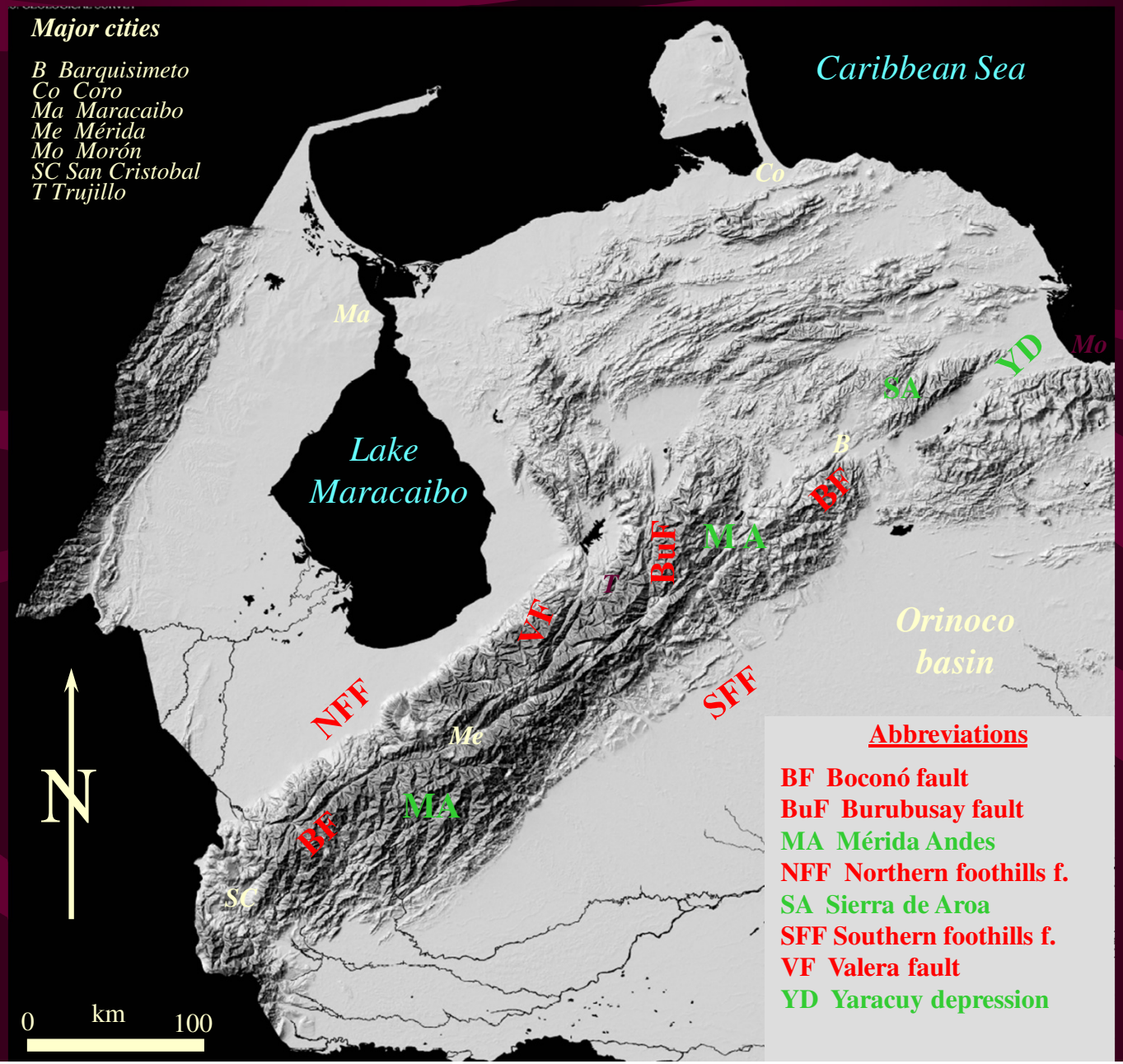
MMI intensity map for the march 26th, 1812 event

Historical earthquakes in the Yaracuy depression

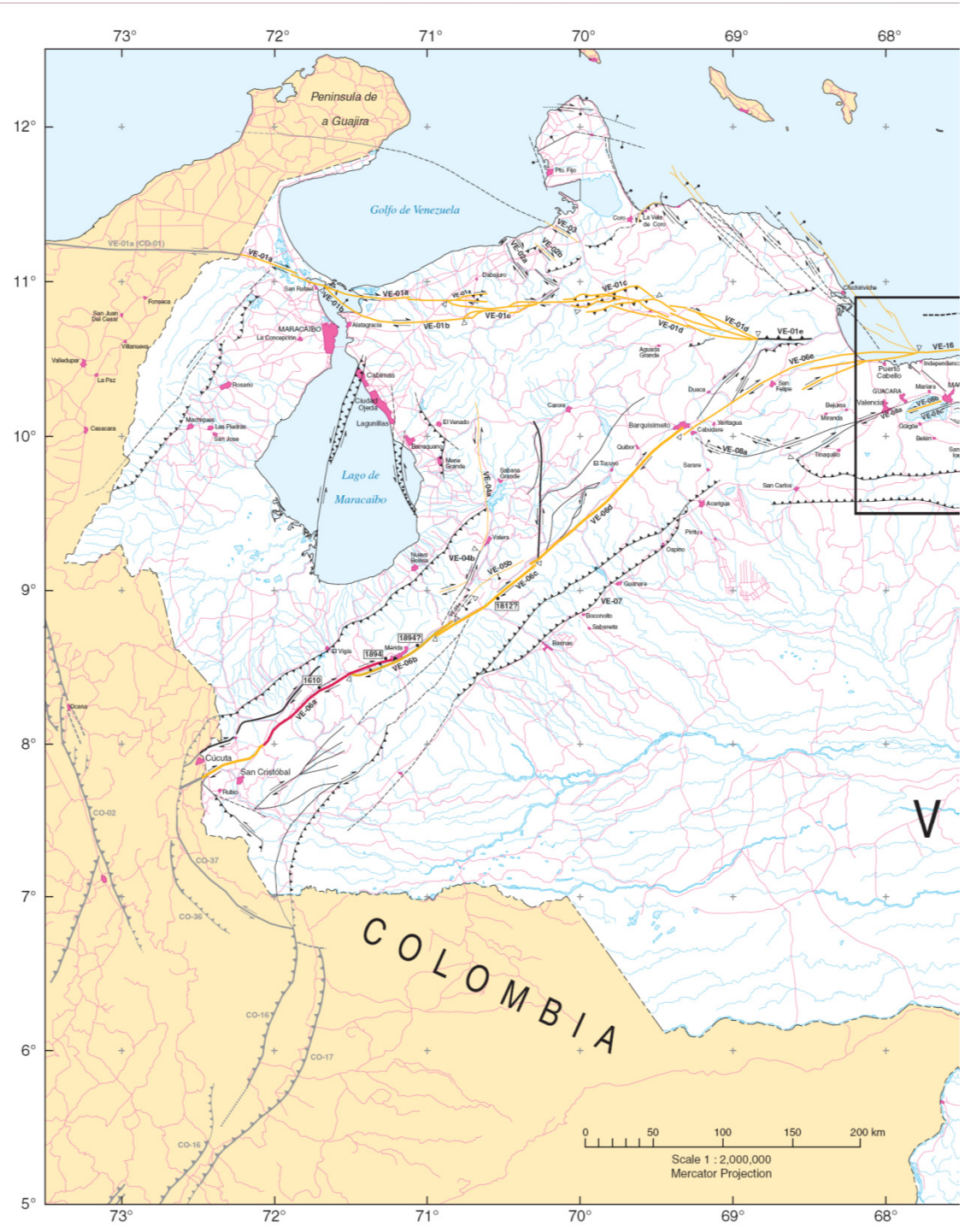


MMI intensities for the march 26th, 1812 event

The Mérida Andes and the Boconó fault

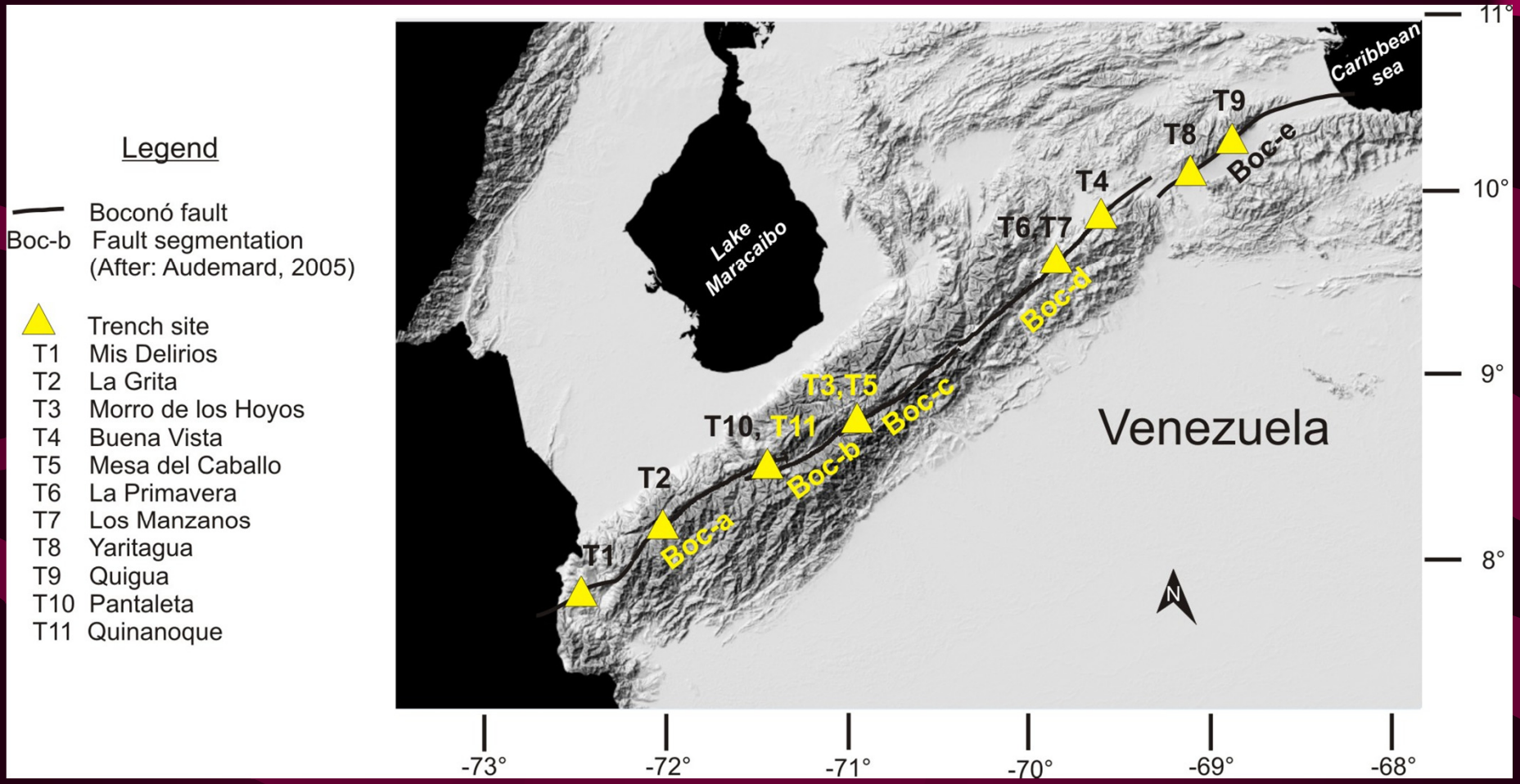


Segmentation of Boconó fault from geometric criteria



Audemard et al. (2000)

