Seismic Expression of Fault Related Folding in Southeastern Turkey

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Petroleum Ltd.

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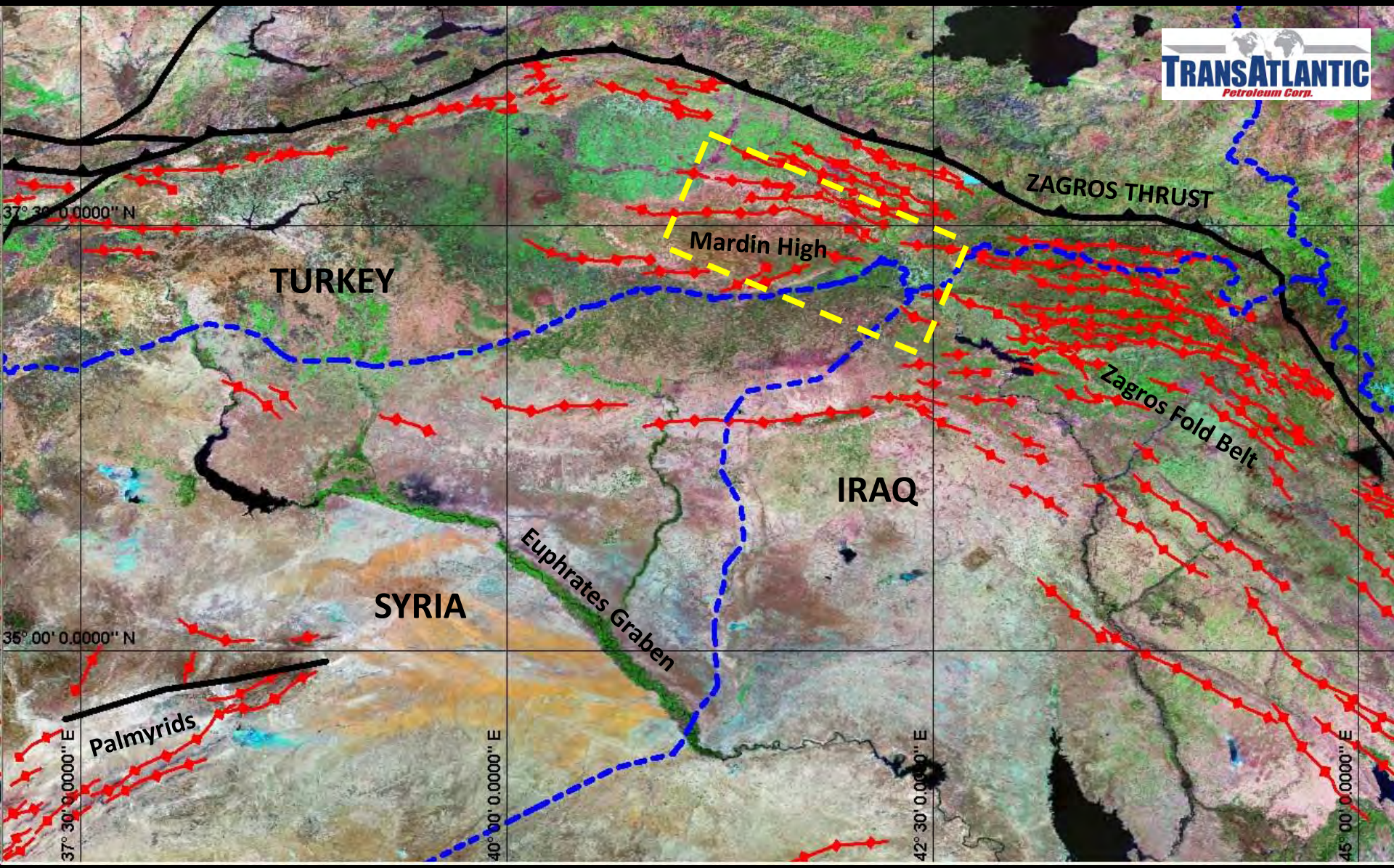
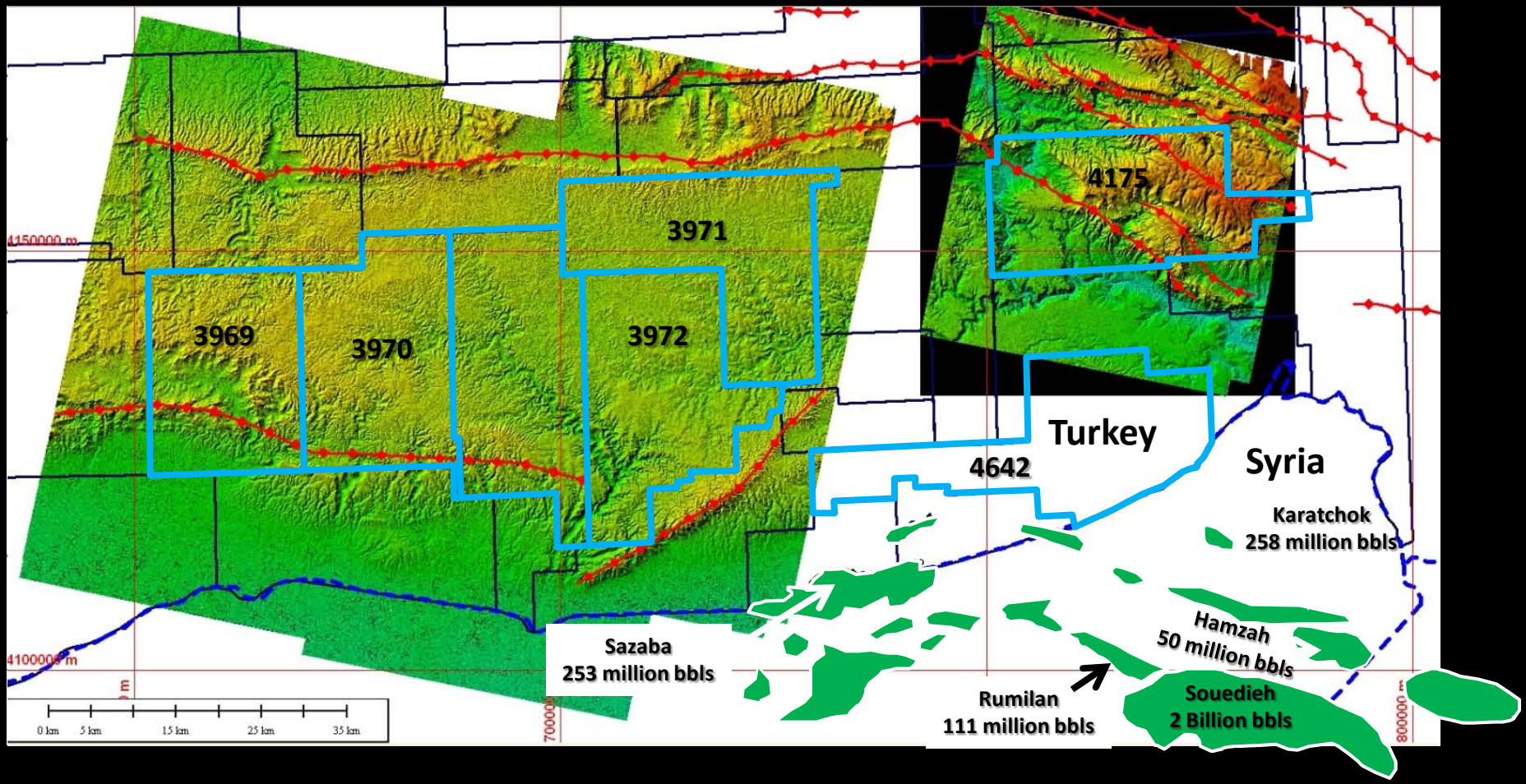


Location of the study area in SE Turkey



Location of Licenses 3969,3970,3971,3972,4642 and 4175 in SE Turkey. These licenses are on trend with major oil and gas fields in the Zagros fold belt.

