Geometry, timing and consequences of subduction processes in the Pamir and Hindu Kush regions

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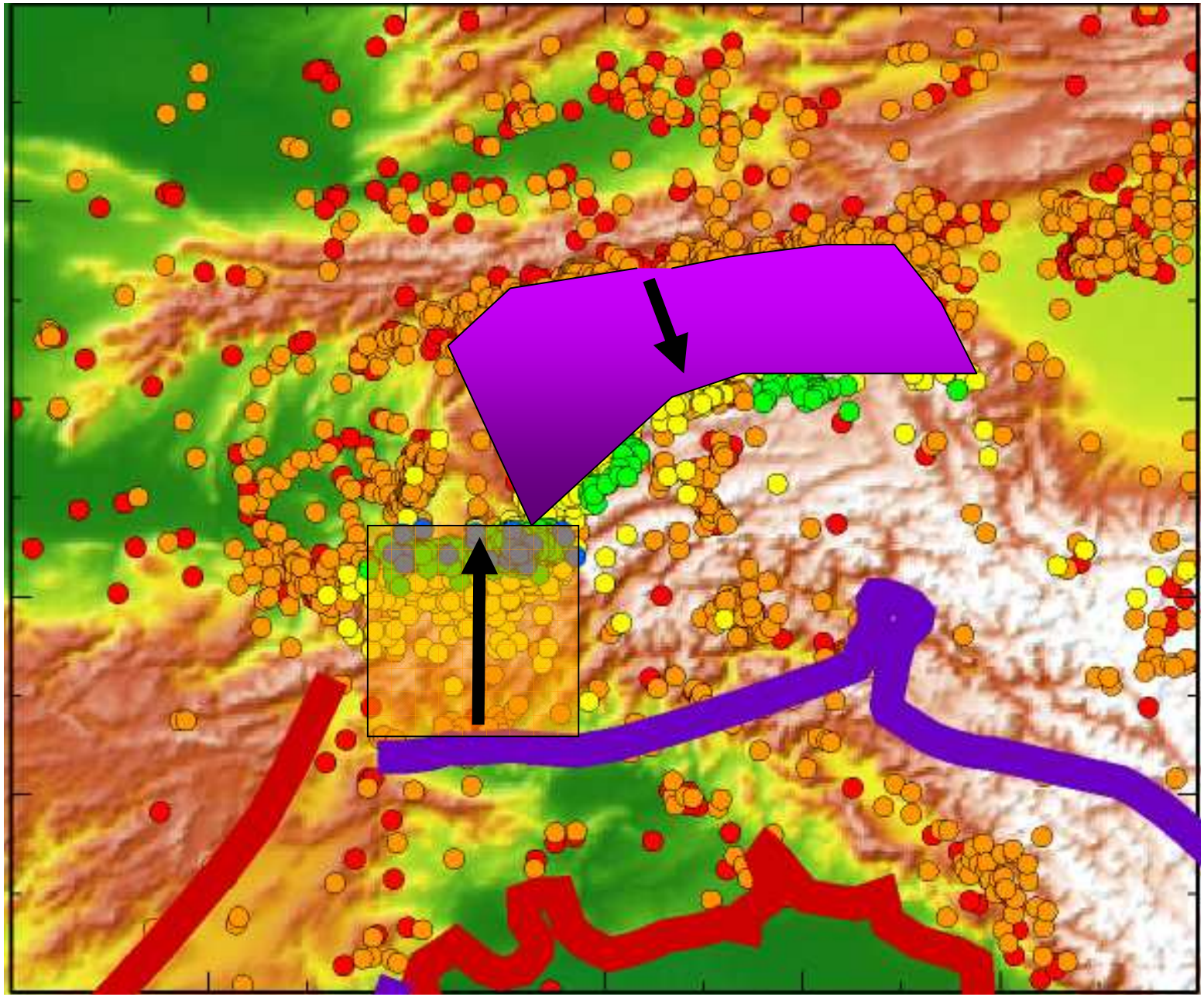
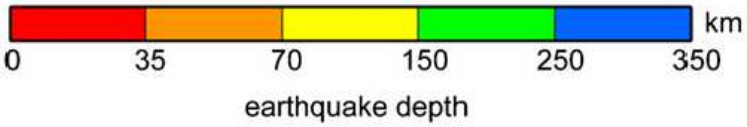
SCIENCES TECHNOLOGIE MEDECINE