Paleoseisimic assessments performed between 1986-2006



BOCONÓ A: La Grita Trench

2 historical quakes recognized: 1610 & 1894 AD

BOCONÓ A: La Grita Trench

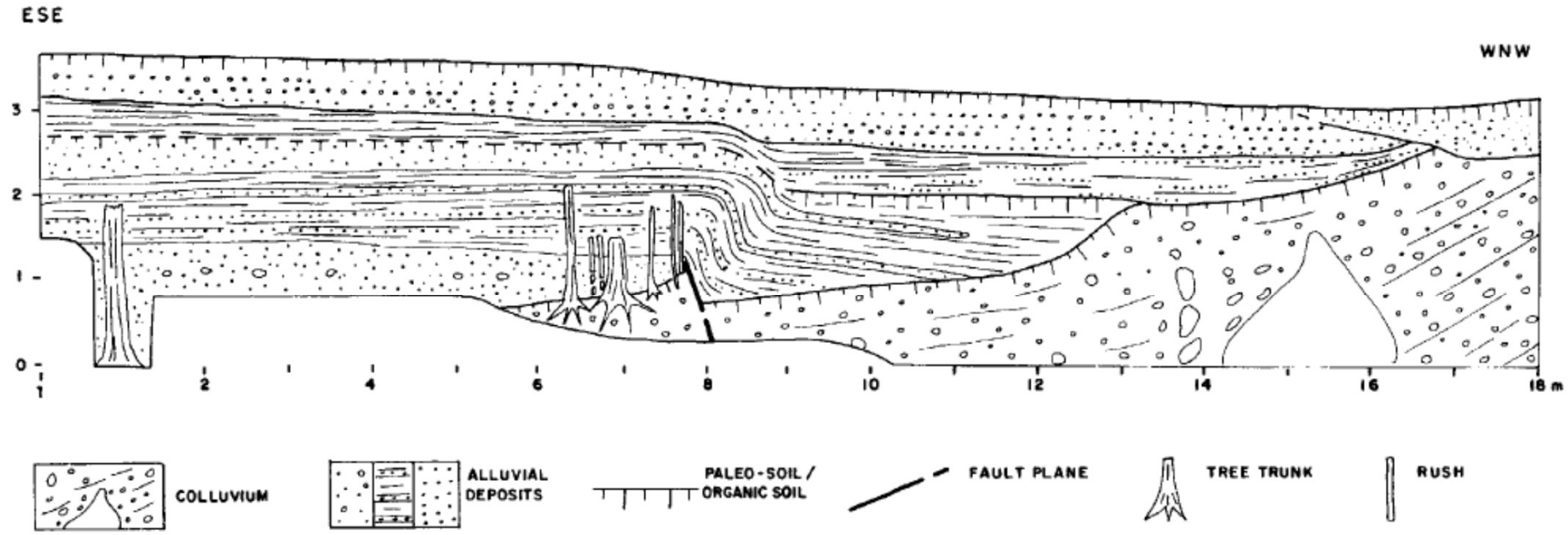
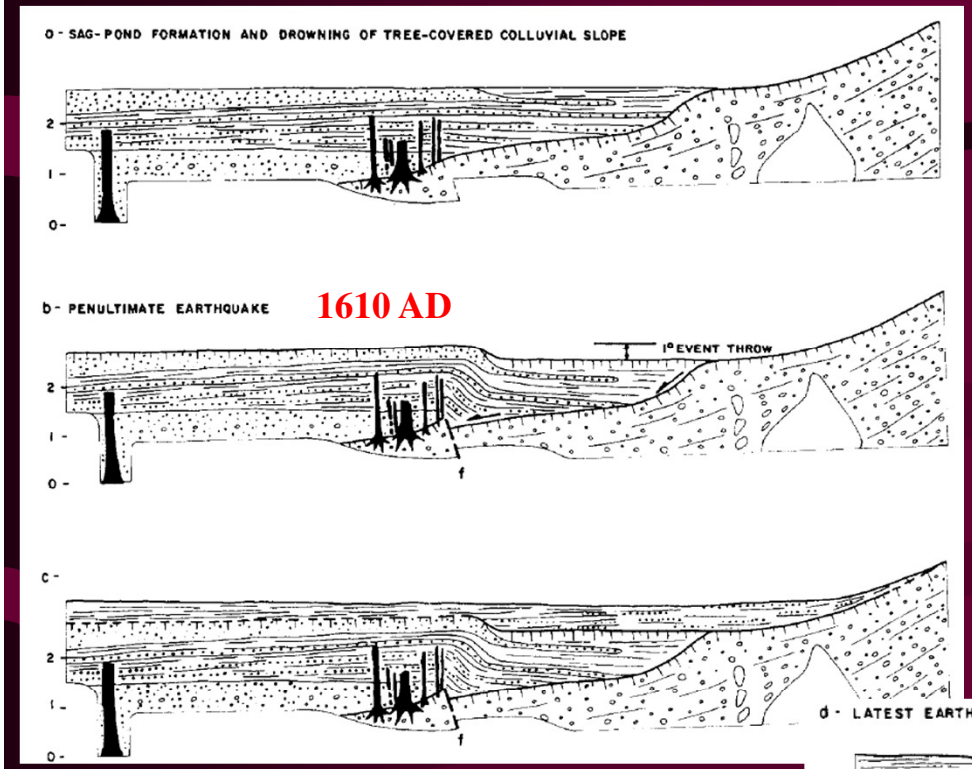


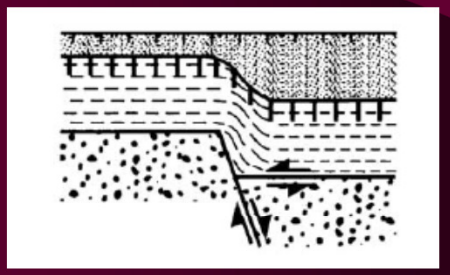
Fig. 2. Southwest-wall log of the La Grita trench across the Boconó fault.

HOLOCENE AND HISTORICAL EARTHQUAKES ON THE BOCONÓ FAULT SYSTEM, SOUTHERN VENEZUELAN ANDES: TRENCH CONFIRMATION

FRANCK A. AUDEMARD MENNESSIER

J. Geodynamics Vol. 24, Nos 1–4, pp. 155–167, 1997



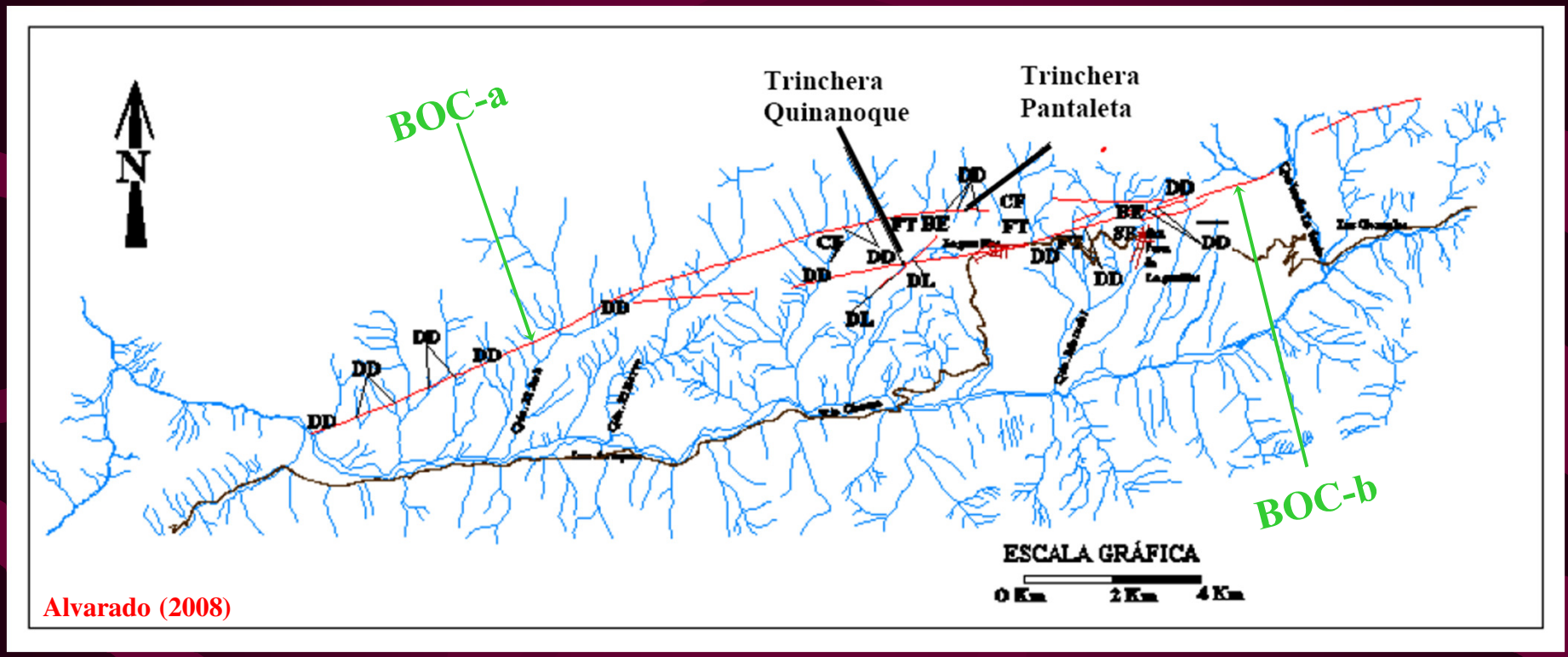


J. Geodynamics Vol. 24, Nos 1–4, pp. 155–167, 1997

Fig. 3. Paleoseismic reconstruction of the two latest earthquakes that occurred on the southern segment of the Boconó fault based on data collected at the La Grita trench.

