Giant strike-slip rupture in Tibet
the Mw7.8 Kokoxili Earthquake, Nov. 14th, 2001

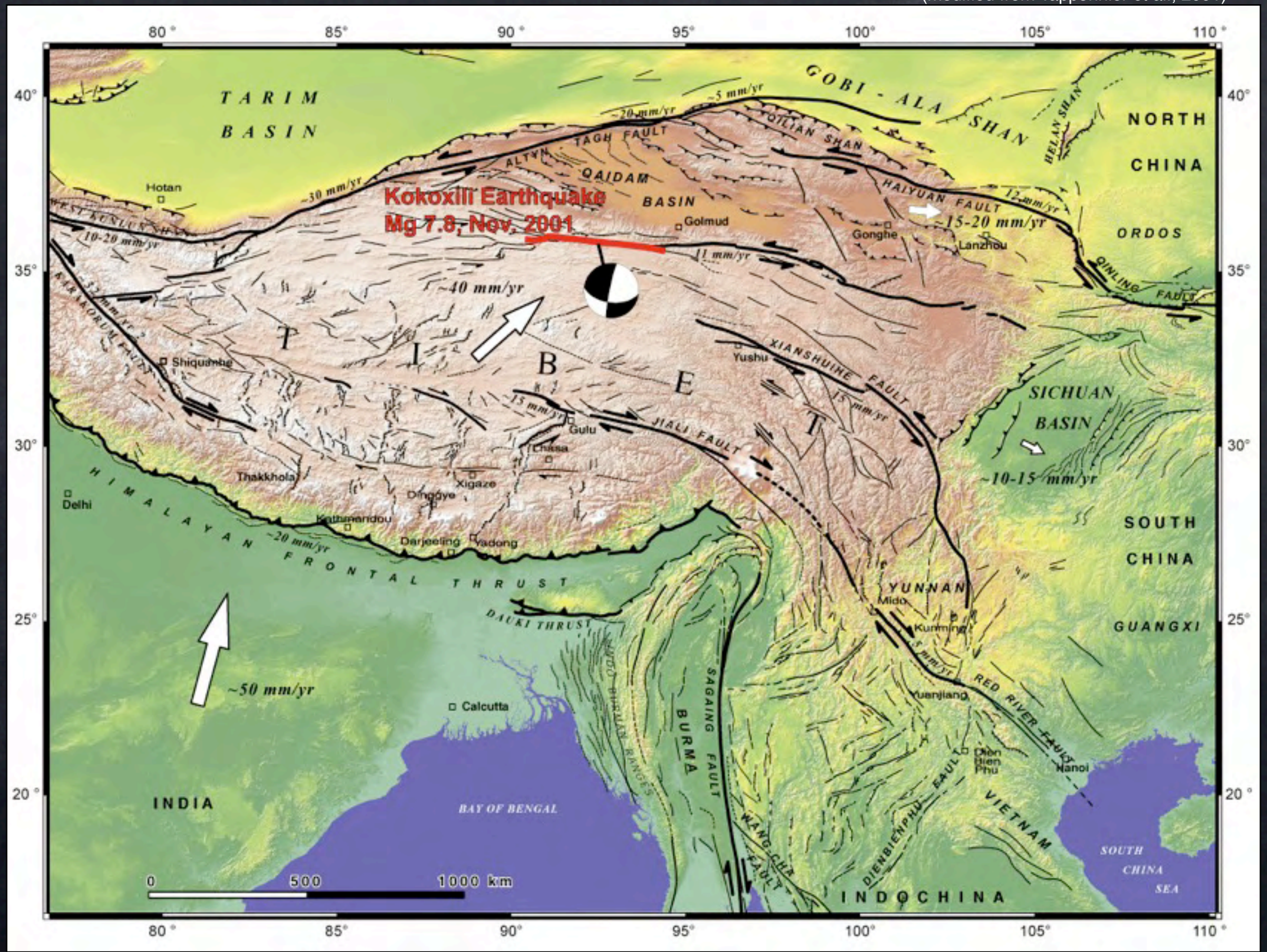
Yann Klinger

Institut de Physique du Globe de Paris

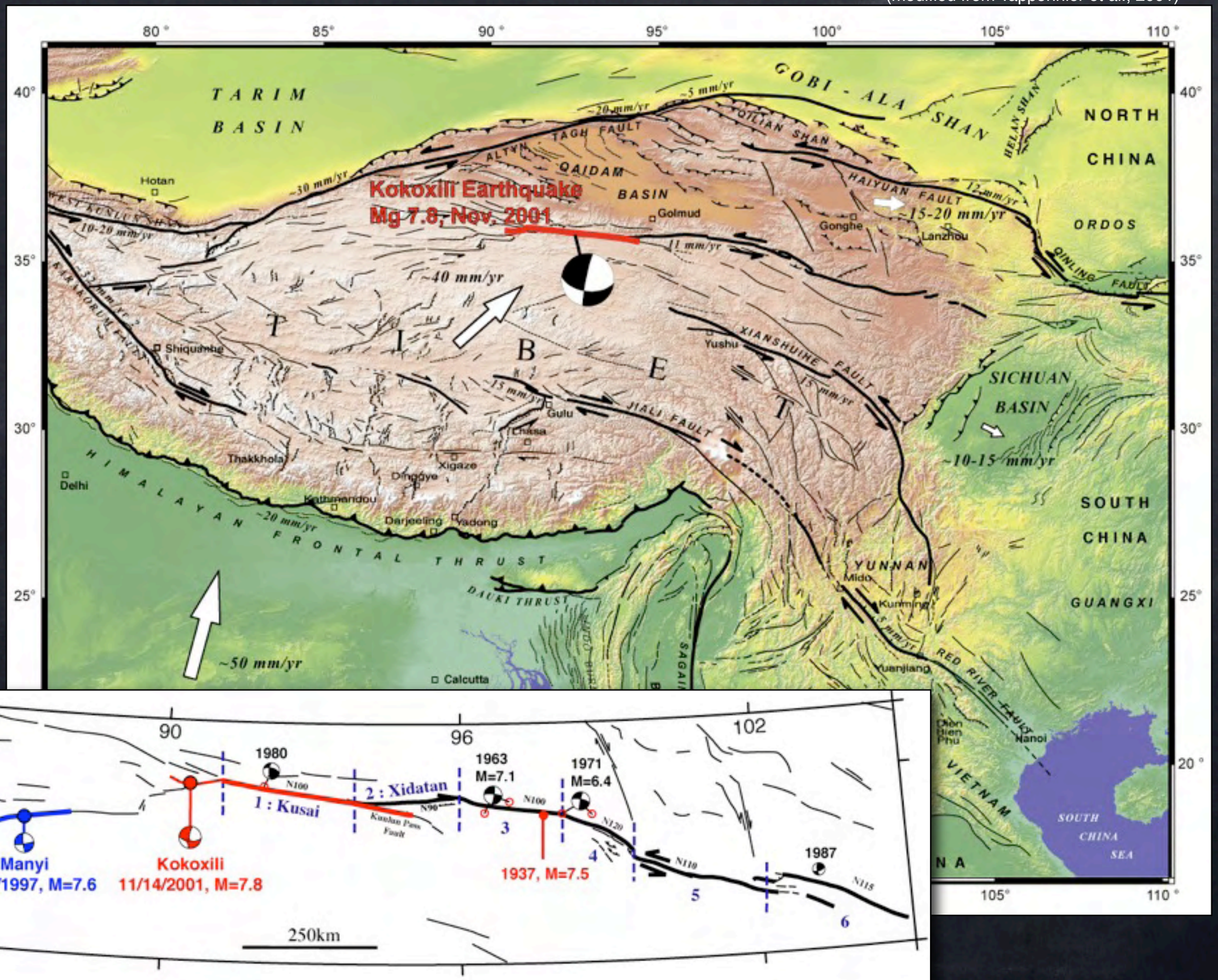
main co-workers:
H. Li, J. Liu, C. Lasserre, G. King,
P. Tapponnier, J. Van der Woerd, X. Xu

Surface Fault Displacement Hazard Workshop, UC Berkeley, May 20-21, 2009

(modified from Tapponnier et al., 2001)



(modified from Tapponnier et al., 2001)

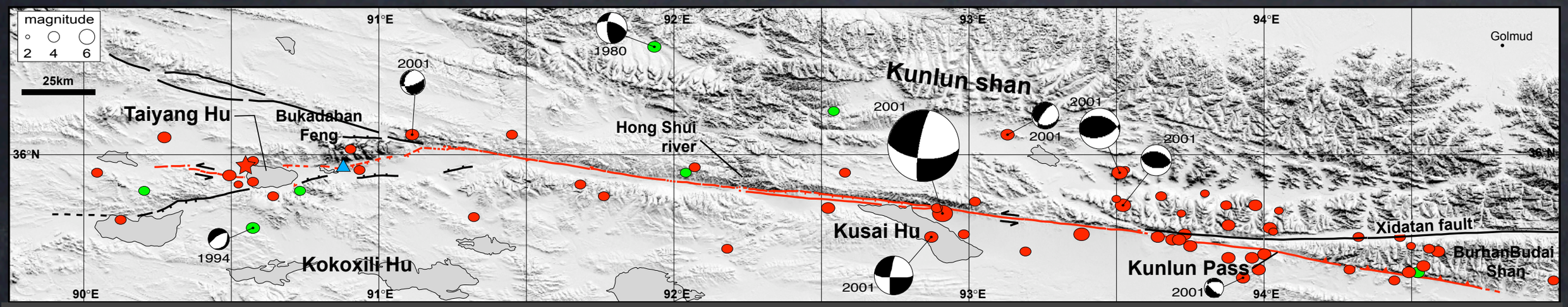


7.9	2001 Kokoxili
7.8	1906 San Andreas
8.4	1905 Bolnai
7.8	1939 Erzincan
7.9	2002 Denali
7.9	1857 Fort Tejon
8.1	1957 Gobi Altay