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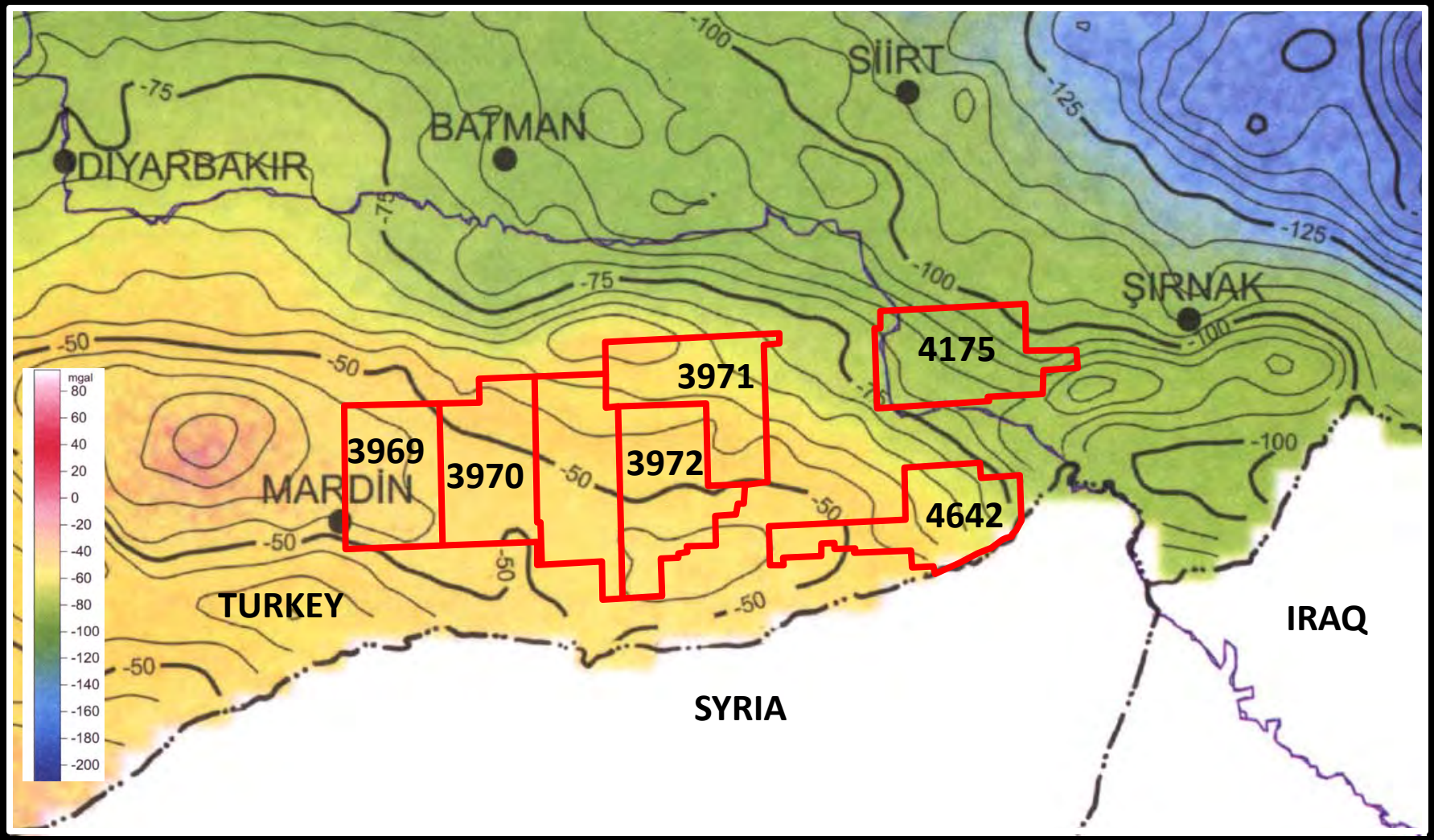

Bouguer Gravity data over the Mardin High. Licenses 3969,3970, 3971, 3972,4642 and 4175 are situated on the Mardin regional basement high. TransAtlantic is acquiring 750 gravity stations over this area Fall 2009 to assist in exploration and planning of future seismic acquisition.

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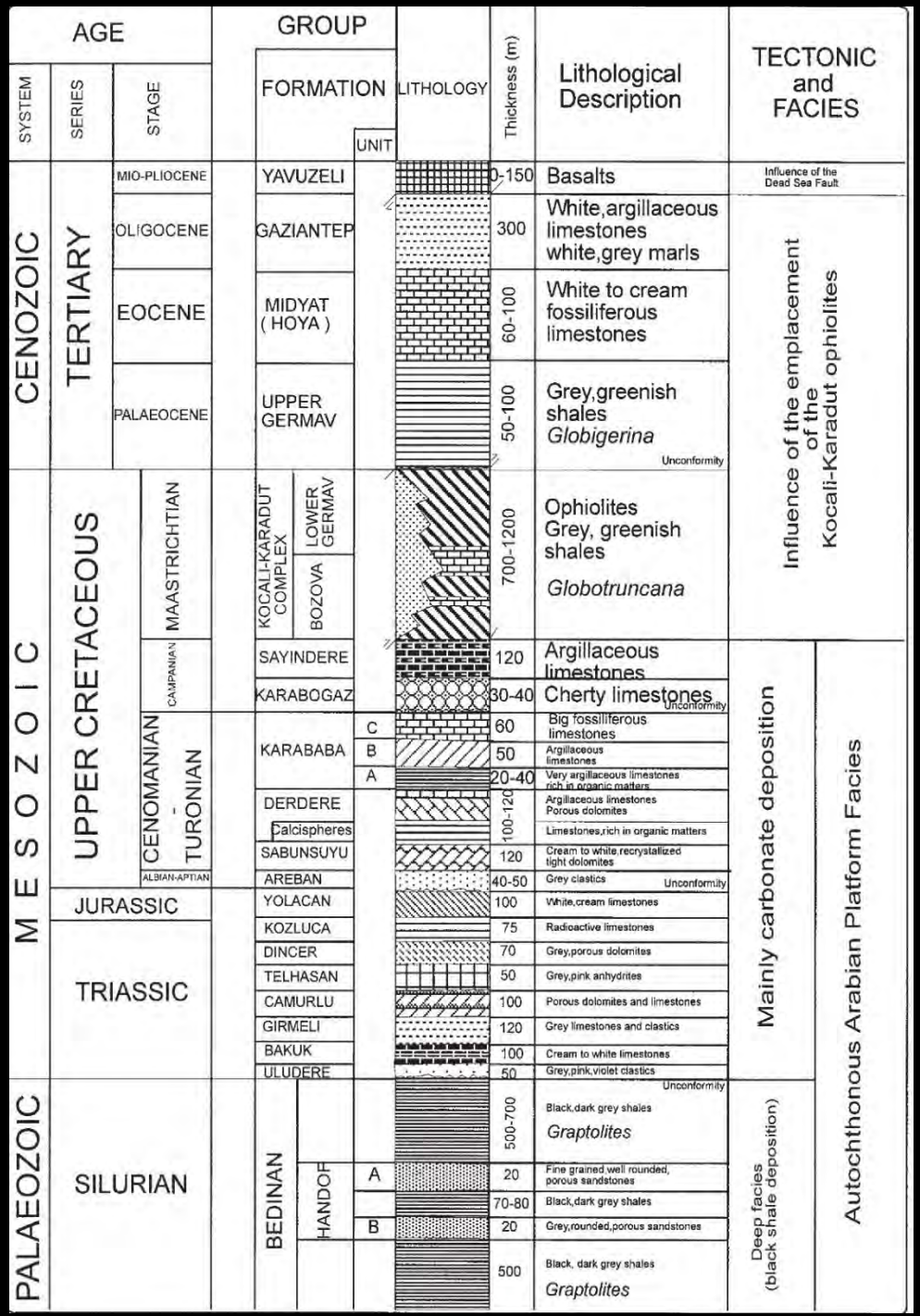

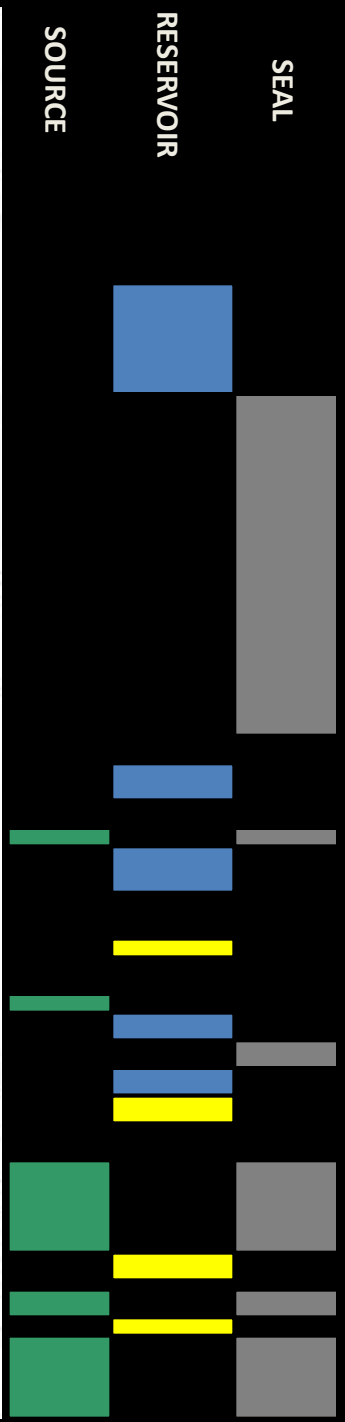

- Stratigraphic column of proven plays in SE Turkey
- Potential Mesozoic and Paleozoic source rocks, reservoirs and seals.
- These reservoirs are productive from the same hydrocarbon systems In Iraq and Syria.
- Rich source rocks of Silurian, Triassic and Cretaceous age are proven.