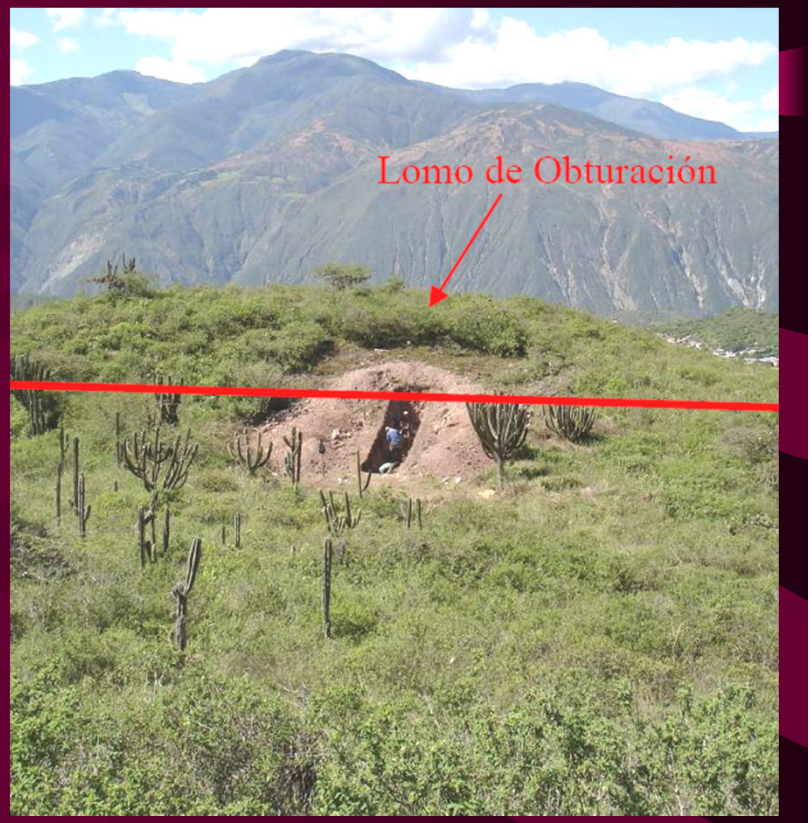
BOC-A & BOC-B stepover

Lagunillas pull-apart basin



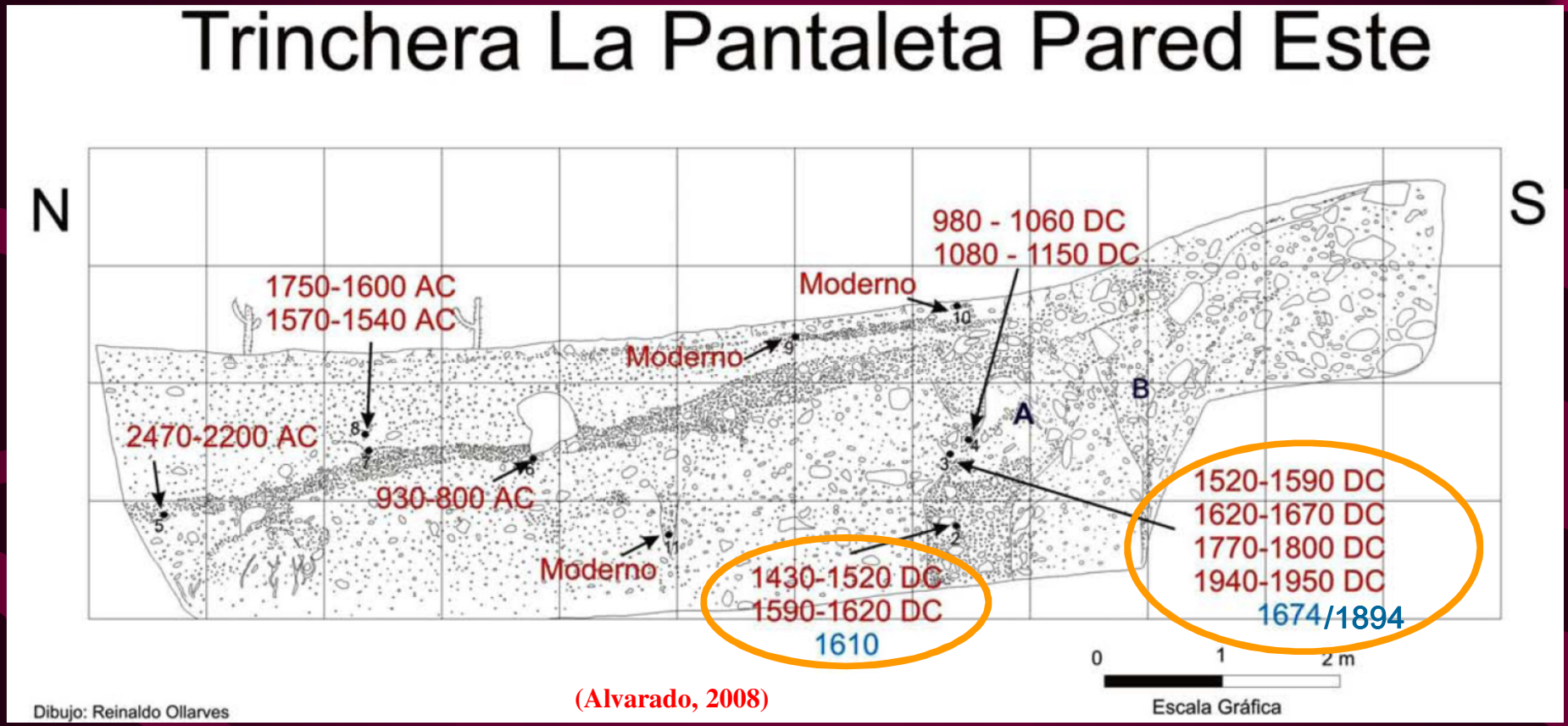
Alvarado (2008)

BOCONÓ A: La Pantaleta Trench



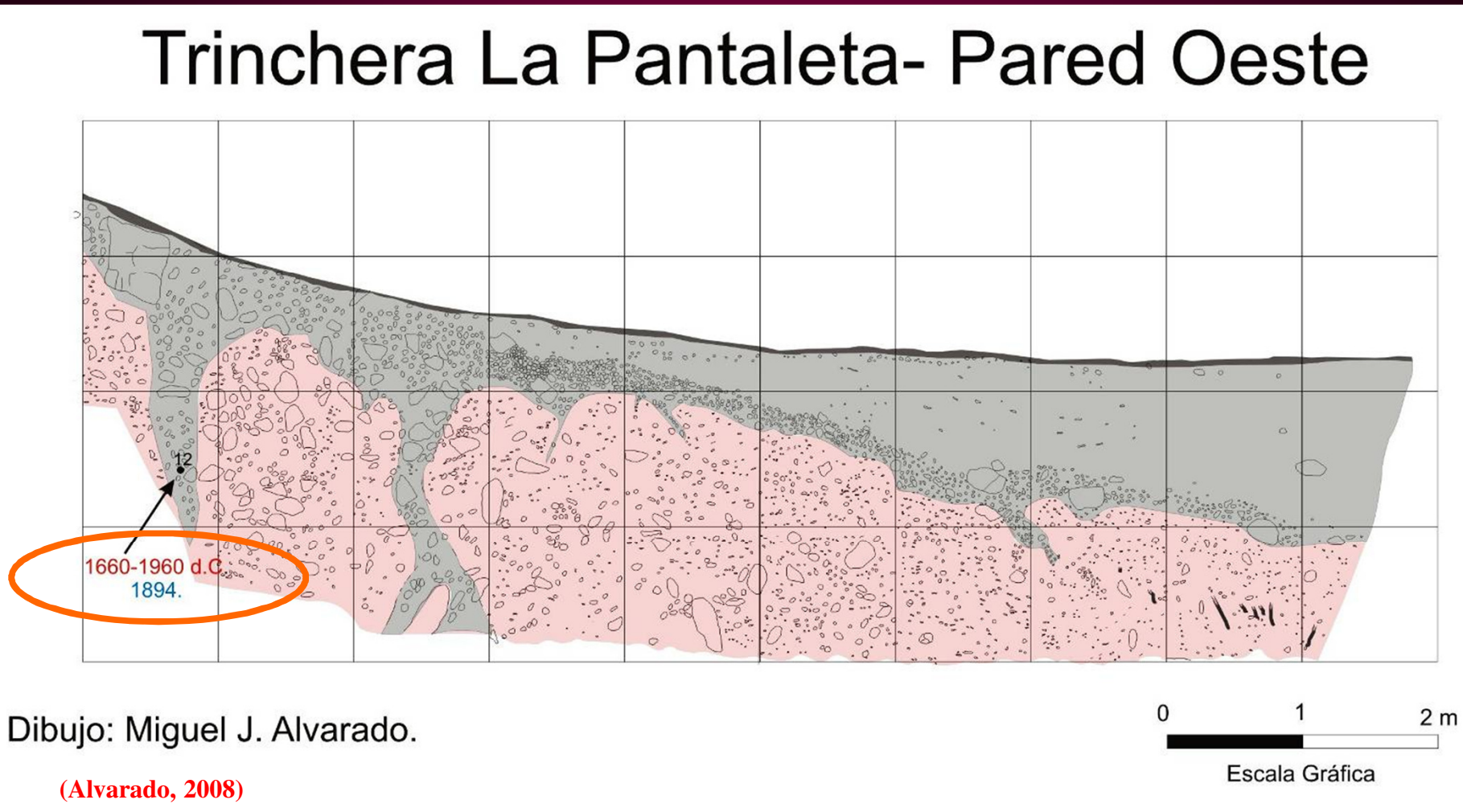
Pounded Q sediments behind shutter ridge

BOCONÓ A: La Pantaleta Trench



(Alvarado, 2008)

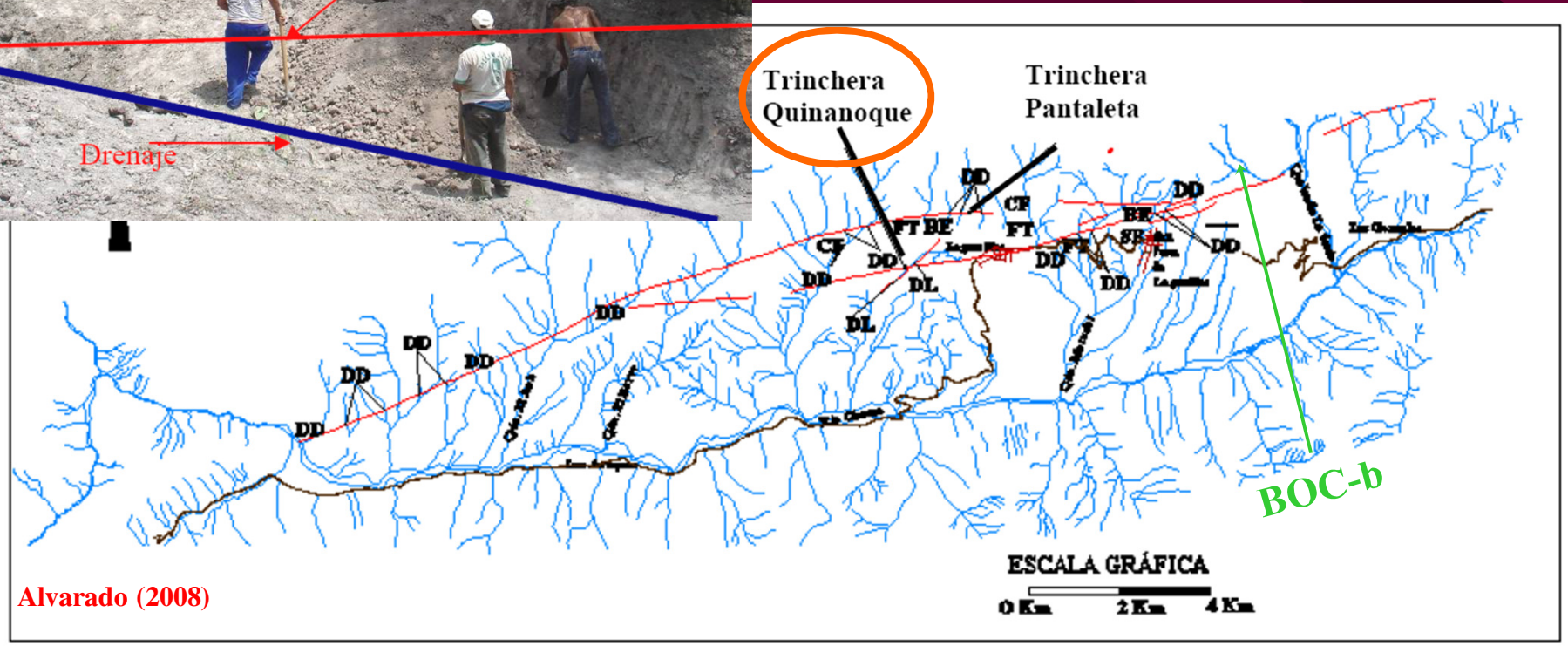
BOCONÓ A: La Pantaleta Trench



(Alvarado, 2008)

