Hints of active deformation in the southern Adriatic foreland: Holocene tectonics along the Apulia offshore (Italy)

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Special session: Seismotectonics and seismic hazard of the Adria region

What are we going to talk about ?

The issue: active tectonics W of the Gargano Promontory (?)

Geological and geophysical framework

The VHR seismic reflection data

Some results and ...

... some concluding remarks

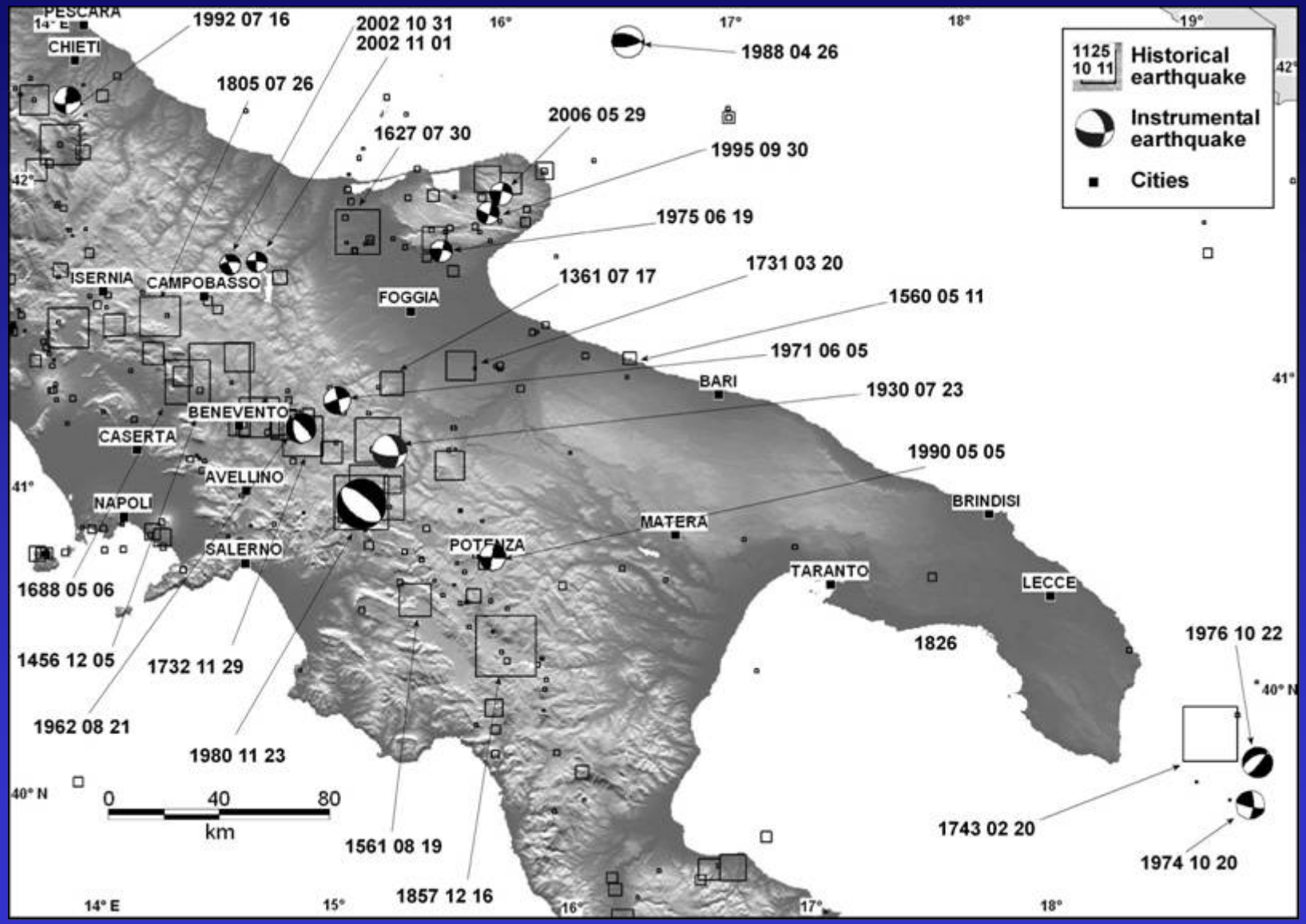
The issue: Is the Gondola Line active ?

- The 2002 Molise seismic sources are located along the western part of a regional fault system, the Molise-Gondola shear zone (MGsz; *Di Bucci et al., Tectonics, in press*)

- On land, this system is mainly represented by the Mattinata Fault, with a polyphase activity since the Mesozoic. Present-day activity with right-lateral motion is confirmed by recent seismicity (1975, 1995 and 2006 earthquakes), GPS data, geomorphological and paleoseismological data

- Off-shore, the Mattinata Fault is aligned with the regional, E-W to NW-SE oriented Gondola Line. Its multi-history deformation pattern closely resembles the long-term complex evolution of the Mattinata Fault, except for the lack of significant seismicity

Main historical and instrumental seismicity



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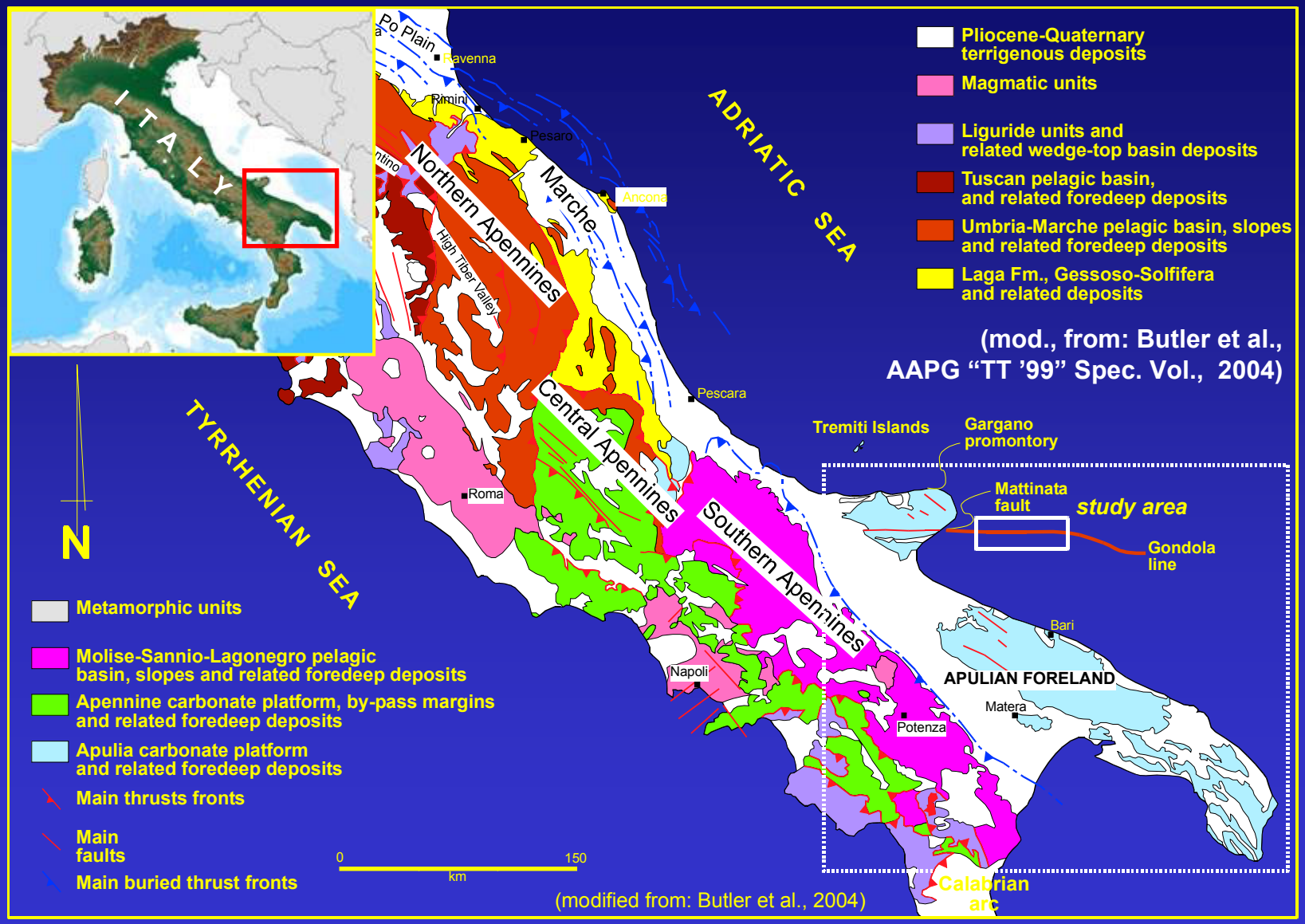
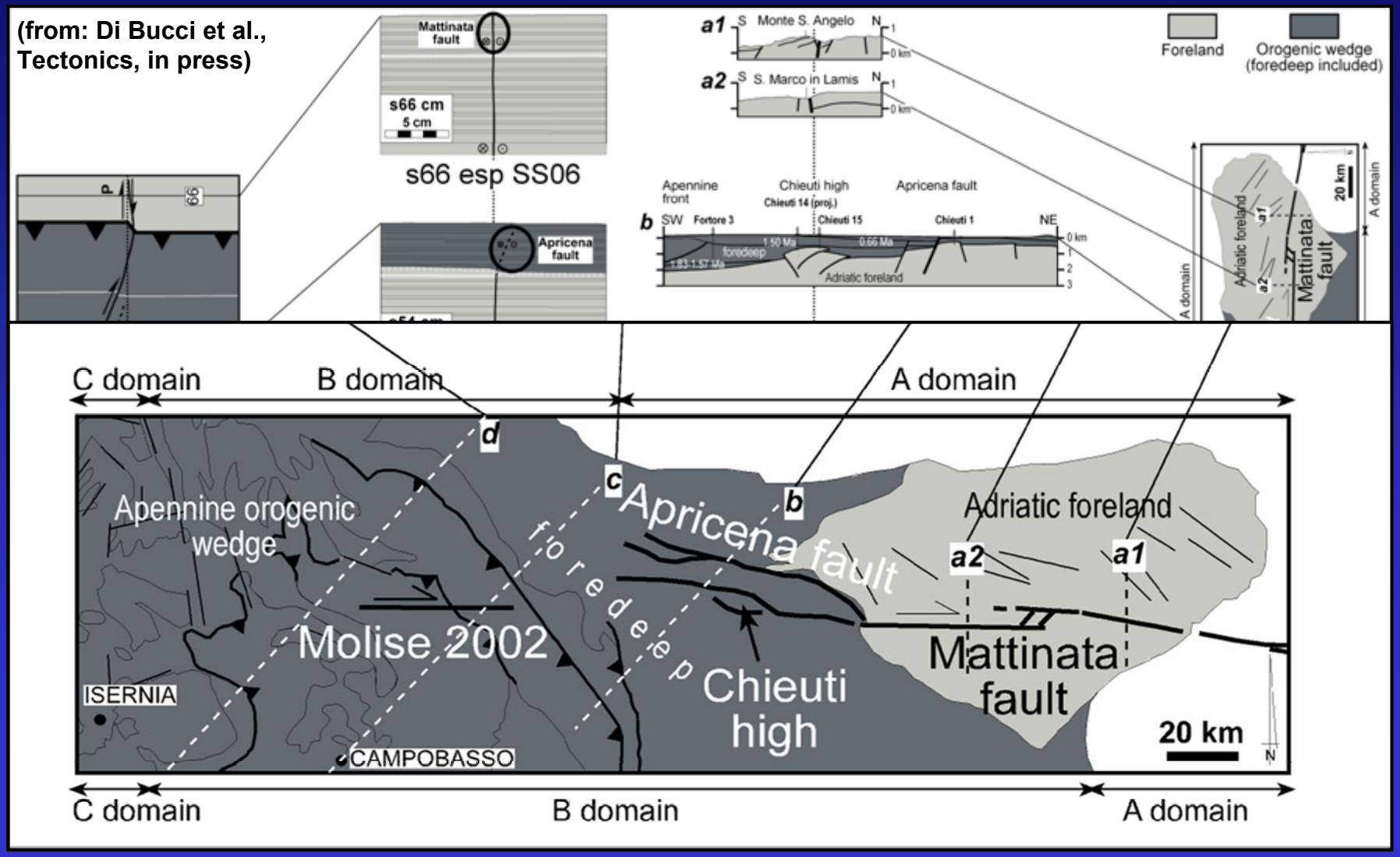
(from: Di Bucci et al., Tectonics, in press)h