Length of rupture

Average and maximum offset

The Kokoxili rupture



430km of ground rupture, above 4000m

morphology of surface rupture changes over short distances

Field observation

Field observation

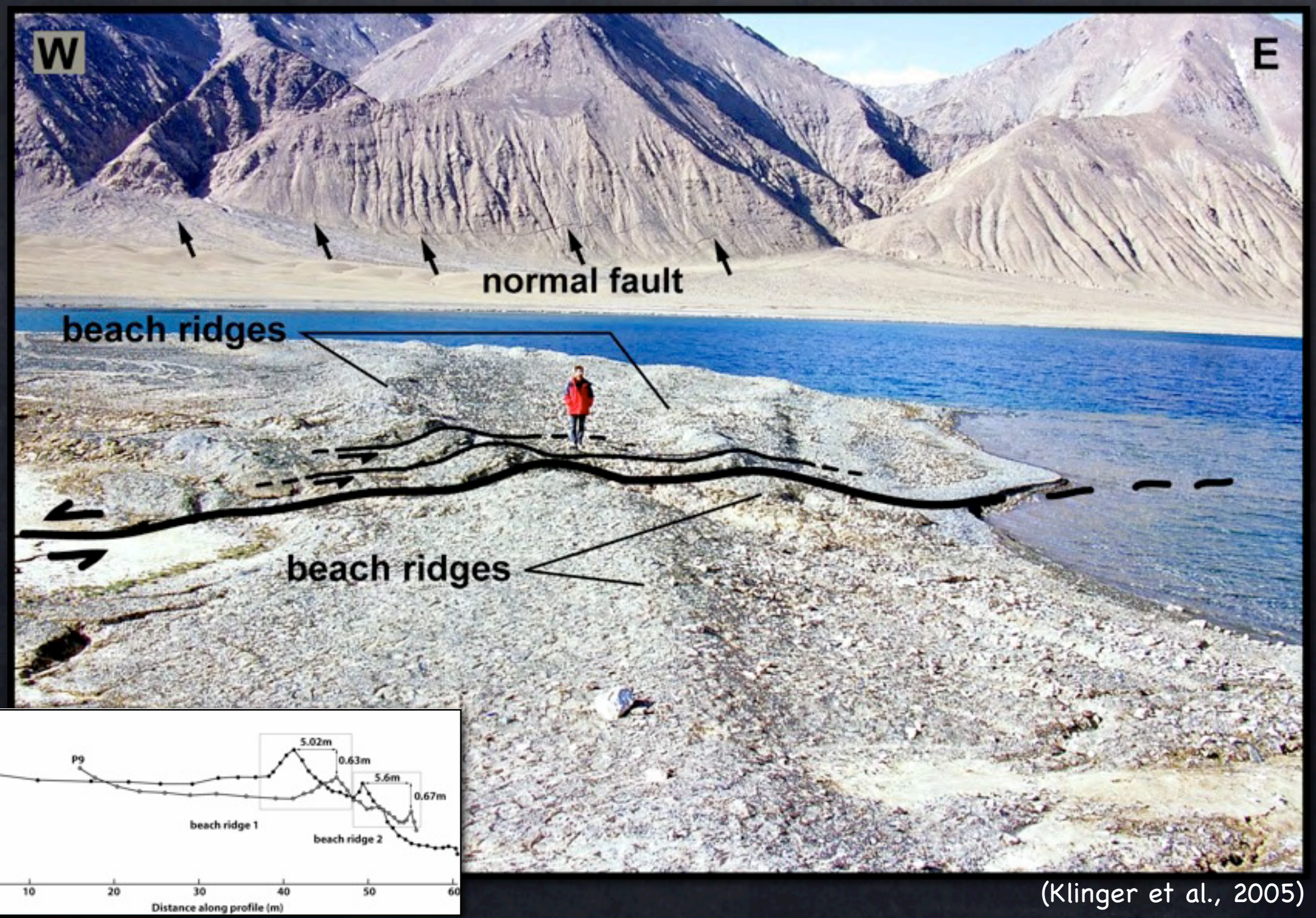
Field observation

Normal faulting

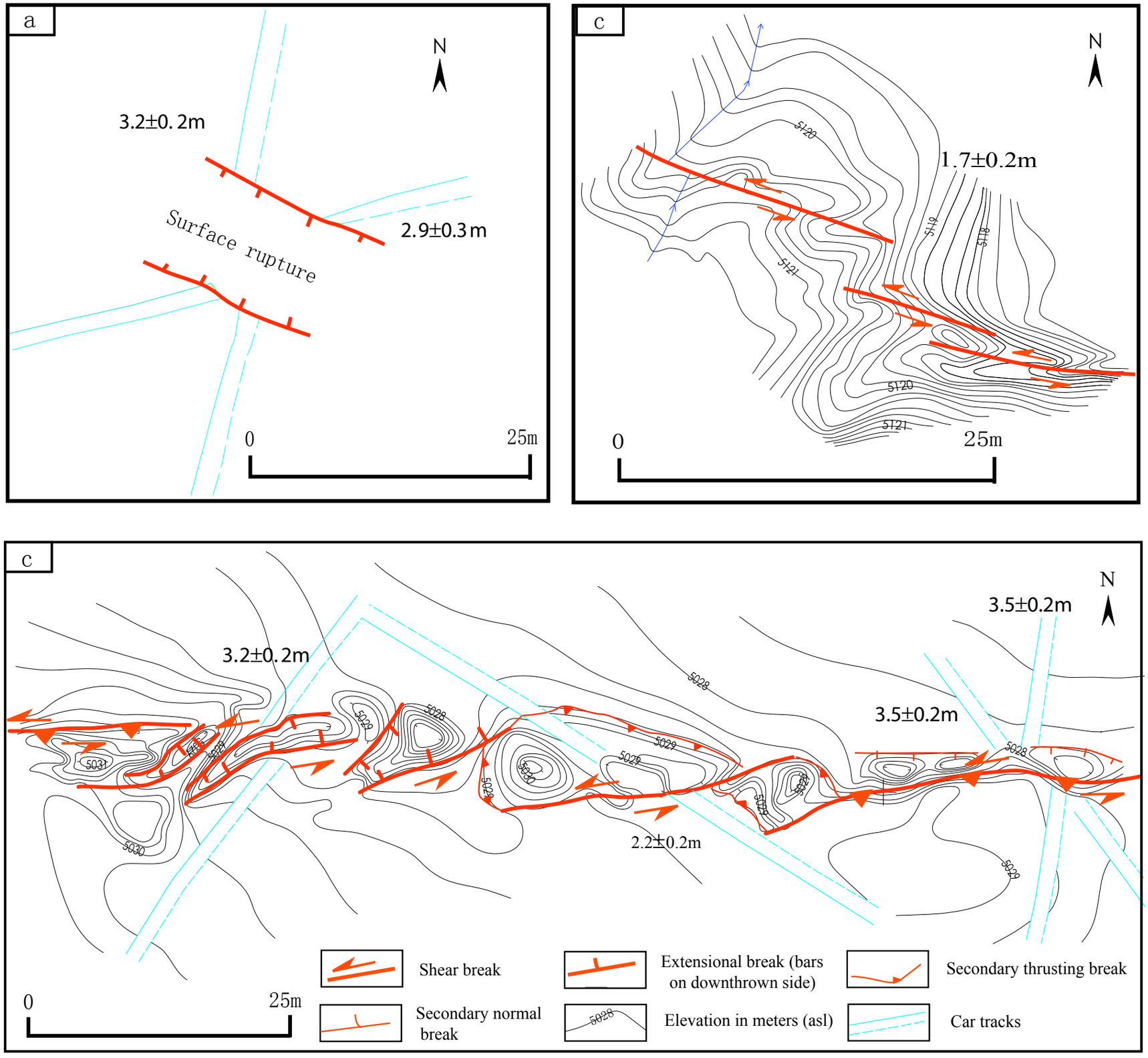
Normal faulting

Thrust faulting

Field observation

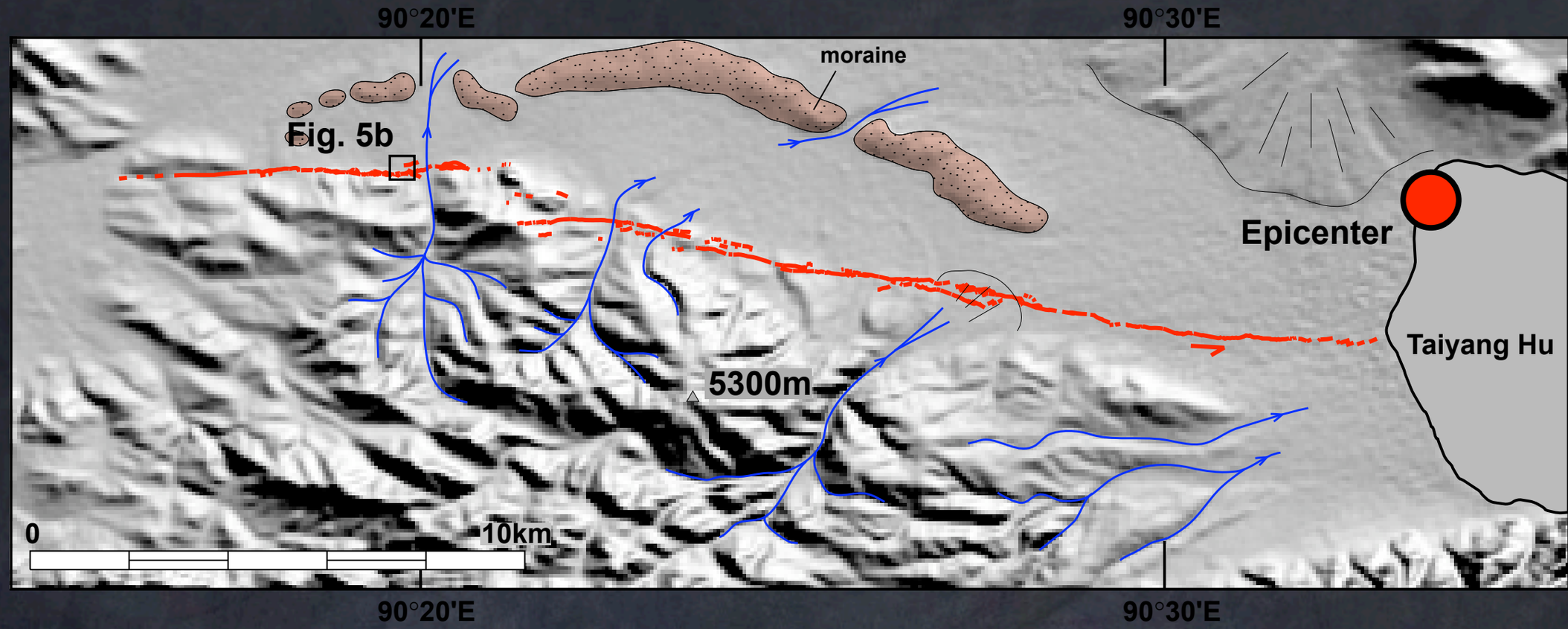


(Klinger et al., 2005)



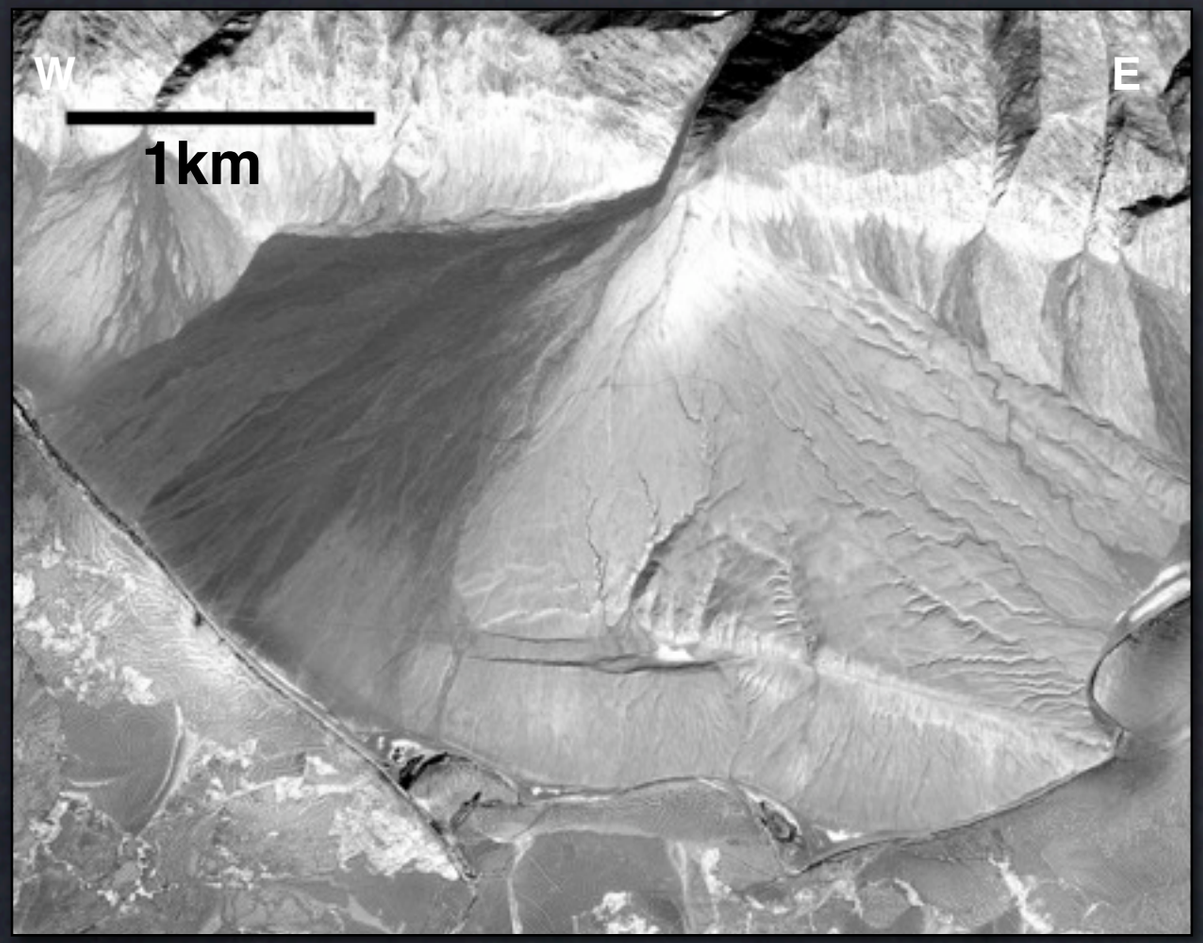
(Xu et al., 2006)

Total station measurements in several sites

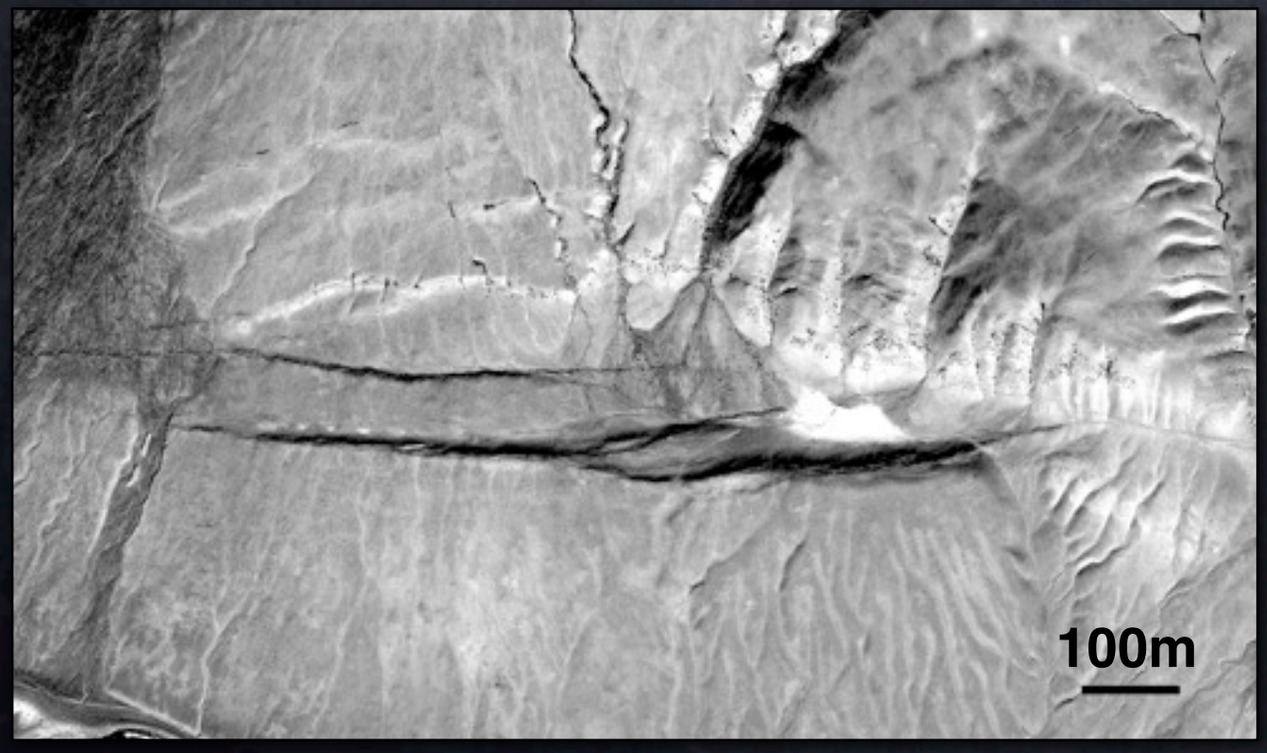

90°20'E
90°30'E
moraine
Fig. 5b
Epicenter
Taiyang Hu
5300m
0
10km
90°20'E
90°30'E