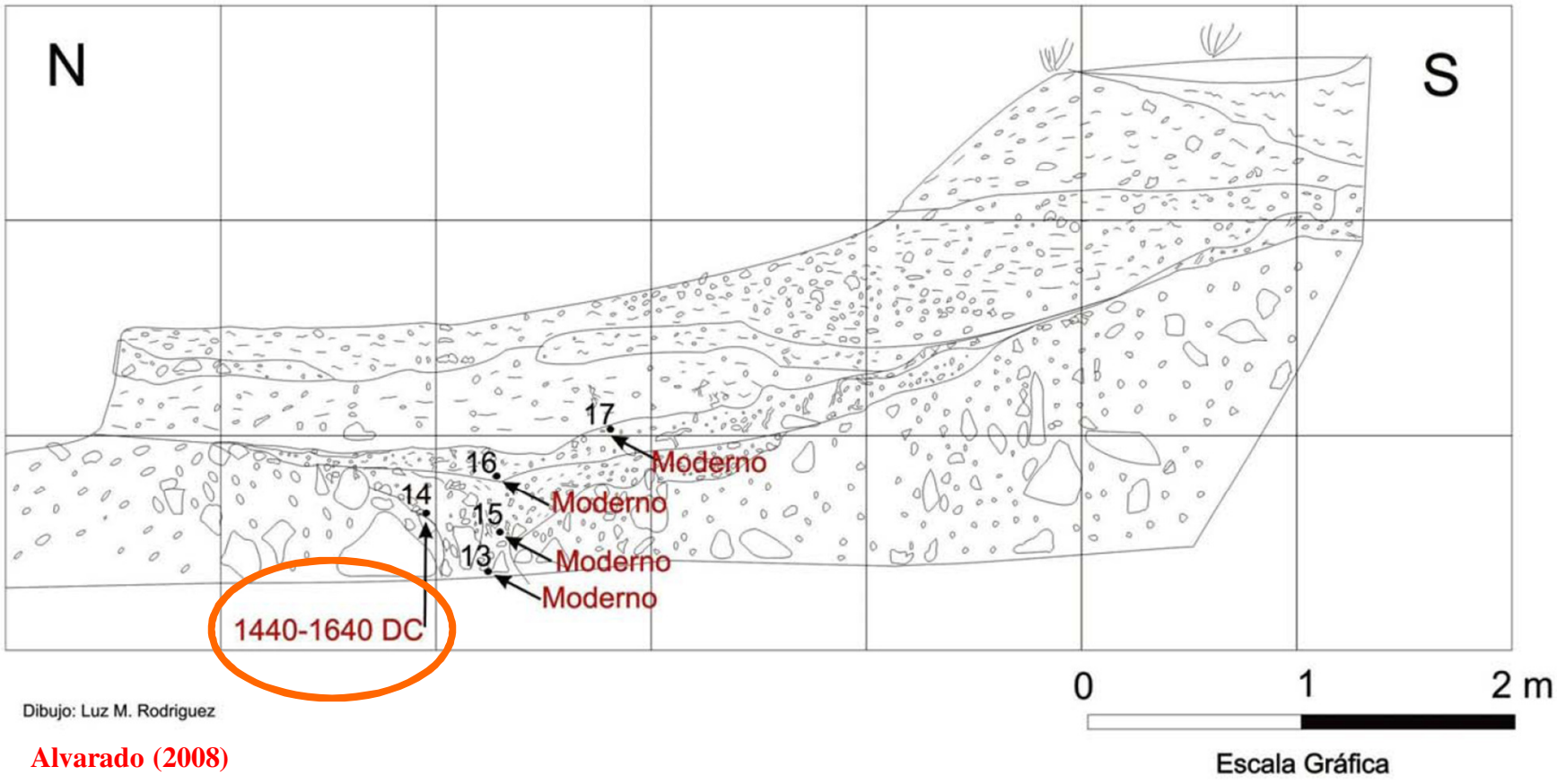
Return period: ≥ 300 yr

BOCONÓ B: Quinanoque Trench



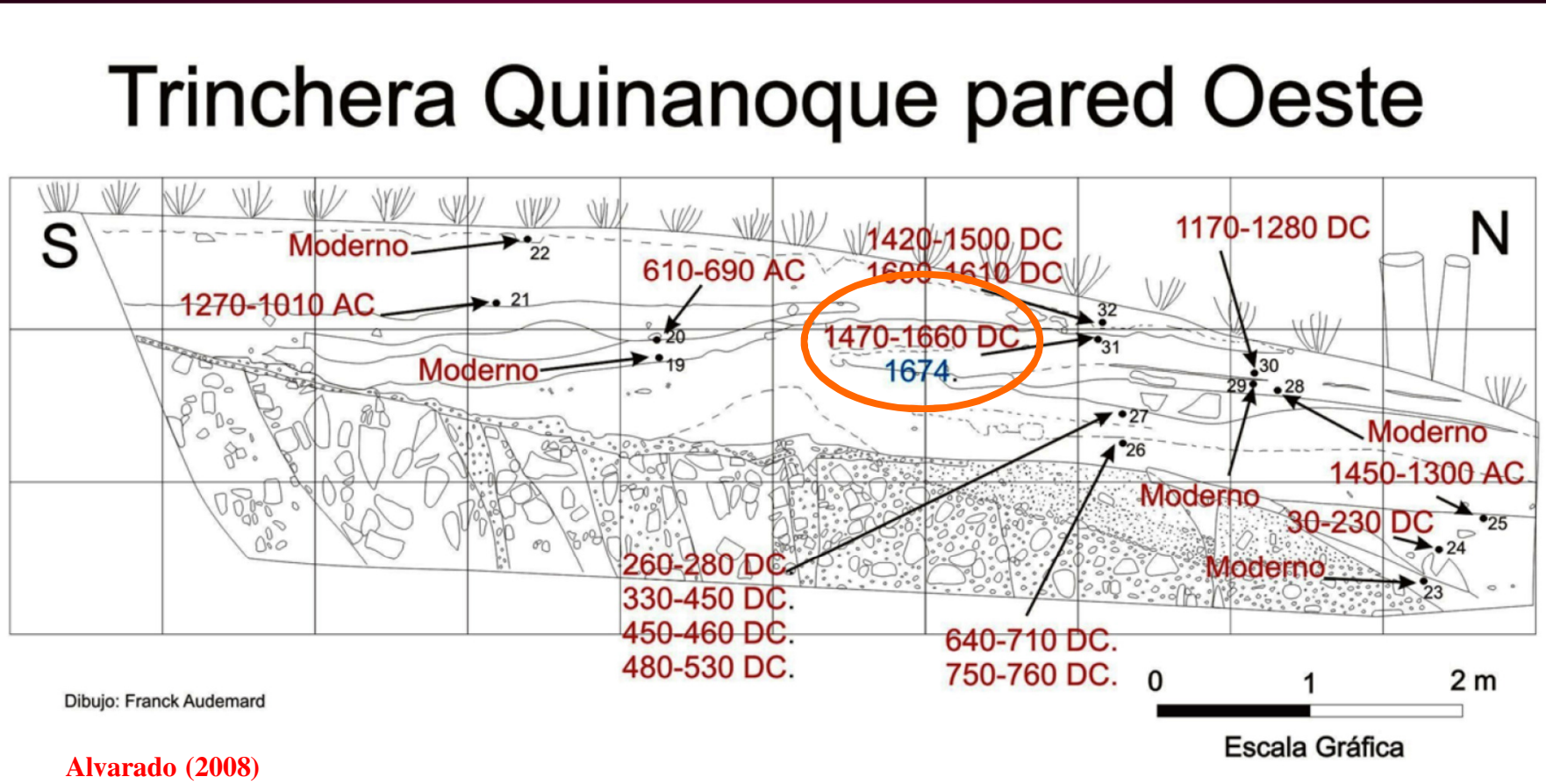
Alvarado (2008)

BOCONÓ B: Quinanoque Trench



Alvarado (2008)

BOCONÓ B: Quinanoque Trench

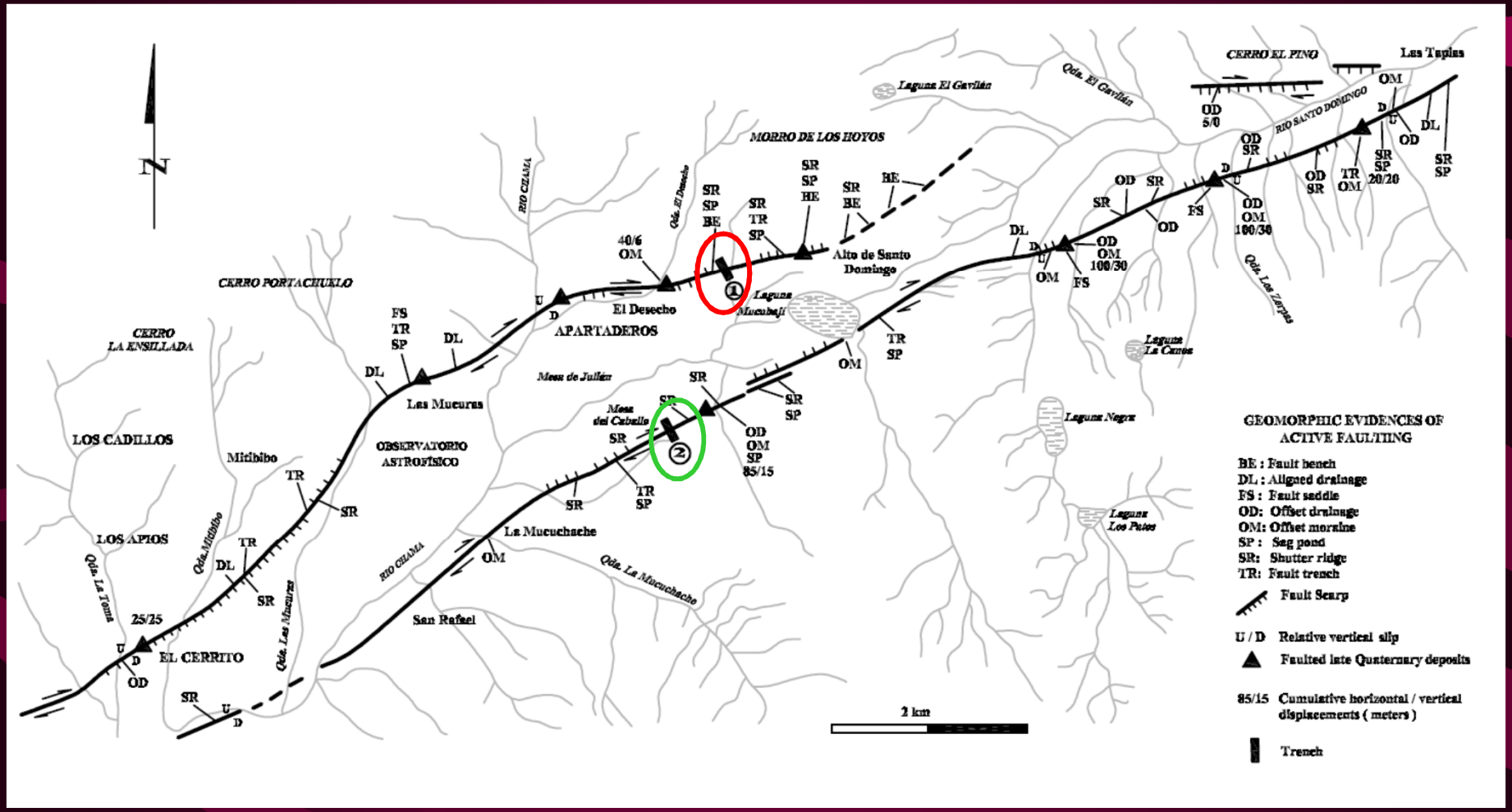


Alvarado (2008)