Main geological features of southern Italy

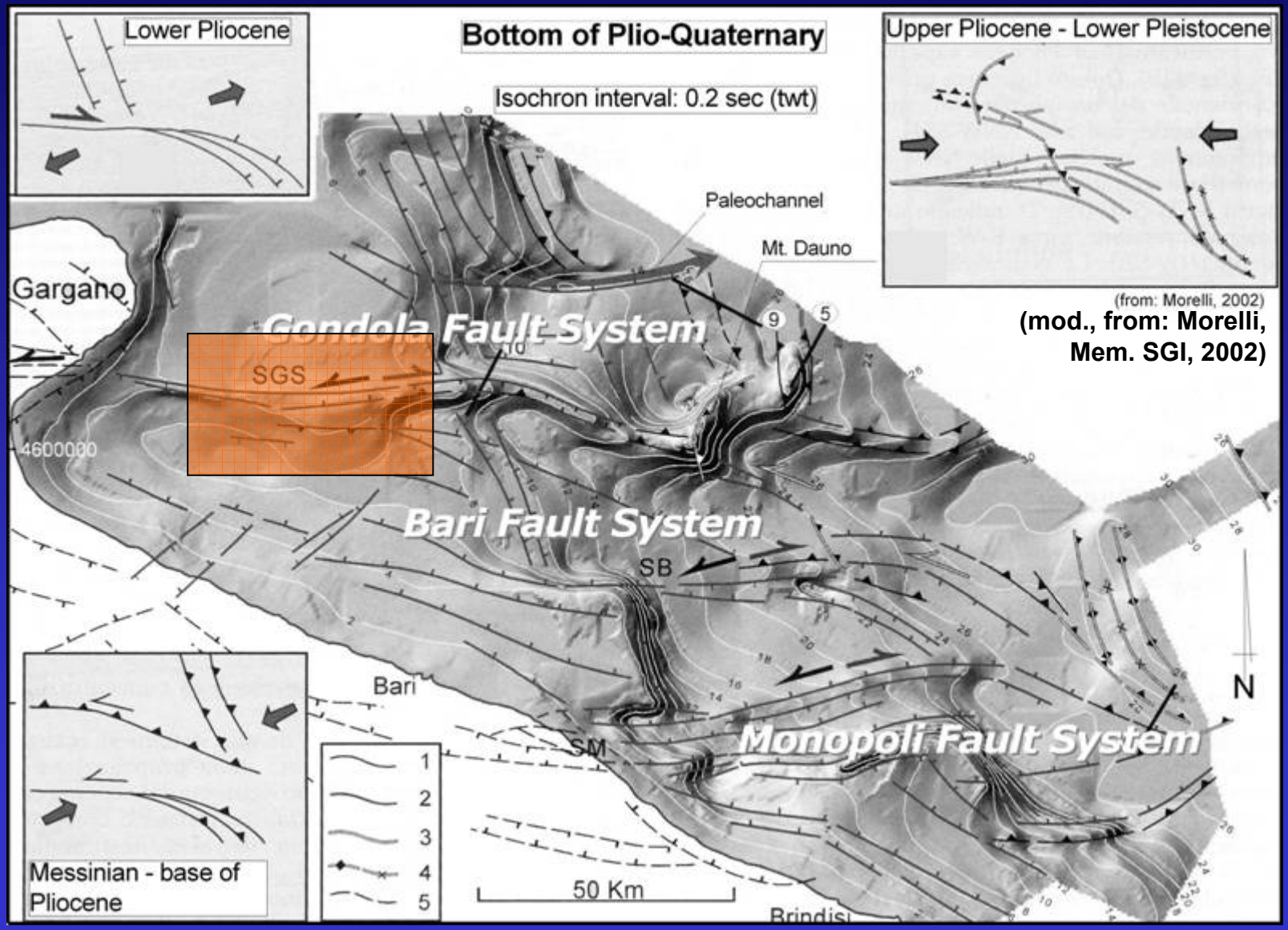


Analogue experiment of the right-lateral reactivation of the Mattinata-Gondola sz

(from: Di Bucci et al., Tectonics, in press)



Regional shear zones offshore Apulia



(from: Morelli, 2002)

(mod., from: Morelli, Mem. SGI, 2002)

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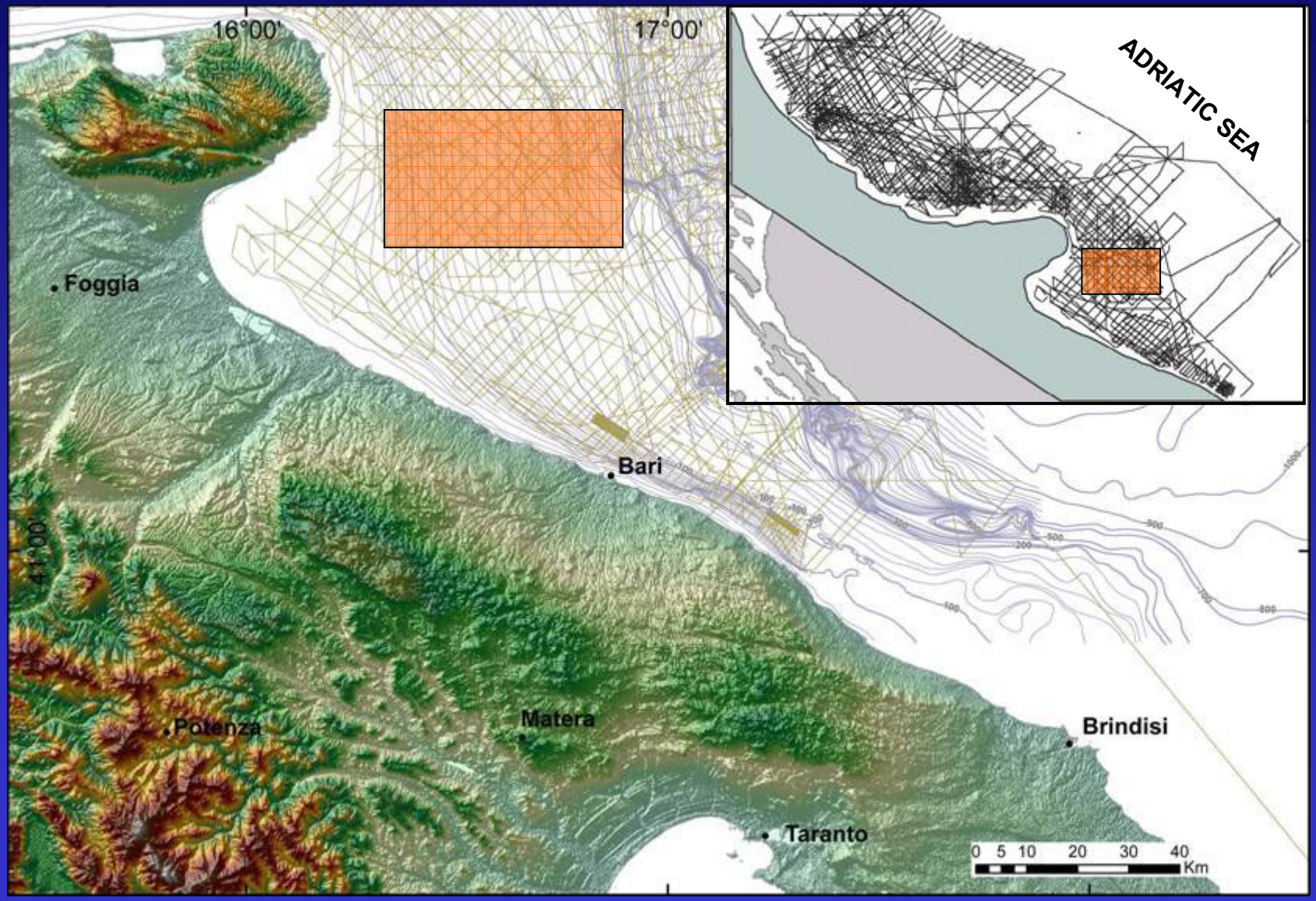
Our dataset – on map