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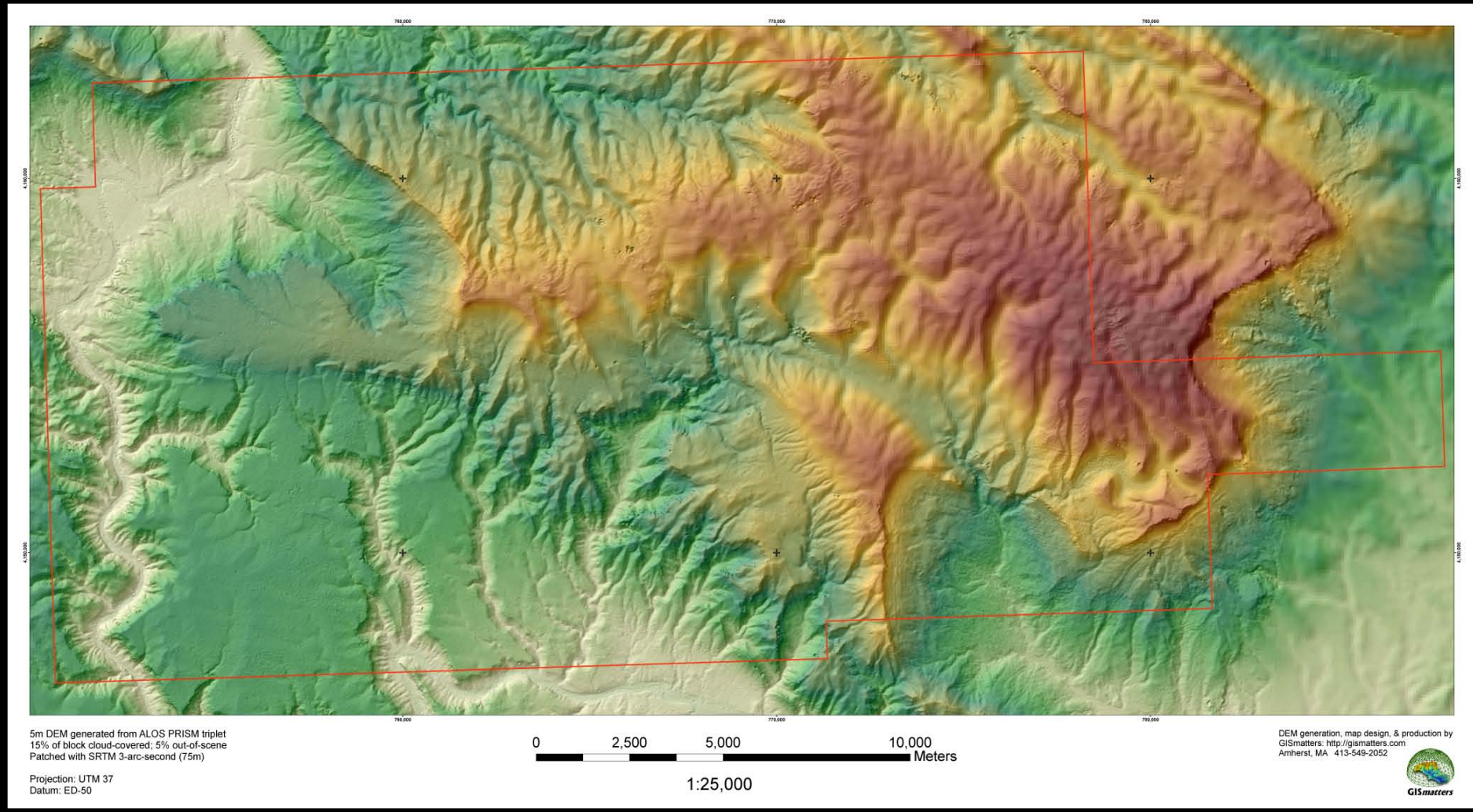