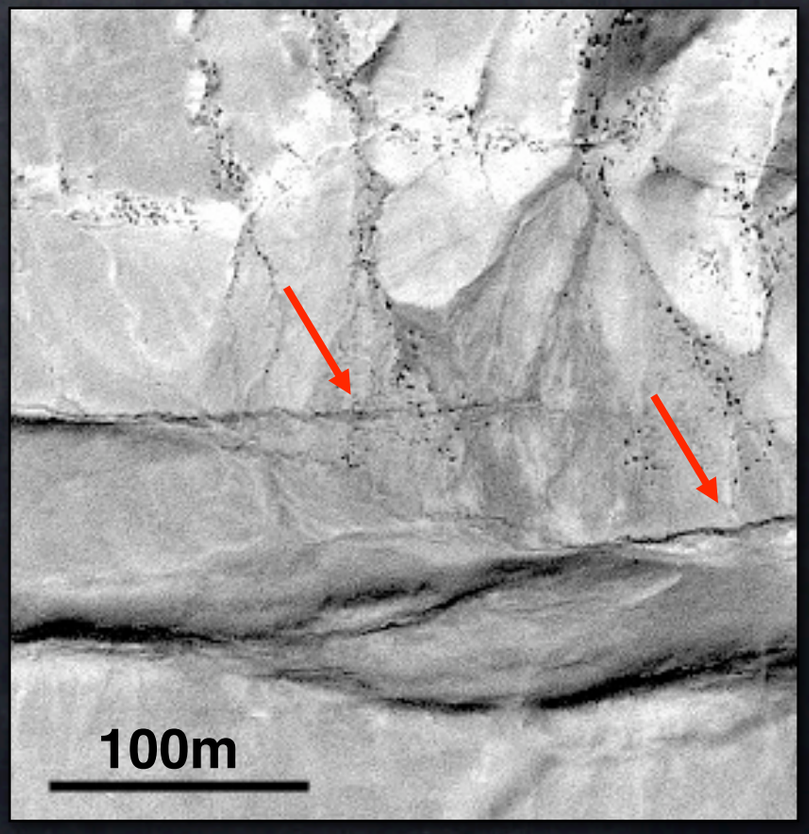

100 m
N.
Fig. 5C

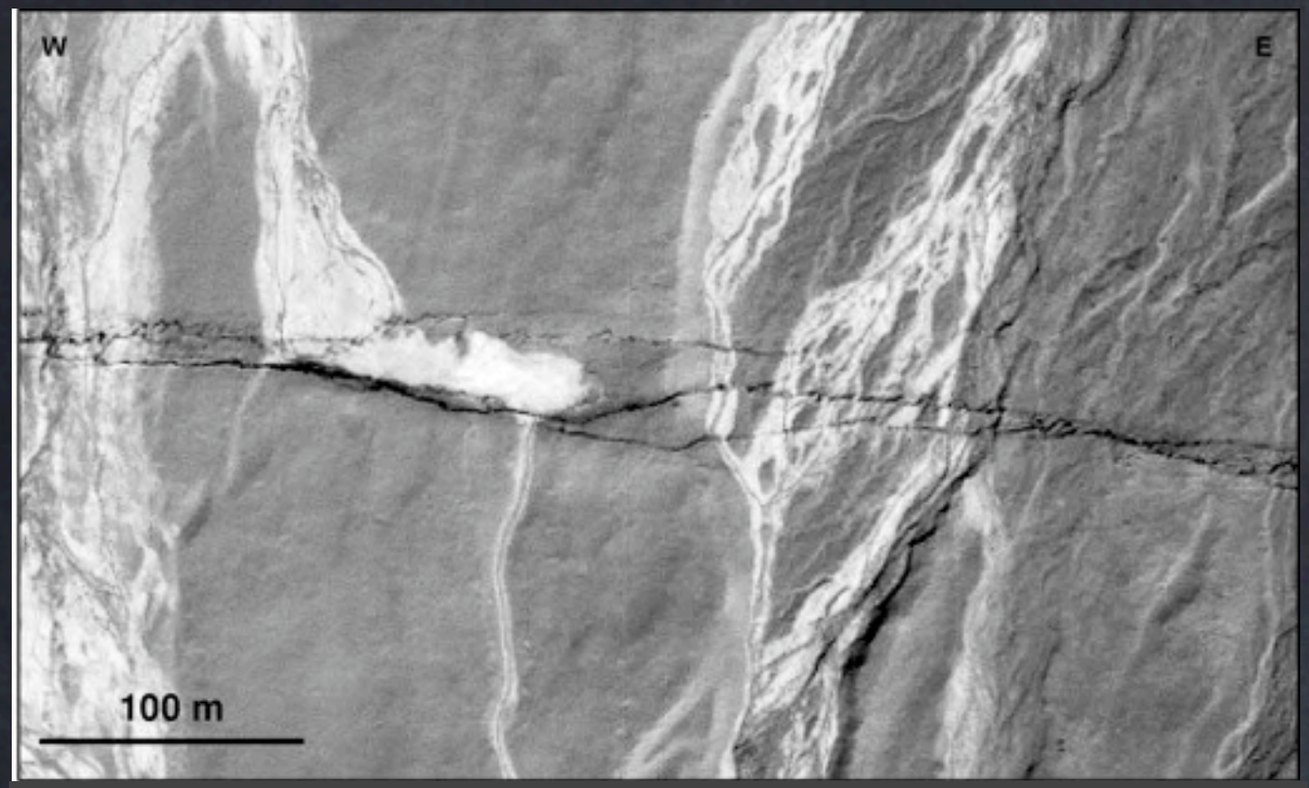

4.5m

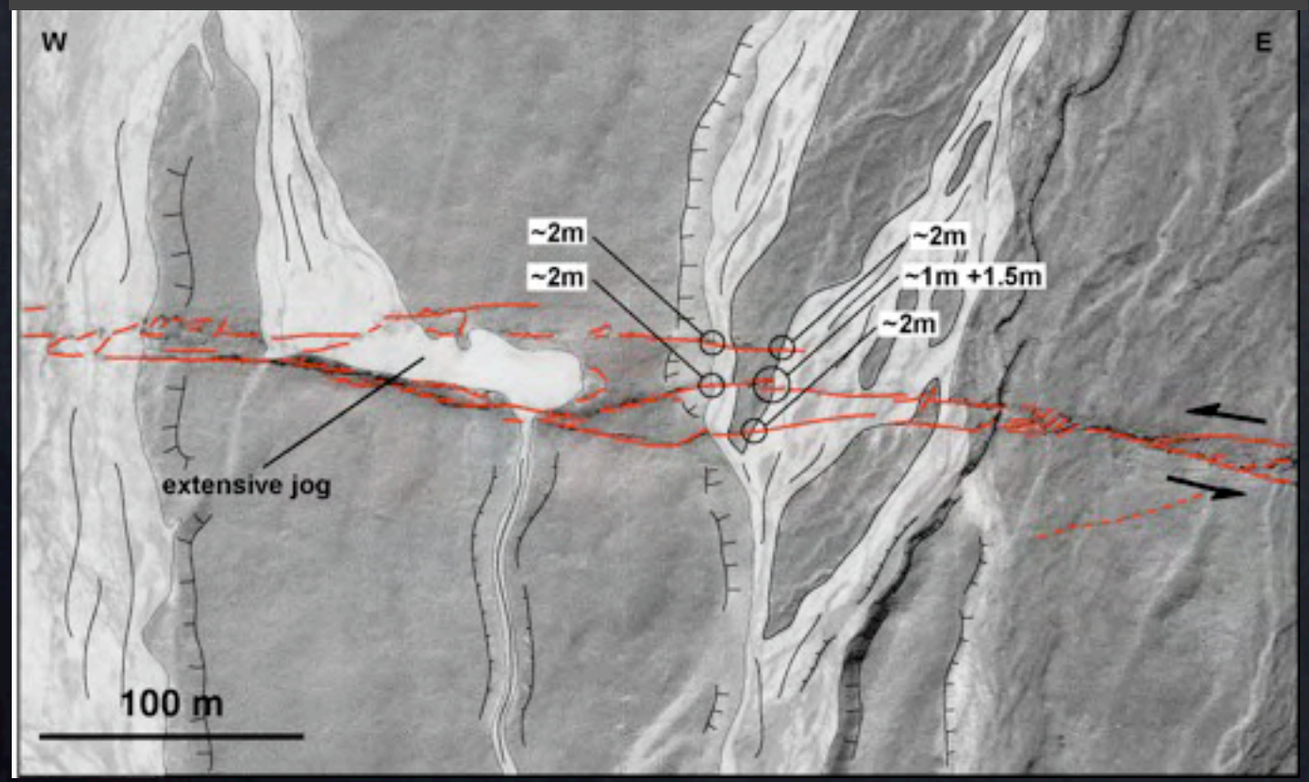

W
E
1km


S
N


100m

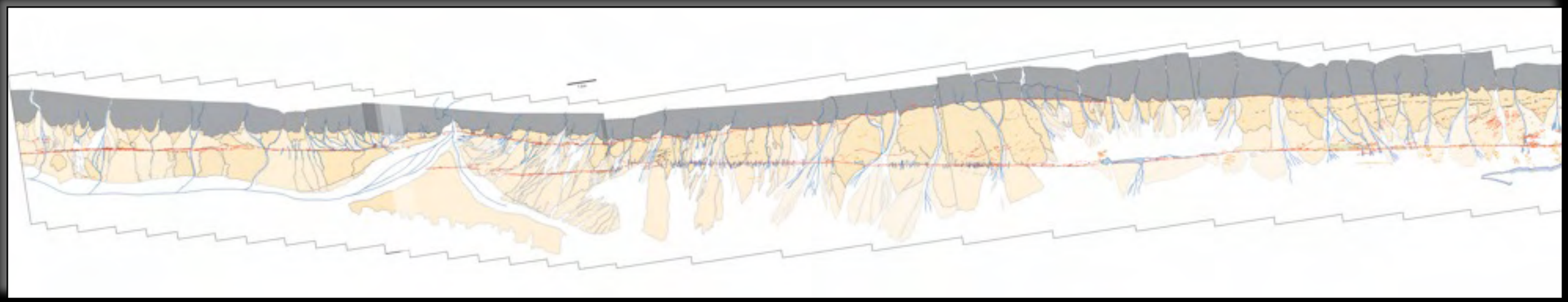

100m

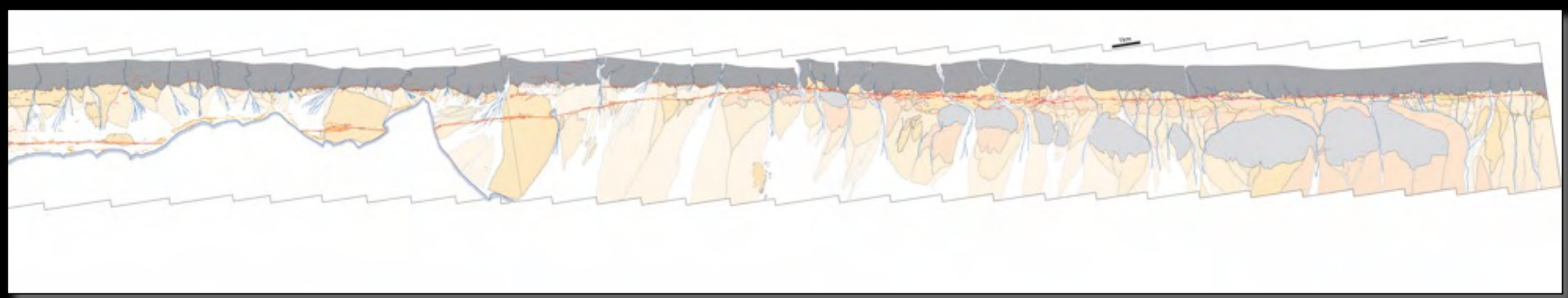




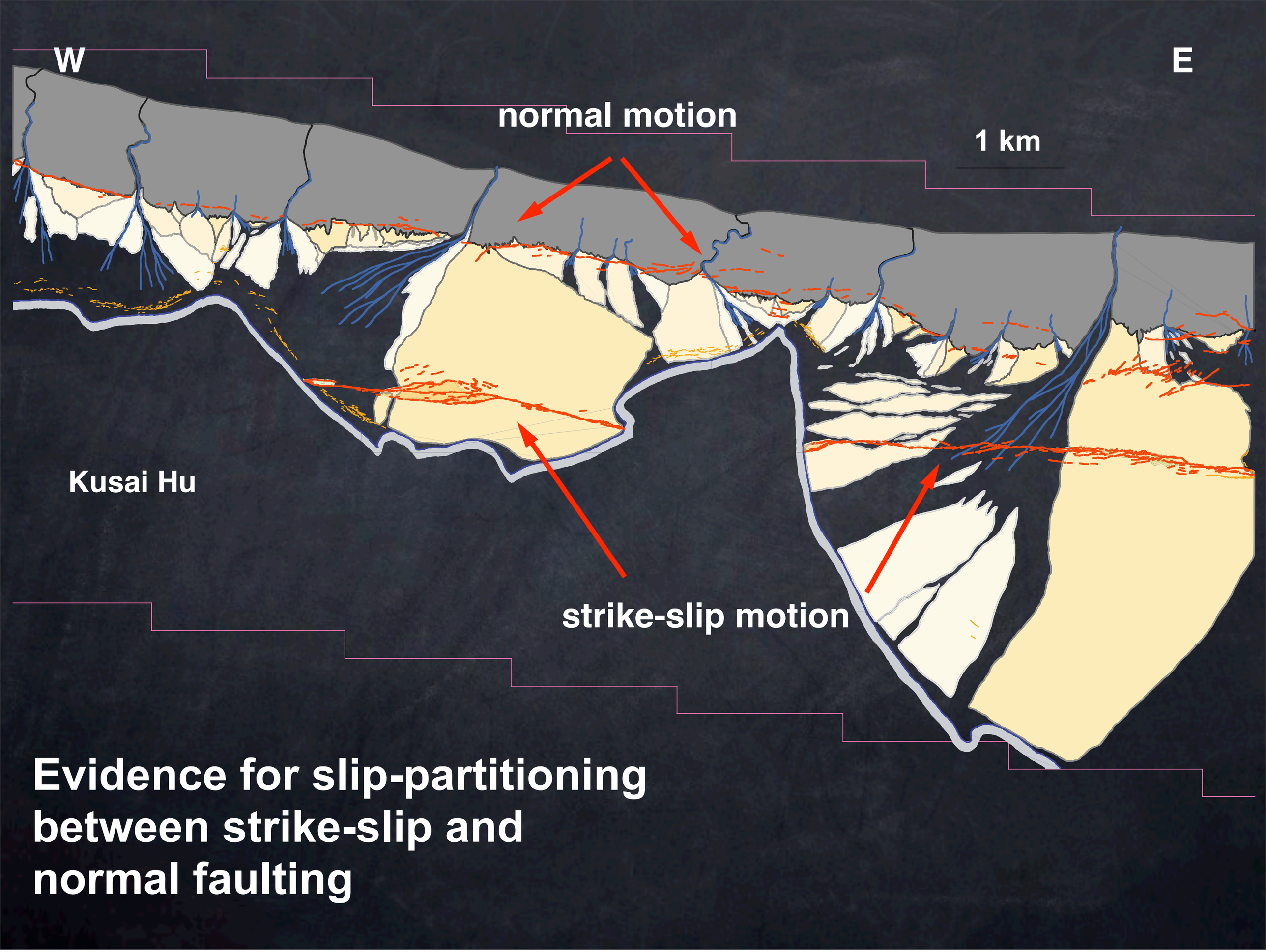
Details of the rupture from high resolution images

Detailed map of the central part of the rupture (~100 km)



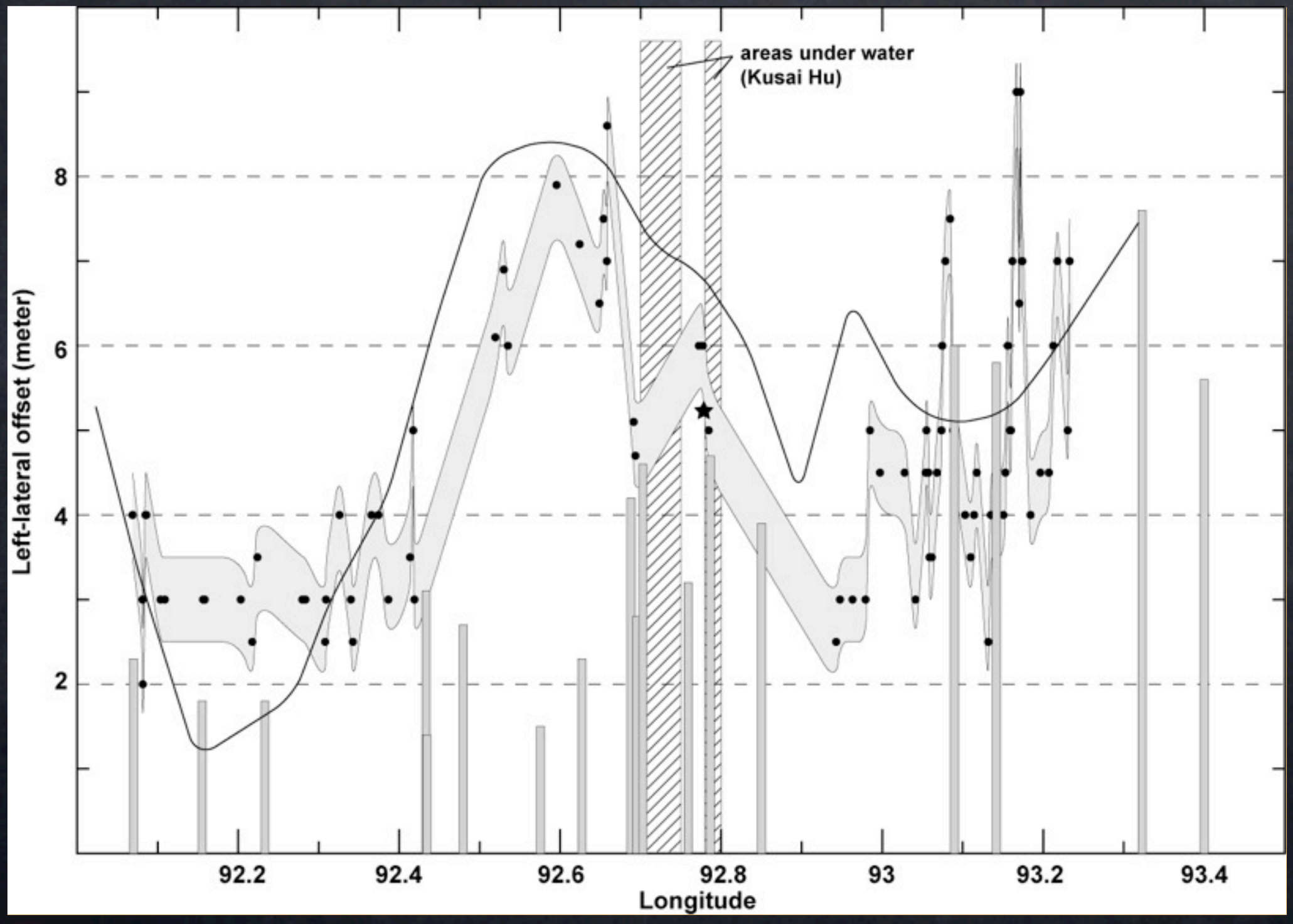