Our dataset – characteristics

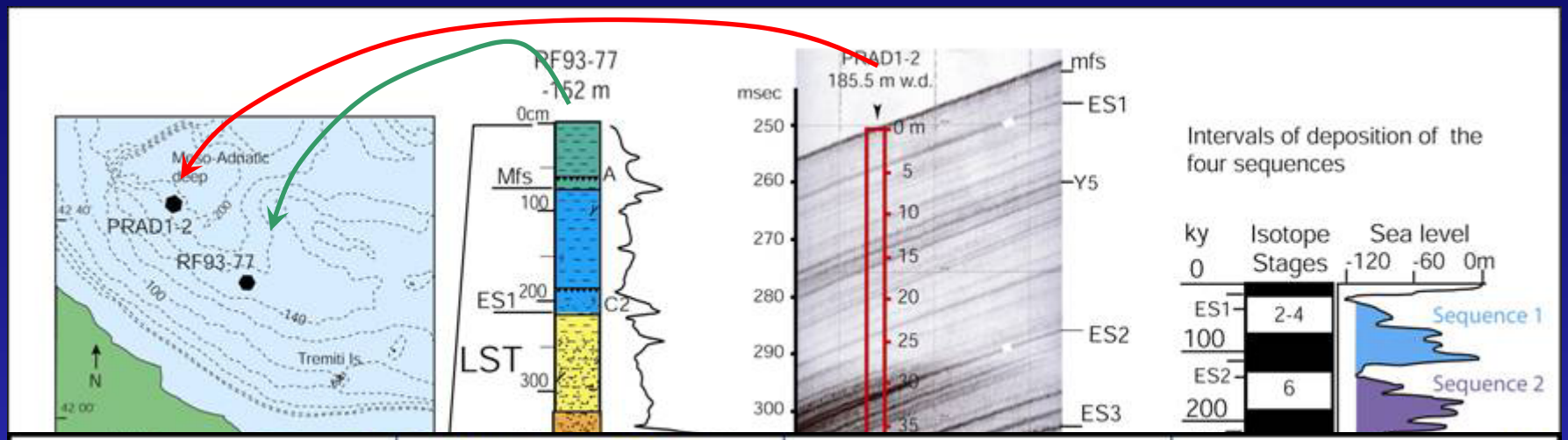
- A network of high-resolution seismic profiles (2-7 kHz Chirp-Sonar, 3.5 kHz Sub-bottom, 500 joule Uniboom, 1 kjoule Sparker) and core data

- Chirp-Sonar seismic lines, with very high vertical resolution (ca. 50 cm) and vertical exaggeration up to 100 times

- Sedimentological and chrono-stratigraphic constraints provided by sediment cores and borehole (PRAD 1-2)

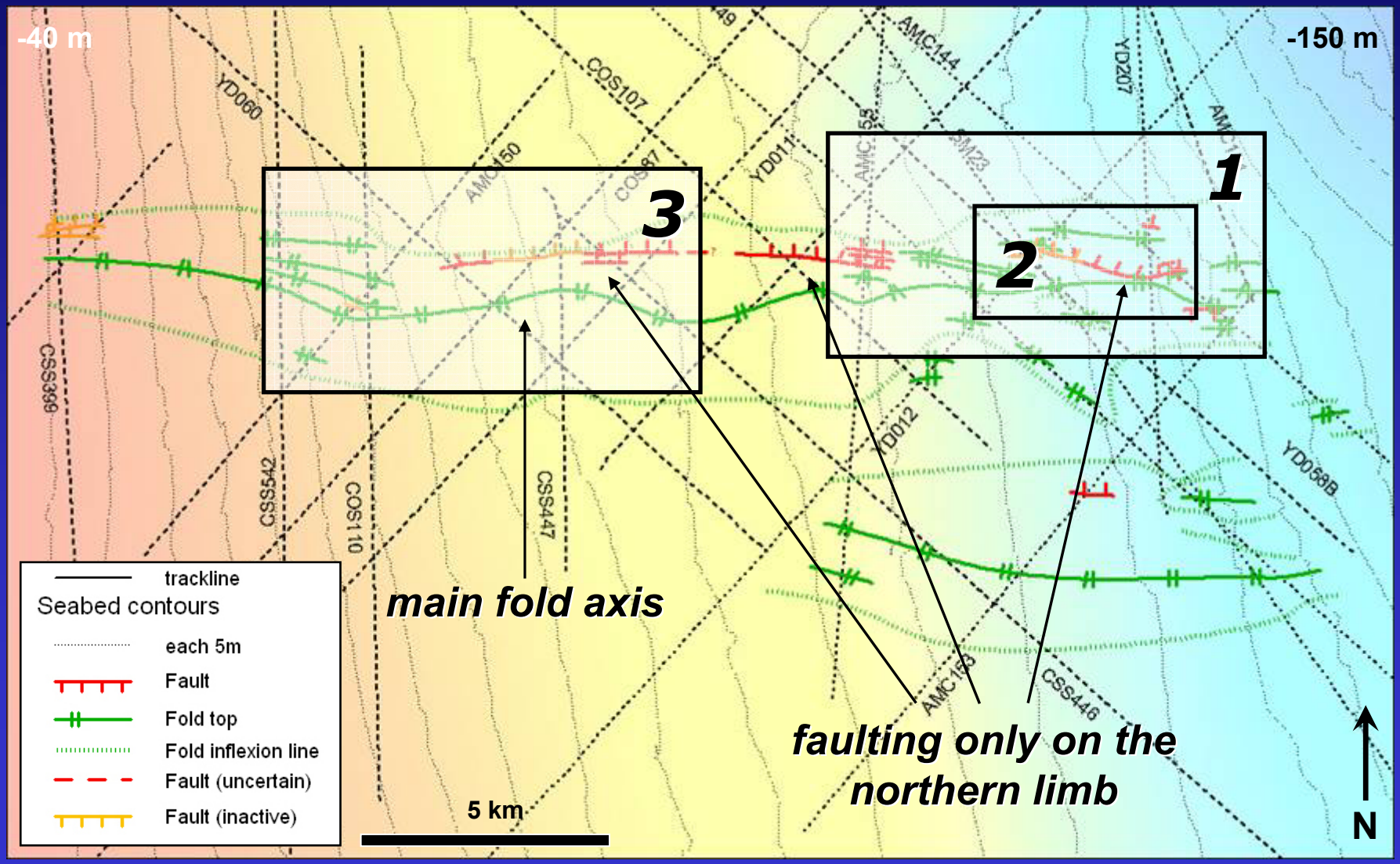
- This dataset allows to investigate the upper 80-100 m of the Quaternary succession, i.e. the middle-late Pleistocene and Holocene interval