Return period: ≥ 450-500 yr

BOC-B & BOC-C stepover

Apartaderos pull-apart basin

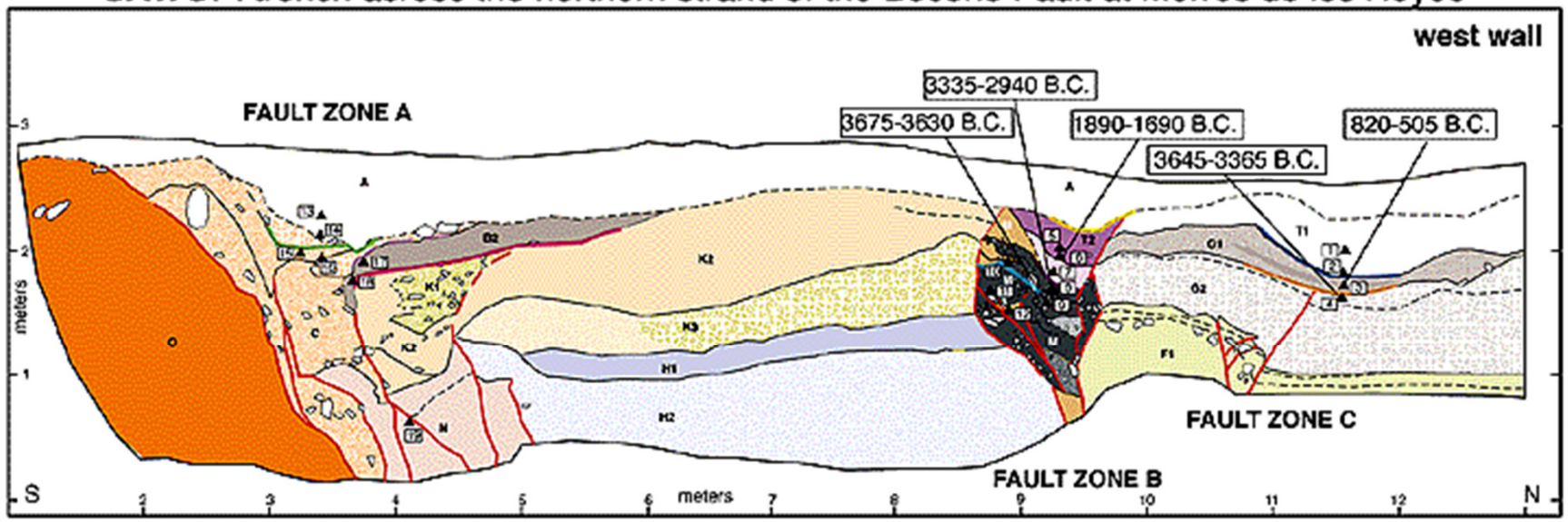


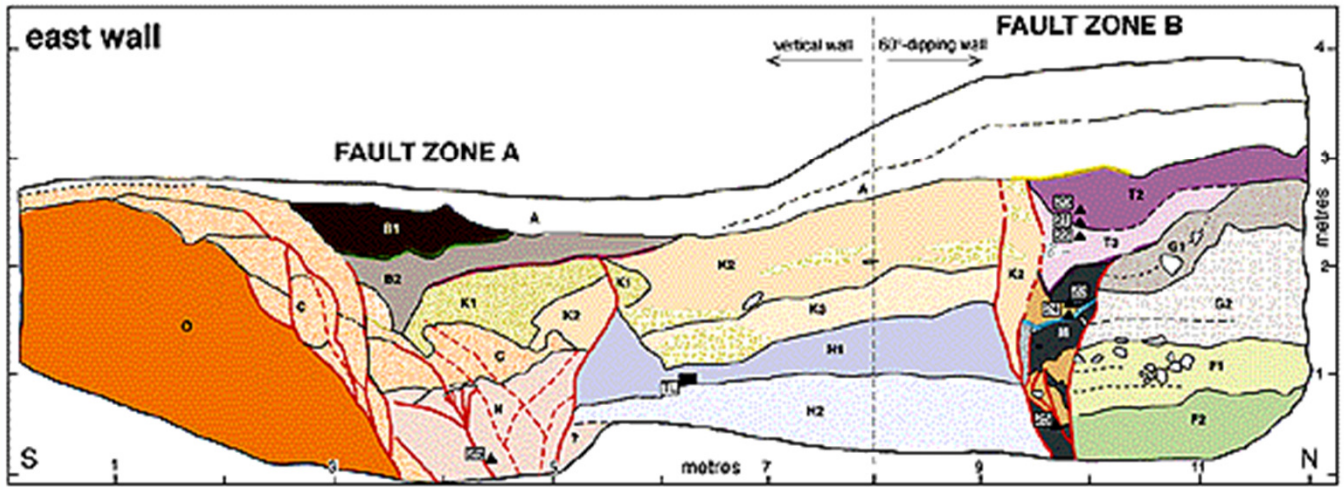
Location of trenches at BOC-b & BOC-c stepover

Audemard et al., 2008

BOCONÓ B: Morro de Los Hoyos Trench

SAWOP: trench across the northern strand of the Bocono Fault at Morros de los Hoyos





(Audemard et al., 1999)

BOCONÓ B: Morro de Los Hoyos Trench

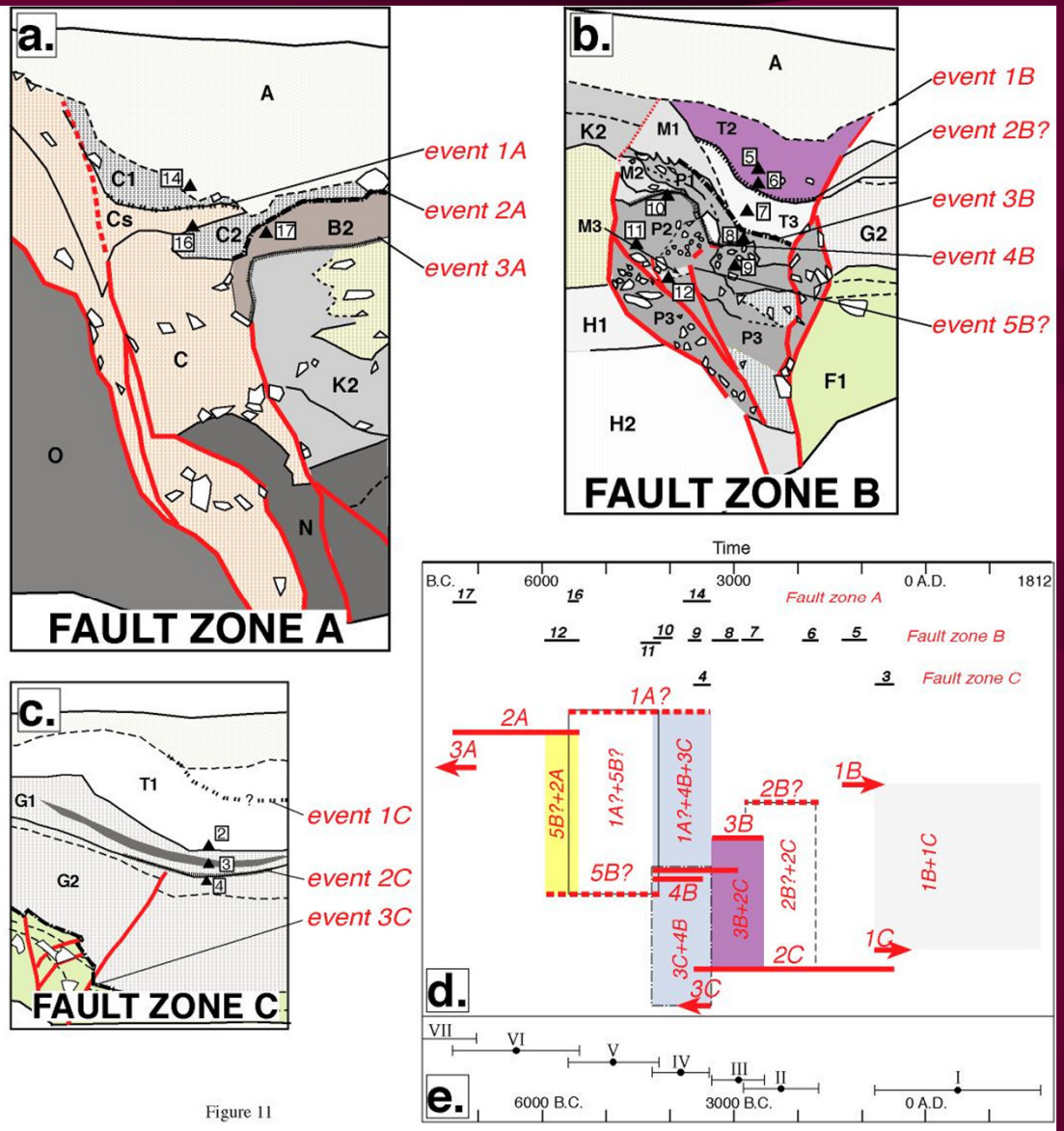


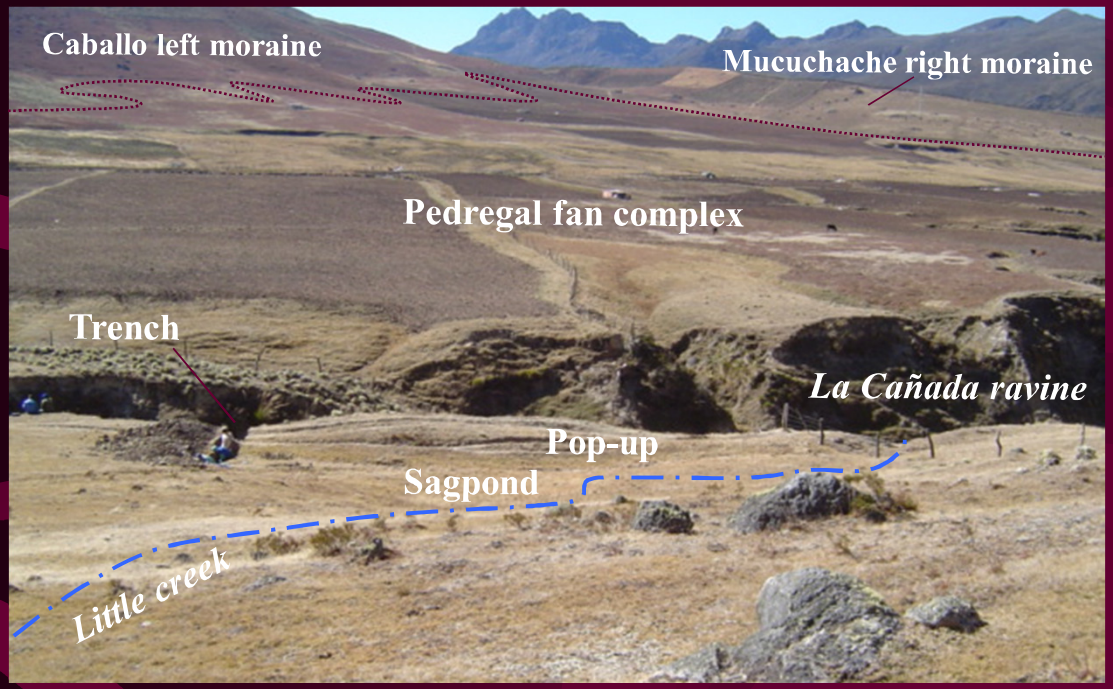
Figure 11

Paleo-earthquake determination

Recurrence:
1150-1450 yr
for Ms ≥ 7.0

(Audemard et al., 1999)