cnrs INSU
Observer & comprendre

Asian slab
Dipping southward

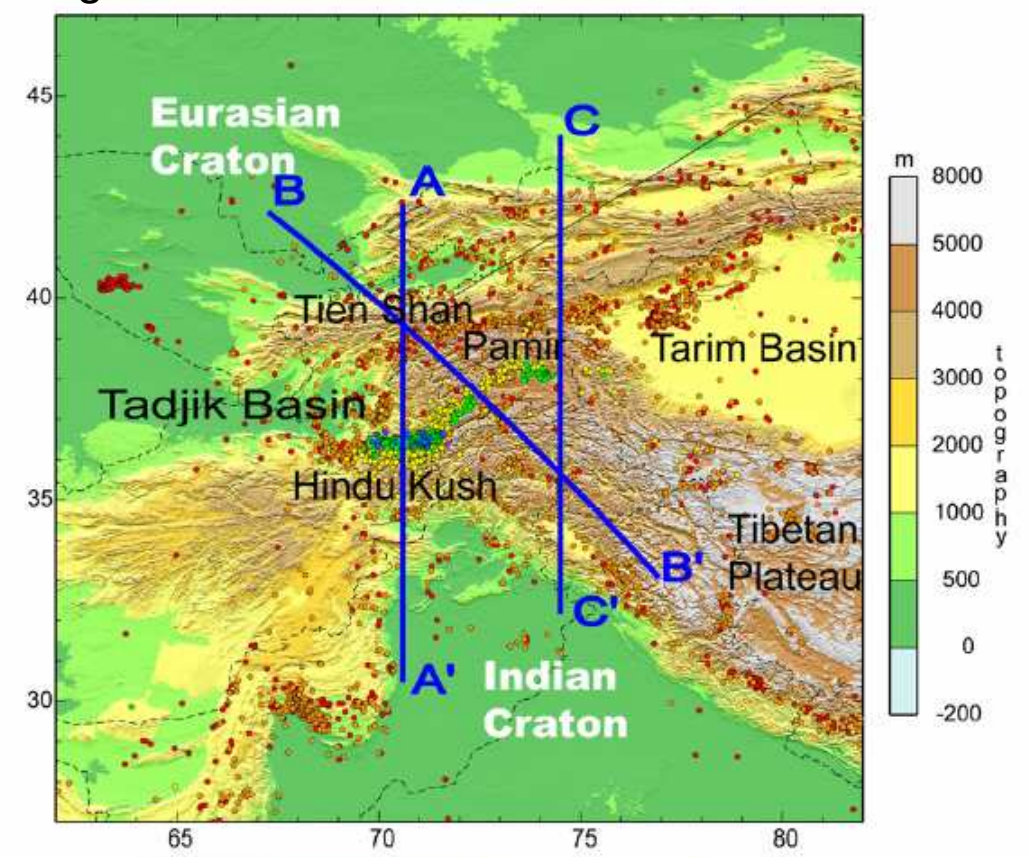
Indian slab
Dipping northward

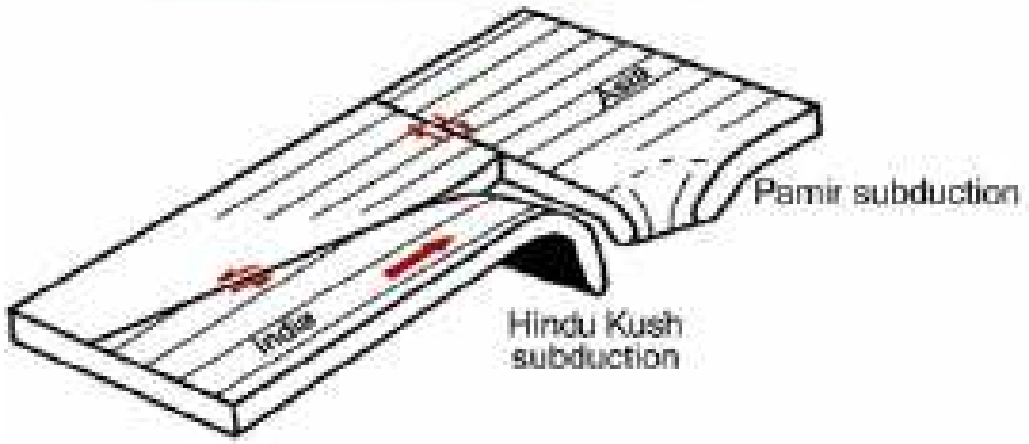


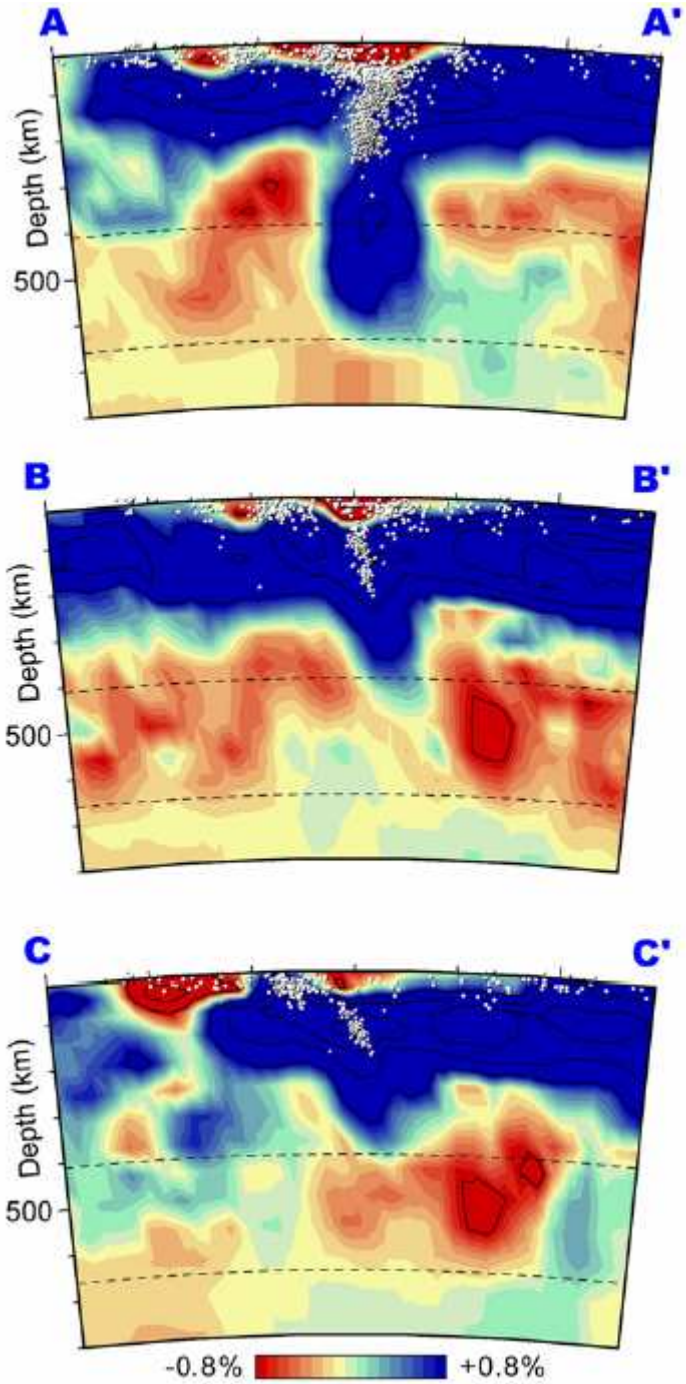


Seismotectonic map of Pakistan

Negredo et al, EPSL, 2007

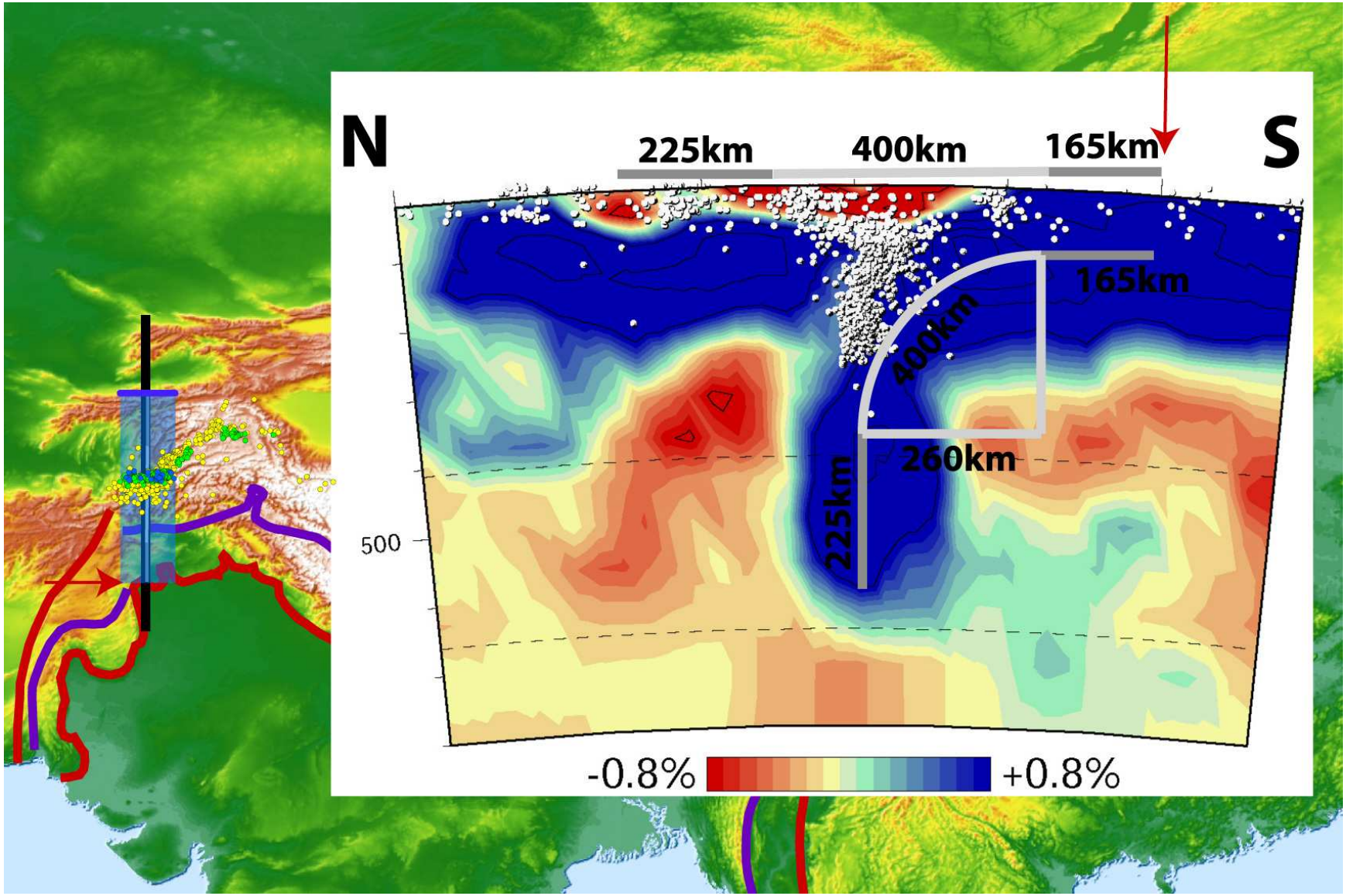




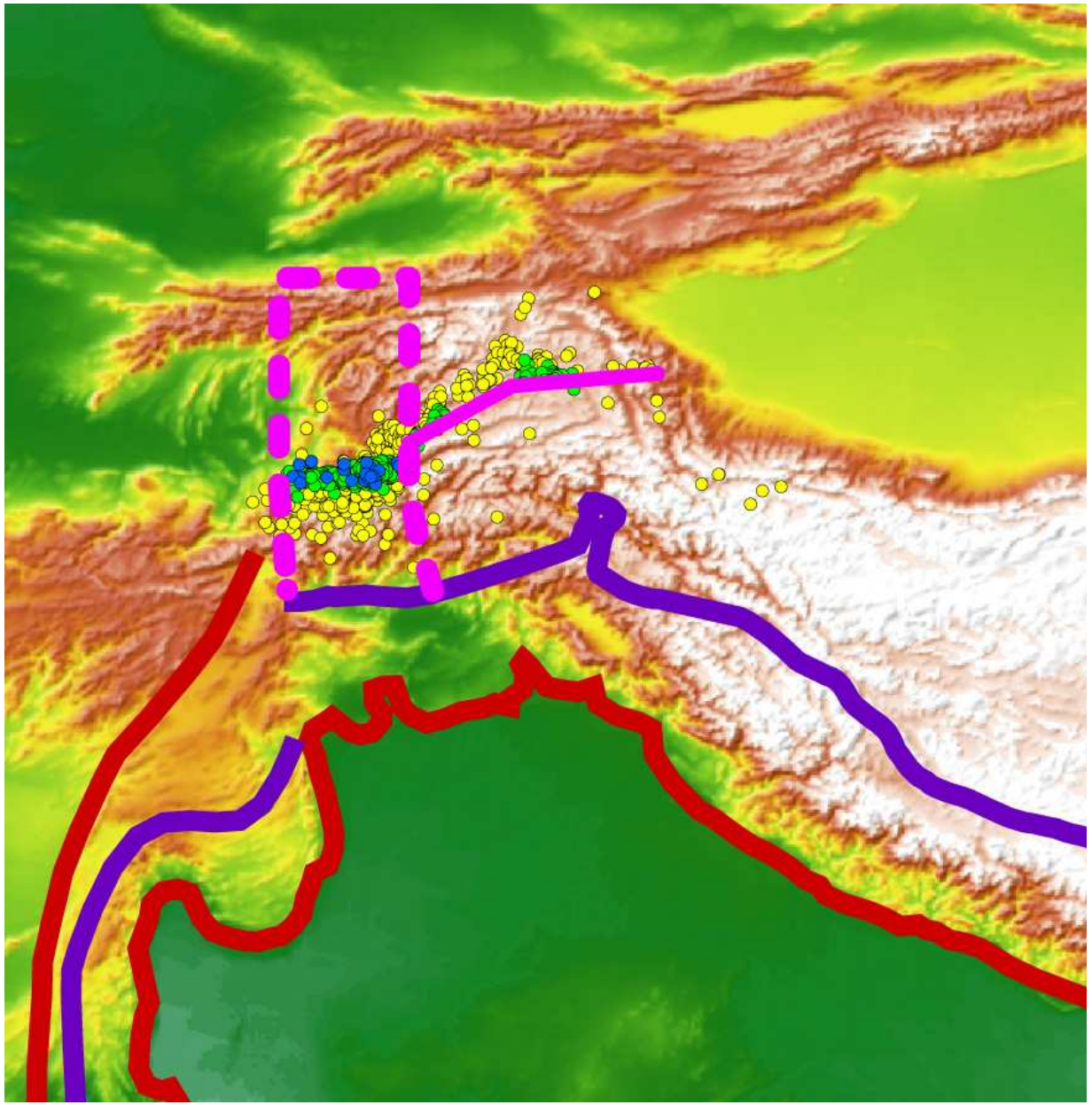


Tomographic cross-sections from **Villaseñor et al., 2003**