(Klinger et al., 2005)

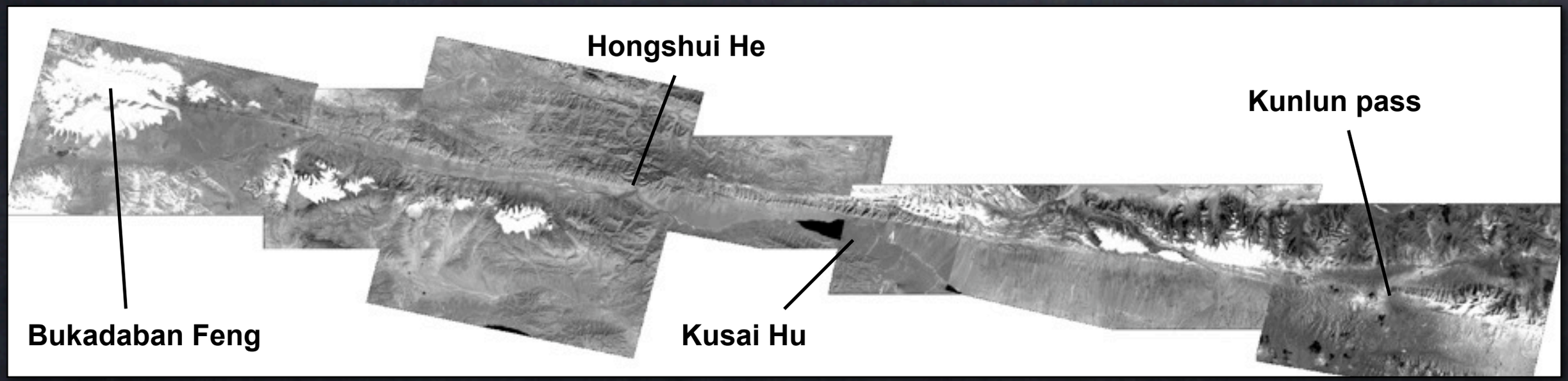


Evidence for slip-partitioning between strike-slip and normal faulting

Details of the rupture from high resolution images



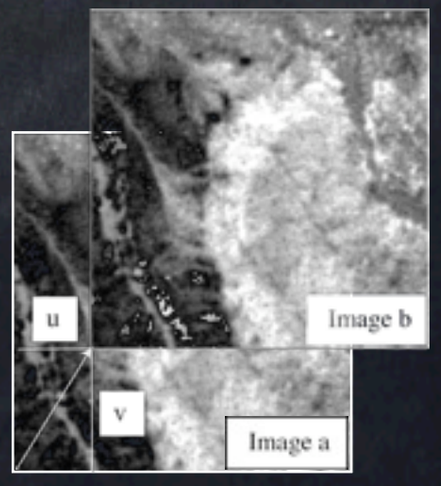
Detailed slip-curve from offset of optical images



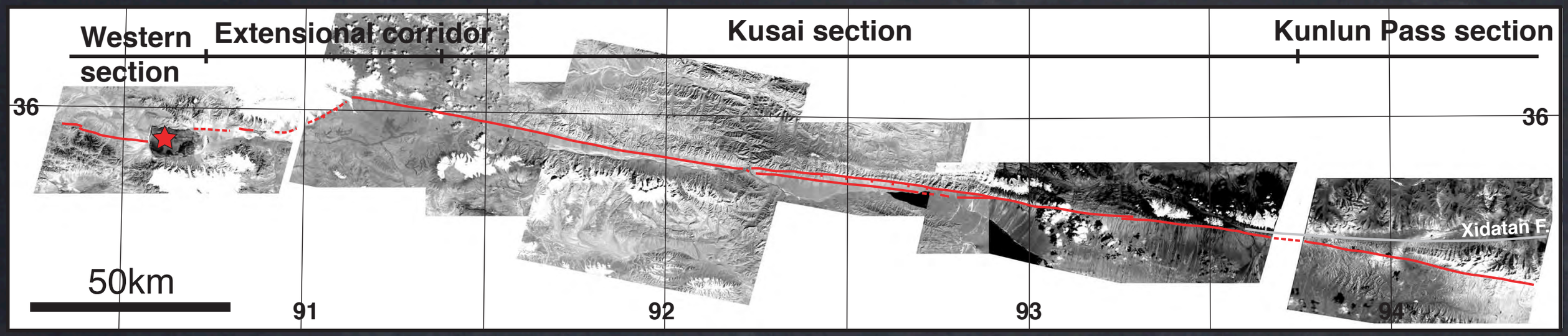
8 couples of Spot images (~400km)

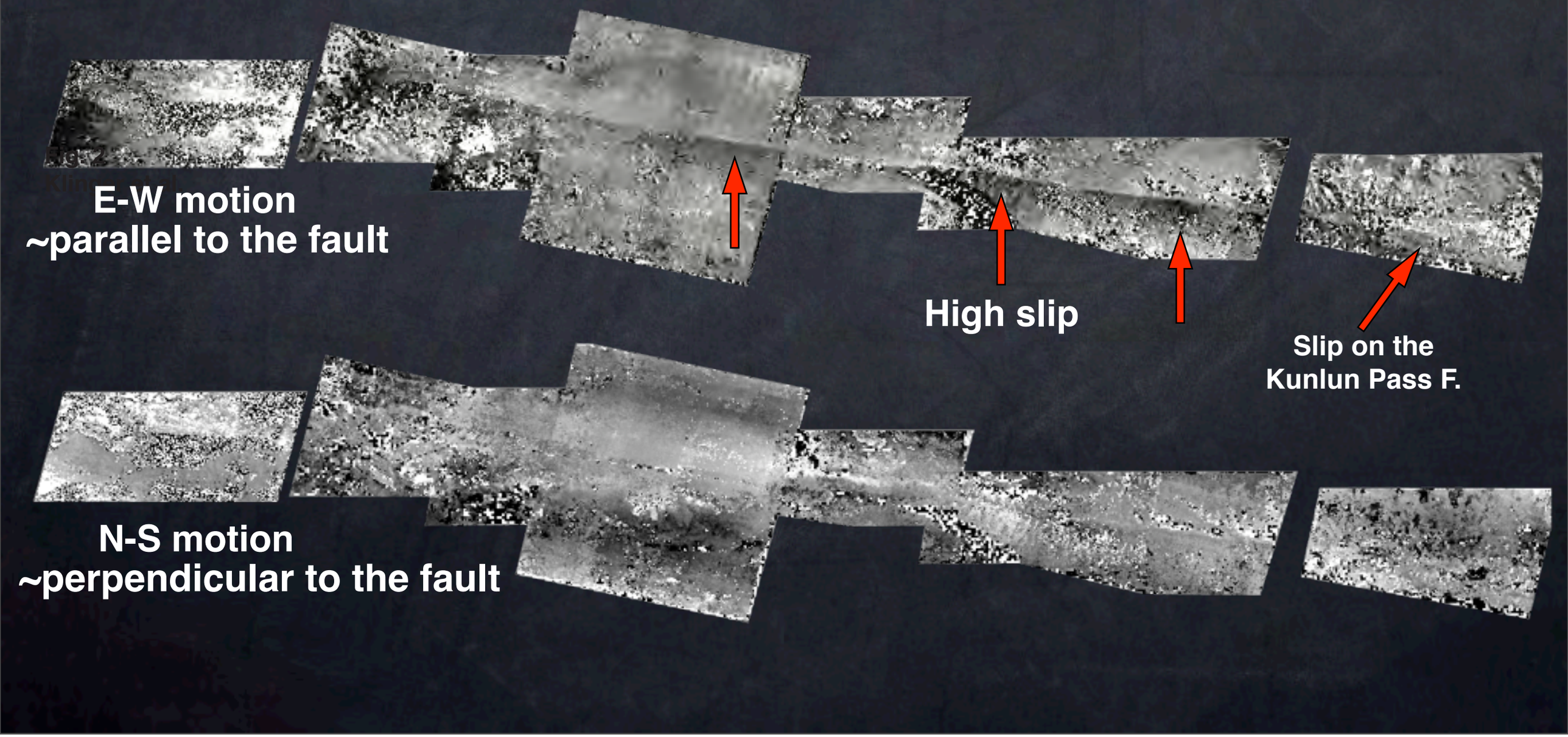
Time between 2 images from 1 to 10 years