4175 ALOS PRISM Digital Elevation Model, 2.5 meter resolution

All Terrain

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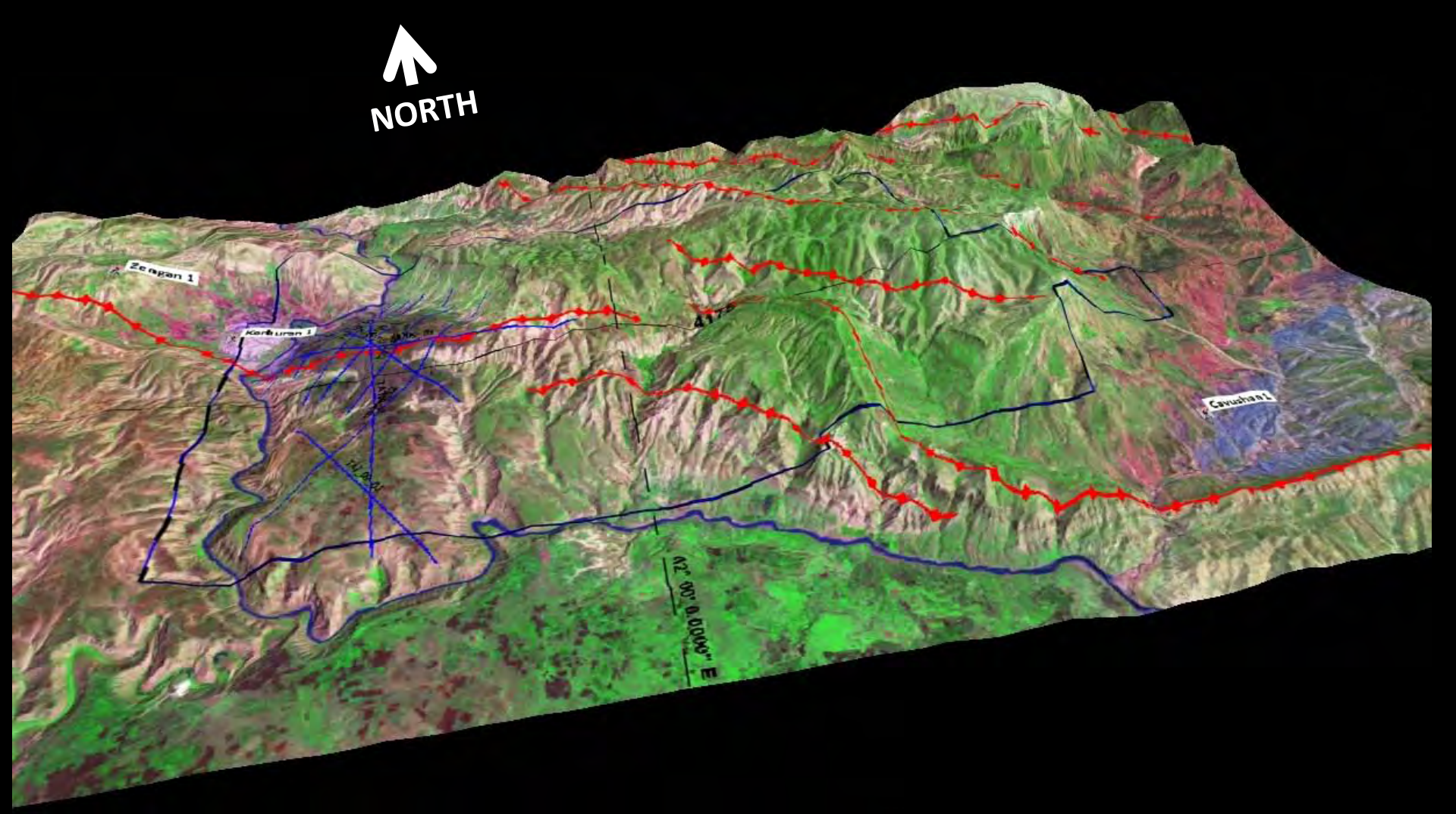
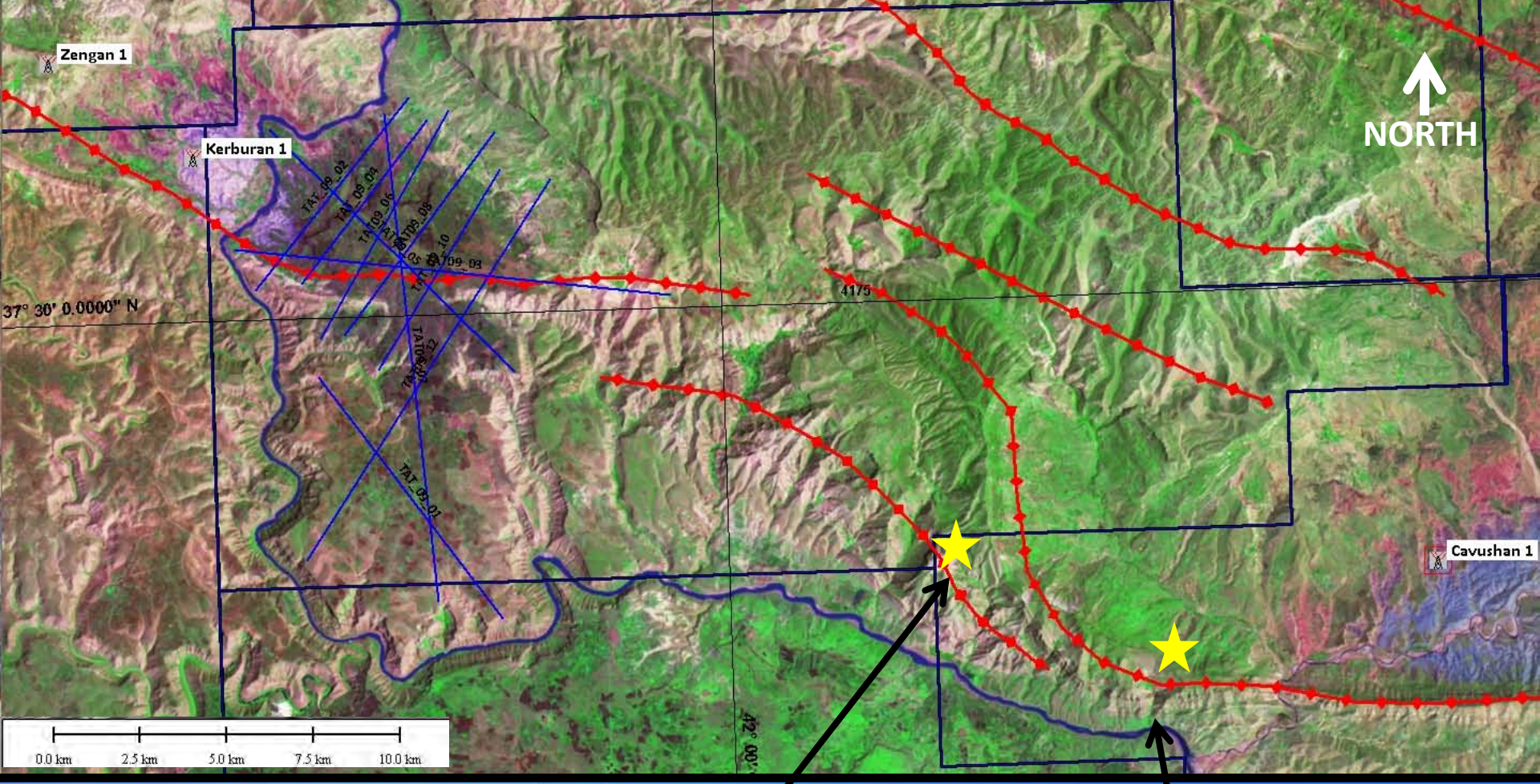
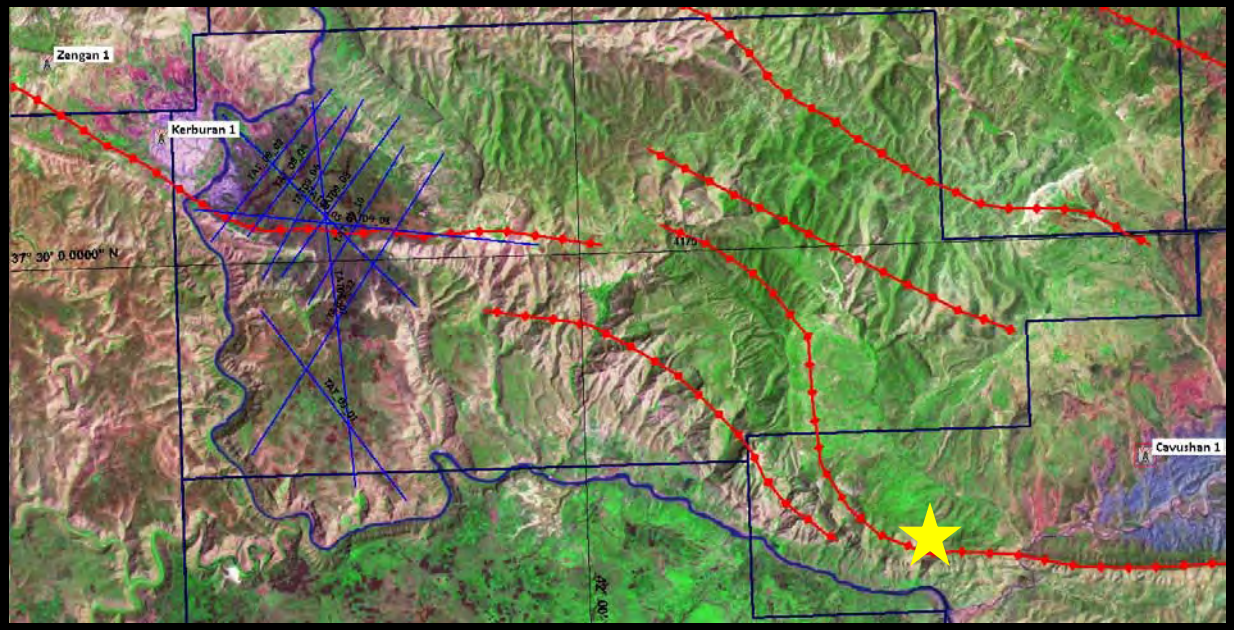
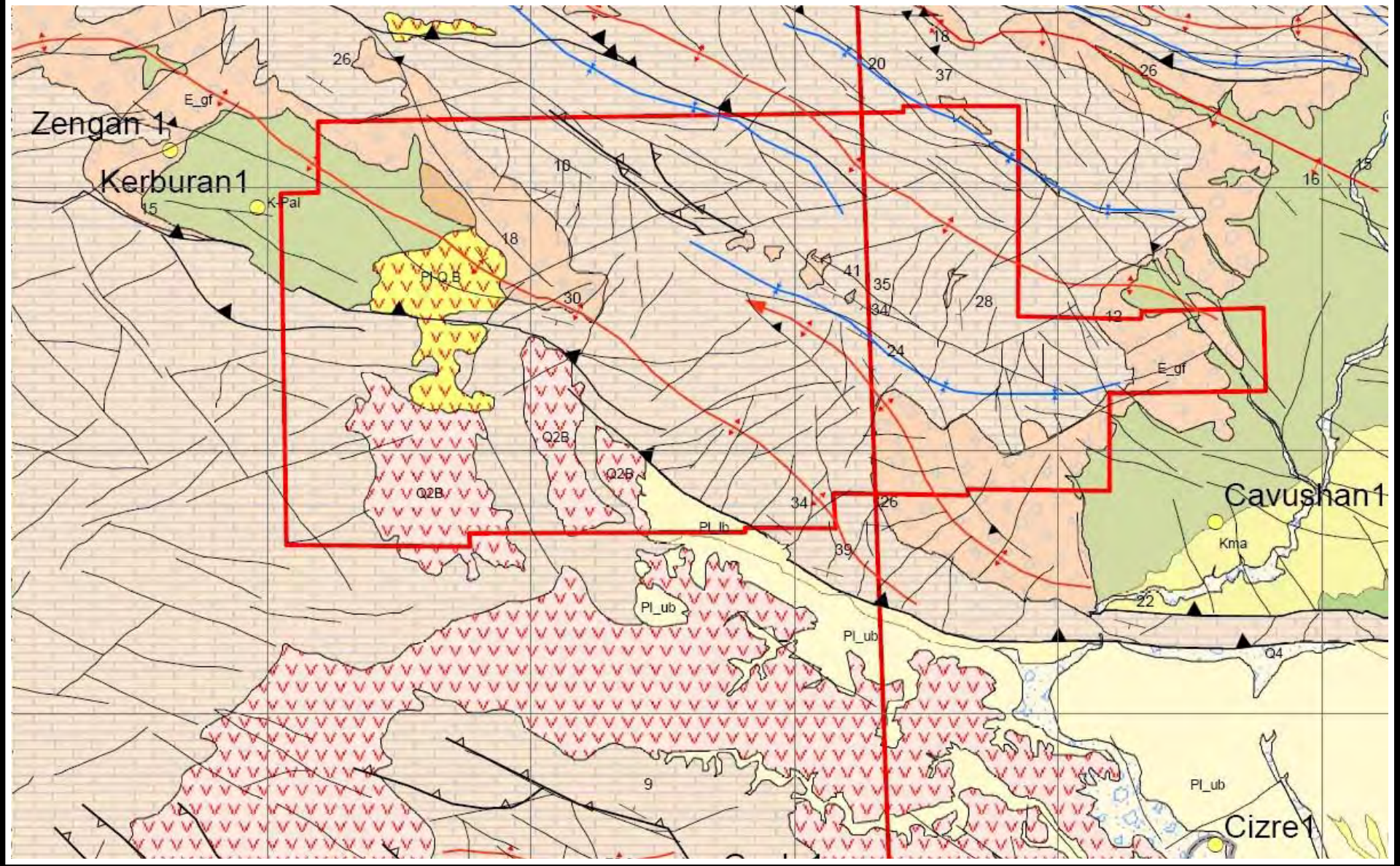

NORTH
Zeragan 1
Karaburan 1
Cavuchan 1
42° 00' 0.0000" E



http://www.gigapan.org/gigapans/36680/


Zengan 1
Kerburan 1
37° 30' 0.0000" N
Cavushan 1
NORTH



4175 License FUGRO-NPA Regional geological map

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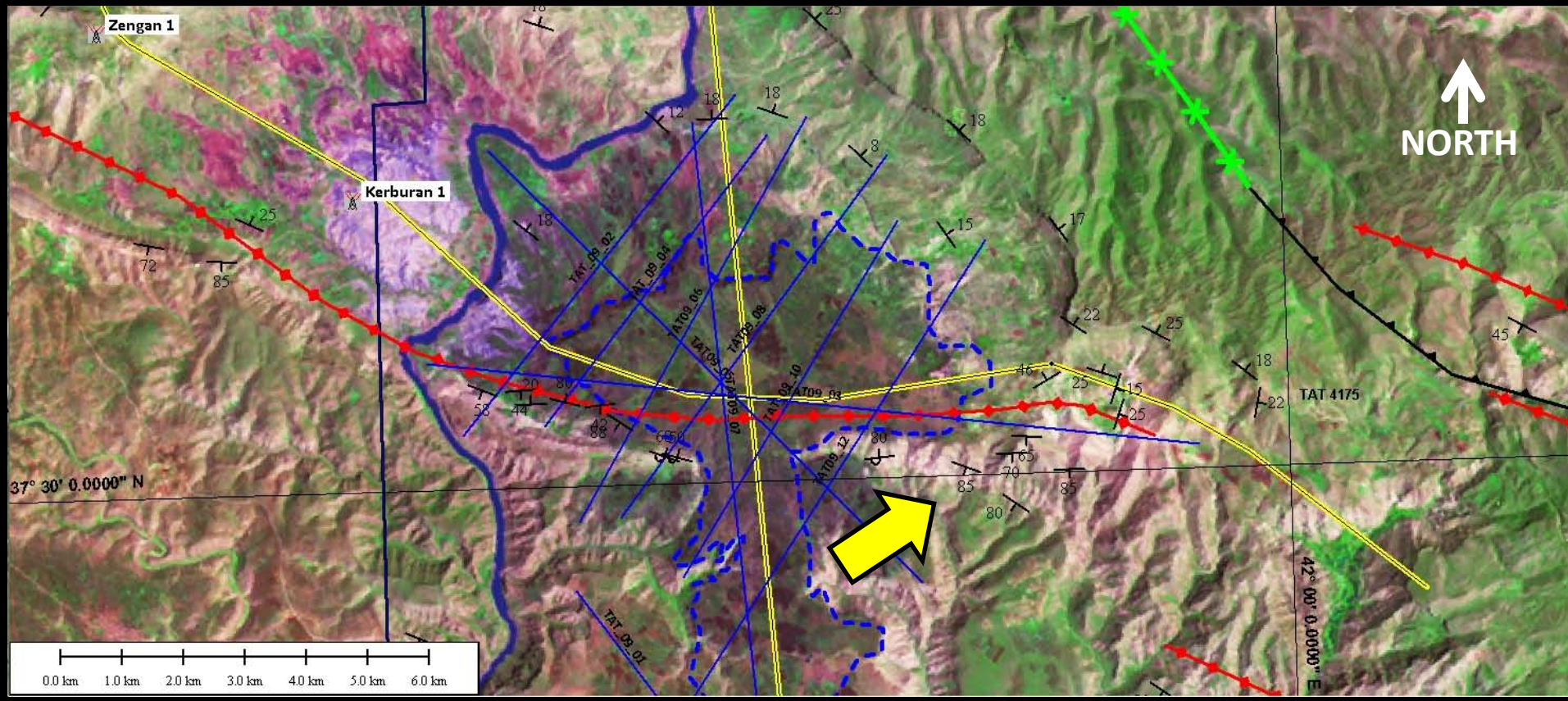