Negredo et al, EPSL, 2007

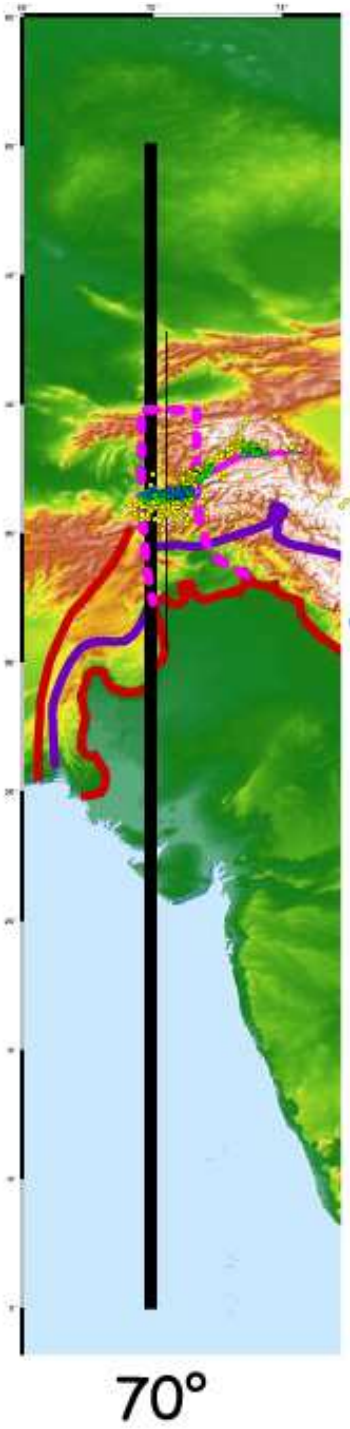


Roll back to horizontal of the indian slab

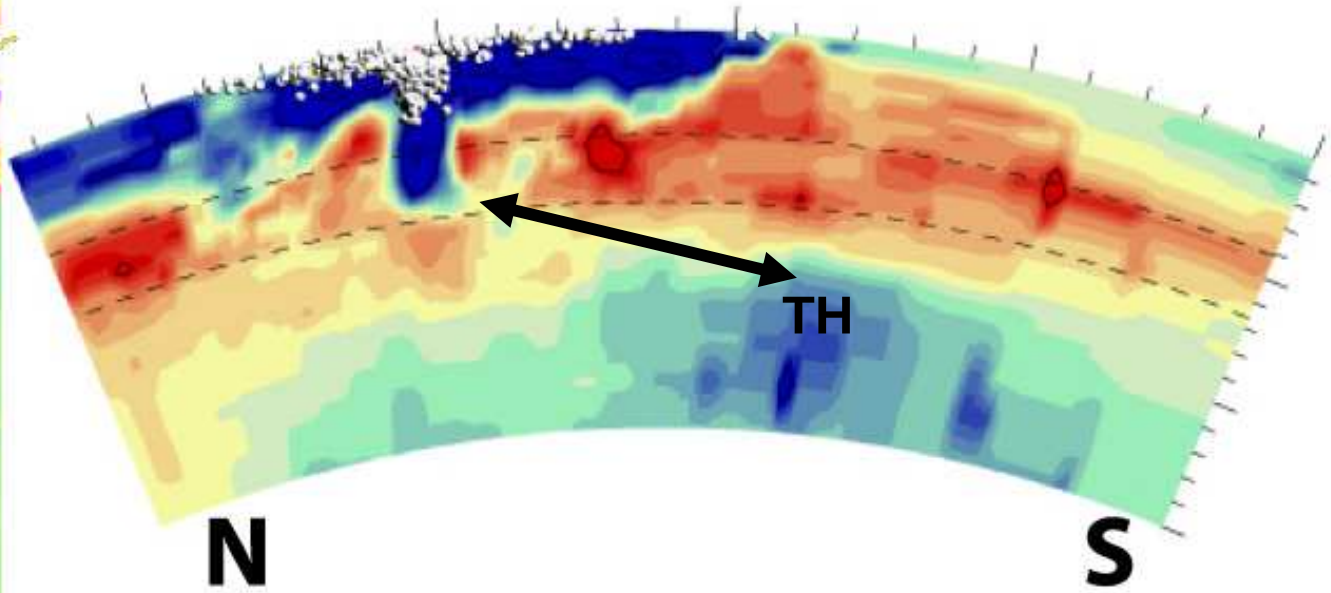


A « slab finger » rolls back to horizontal,

showing the local maximum northern extend of the indian lithosphere



Slab breakoff

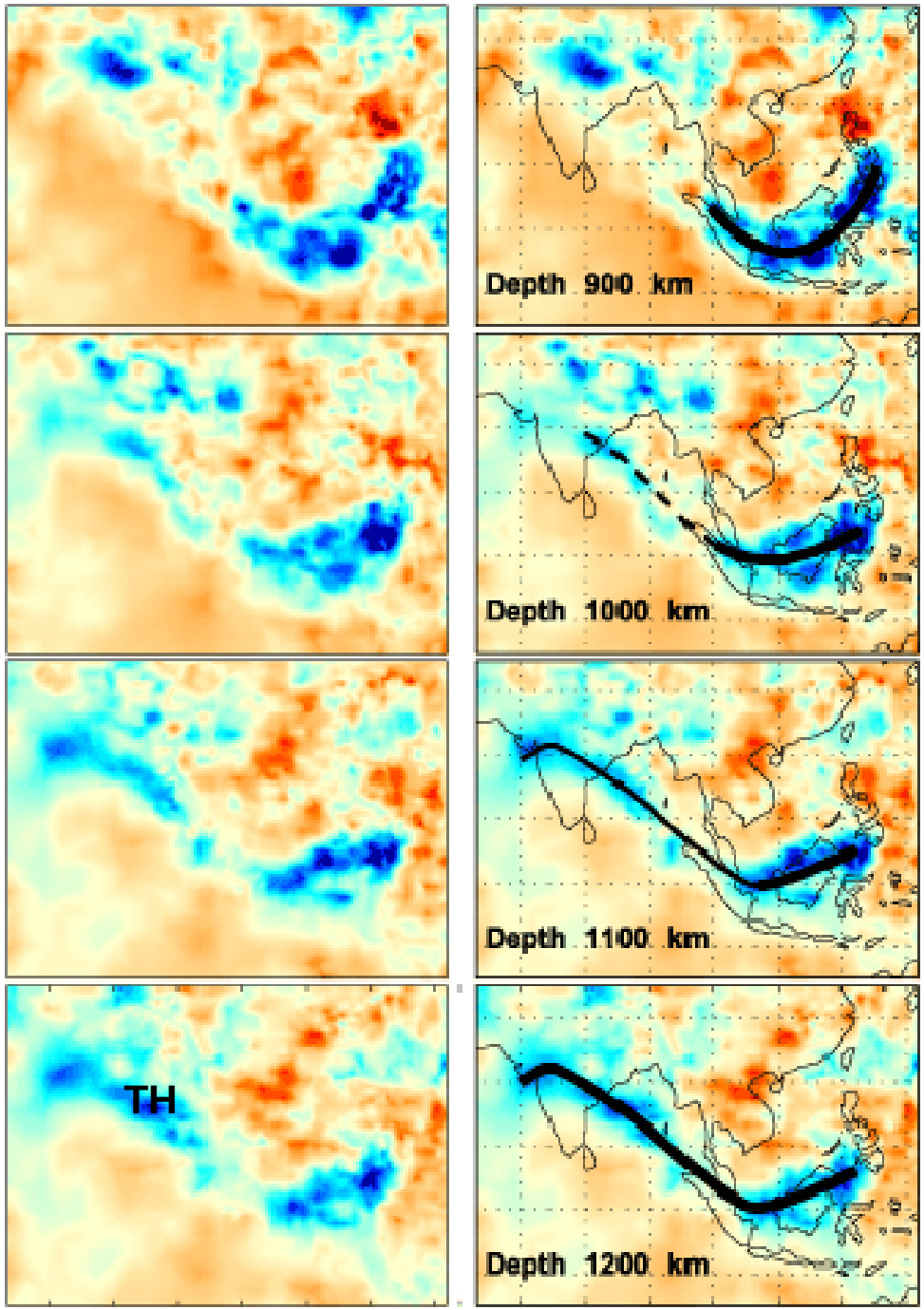


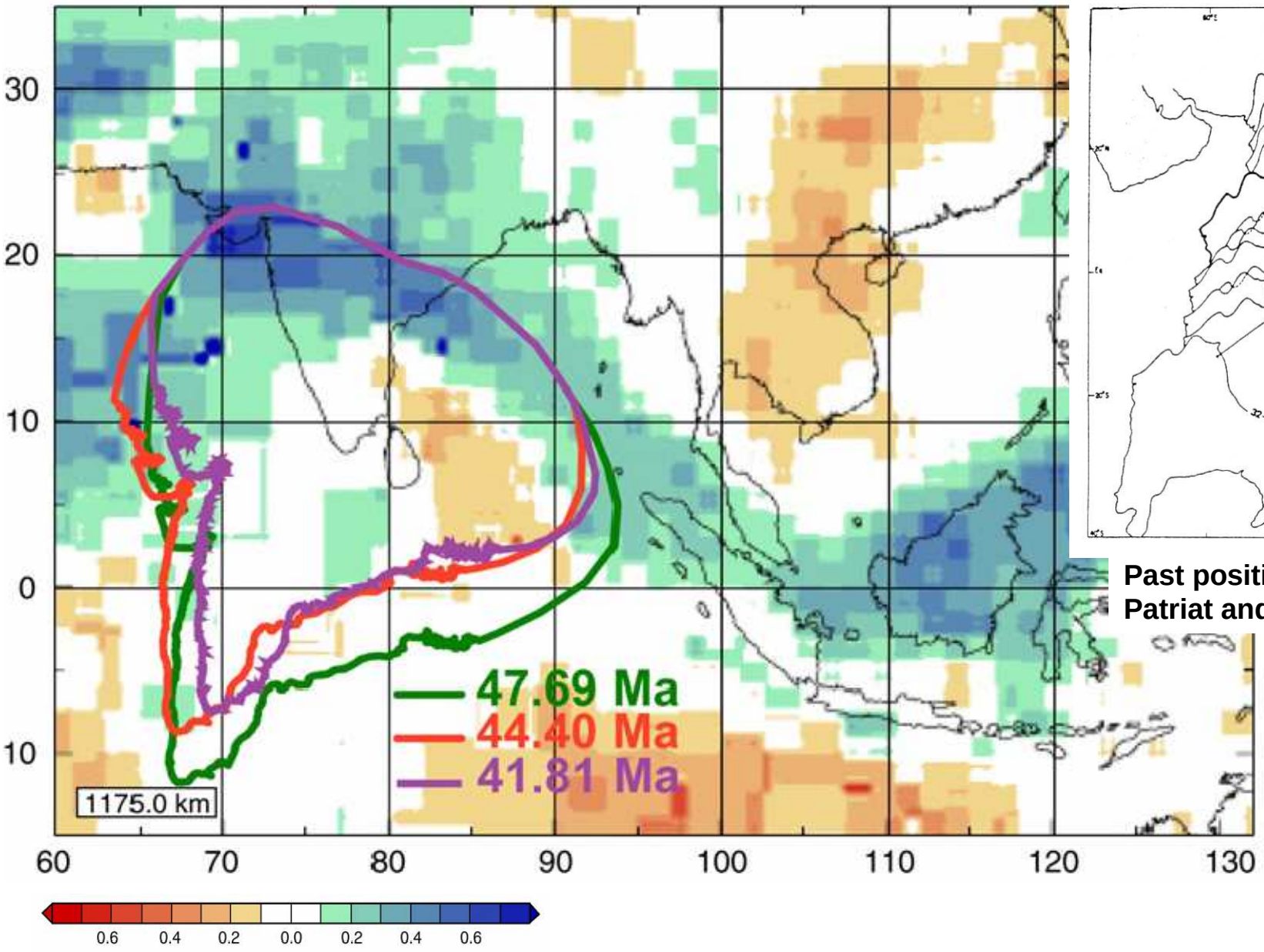
TH, marking the locus of late Mesozoic oceanic subduction