→ Arid climate preserves coherence

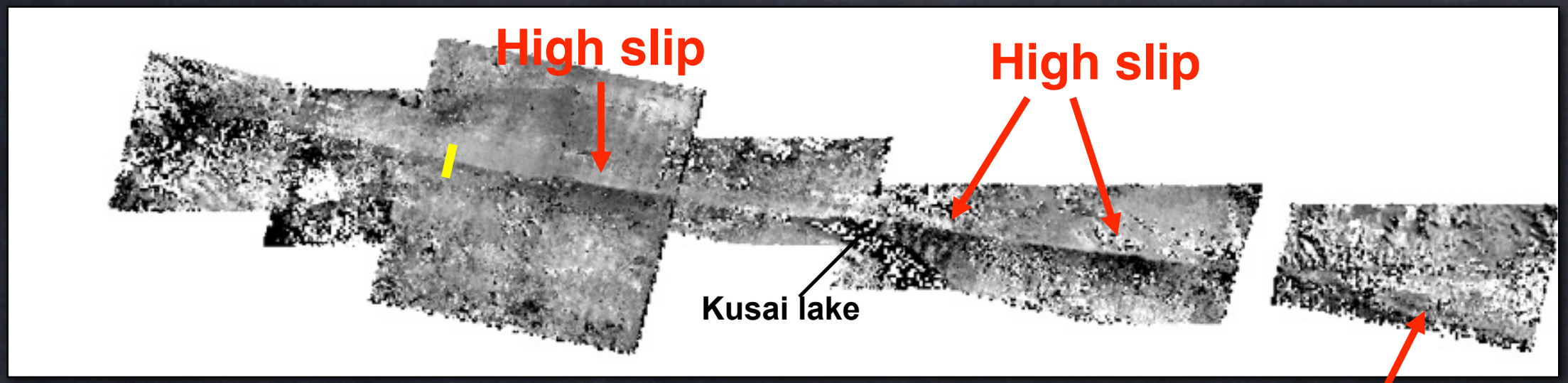


Optical correlation of Spot images



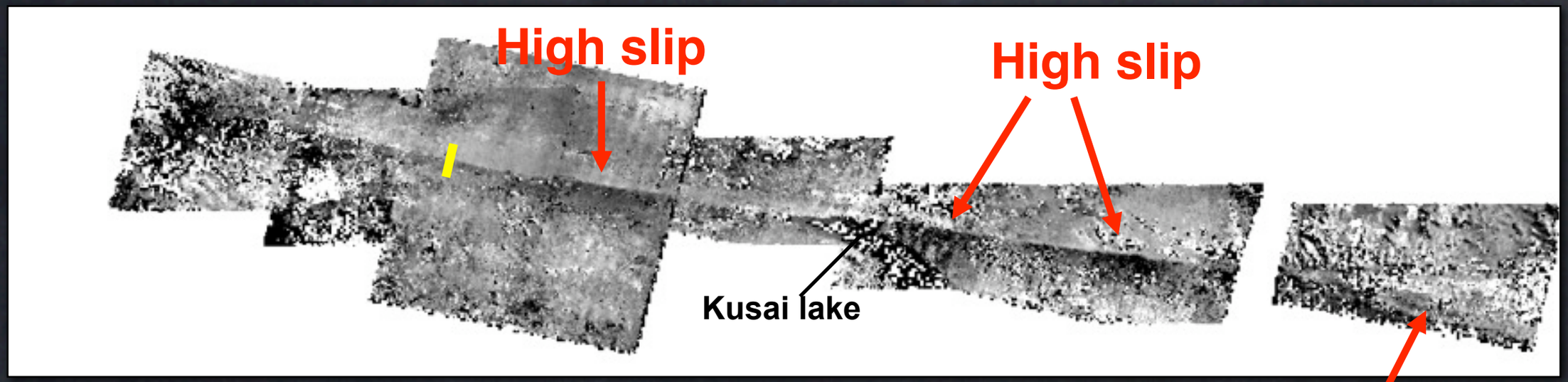


Displacement parallel to the fault

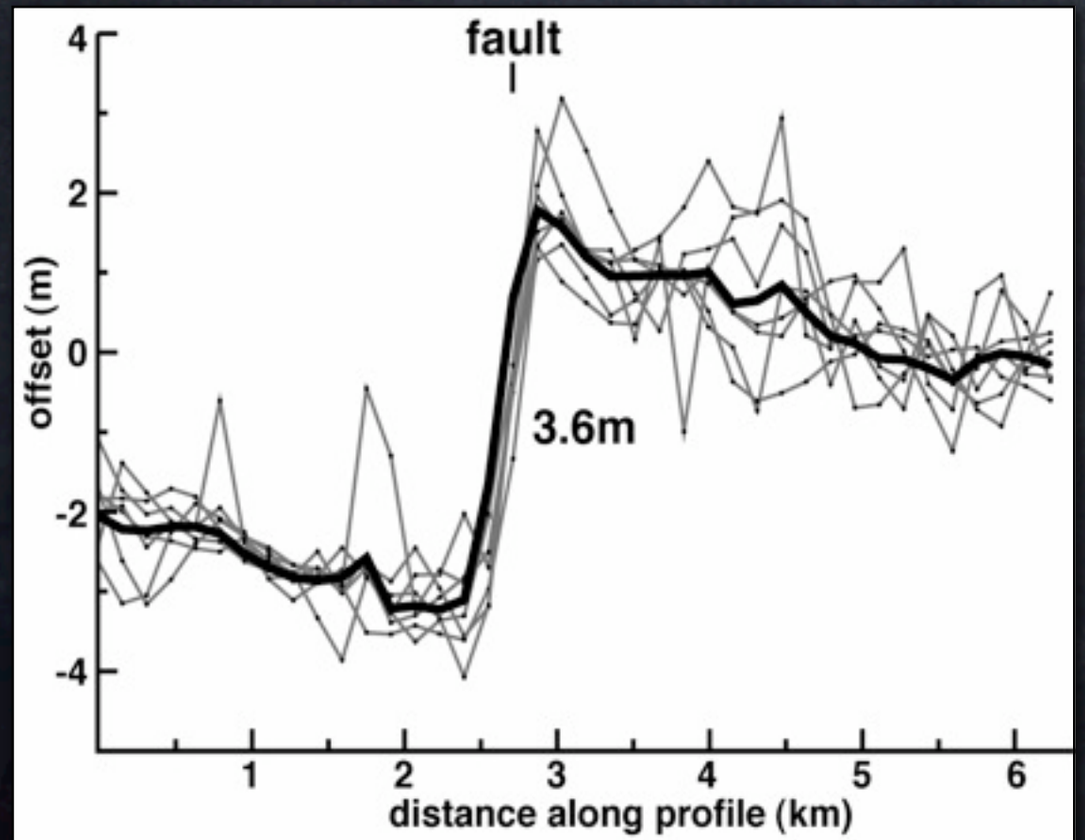


Visible slip
along the Kunlun pass F.

Displacement parallel to the fault

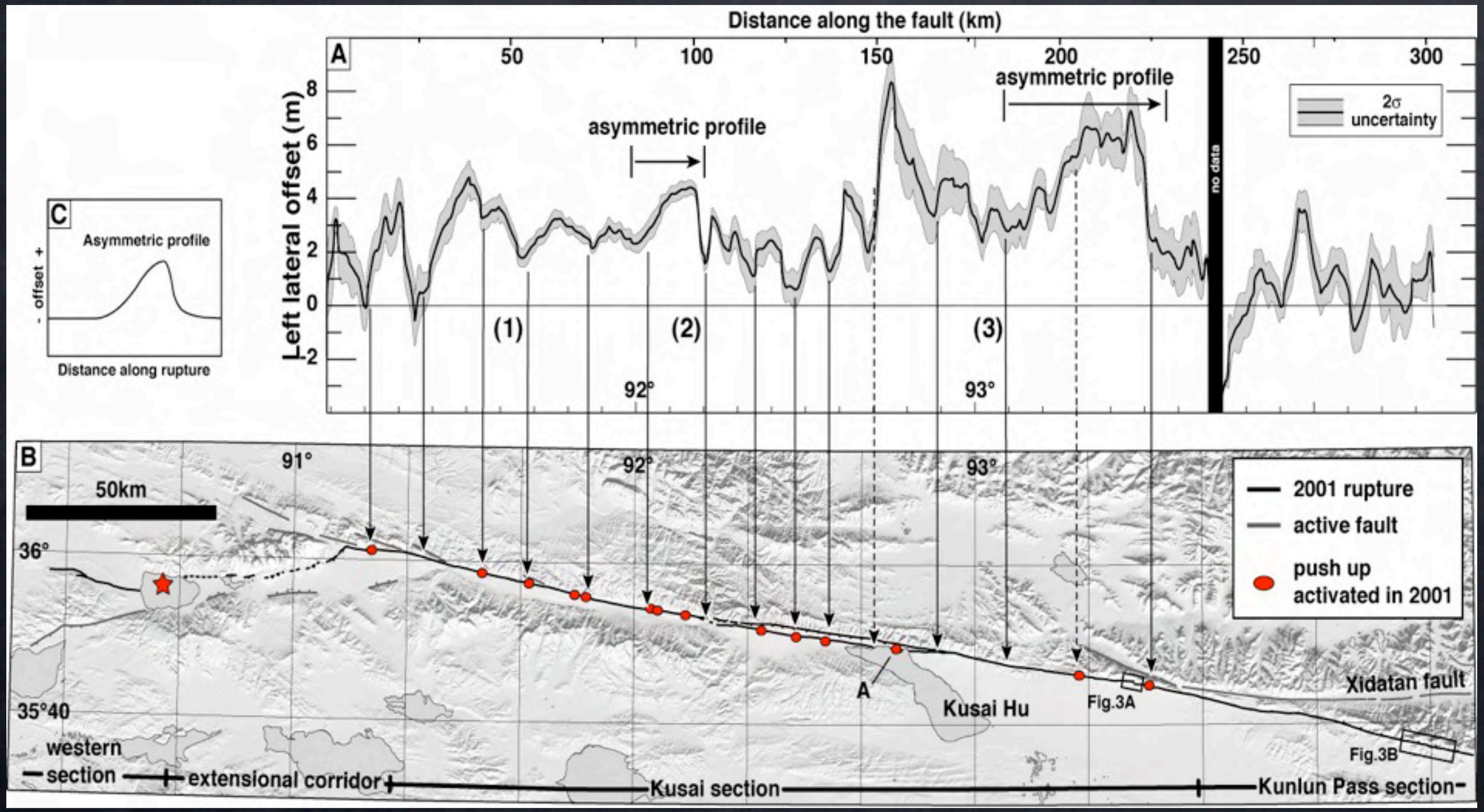


Visible slip along the Kunlun pass F.