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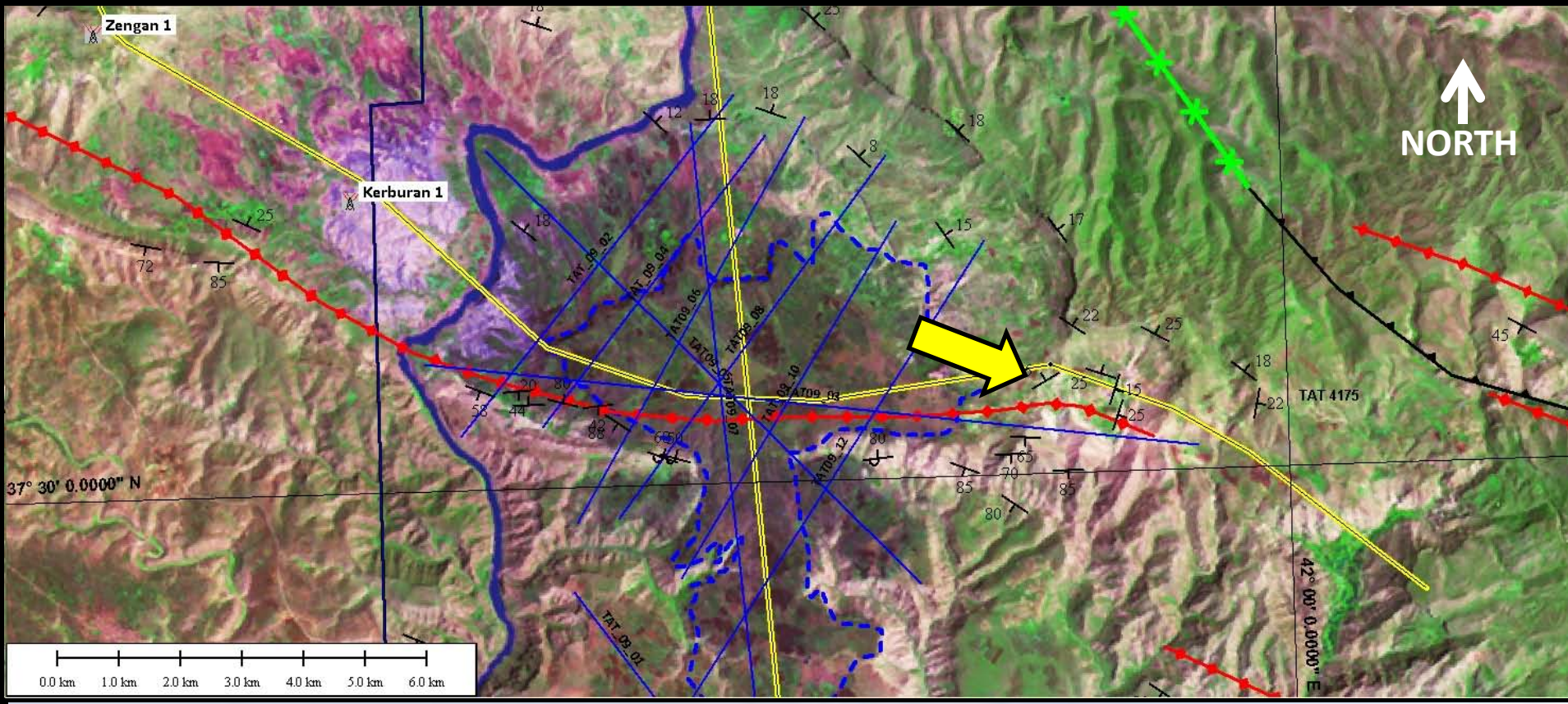