Depositional sequences

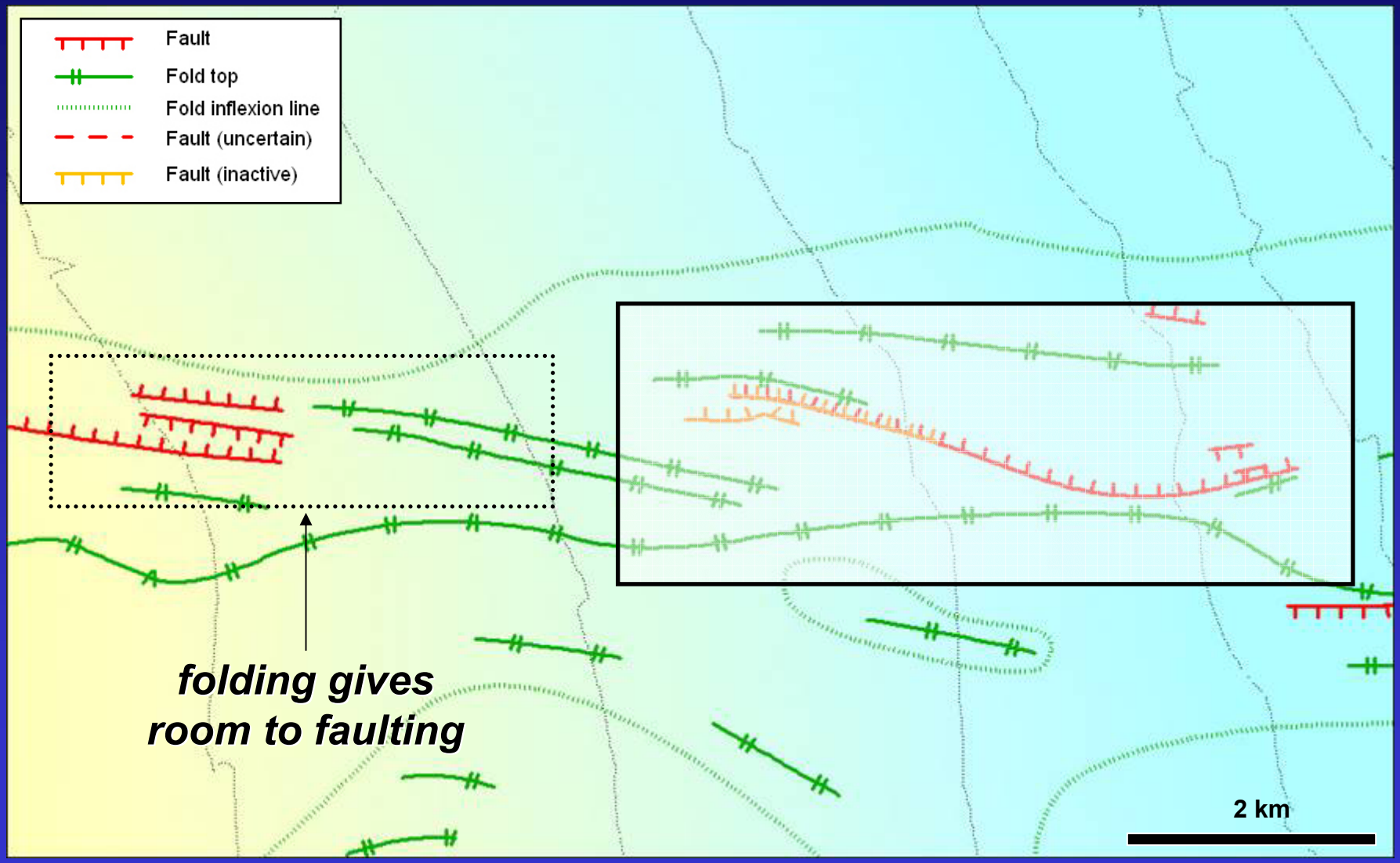


Sequence	Oxygen Isotope Stage	Age (ka)	Erosional Surface
		Present-day – 20/30	
			ES1
Sequence 1	OIS 2-6	20/30 – 130/140	
			ES2
Sequence 2	OIS 6-8	130/140 – 230/250	
			ES3
Sequence 3	OIS 8-10	230/250 – 330/350	
			ES4
Sequence 4	OIS 10-12	330/350 – 430/450	
			ES5