1km wide stack from profiles measured every ~150m

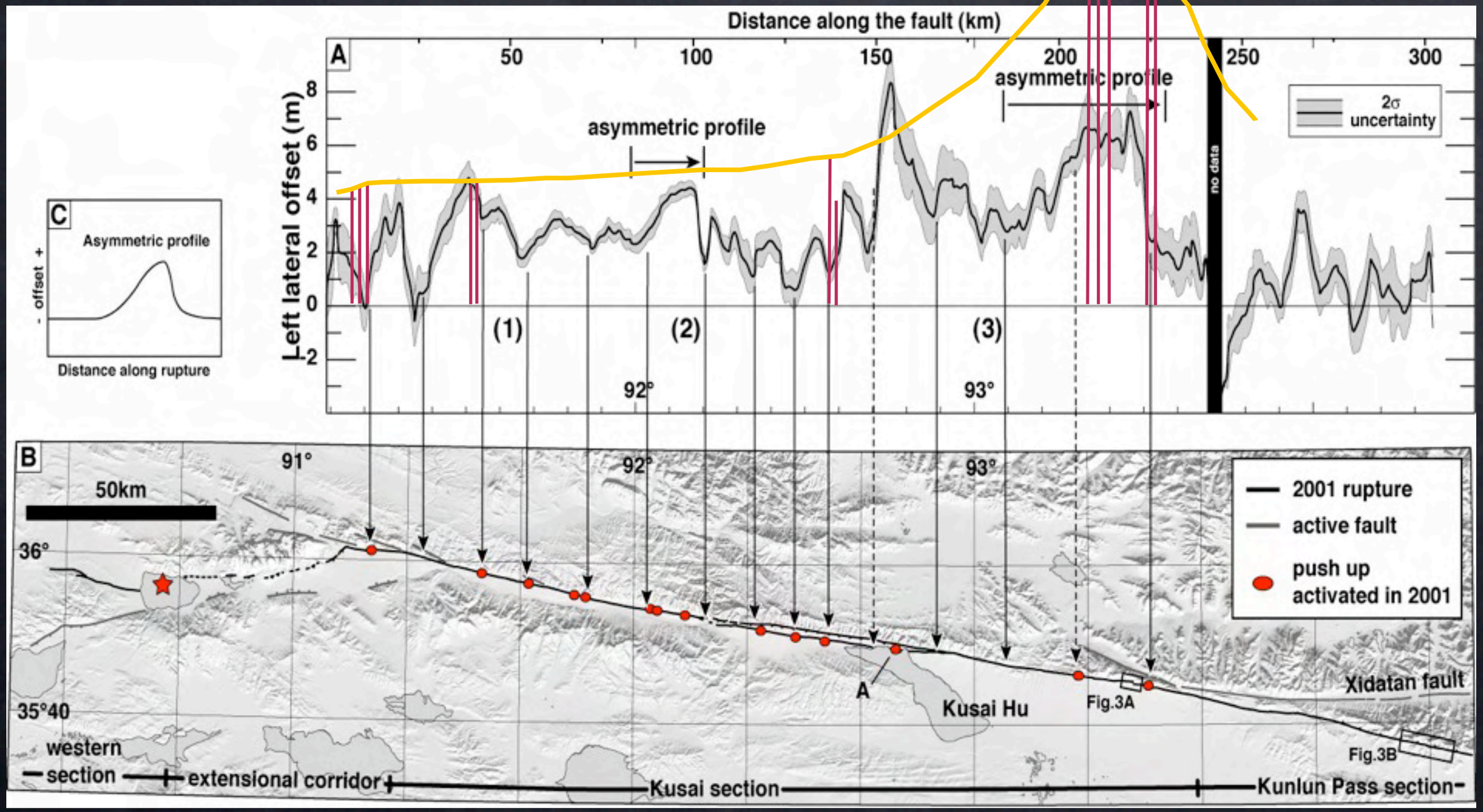
correlation between slip-variation and geometric irregularities of the fault trace



(Klinger et al., 2006)

Evidences for a barrier model

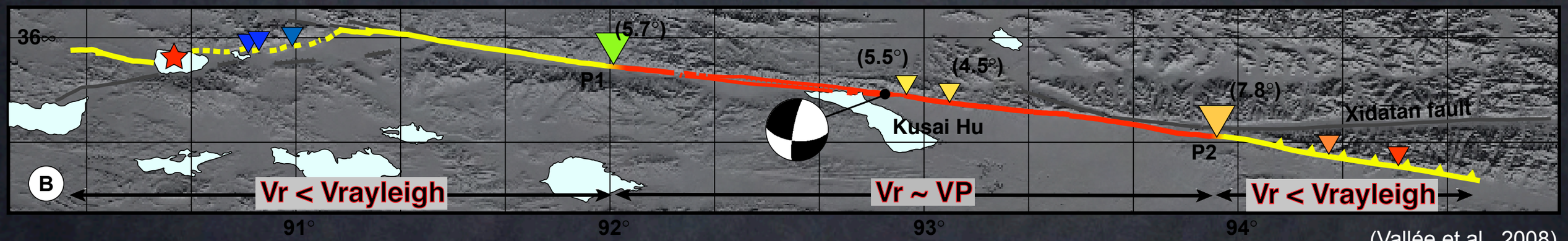
correlation between slip-variation and geometric irregularities of the fault trace



(Klinger et al., 2006)

Evidences for a barrier model

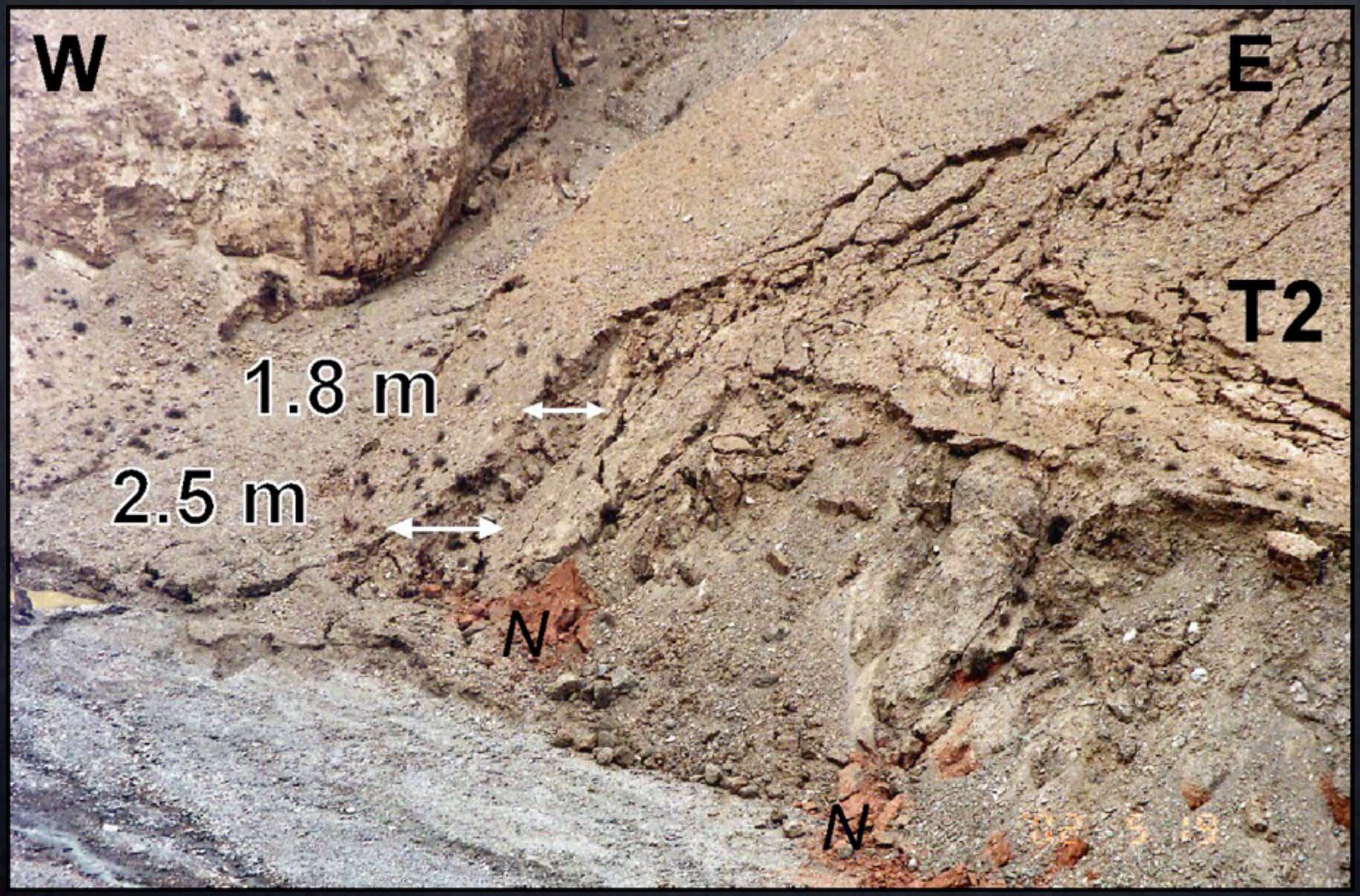
Geometry of rupture impacts rupture velocity

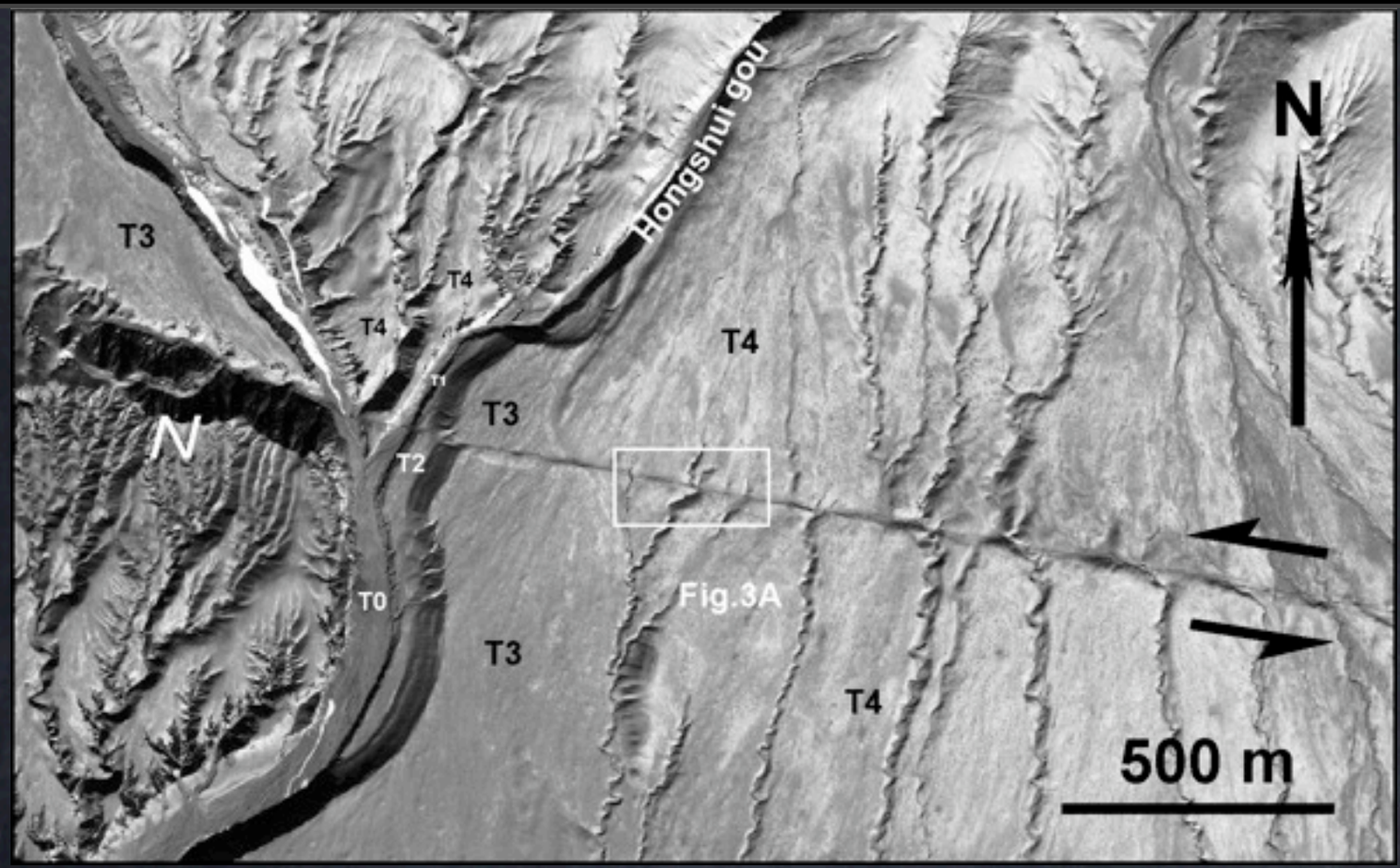


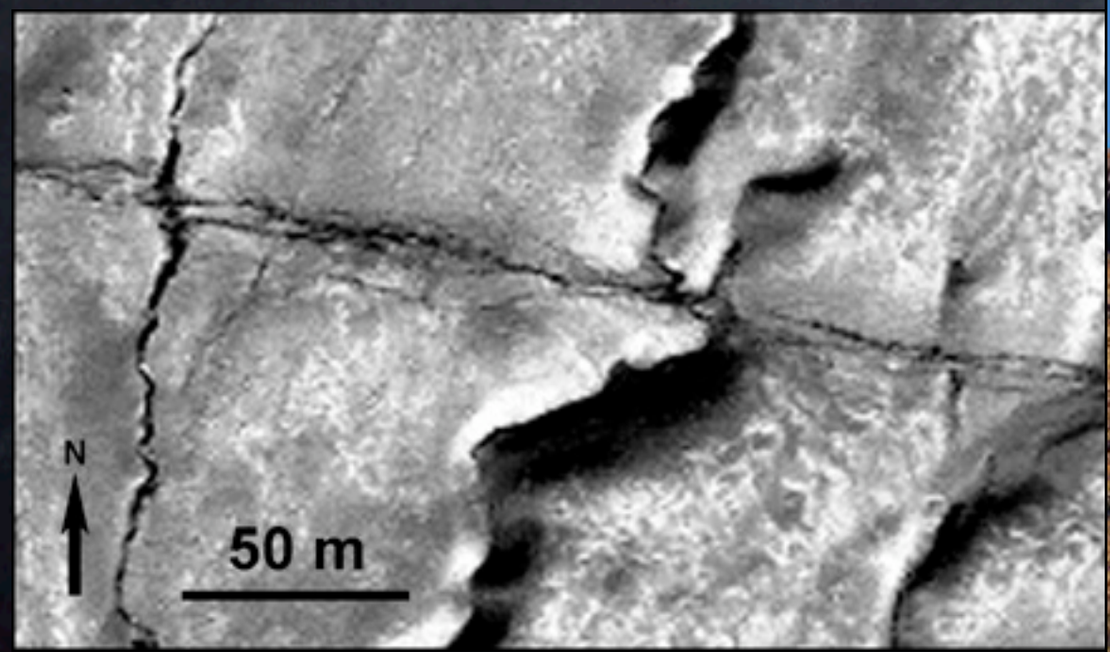
(Vallée et al., 2008)