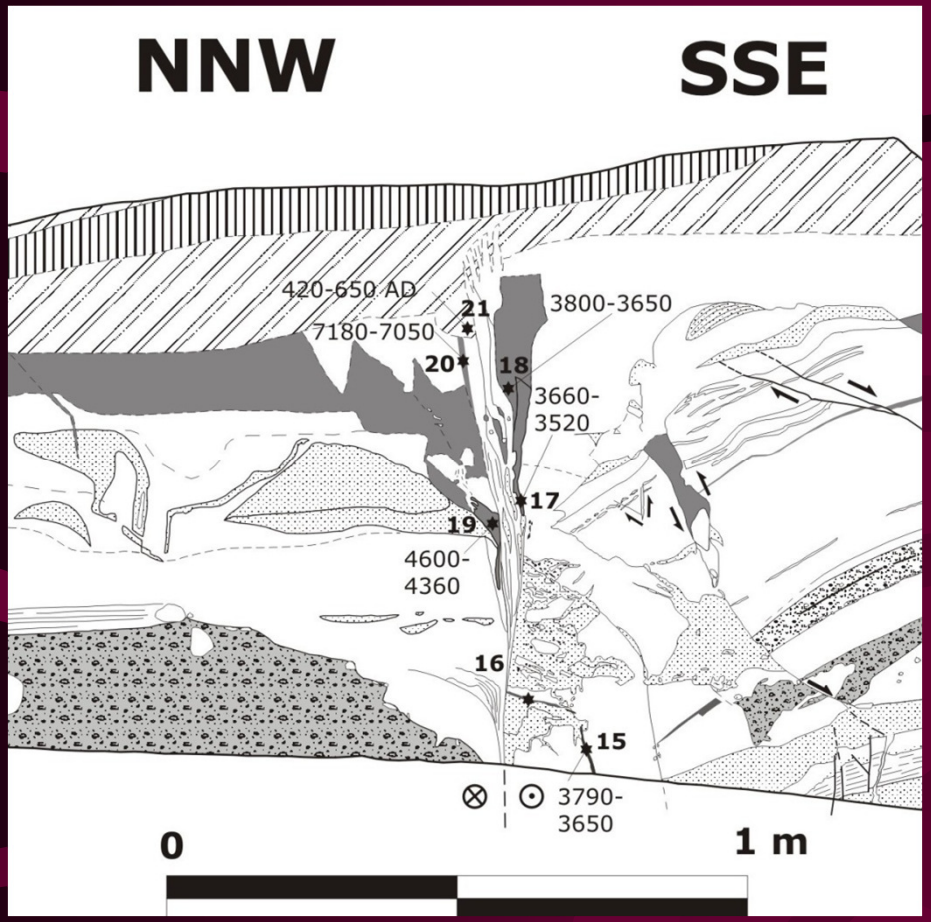
BOCONÓ C: Mesa del Caballo Trench

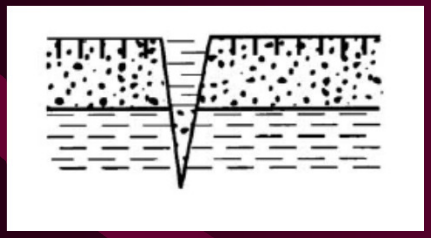


(Audemard et al., 2008)

BOCONÓ C: Mesa del Caballo Trench

Audemard et al. (2008)

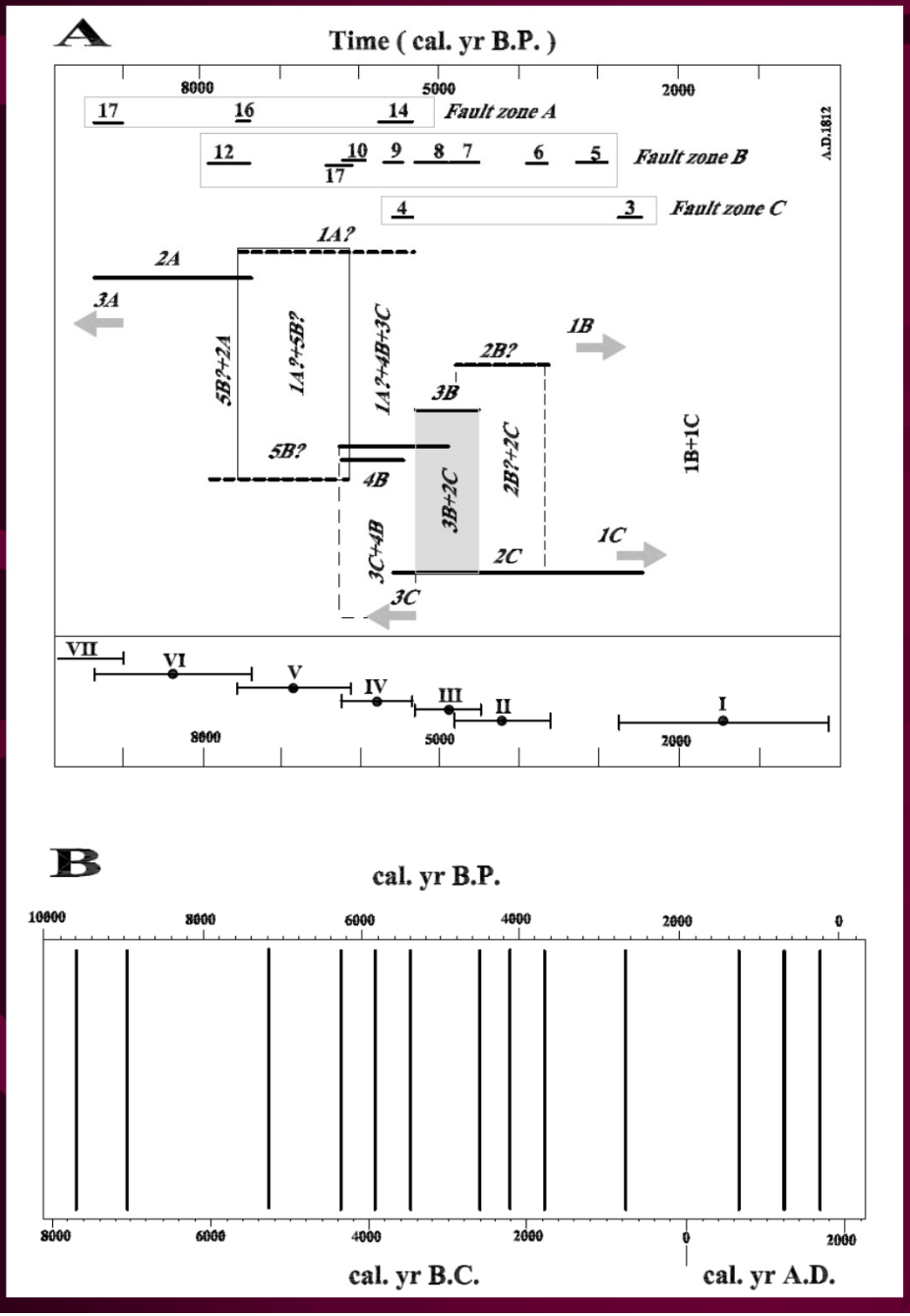




Recurrent Open-crack filling

Mesa del Caballo trench (Mérida,Venezuela)

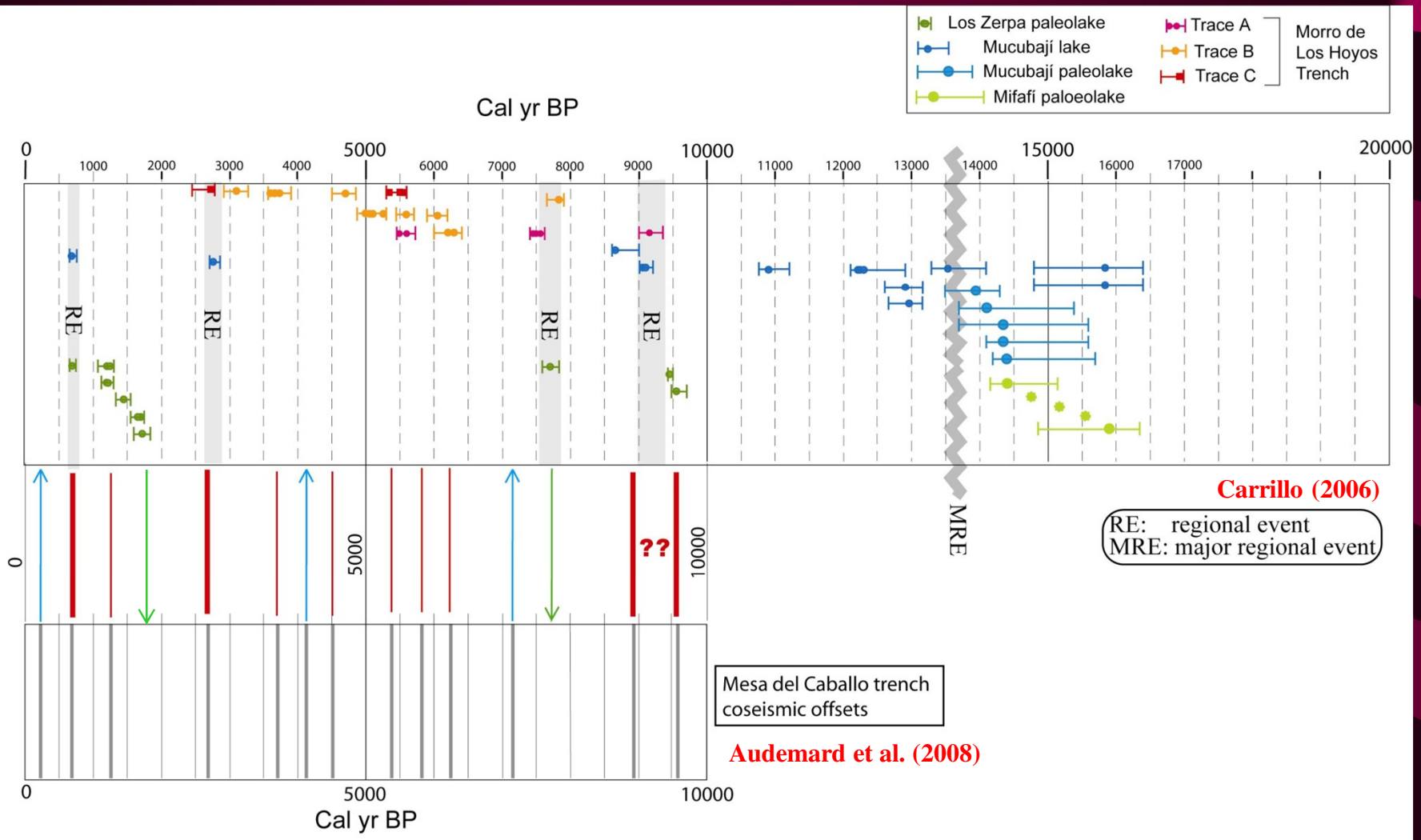
Earthquake correlation between BOC-b & BOC-c



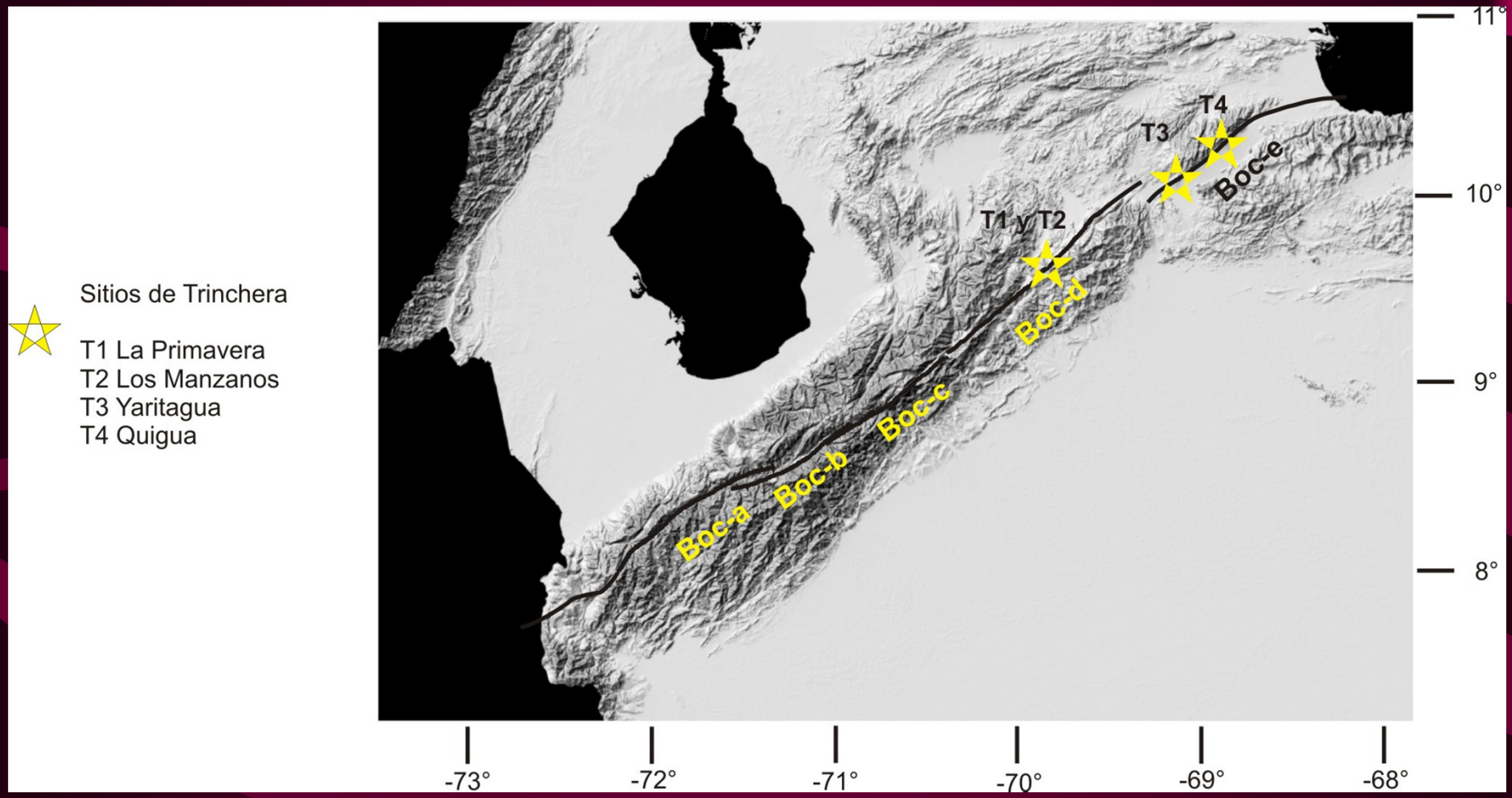
- Joint slip every 1150-1450 yr
- 2 intercalated events only on BOC-c every 400-450 yr