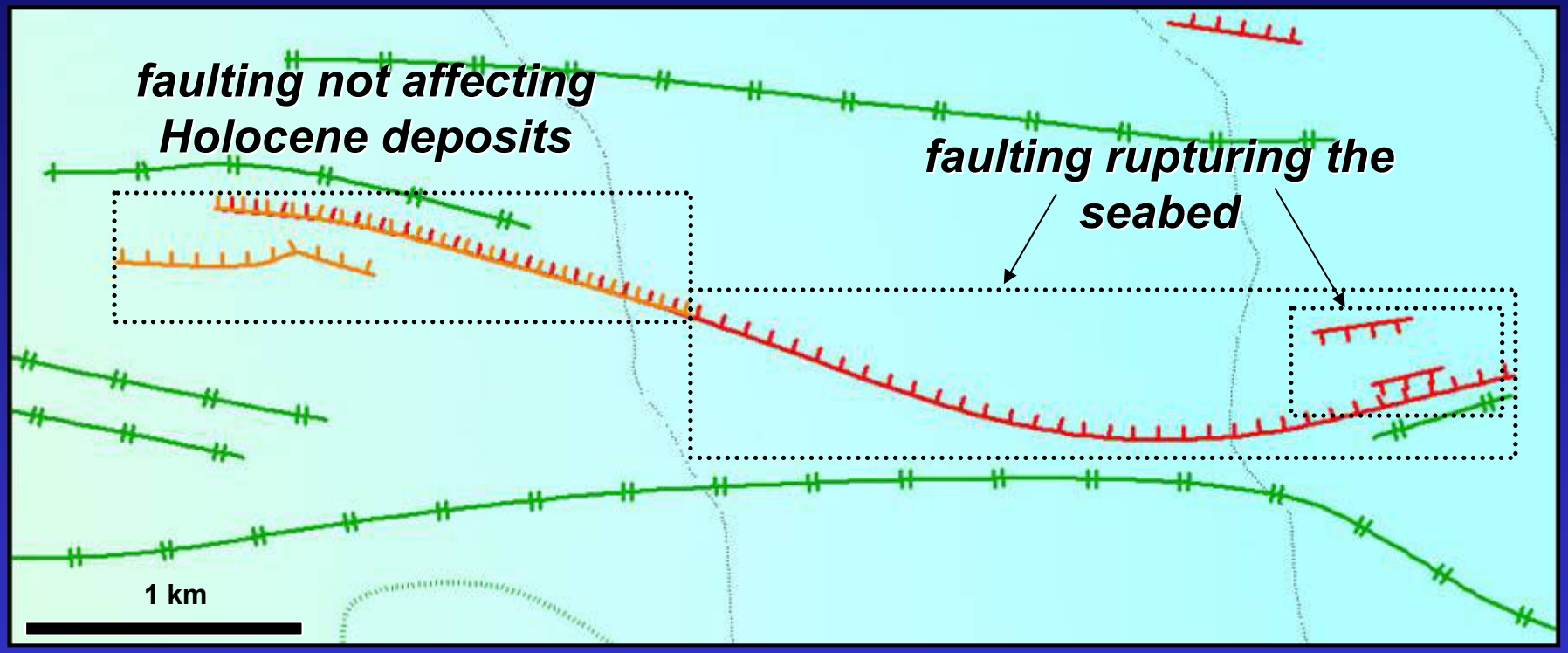
Structural map – summary

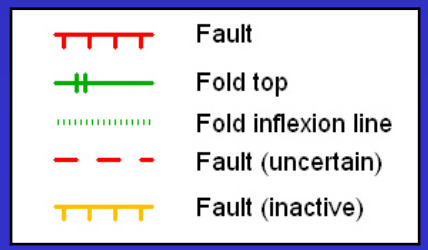


Close-up on structural map – *1*

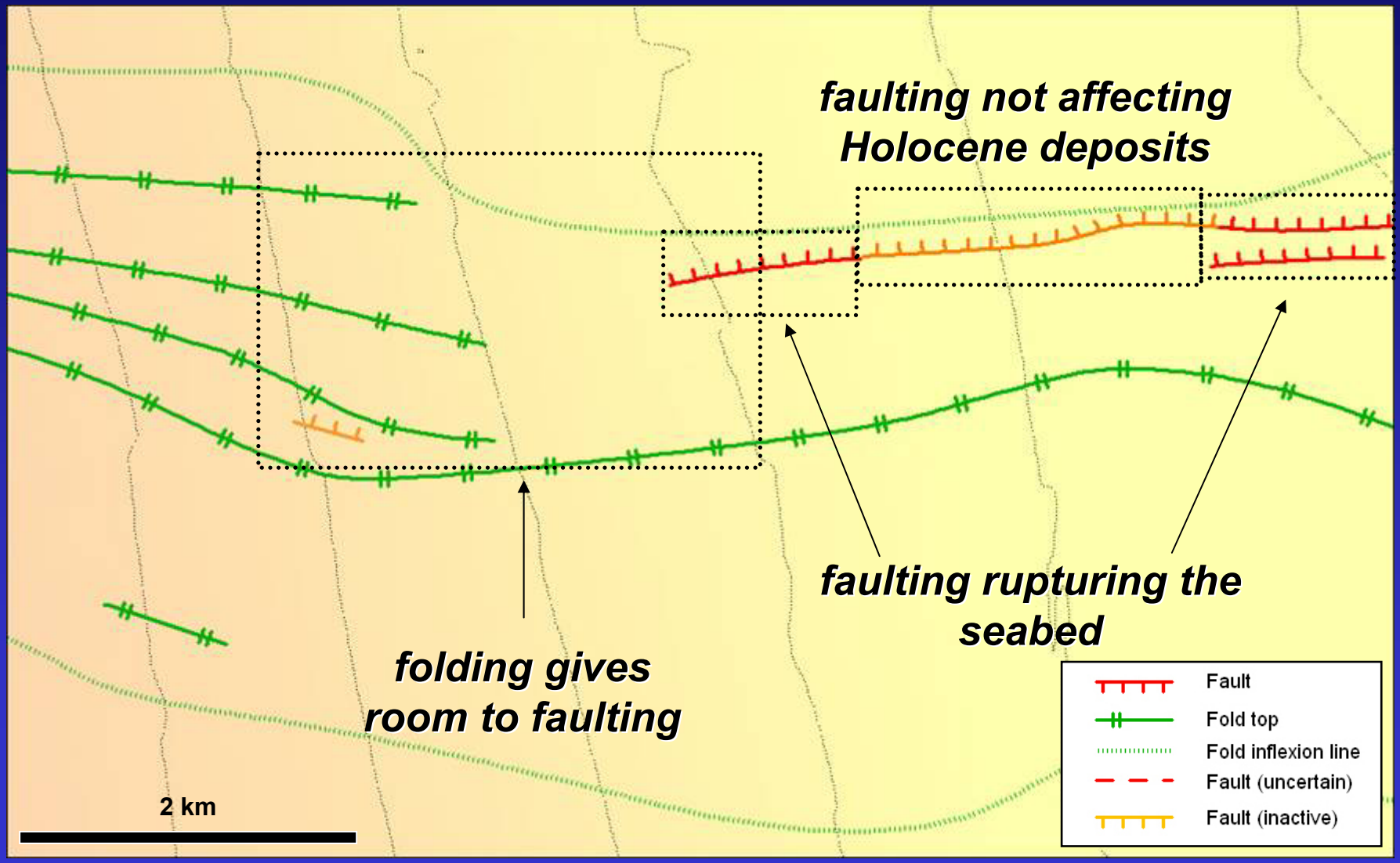


Close-up on structural map – *2*

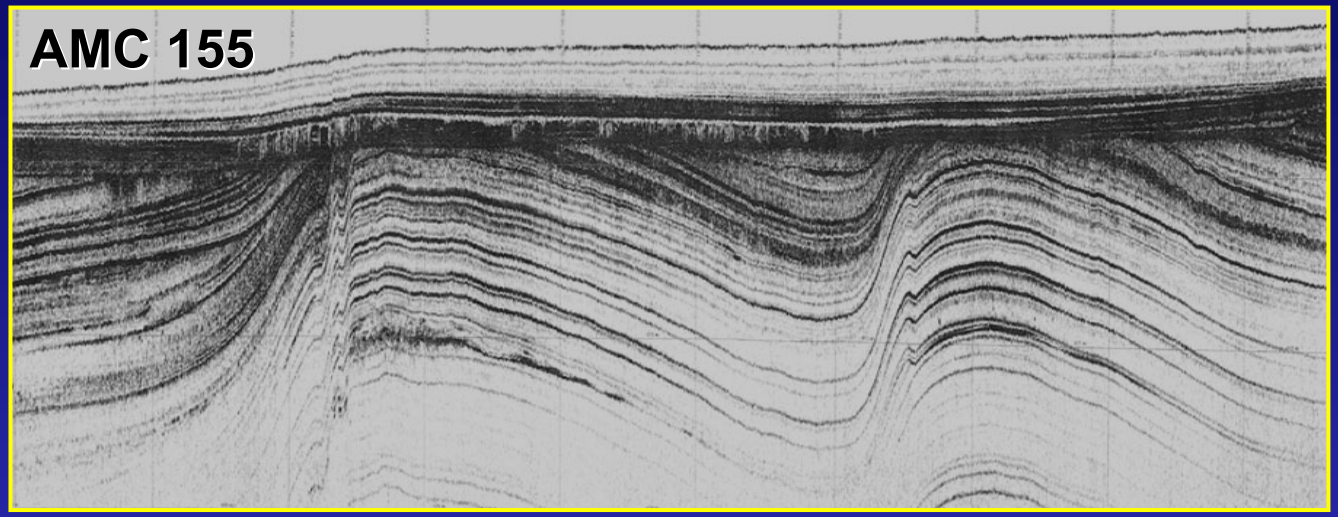




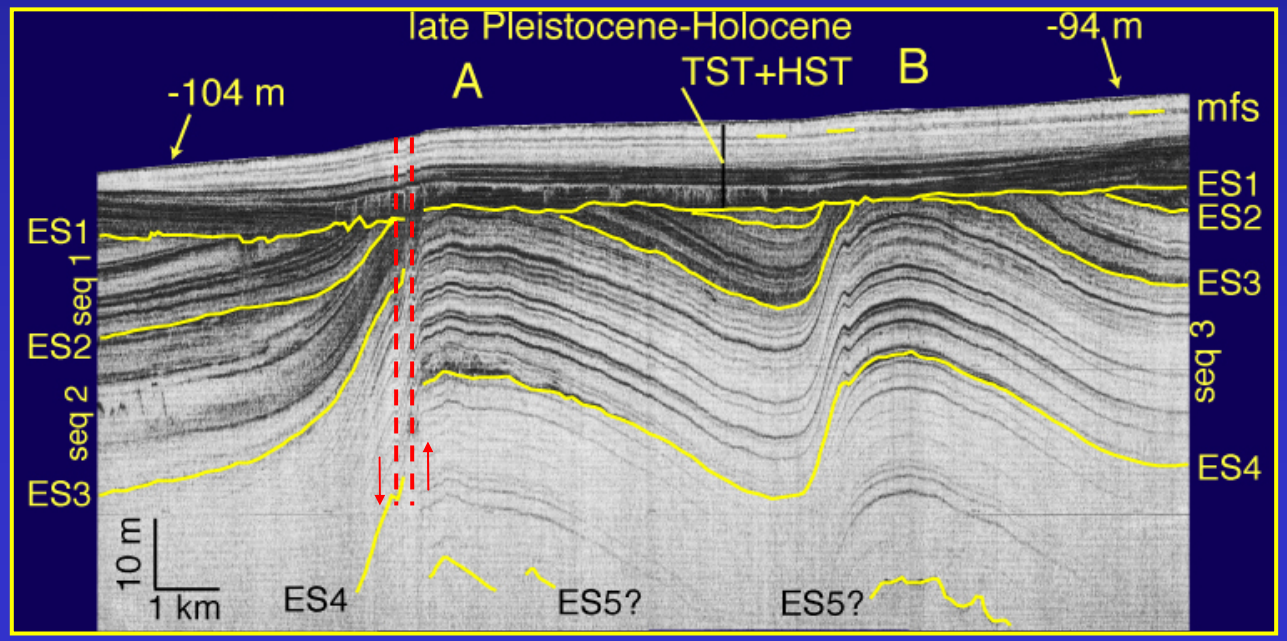
Close-up on structural map – *3*