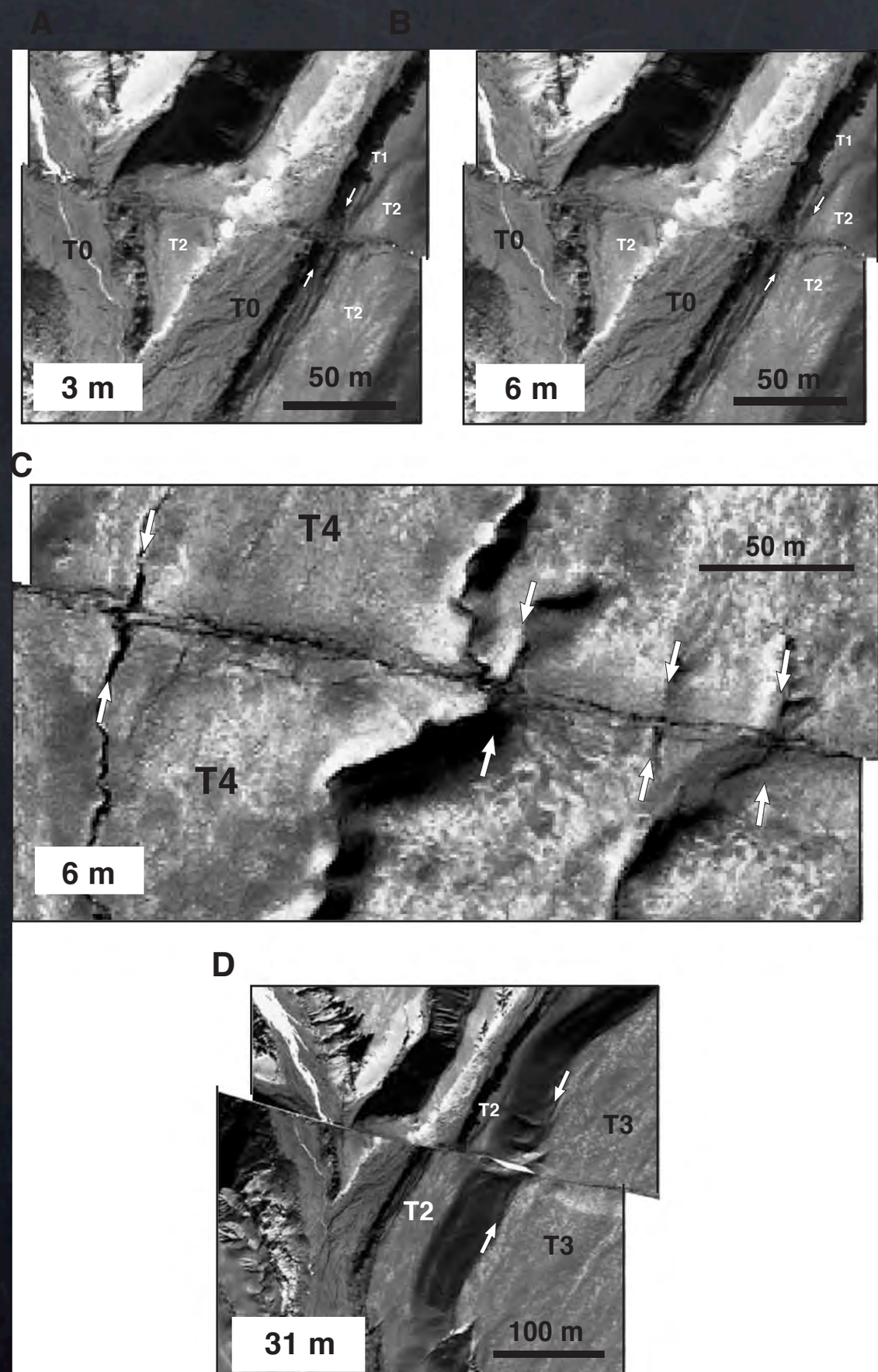
Changes in azimuth correspond to onset and stop of supershear rupture

Earthquake vs cumulative deformation


W
E
T2
1.8 m
2.5 m
N
N


Hongshui gou
N
T3
T4
T4
T1
T3
T2
T4
T0
Fig.3A
T3
T4
500 m

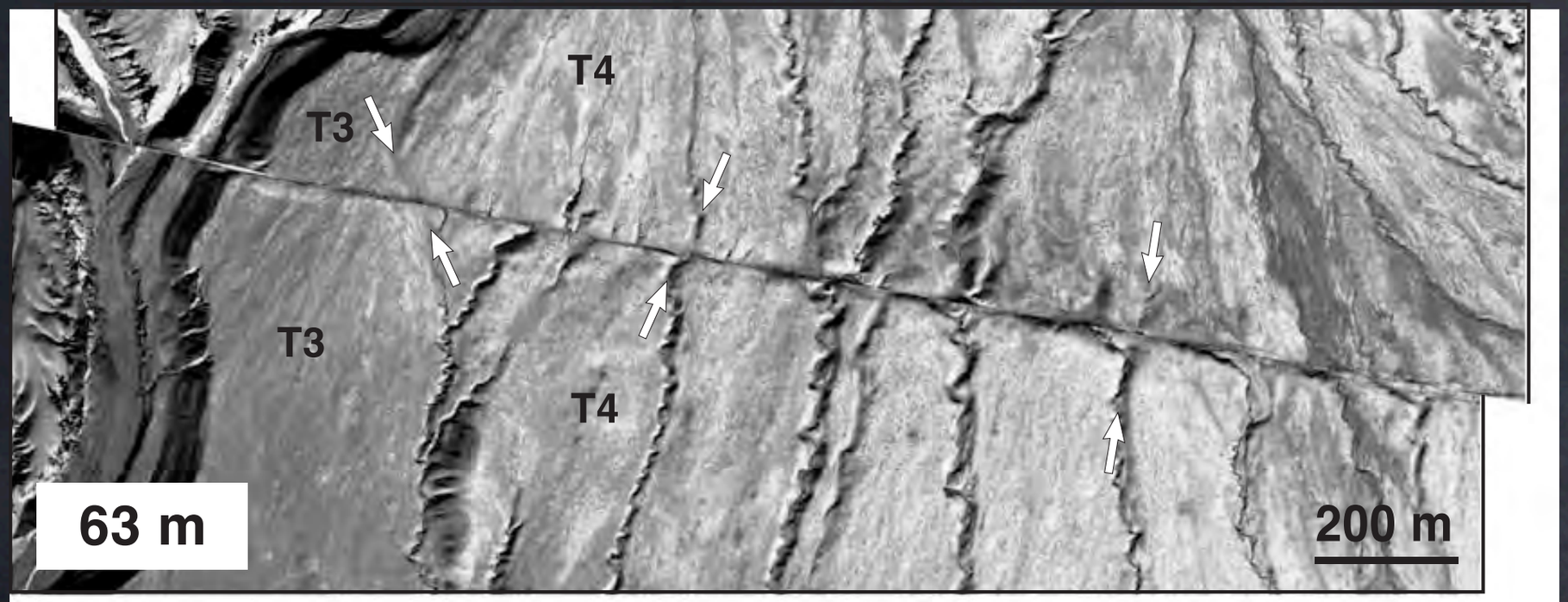

N
50 m



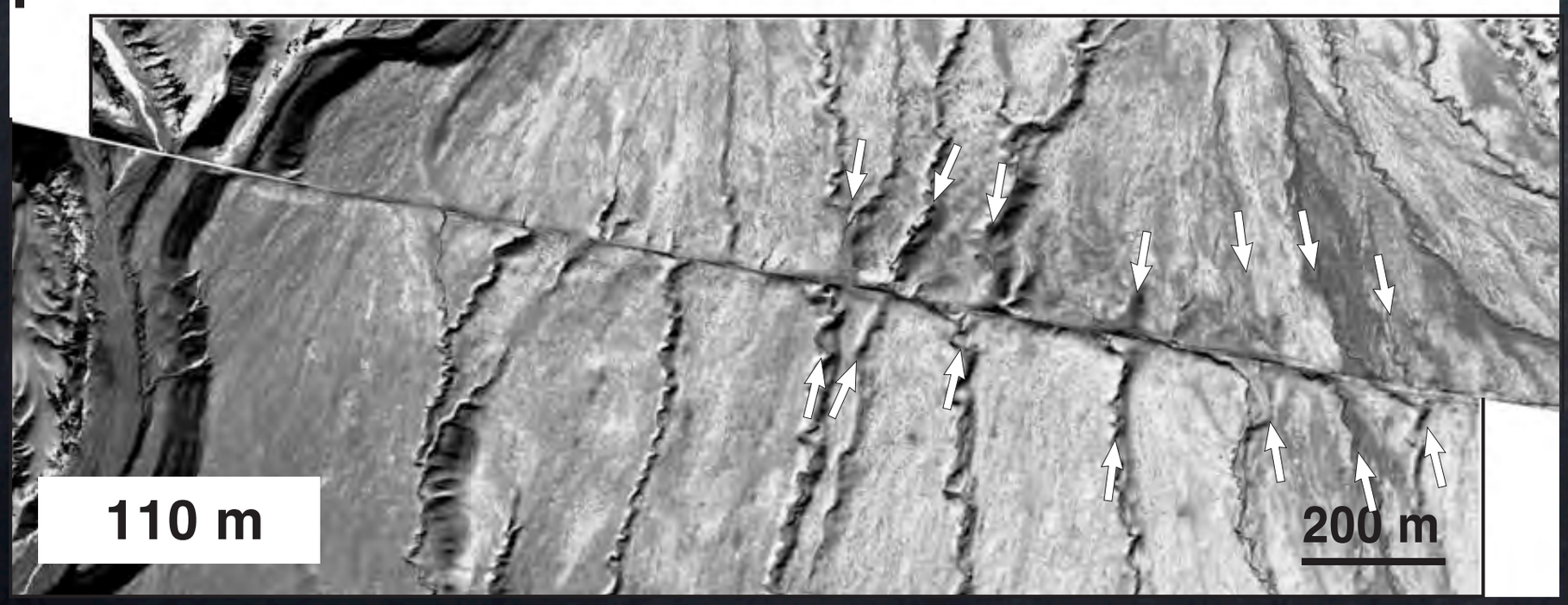
Cumulative offset multiple of co-seismic offset