Audemard et al., 2008

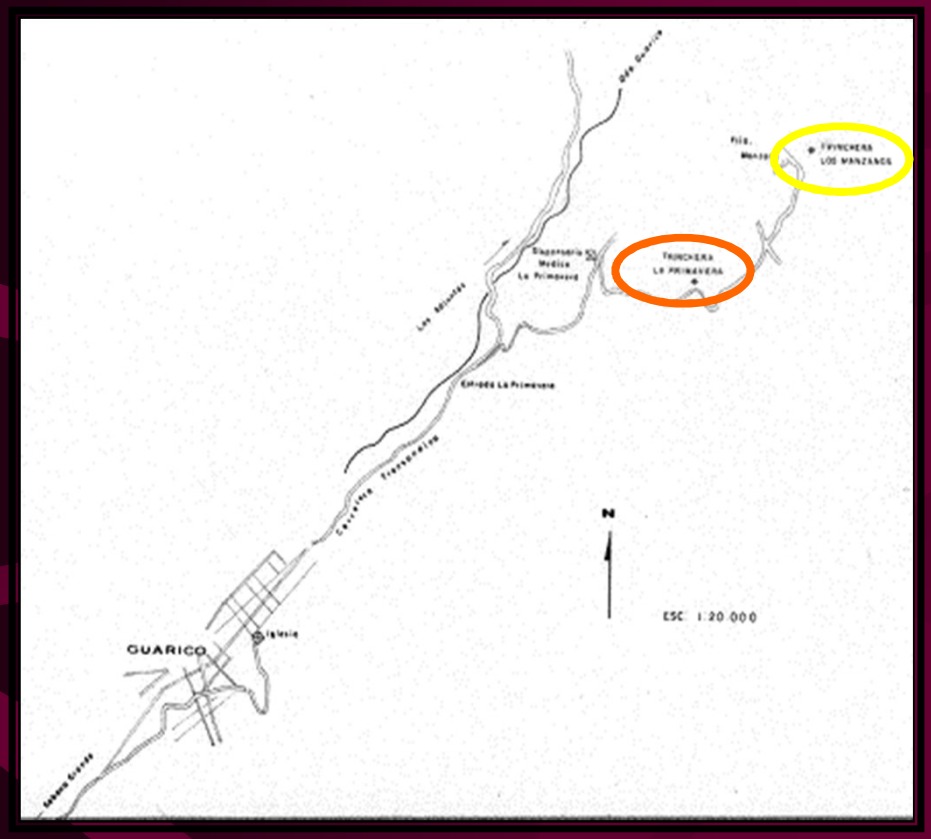
Complemented with seismogeologic perturbations recorded in lakes



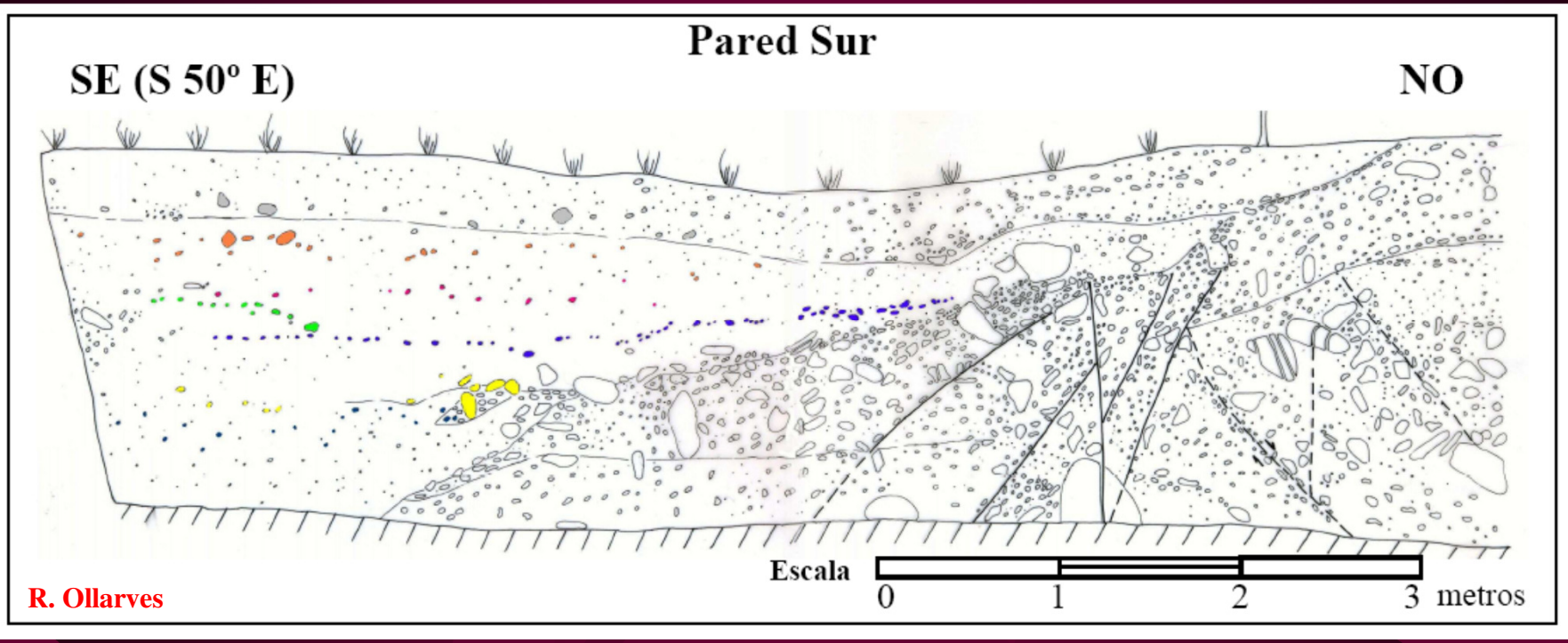
2005 trench assessments on segments BOC-D & BOC-E



BOCONÓ D: La Primavera Trench



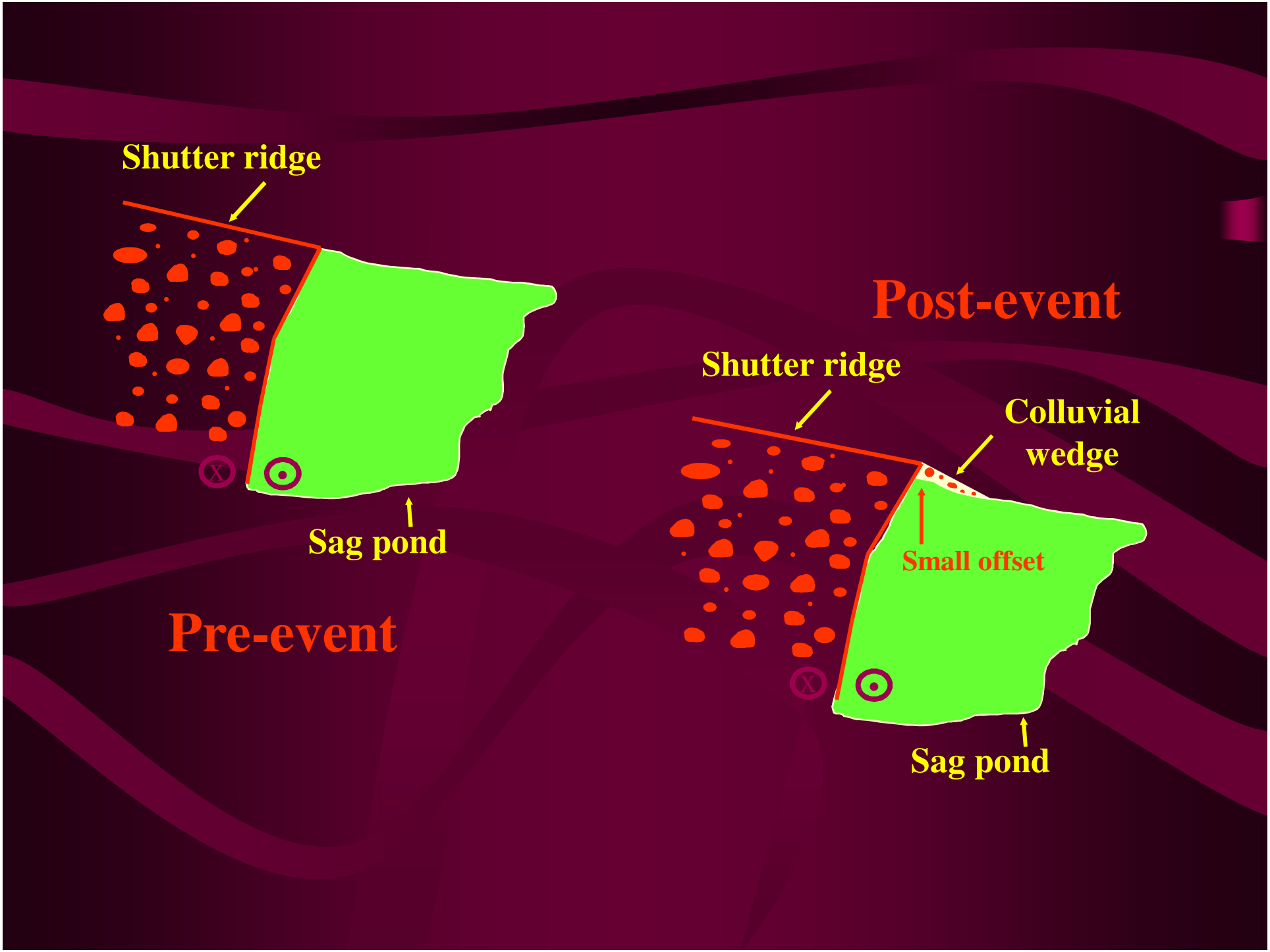
BOCONÓ D: La Primavera Trench



Colluvial wedges (Cuñas coluviales)