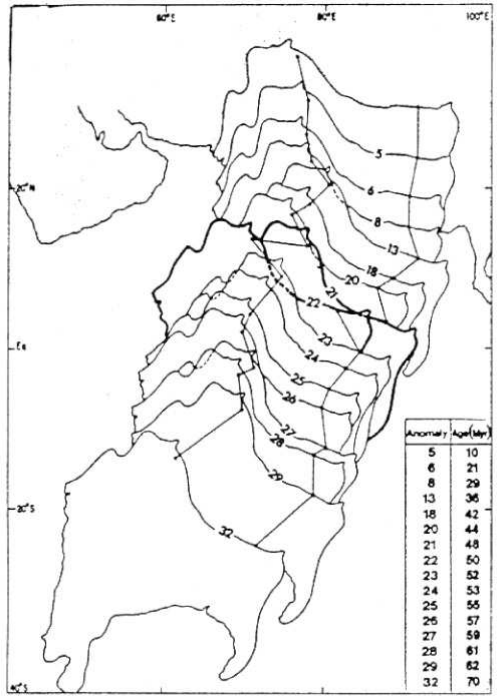
Anomaly TH vanishes
above 1000km
interpreted as slab breakoff
occurring along the whole northern
boundary of the indian continent

Stable position of TH anomaly
down to 1600km,

Interpreted as late Mesozoic
oceanic subduction

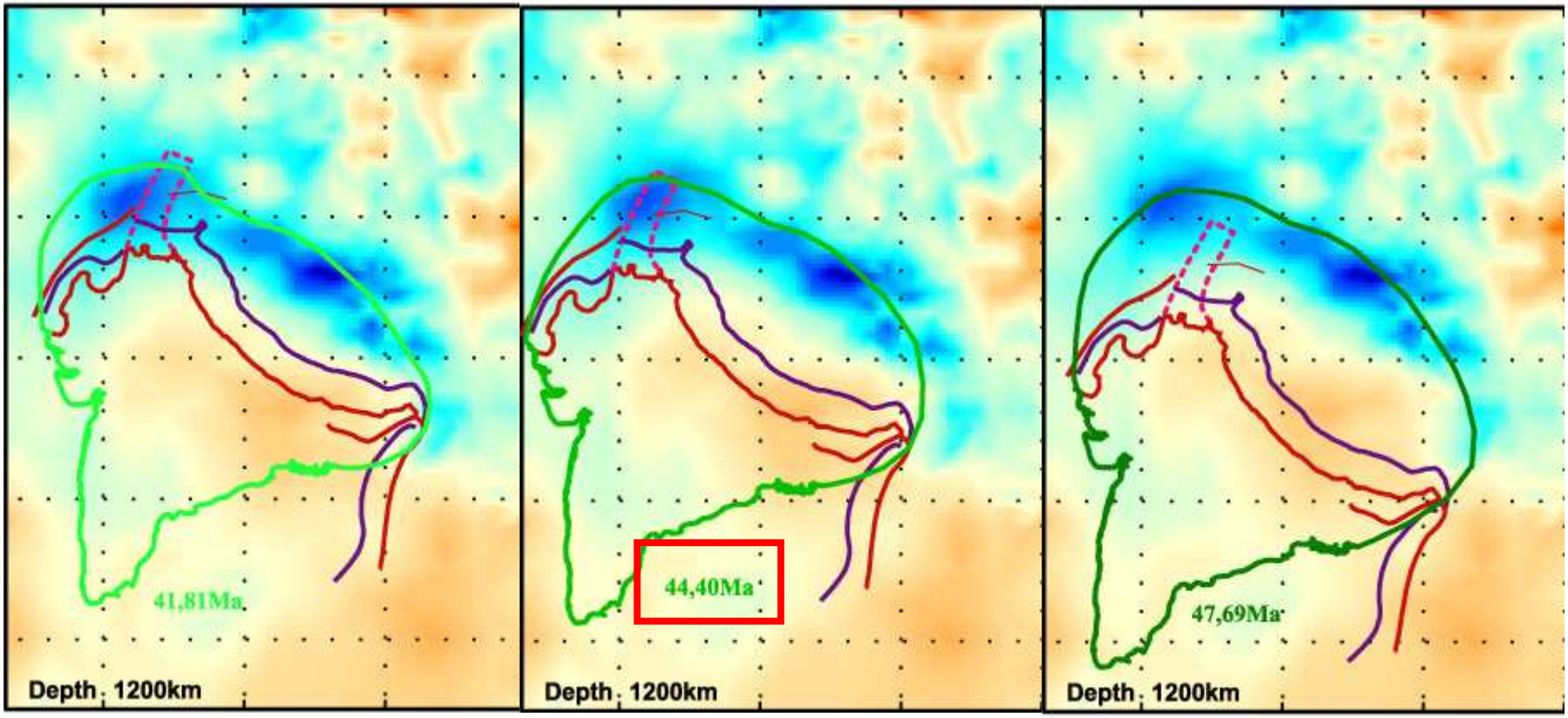






Past positions of India, Patriat and Achache, 1984

The inferred size of continental India after the breakoff increasing with its age