An example of our VHR Chirp data

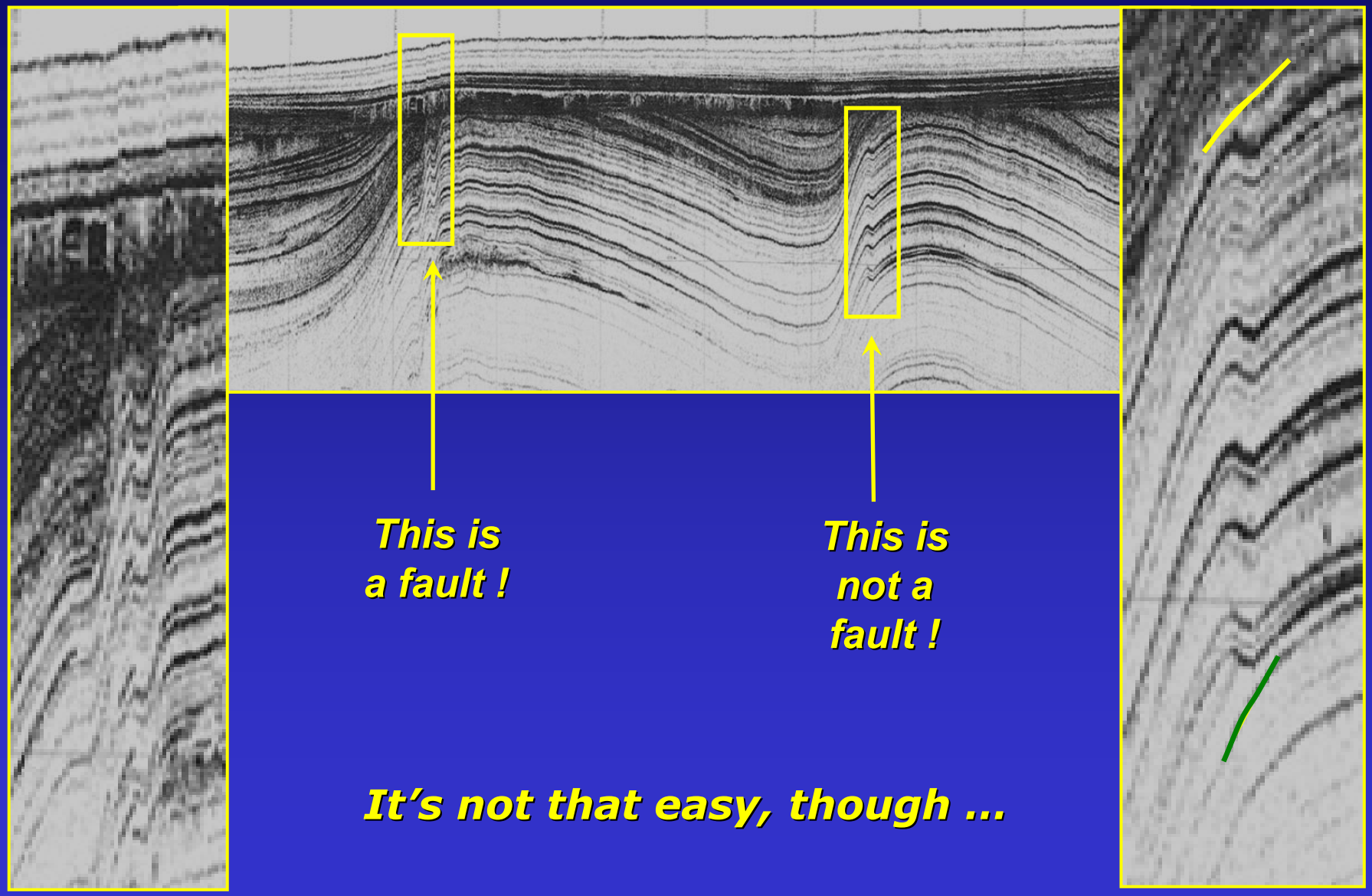


NNE

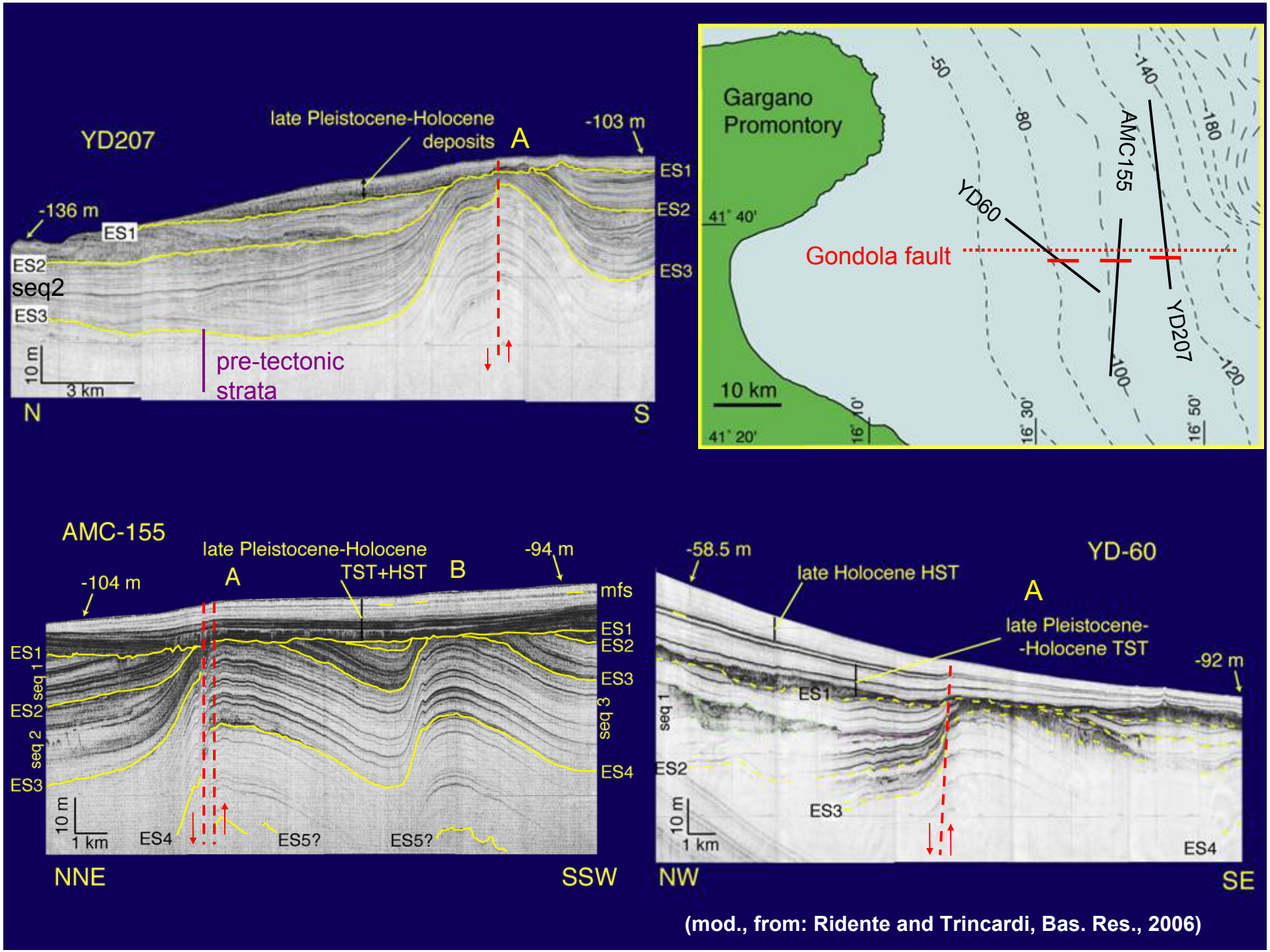


SSW

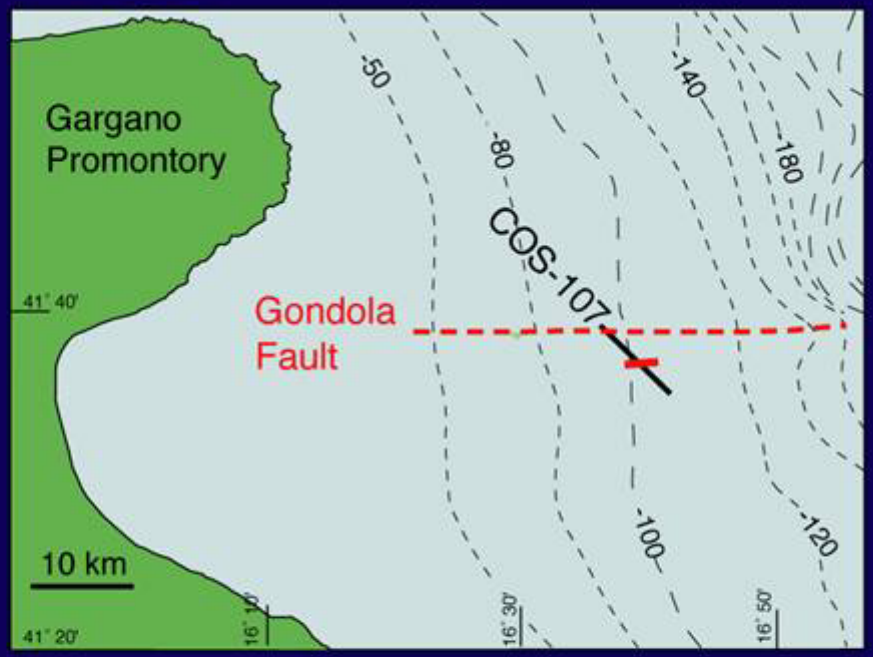
An example of our VHR Chirp data



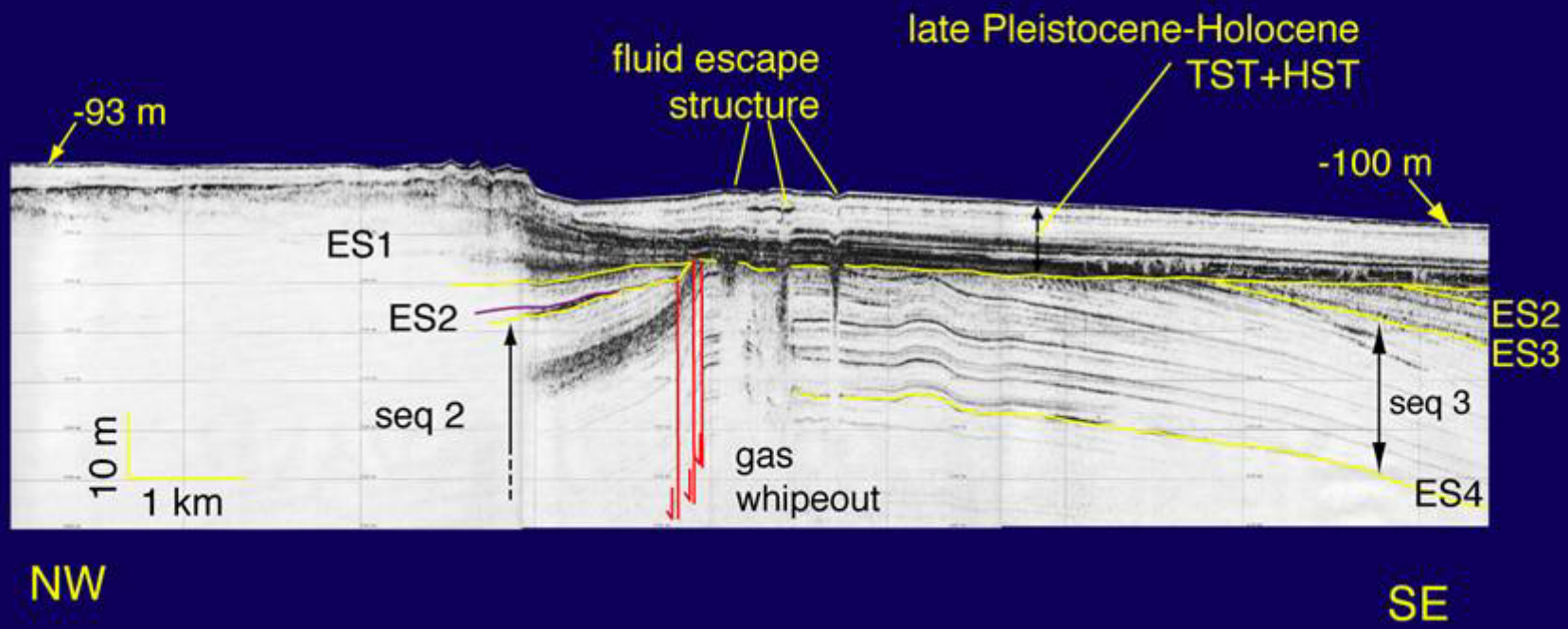
It's not that easy, though …

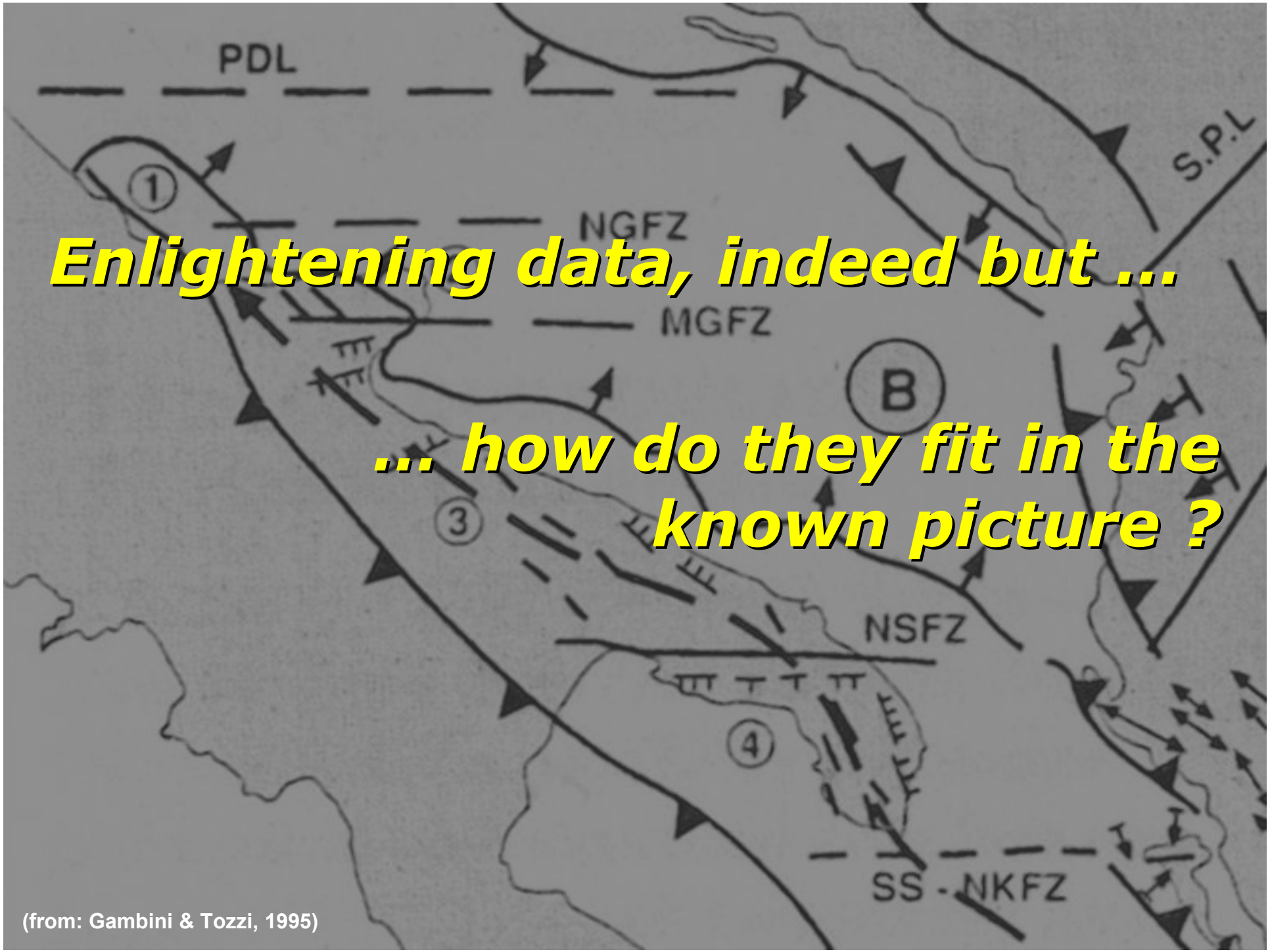