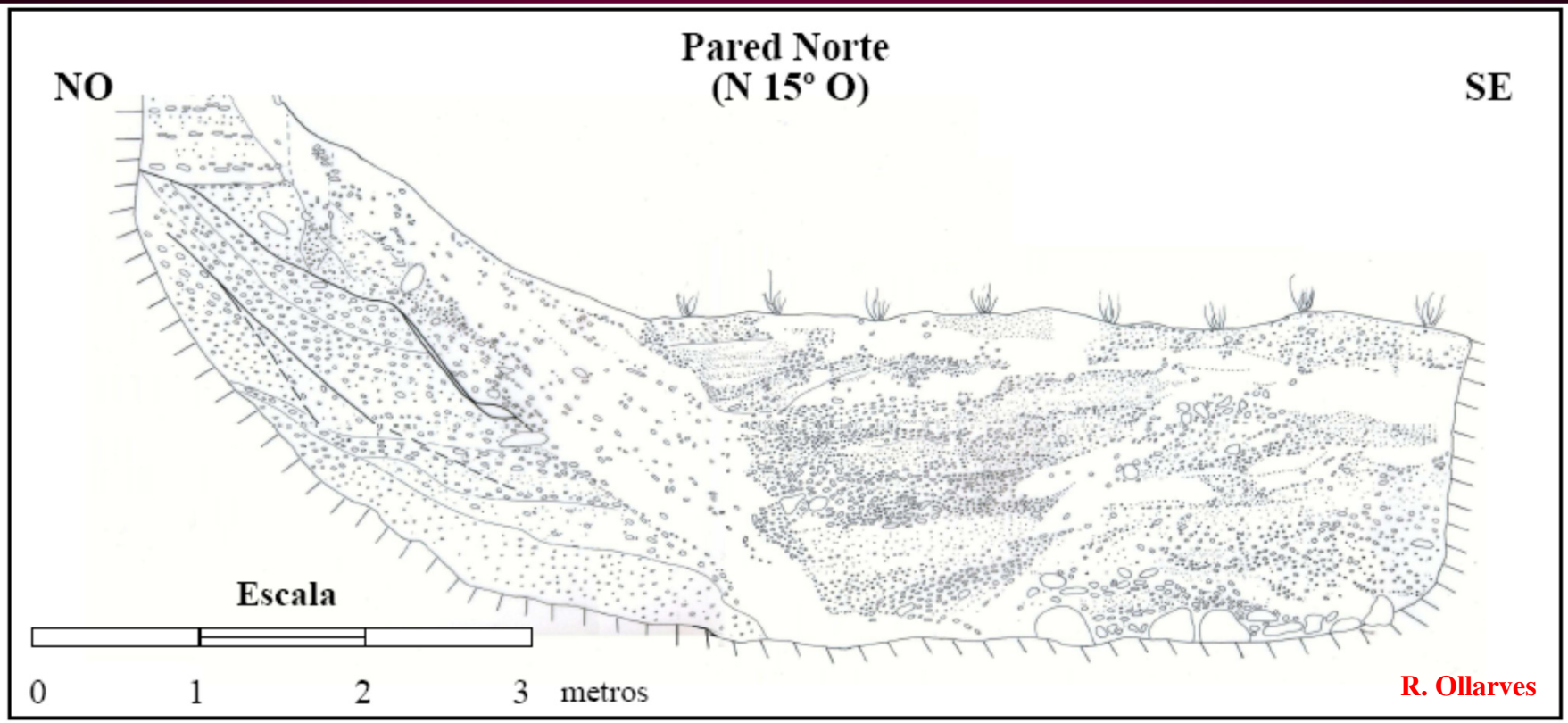
Stonelines
(Líneas de cantos)

La Primavera Trench
(Lara state, Venezuela)

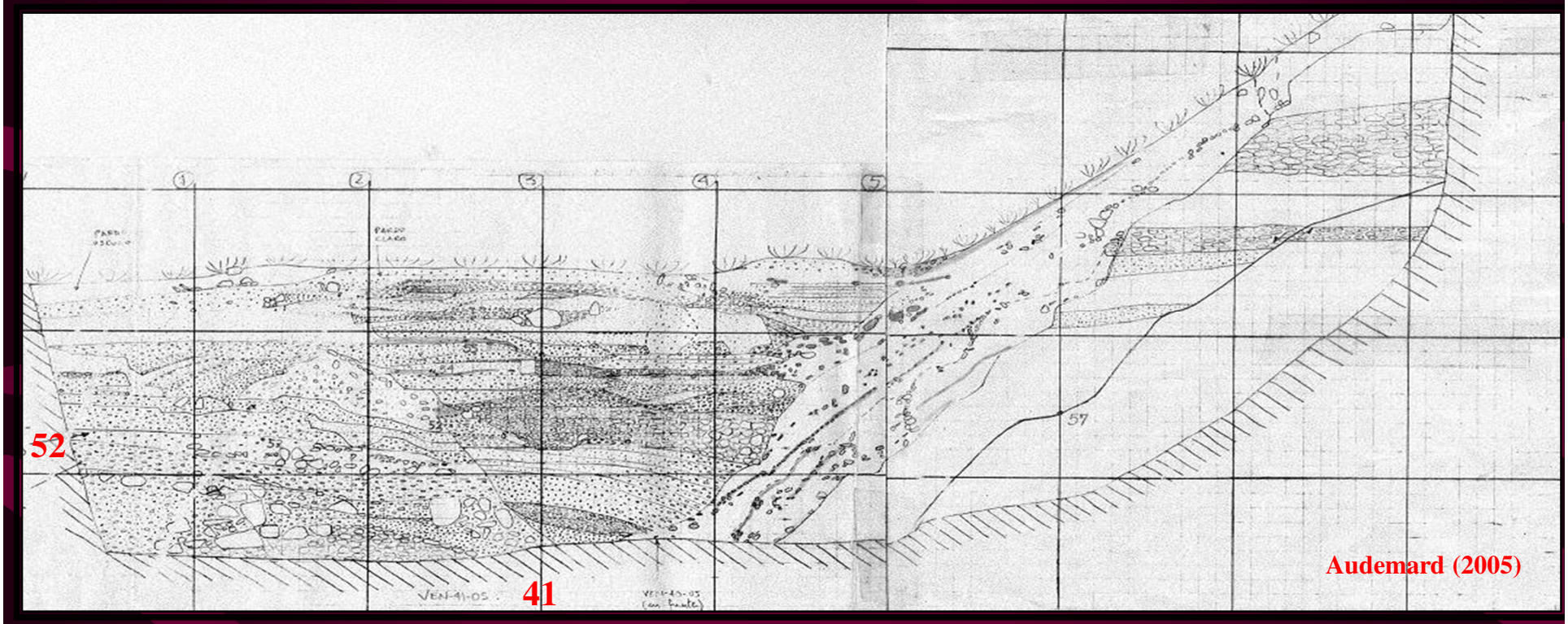

Shutter ridge
Sag pond
Pre-event
Post-event
Shutter ridge
Colluvial wedge
Small offset
Sag pond

BOCONÓ E: El Salto Trench

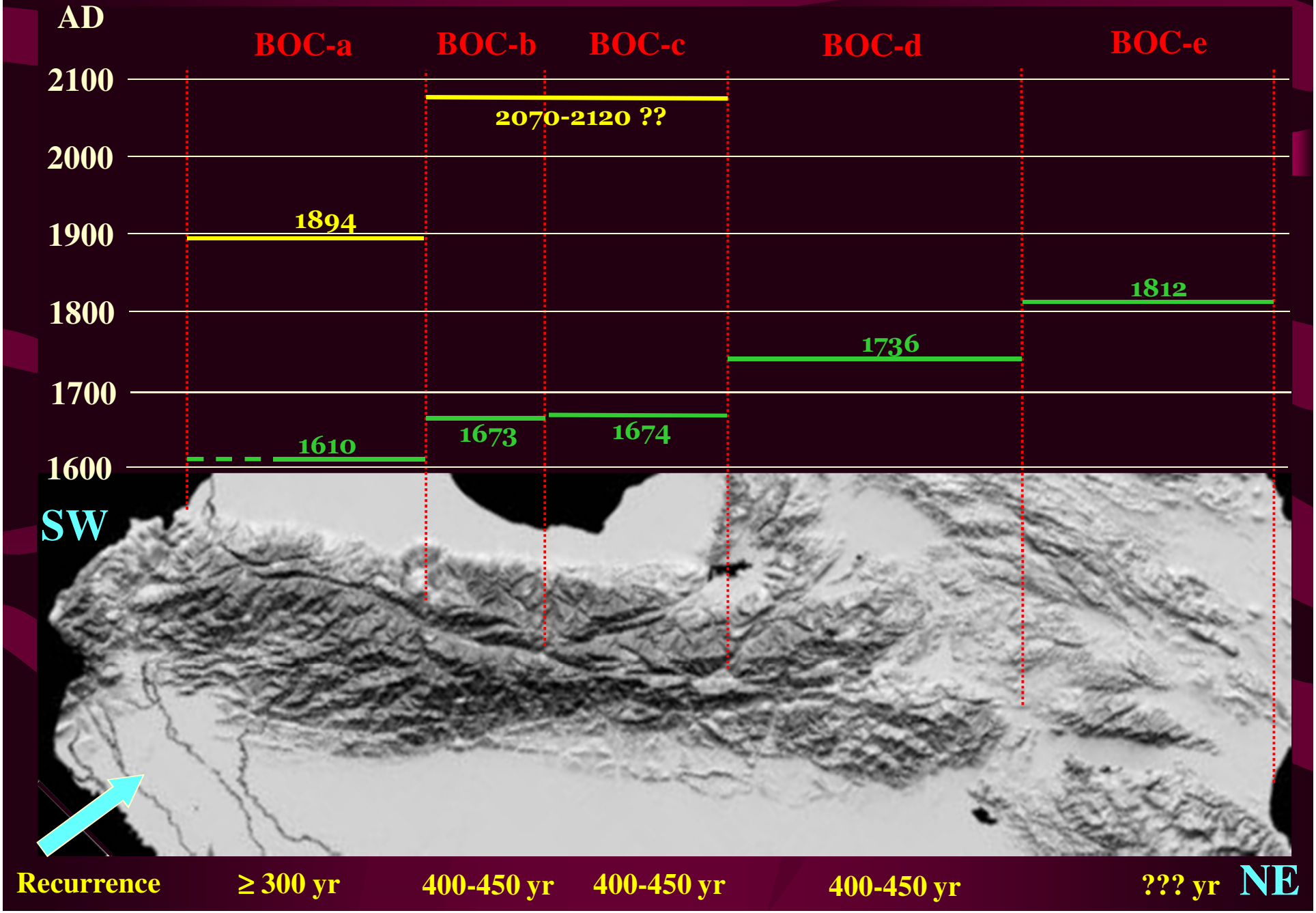
BOCONÓ E: El Salto Trench



BOCONÓ E: El Salto Trench

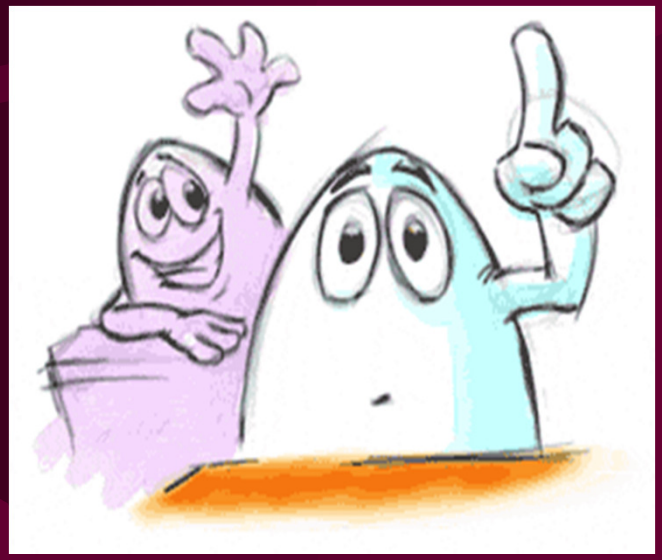


Time-space distribution of major historical earthquakes



Segmentation of the Boconó Fault from paleoseismic trench results, Mérida Andes, Venezuela

Thanks very much for your priceless time



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