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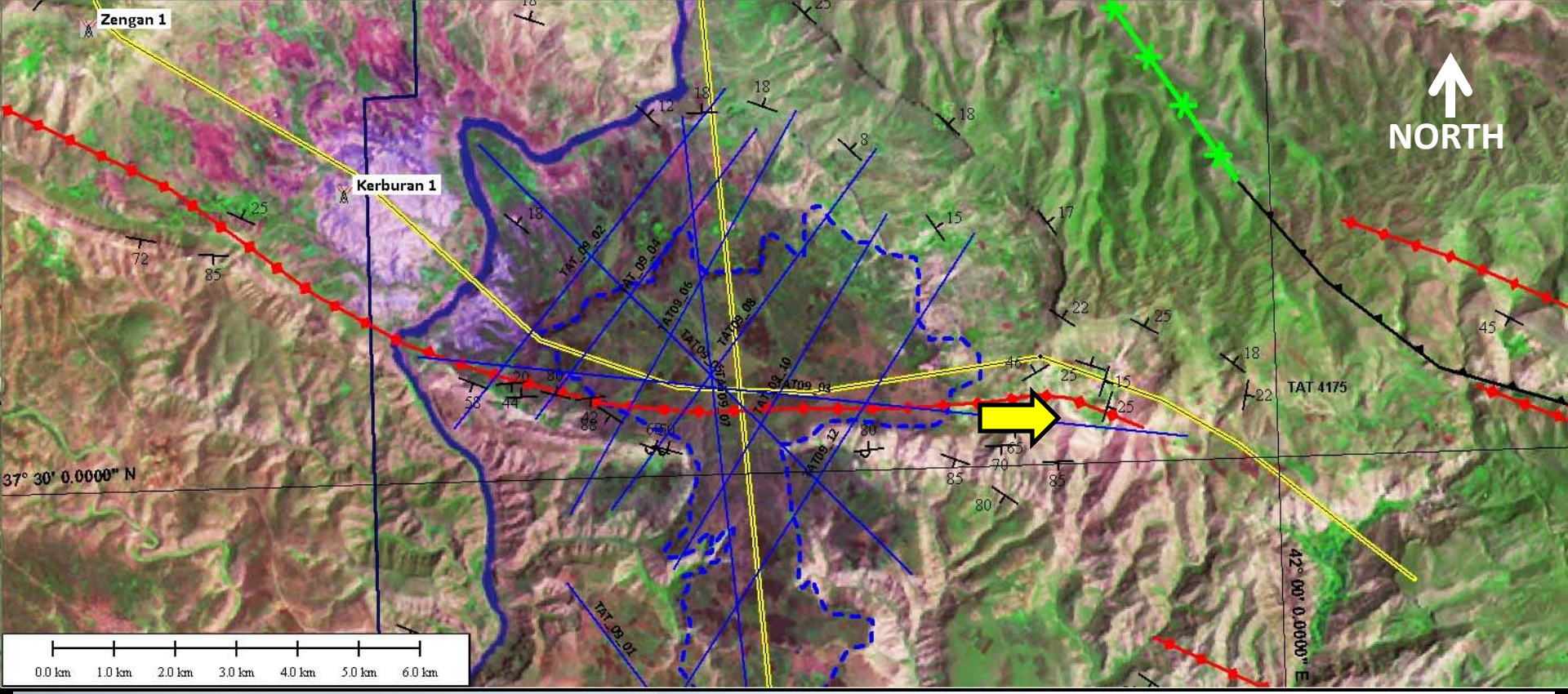
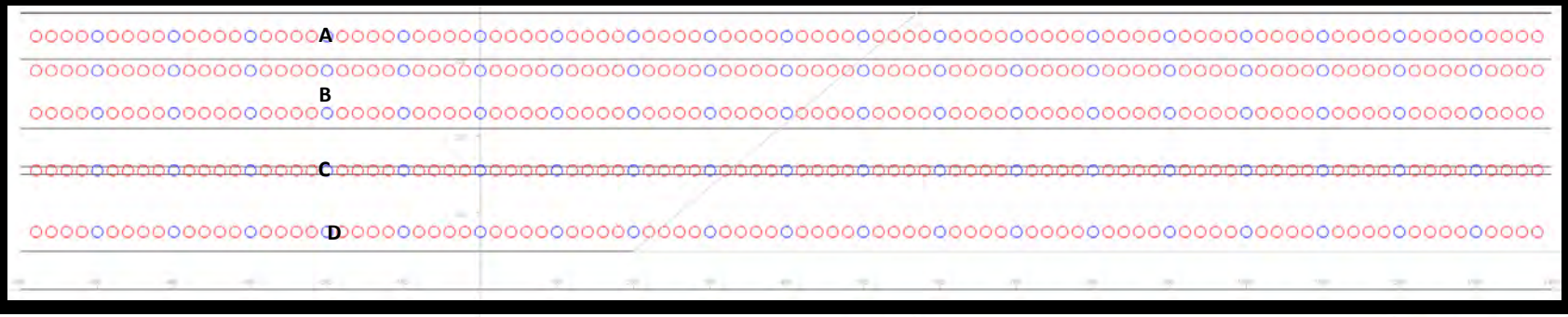
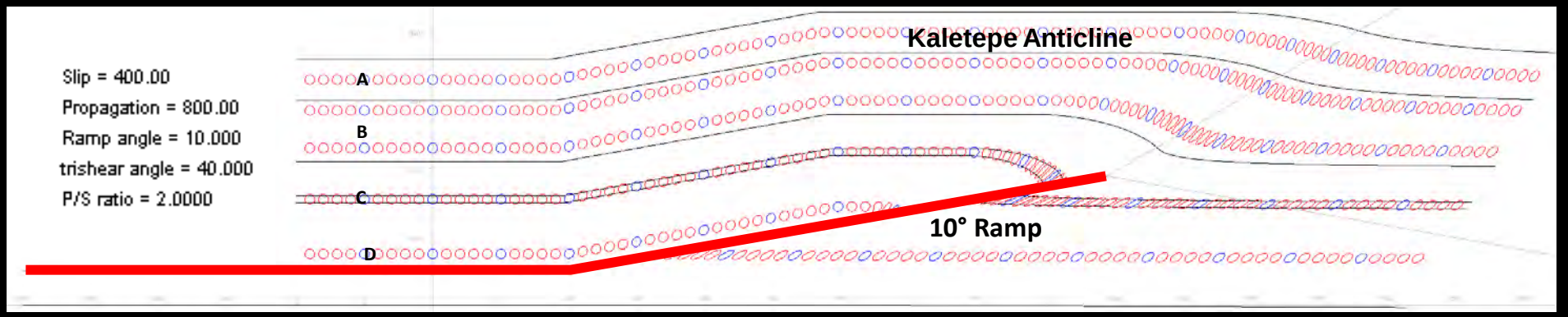
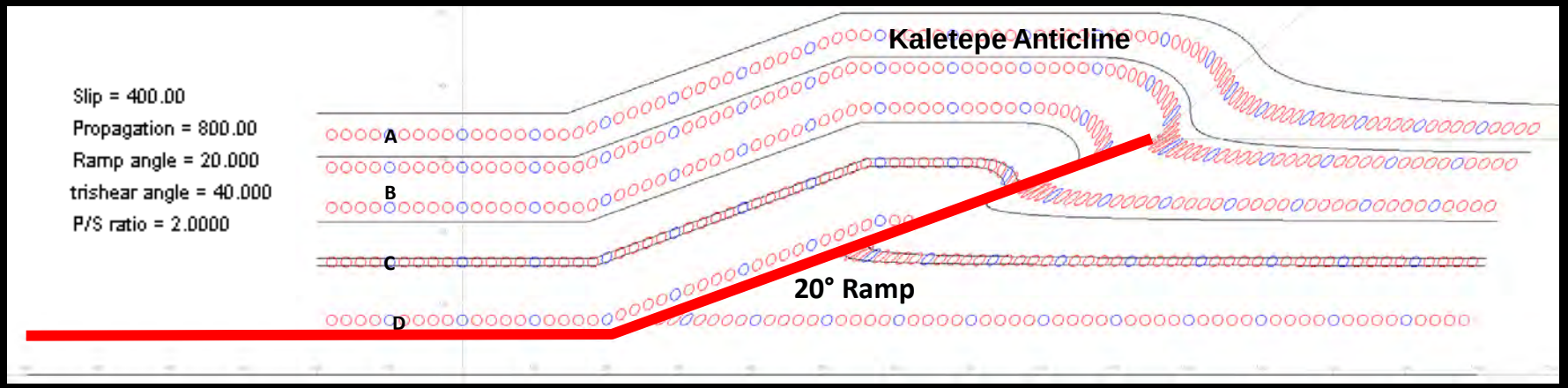

Zengan 1
Kerburan 1
NORTH
TAT 4175
37° 30' 0.0000" N
42° 00' 0.0000" E
0.0 km
1.0 km
2.0 km
3.0 km
4.0 km
5.0 km
6.0 km


Eocene Midyat fm. vertical to overturned to the north.







A = Cretaceous Mardin Group
B = Triassic Cudi Group
C = Permian Kas Group
D = Ordovician Bedinan

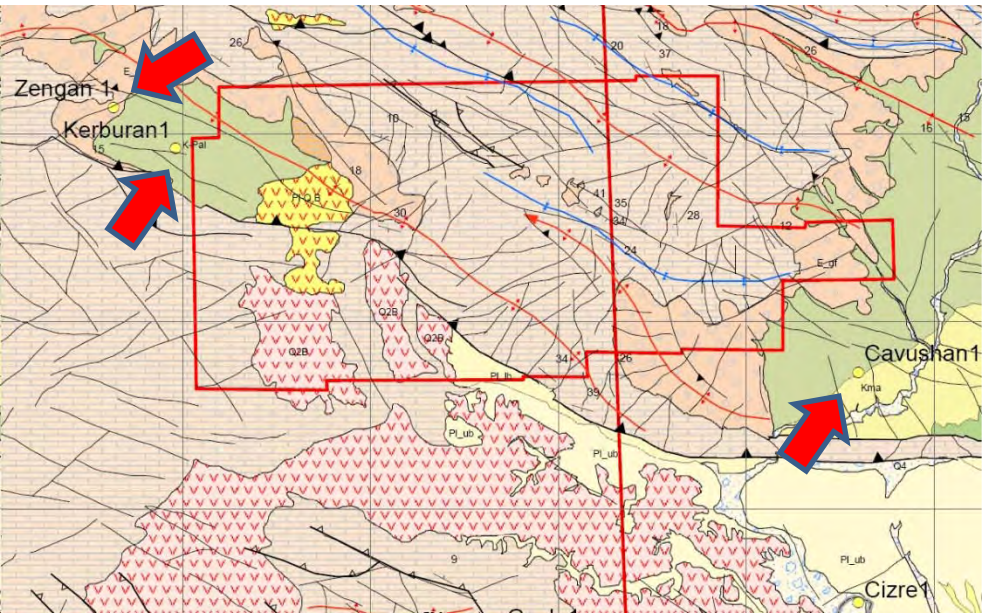
A structural modeling study was undertaken to determine the structural styles of deformation and the angle of the ramps. The model above is believed to be the general style of deformation as a fault-bend fold with possible duplexes and imbrications.