(mod., from: Ridente and Trincardi, Bas. Res., 2006)



COS-107 Chirp Sonar Profile

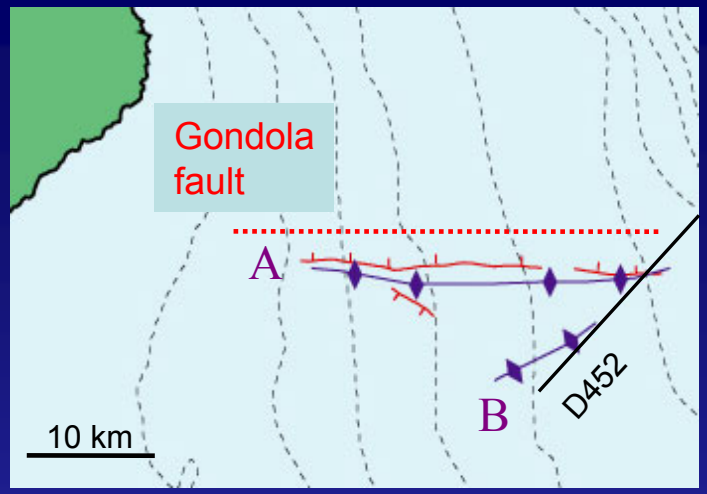


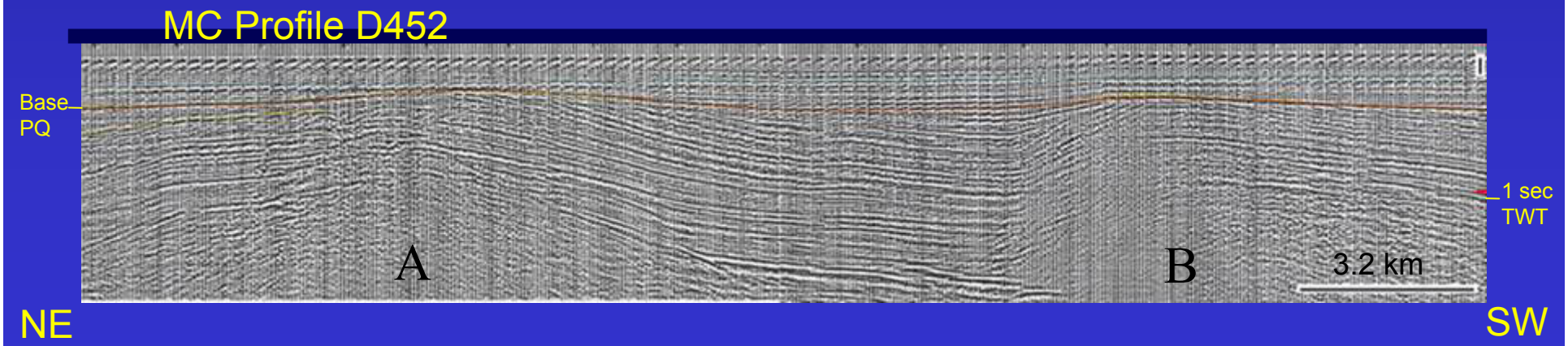


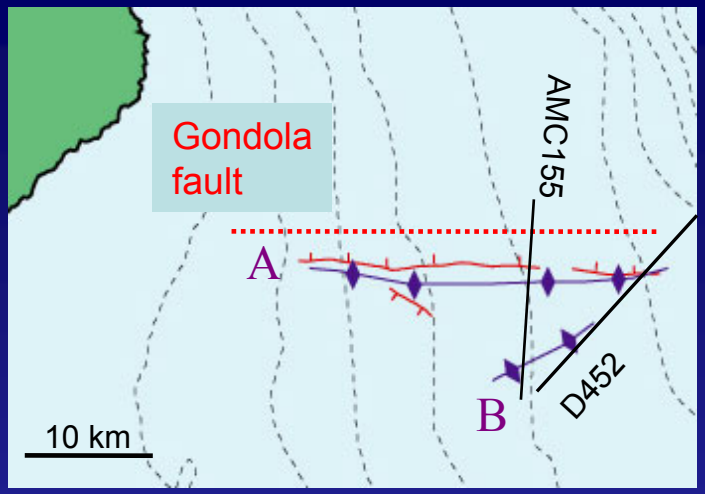
Enlightening data, indeed but ...

... how do they fit in the known picture ?

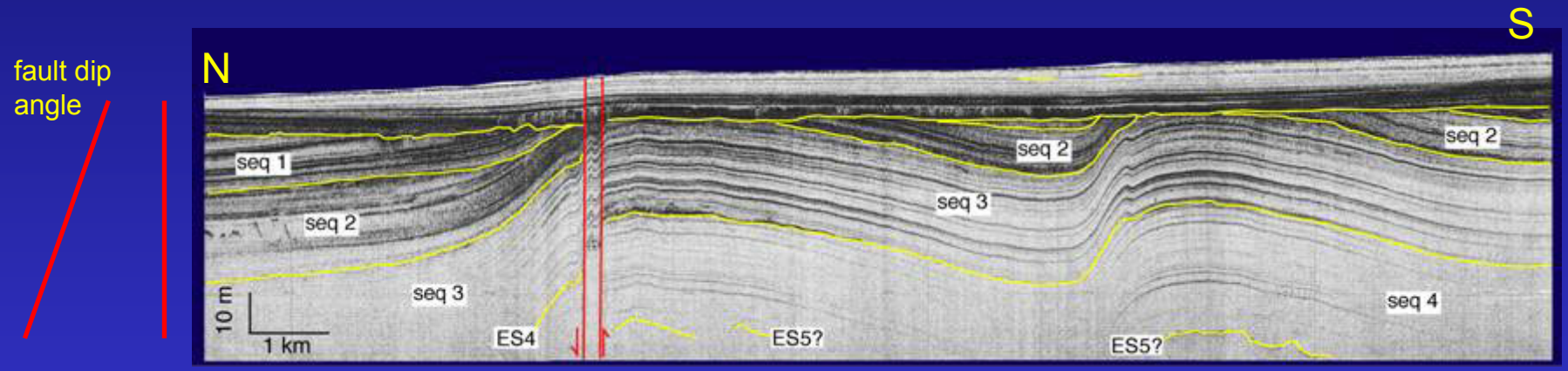
(from: Gambini & Tozzi, 1995)