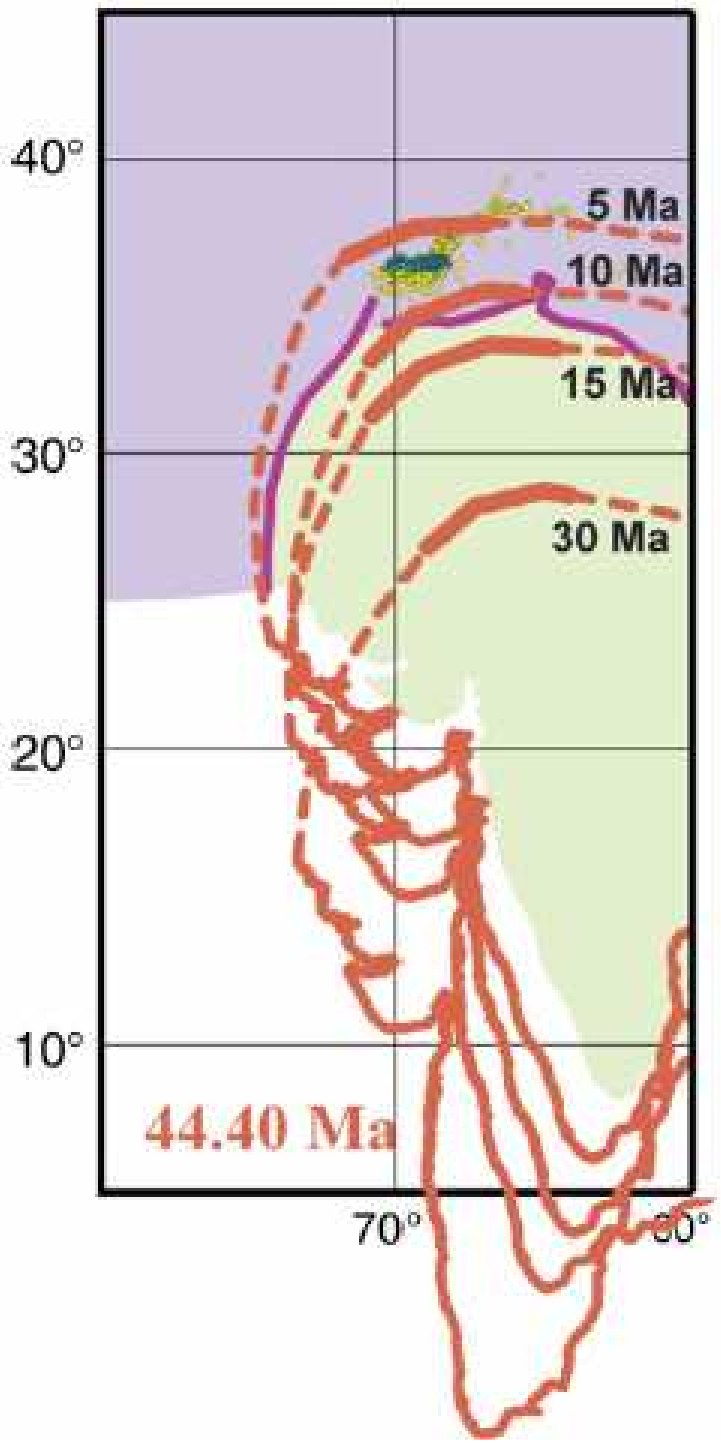


Using the length of the indian slab beneath Hindu Kush (finger slab in dotted pink)

we inferred

⇒ an breakoff age of 45Ma

⇒ geometry of India which will be involve in the following collision process



Indian subduction

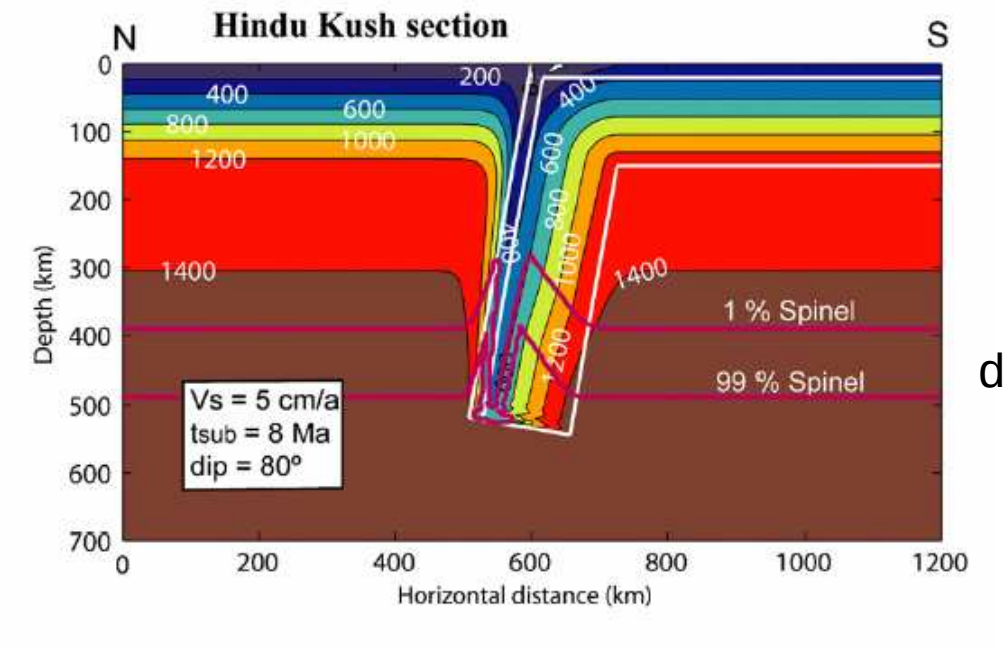
beneath the Hindu Kush:

Stable position

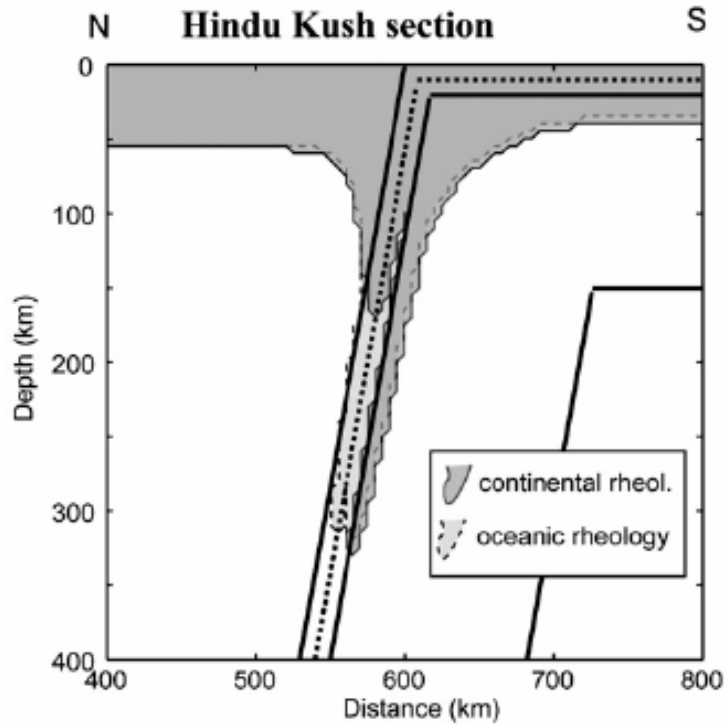
Initiation : 8 Ma

Slab length : 600 km

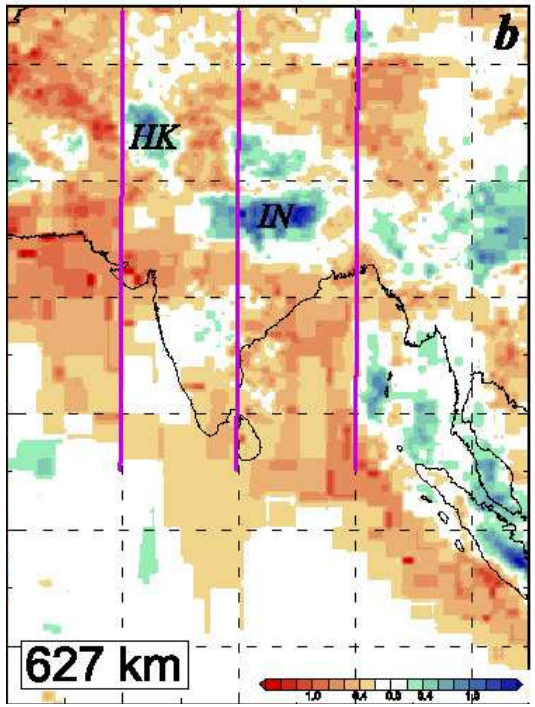
$\Rightarrow$ Velocity : 5 cm/yr

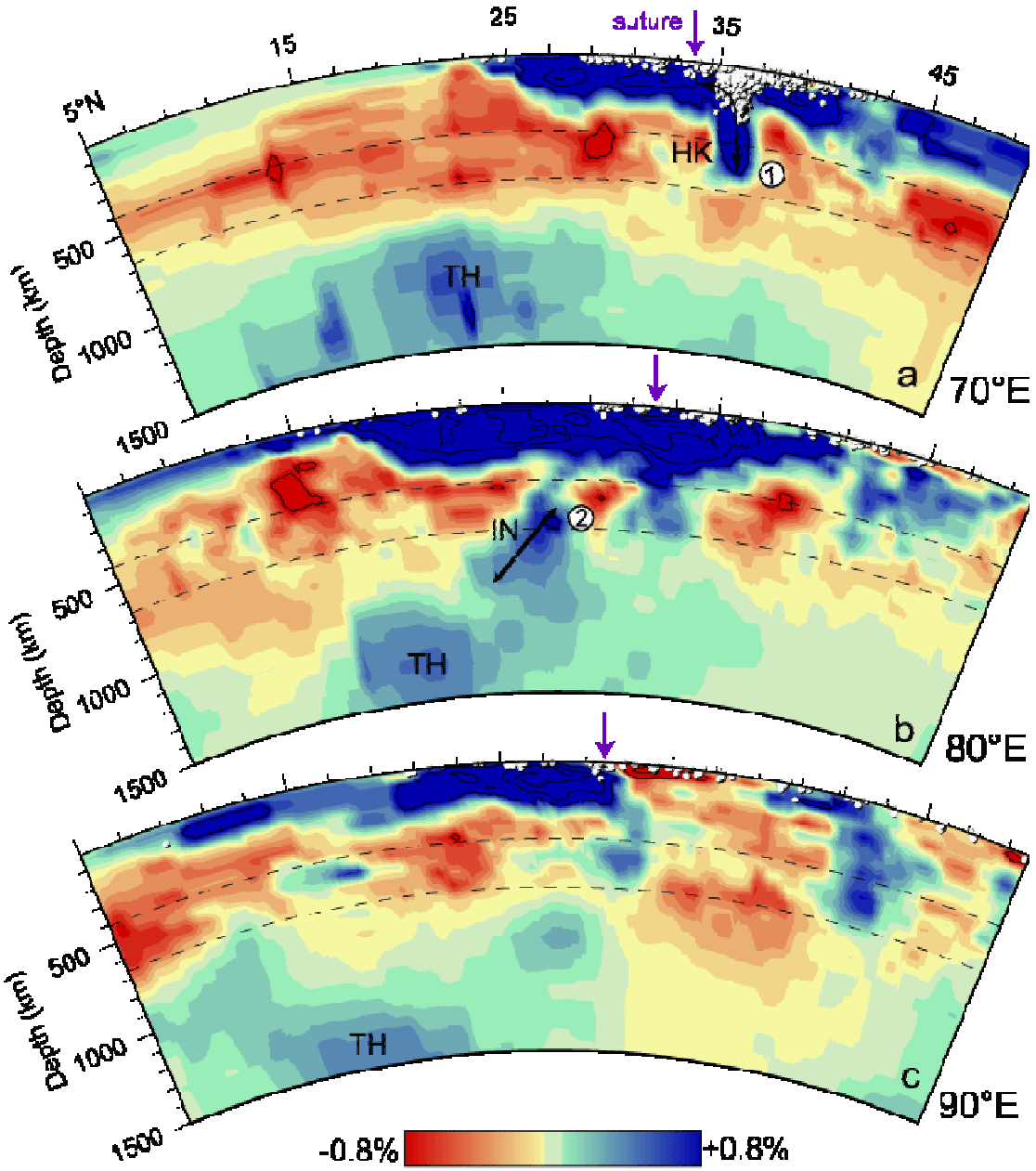


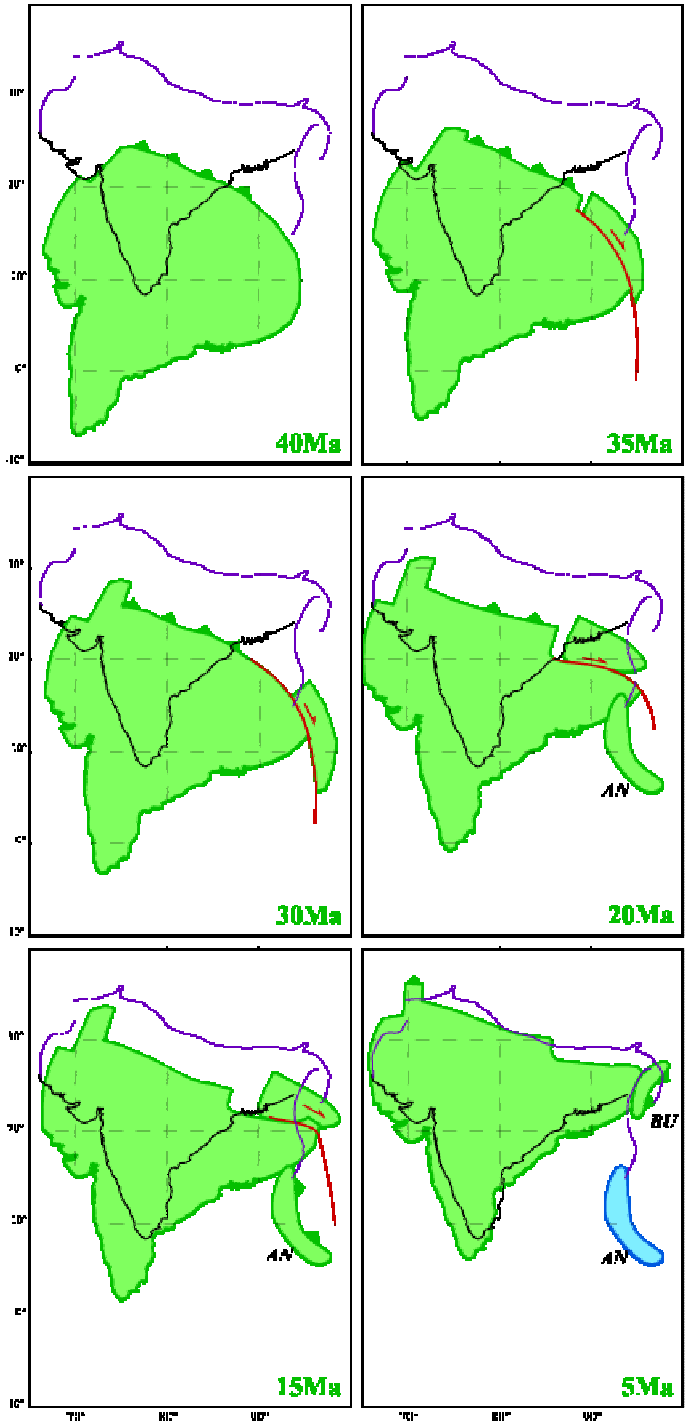
temperature distribution
calculated using the TEMSPOL code
(Negredo et al., 2004)
velocity field is imposed
defined by subduction velocity and slab dip

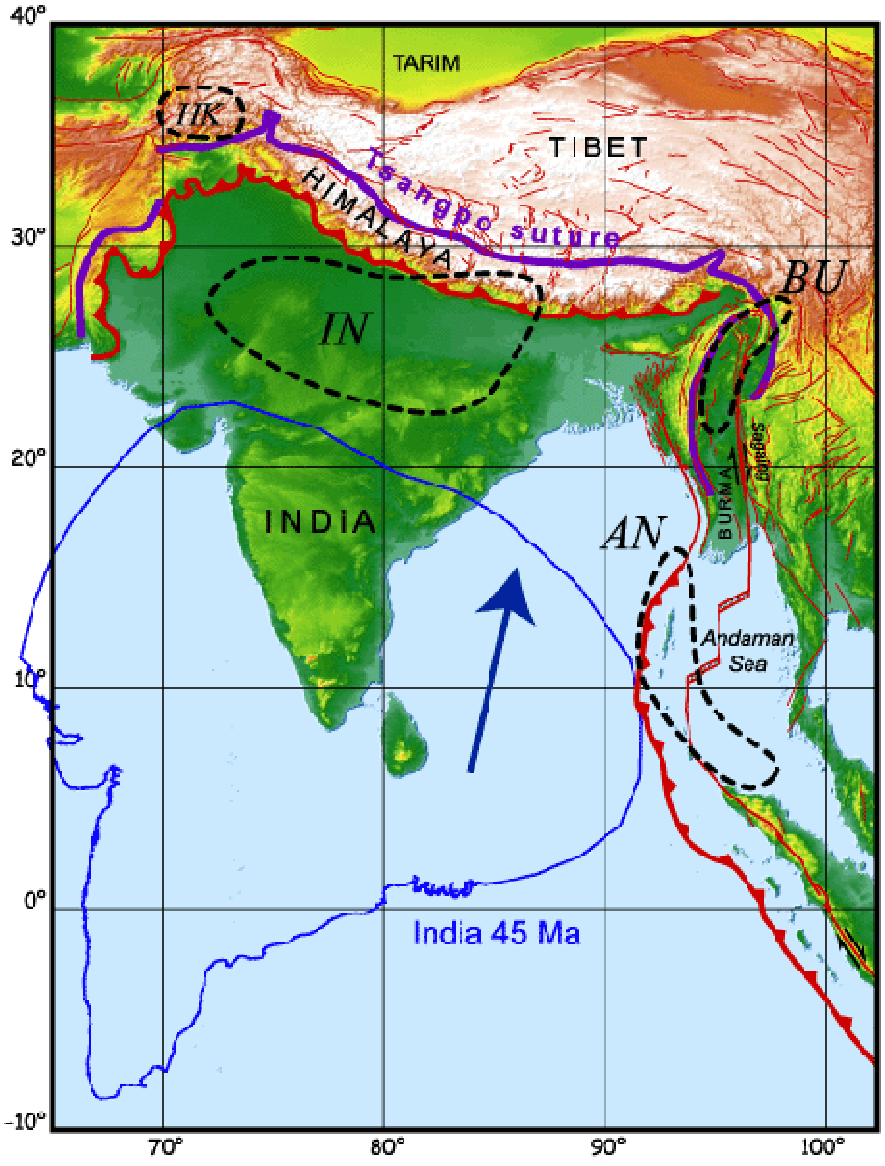


rheological modeling procedure applied by Carminati et al. (2005) to evaluate the extent of brittle regions in subduction zones