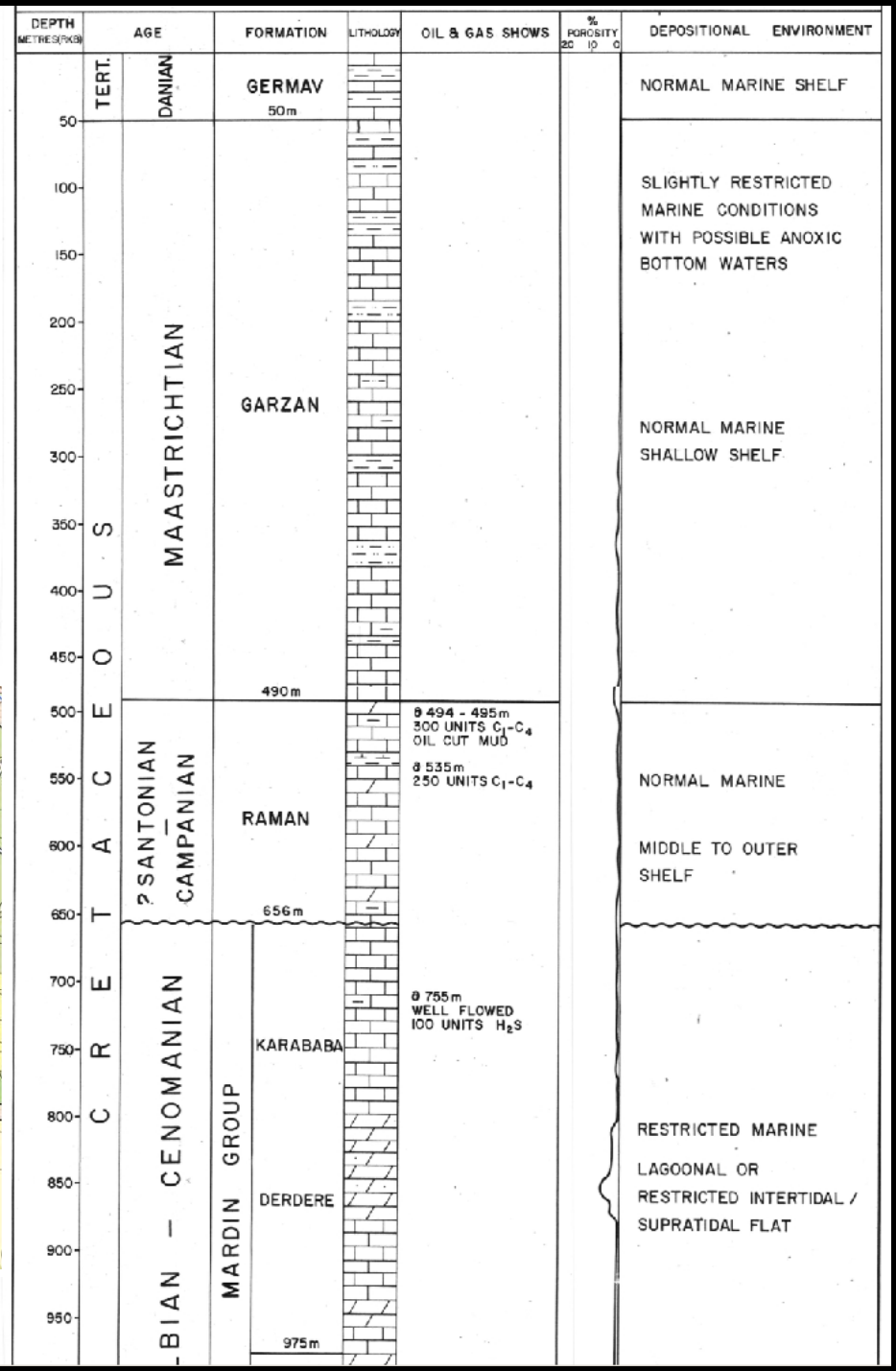
TURKEY

CAVUSHAN – 1

STRATIGRAPHIC SUMMARY COMPOSITE LOG

The Cavushan-1 well was drilled east of the Kaletepe anticline on the down plunge nose of an separate anticline. The well found 1400 meters of Triassic age rocks and over 100 meters of Permian age Kas fm. There were dead oil shows throughout the Cretaceous Mardin group and gas shows in the Paleozoic.