Gondola
fault
A
B
D452
10 km

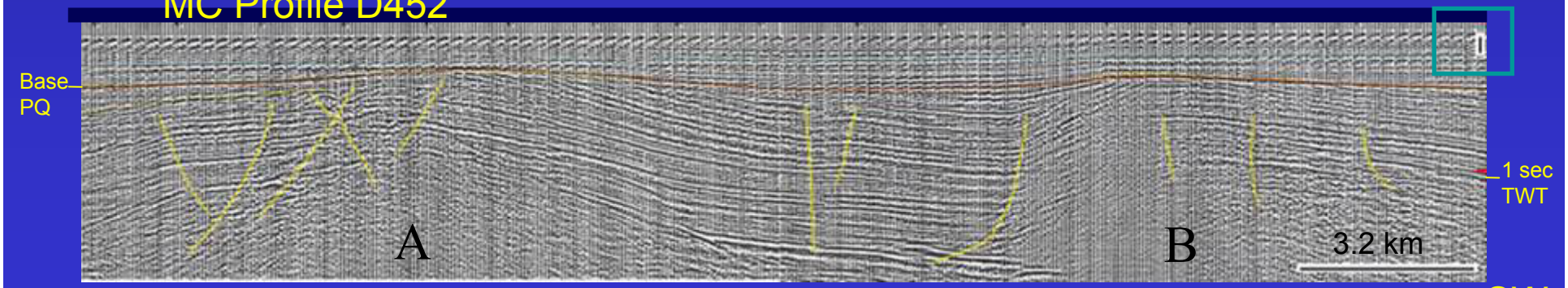

MC Profile D452
Base
PQ
1 sec
TWT
A
B
3.2 km
NE
SW

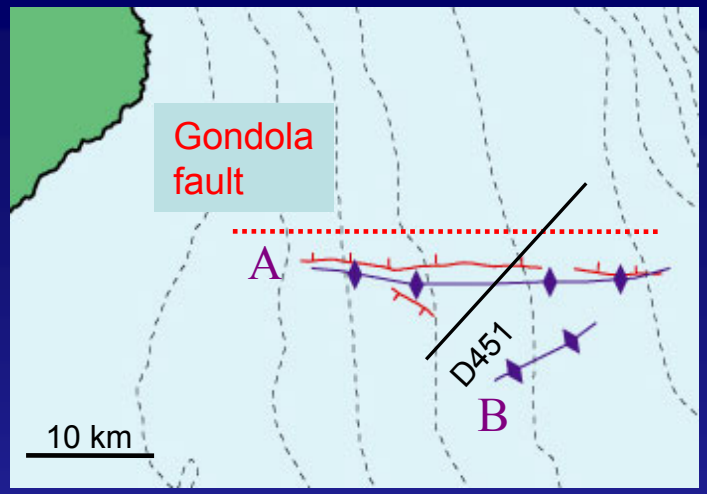


Chirp Sonar Profile AMC-155

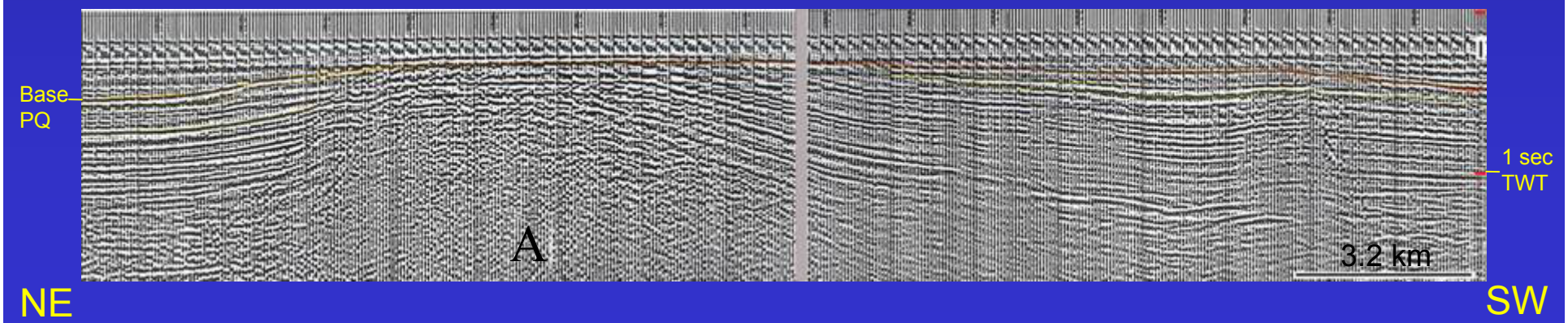


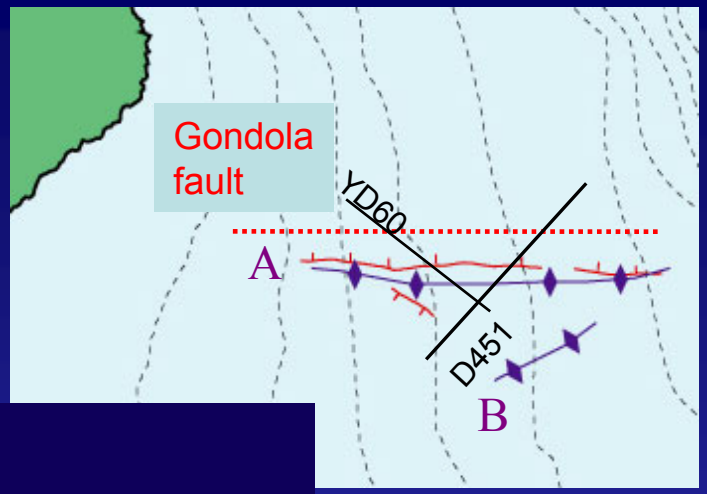
MC Profile D452



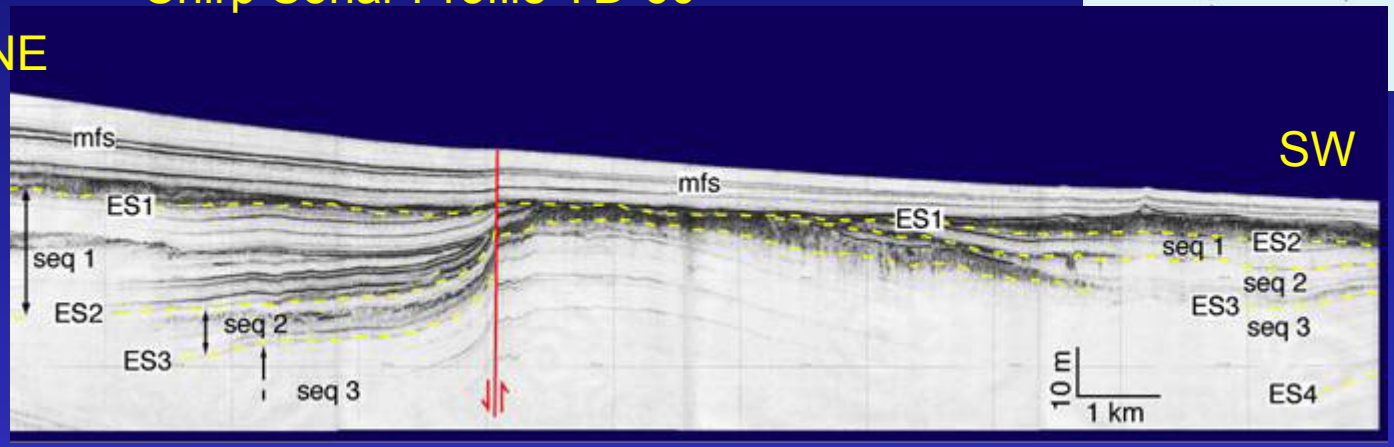


MC Profile D451



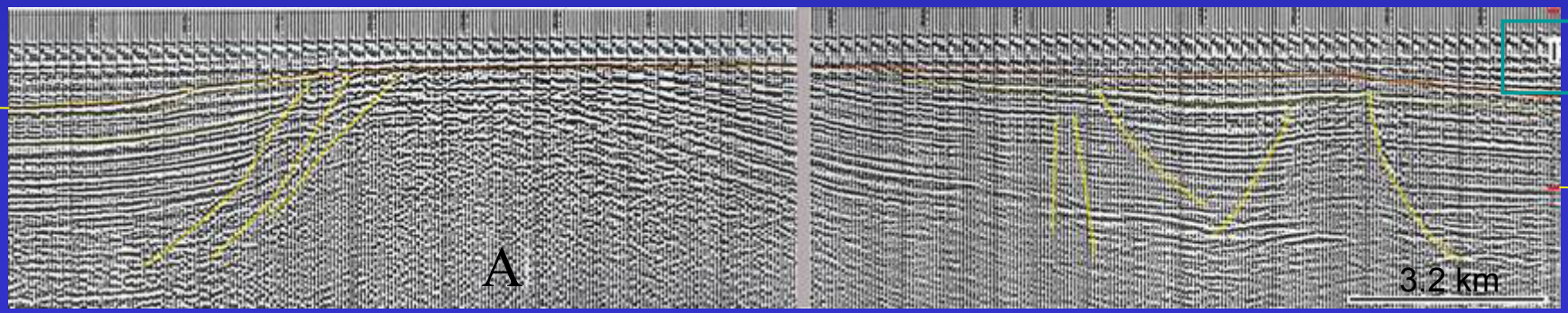


Chirp Sonar Profile YD-60



MC Profile D451

Data gap



NE SW

What can be observed – I ?

- Two main asymmetric similar folds, with E-W-oriented parallel crest lines. The northern limbs, i.e. those slightly more inclined, are also affected by faults

- The northern anticline is more developed, and the deformation affecting its northern limb consists of a set of left-stepping, alternating faults and small anticlines

- Faults exhibit very steep dip and a normal component of motion that causes their northern side to be downthrown to about ten metres

- Mean vertical slip rate for the late Pleistocene and Holocene is ca. 0.05 mm/a. The comparison of the length of these faults with their limited vertical displacement suggests the possible occurrence of a significant horizontal component of motion

What can be observed – II ?

- Deformation pattern affects the middle and late Pleistocene deposits. In some places faults also displace Holocene deposits and the seabed

- The two main fold show comparable shape, wavelength, amplitude, faulted northern limb, and this leads to interpret them jointly as evidence of one deformation system

- Being the Gondola Line located below the analysed structures, we interpret the deformation pattern as due to the reactivation of this major inherited lineament caused by a compressional component of the stress field

So, we are looking at an active fault… close to a well known seismogenic source

- **Seismicity related to E-W dextral strike-slip tectonics along the Mattinata Fault, and very recent (< 5.5 ka) deformation features along the Gondola Line, suggest that the MGsz as a whole is being actively deformed, variably along-strike**

- **Gondola Line shows close affinities with the other parts of the MGsz on-shore. It is an E-W oriented inherited structure, reactivated during the late Pleistocene and Holocene. A strike-slip component of motion can be associated to this structure.**

- **The Gondola activity can be due to a stress field that, like in the case of the Mattinata fault and 2002 Molise earthquakes sources, is compatible with the NW-SE-oriented Africa-Europe convergence. Considering the seismogenic nature of the other parts of the MGsz, one can hypothesize the same behaviour also for the Gondola Line.**


Just A Quick
Note To Say
THANKS!
Thank you
earthprints
repository
http://www.earth-prints.org