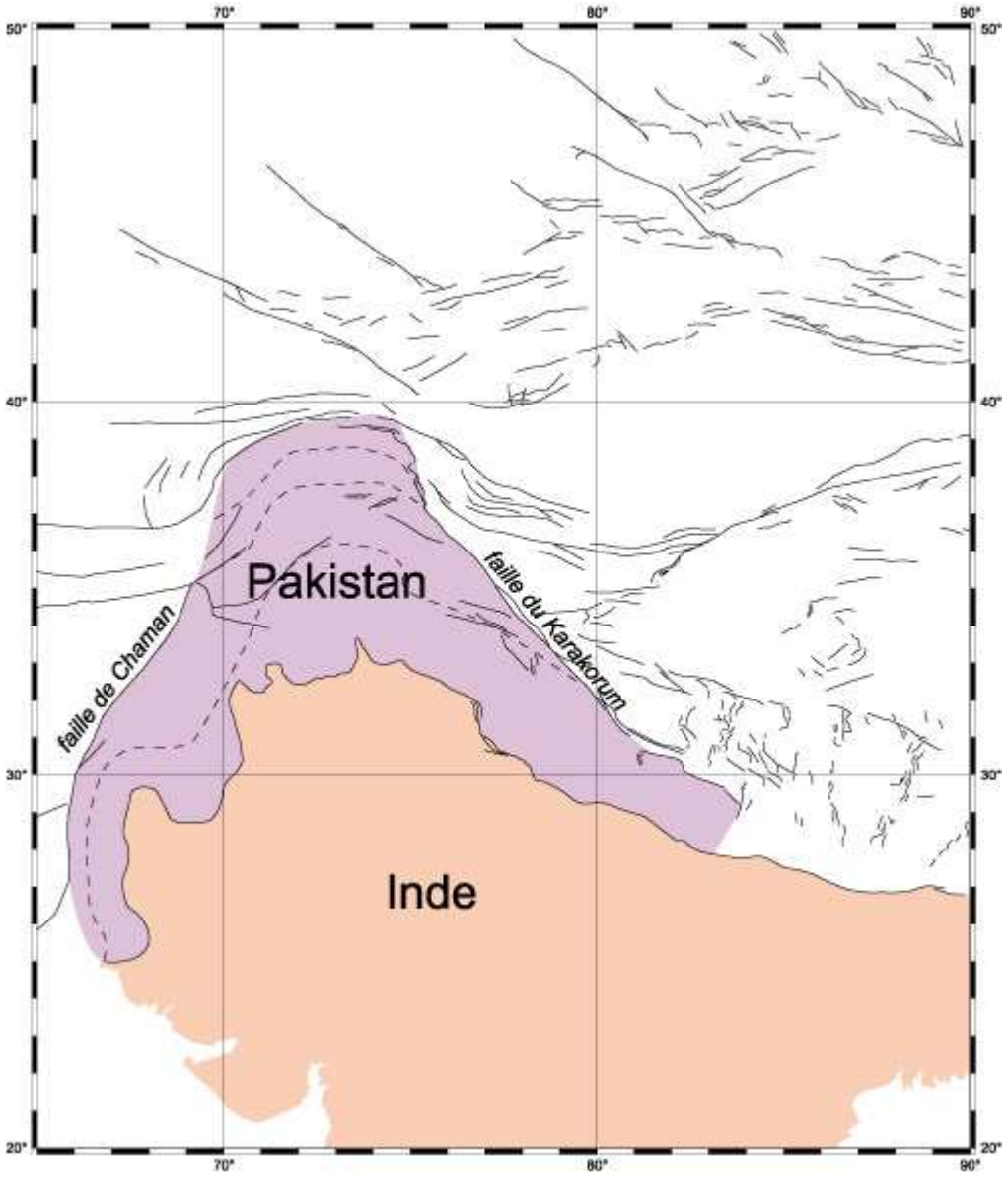

b
HK
IN
627 km


suture
15
25
35
45
5°N
HK
1
TH
a
70°E
Depth (km)
500
1000
1500
IN
2
b
80°E
c
90°E
-0.8%
+0.8%