Long term offset

E

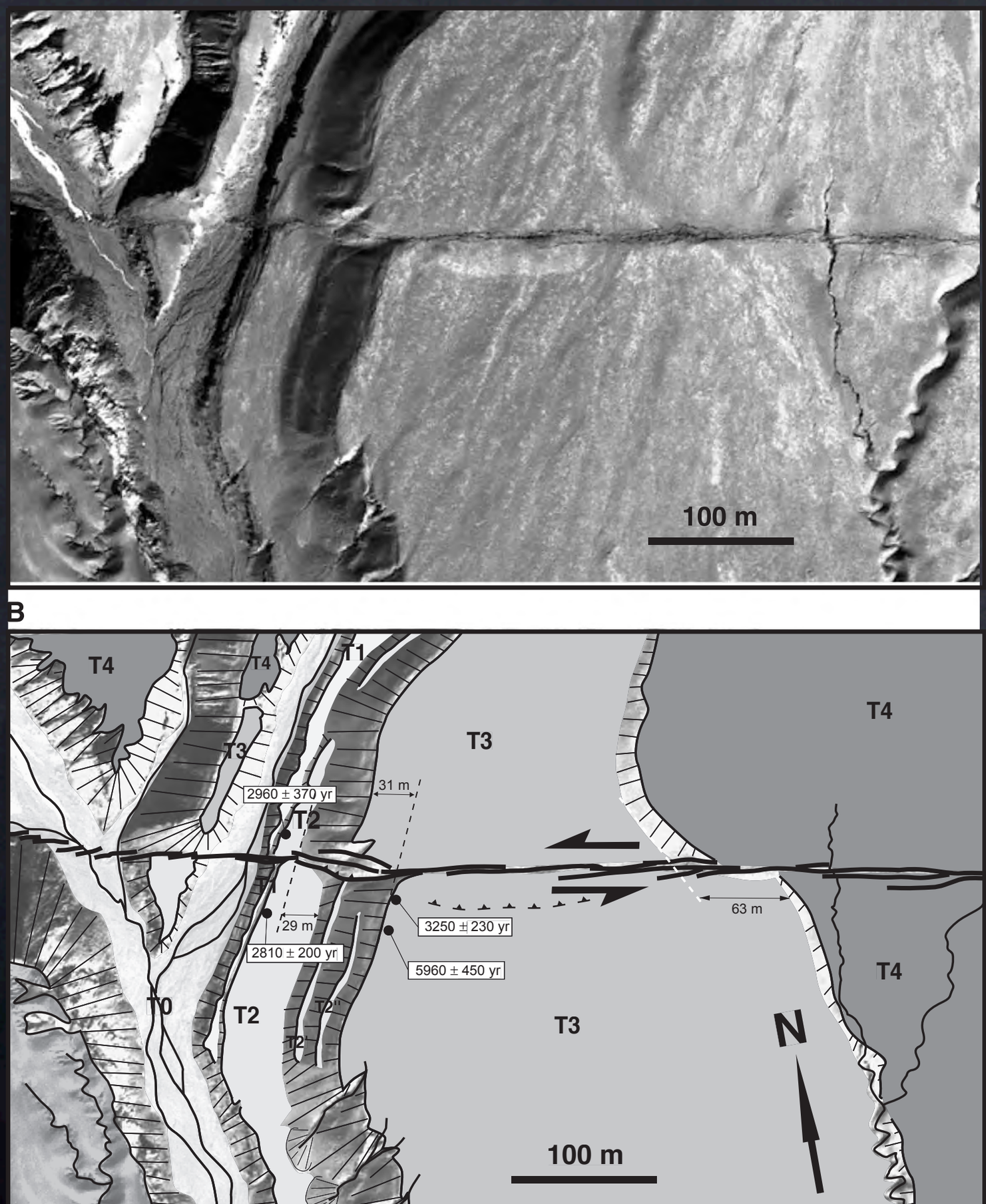


F

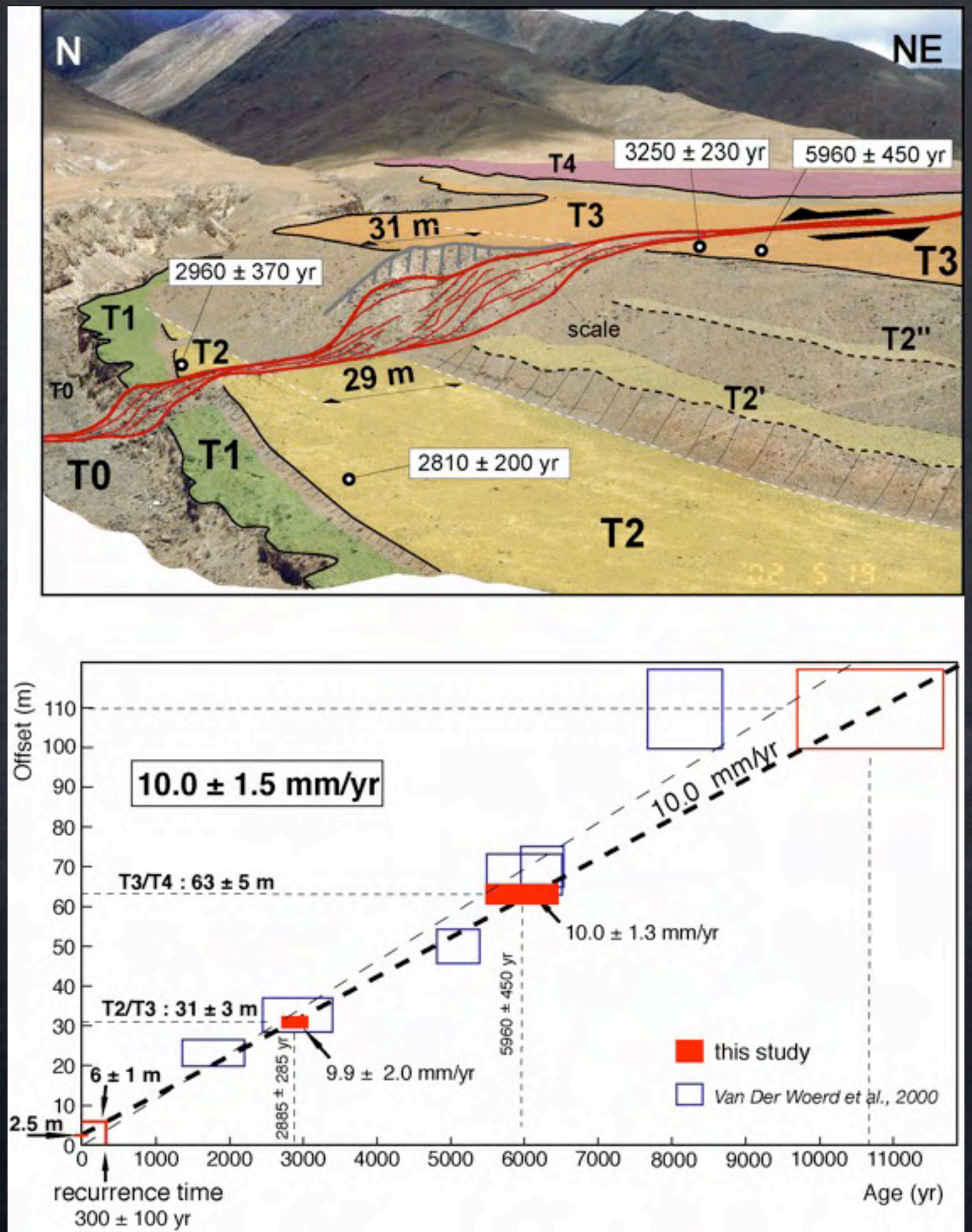


Long term

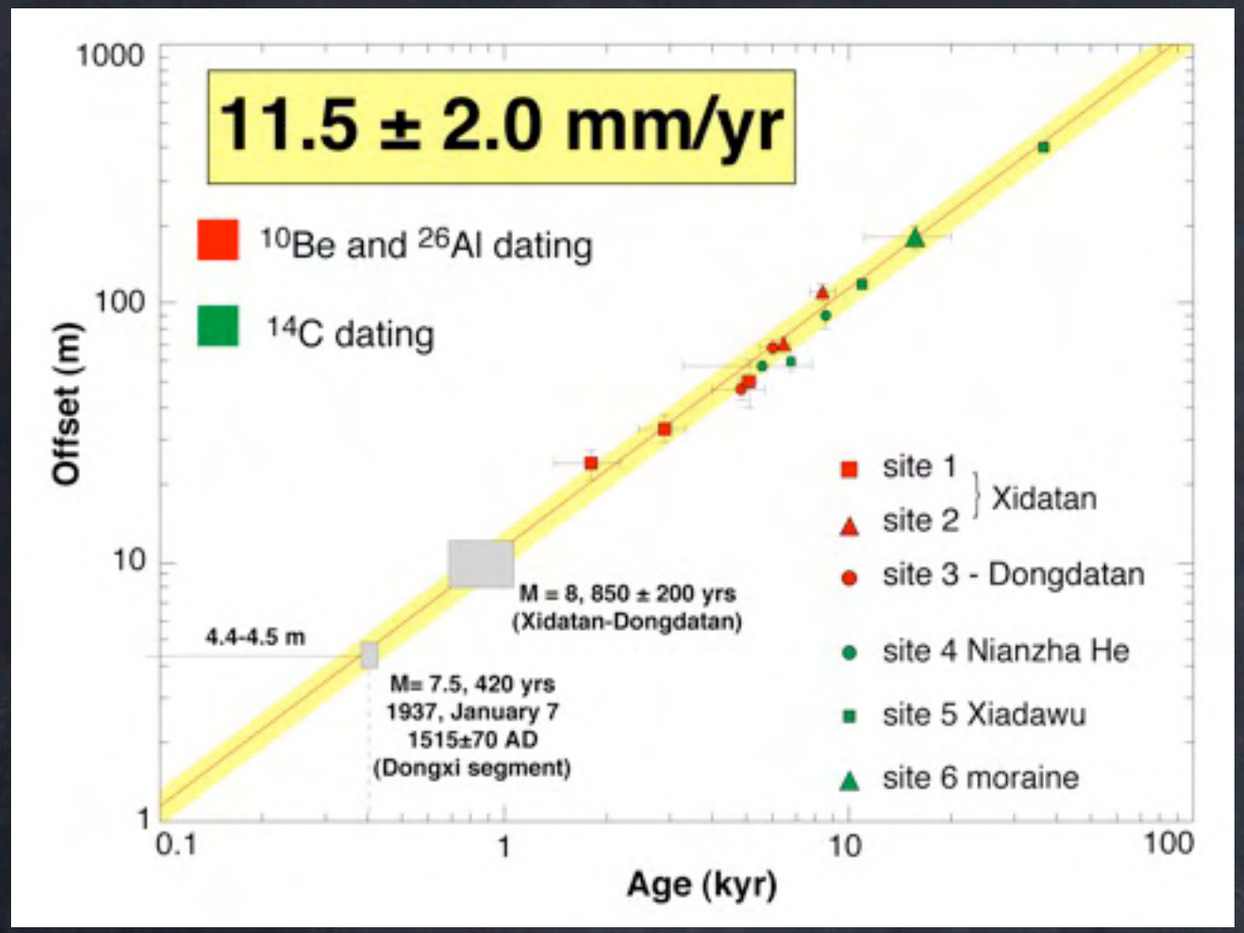
Dating the long term offset



(Li et al., 2005)



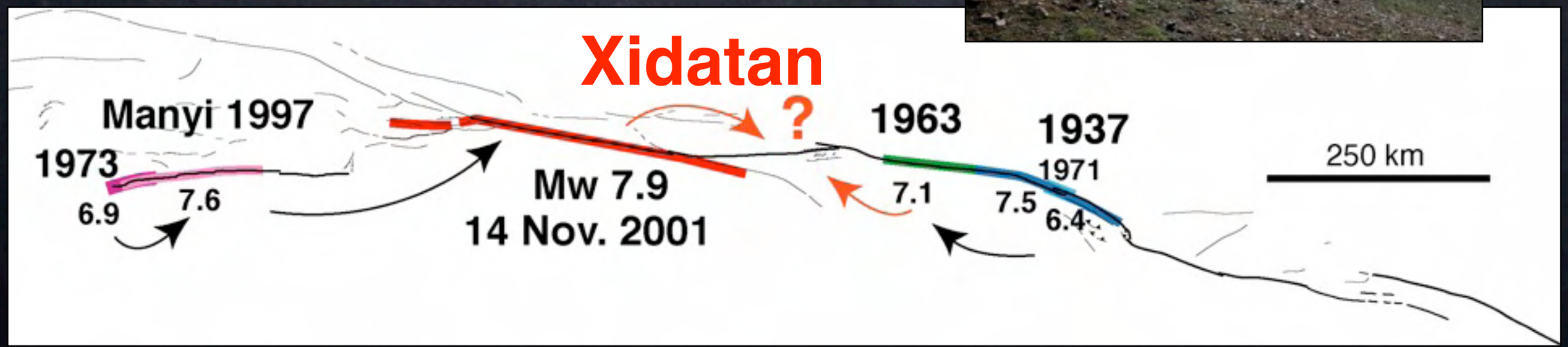
(Li et al., EPSL 2005)

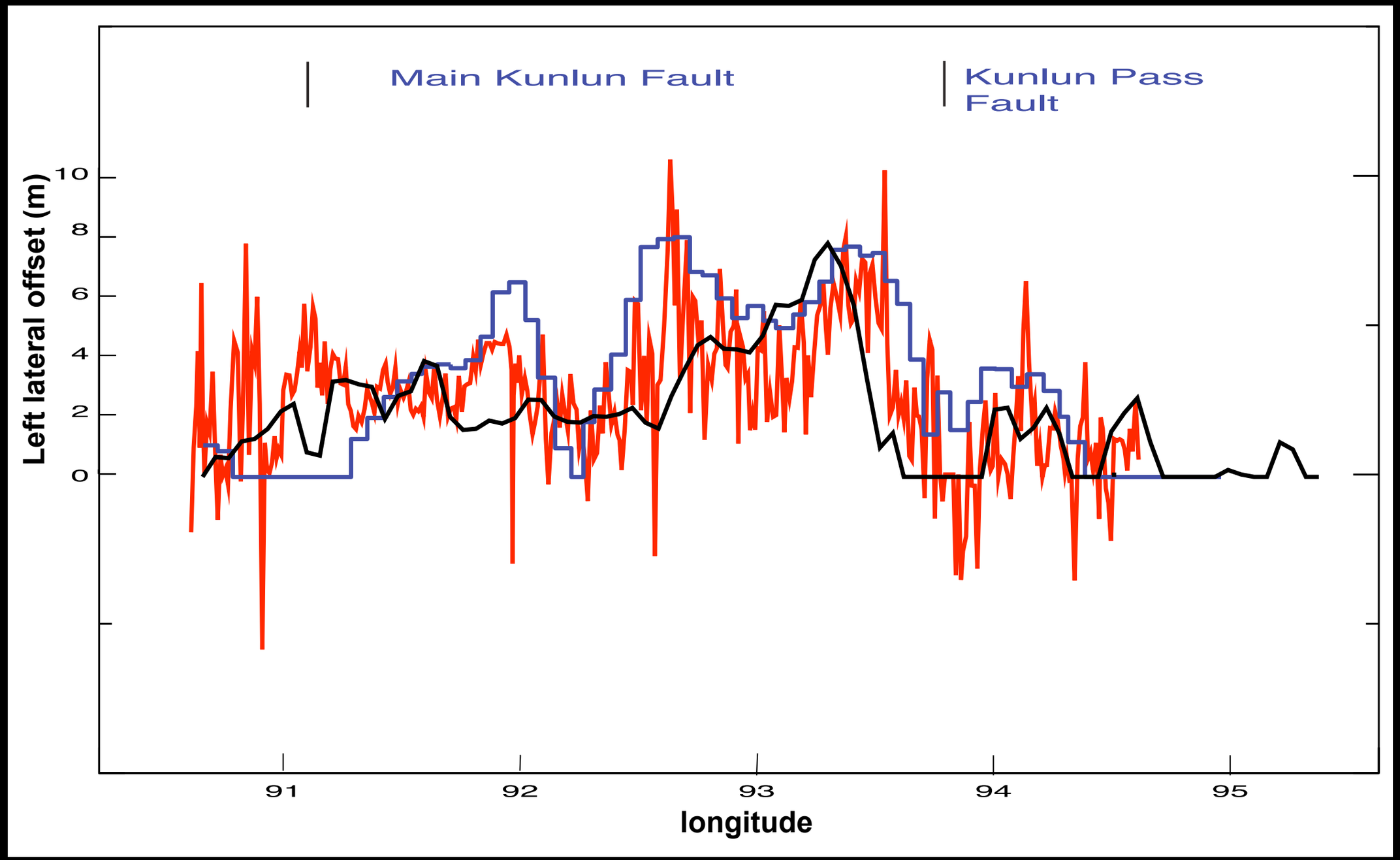


Kokoxili earthquake :D ~ 4 - 5 m
Kunlun Fault V = 11.5mm/y

Return time for similar event:
~500yr along Xidatan segment

Last event at least 600BP





Seismological inversion (Antolik et al., 2004)

Insar (Lasserre et al., 2004)

This study