Thursday 7 april, 9h30, TS6

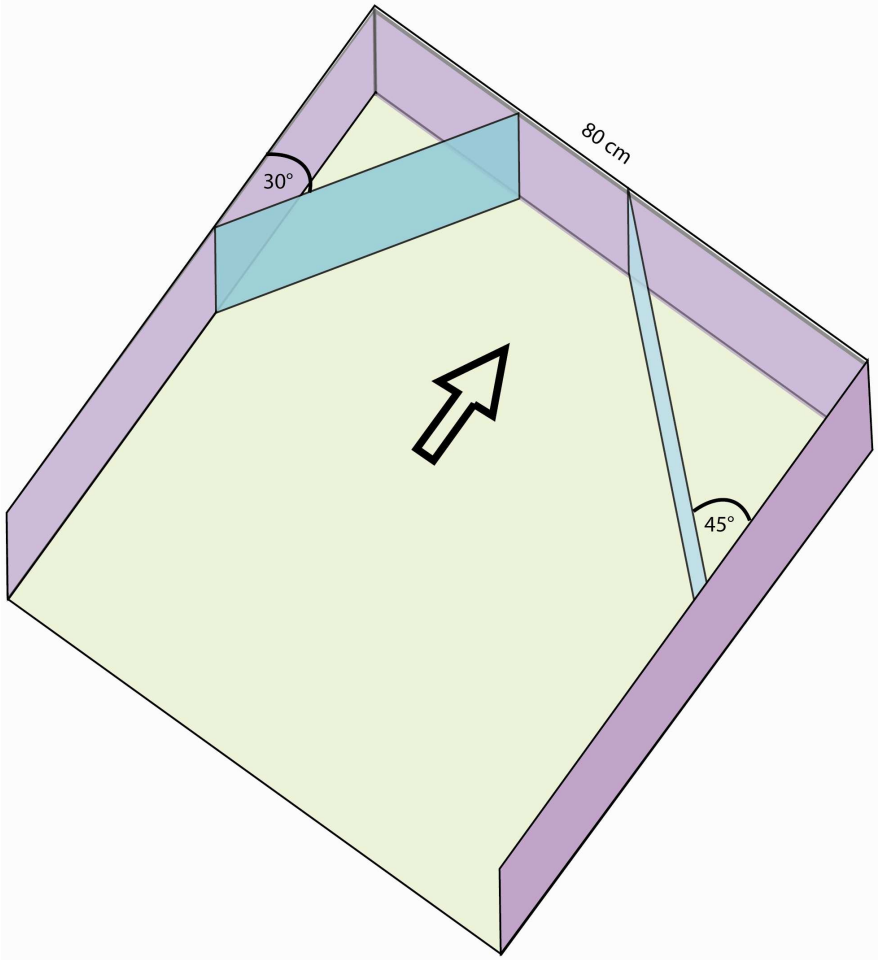


2 main strike-slip faults :
Karakorum
Chaman

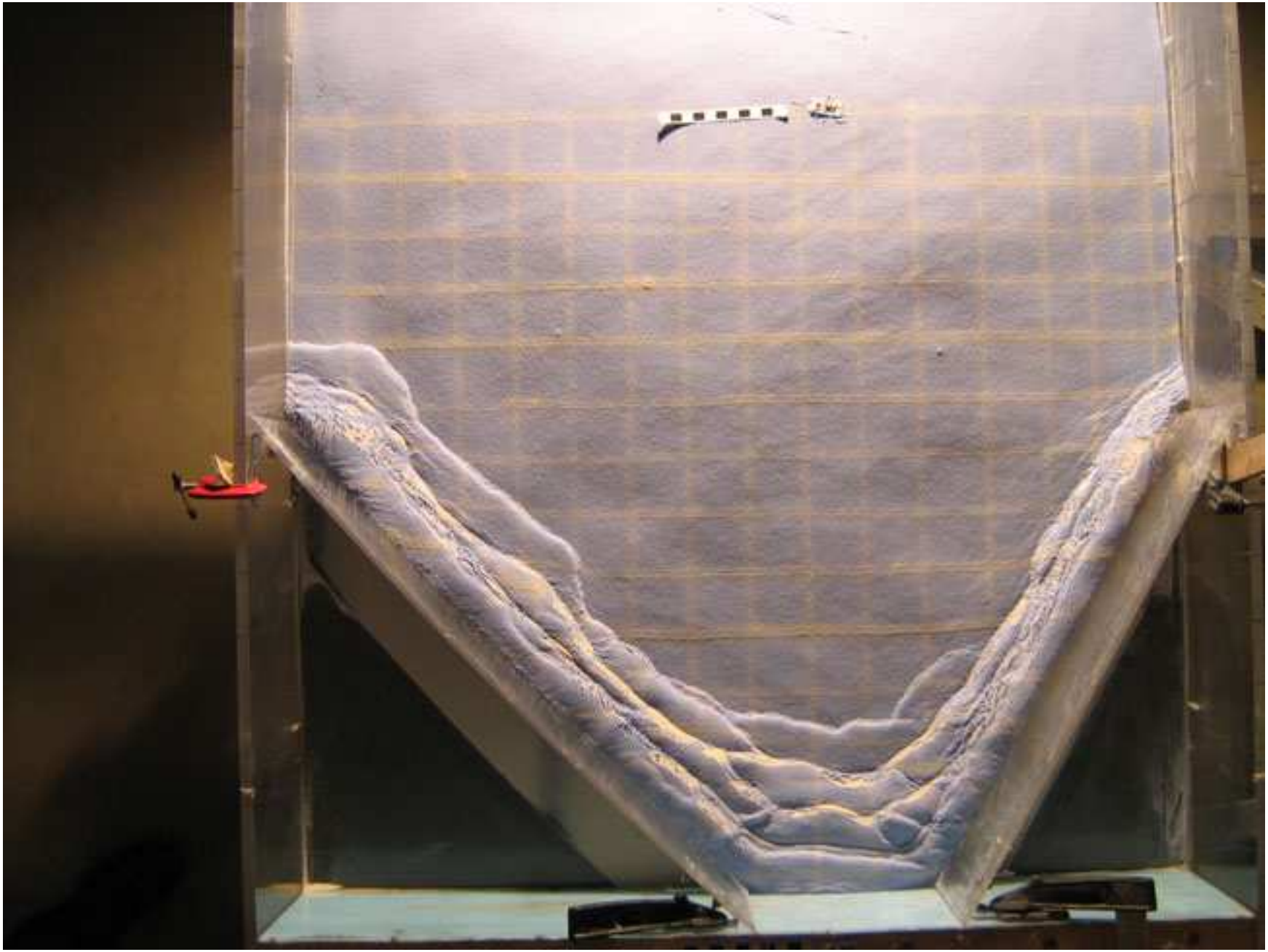
Violaine Vignon phD

very preliminary results

80 cm = 1800 km
1.5 cm = 30 km

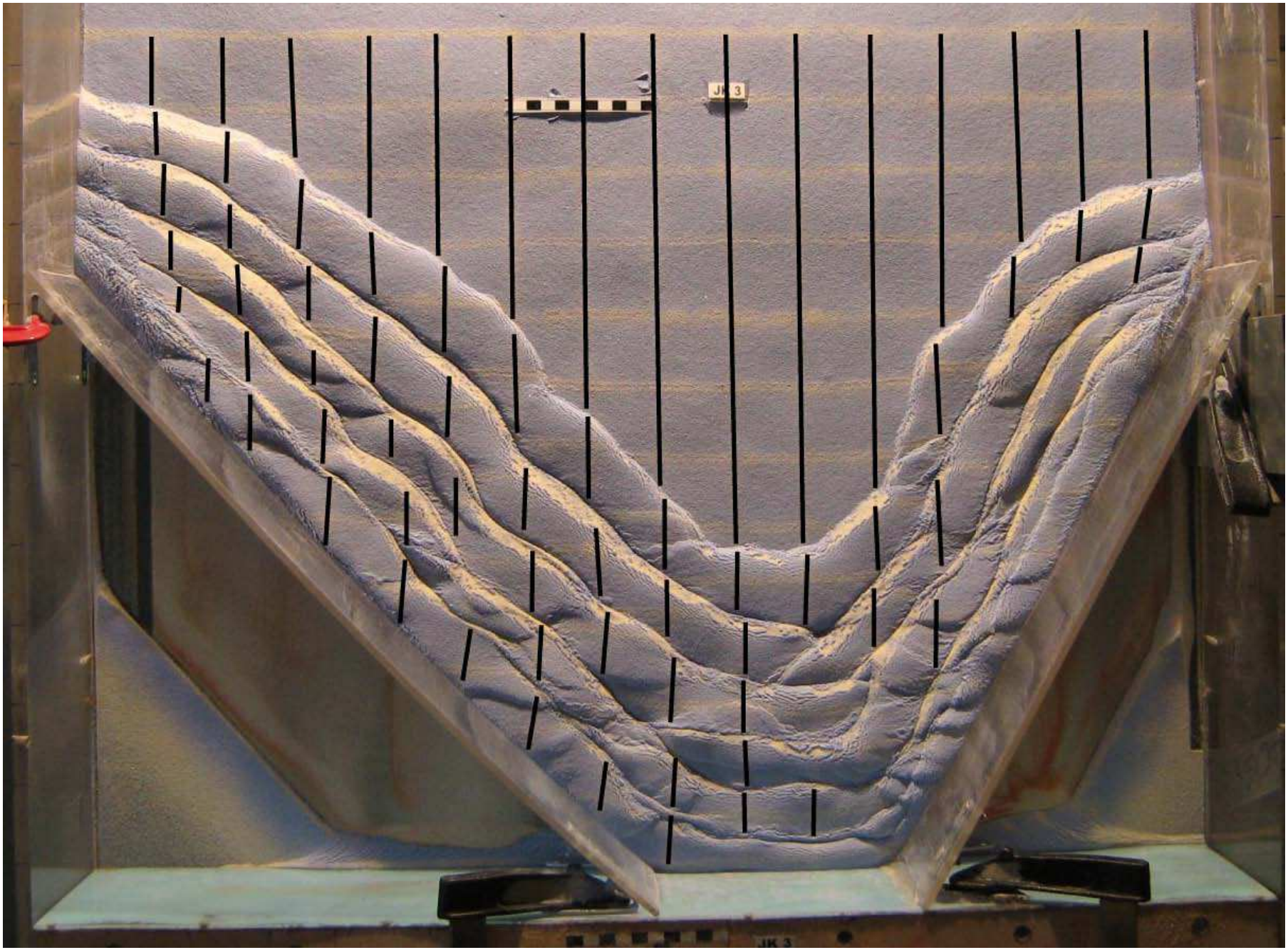


SUD



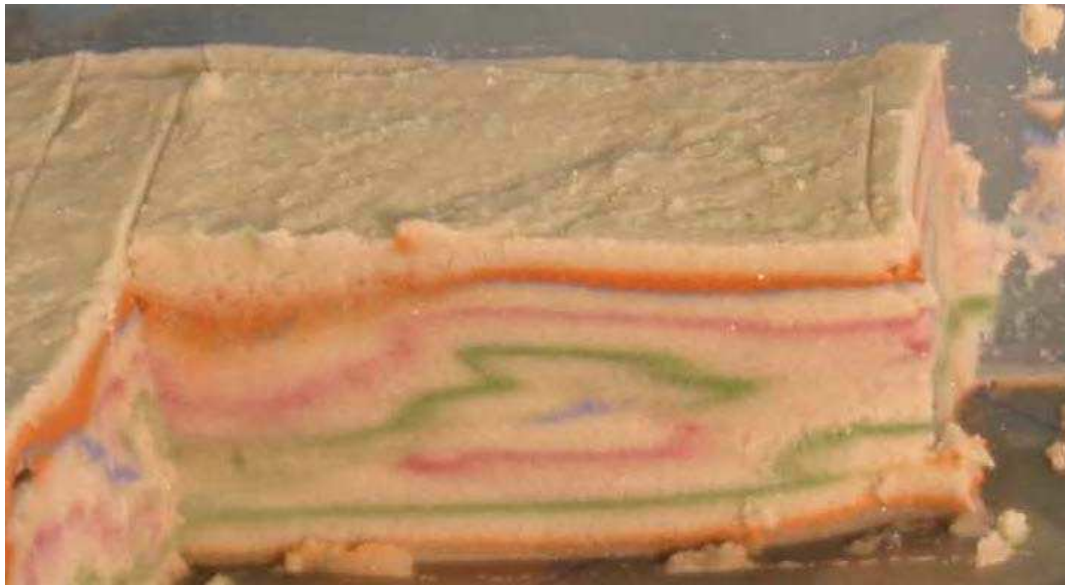
NORD

JK2, sand

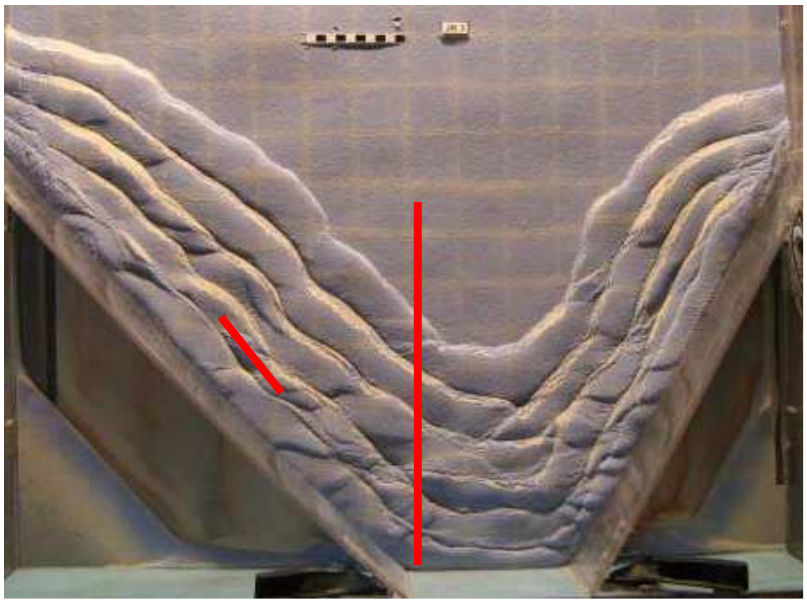


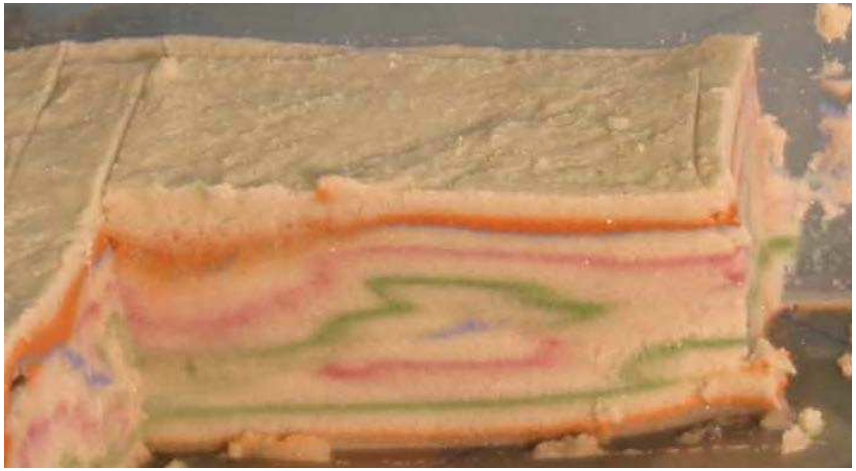
JK7: microbilles (2 mm) + Sable (13 mm)
20 cm shortening

East-West shortening : 8,8%



Component of east-west shortening
in a north-south collision





Component of east-west shortening
in a north-south collision

Conclusion

- Continental subductions
  - Asian lithosphere beneath Pamir
  - Indian lithosphere beneath Hindu kush
    - Total length of Indian plate
    - Break-off at about 45 Ma
    - Initiation subduction at 8 Ma
    - Thermo-kinematic model
- Upper crust
  - East-west compression in a north-south collision
  - No creation of syntaxis, need subduction