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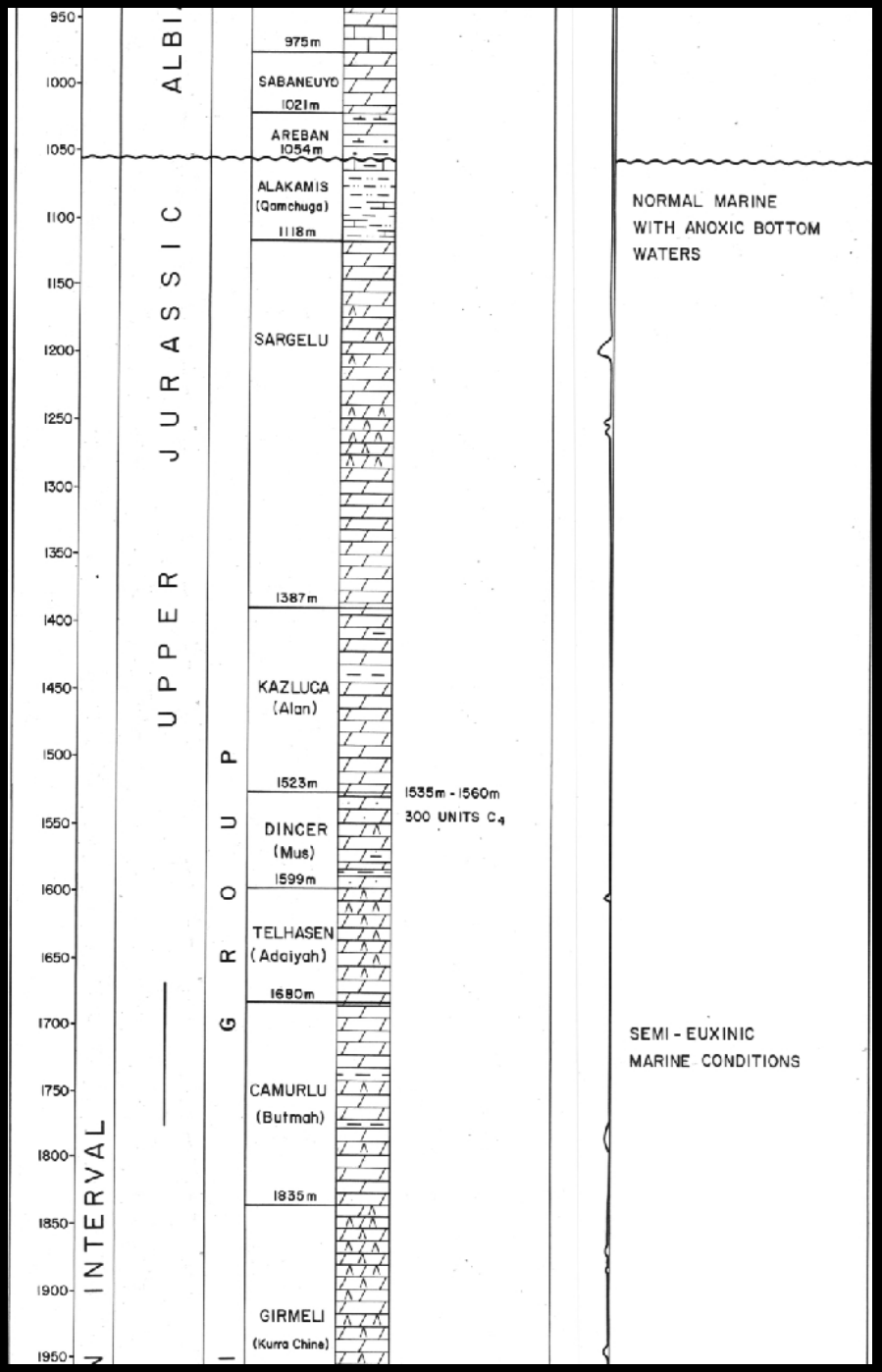
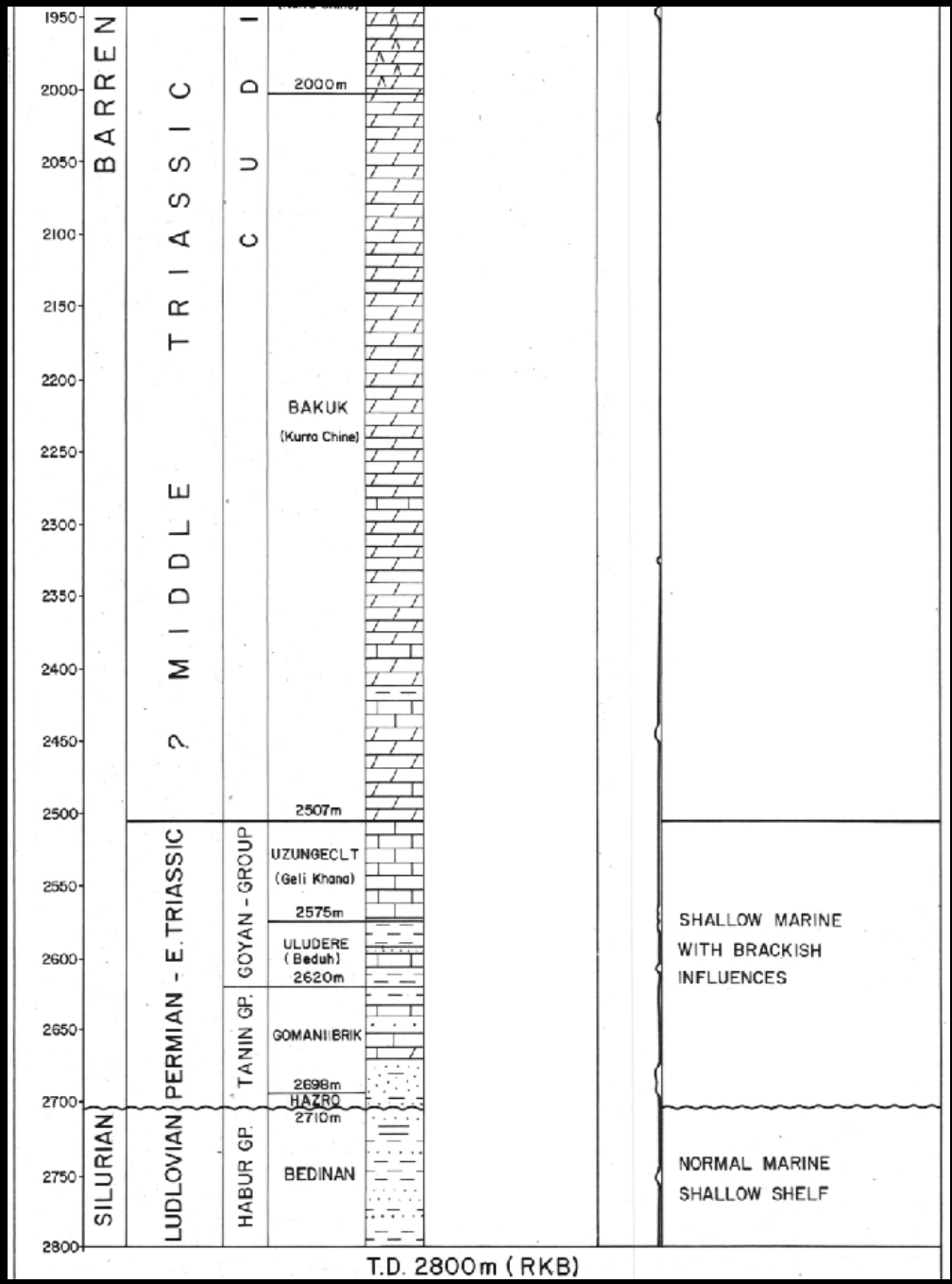
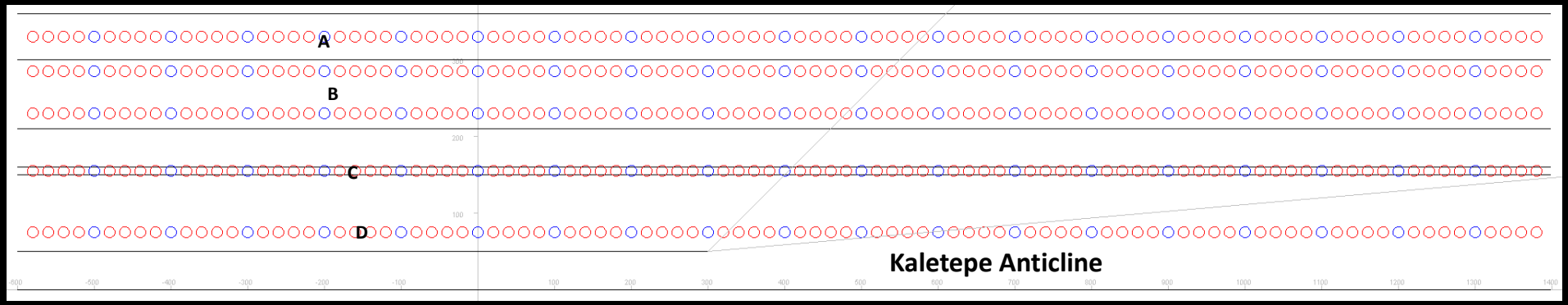
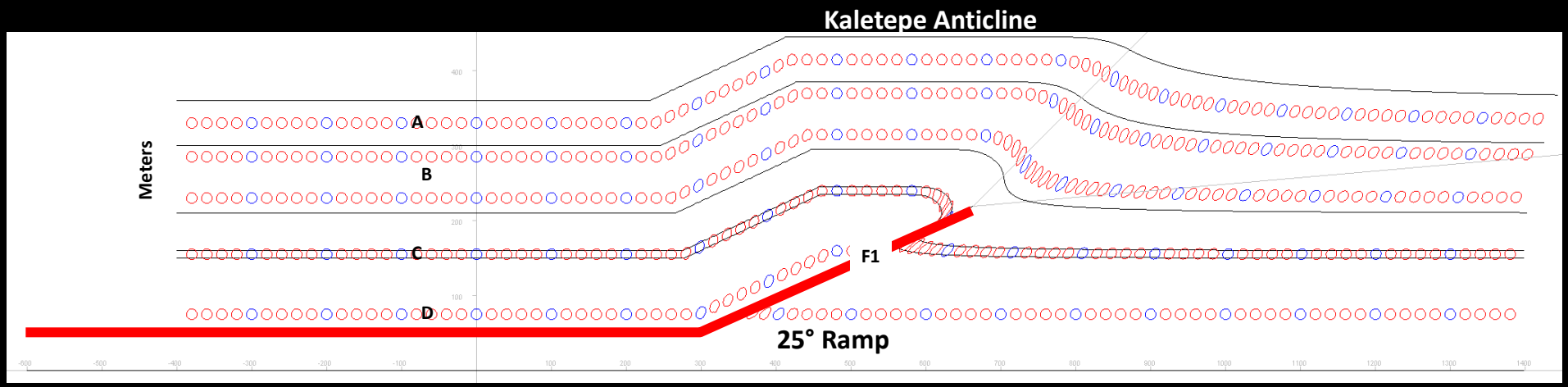
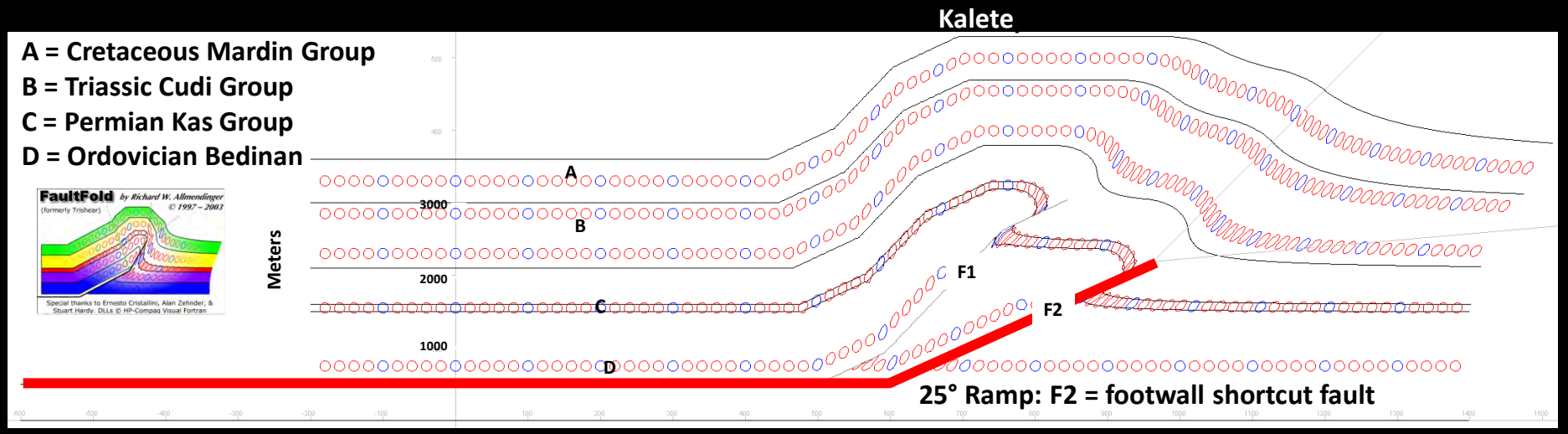
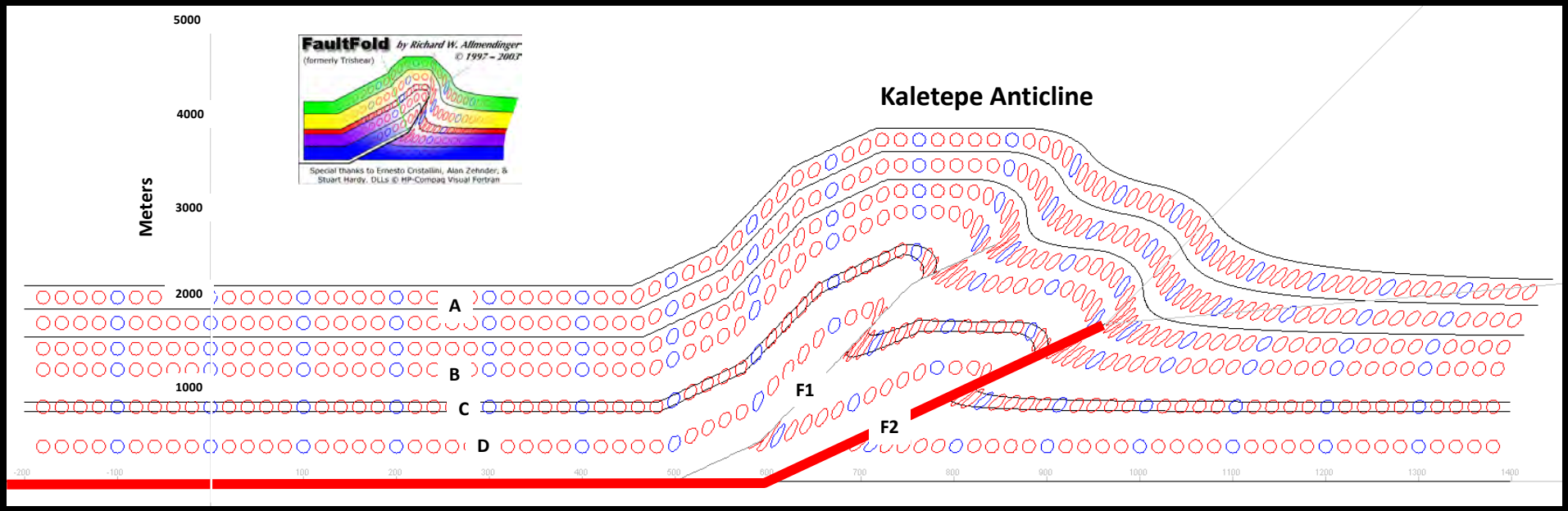

UPPER JURASSIC
ALBI
GROUP
INTERVAL
975m
SABANEUYO
1021m
AREBAN
1054m
ALAKAMIS
(Qamchuqa)
1118m
SARGELU
1387m
KAZLUCA
(Alan)
1523m
DINCER
(Mus)
1599m
TELHASEN
(Adaiyah)
1680m
CAMURLU
(Butmah)
1835m
GIRMELI
(Kurra Chine)
1535m - 1560m
300 UNITS C4
NORMAL MARINE
WITH ANOXIC BOTTOM
WATERS
SEMI - EUXINIC
MARINE CONDITIONS


BARREN
? MIDDLE TRIASSIC
CUDI
2000m
BAKUK
(Kurra Chine)
2507m
PERMIAN - E.TRIASSIC
GOYAN - GROUP
UZUNGECLT
(Geli Khana)
2575m
ULUDERE
(Beduh)
2620m
TANIN GP.
GOMANI BRIK
2698m
HAZRO
2710m
SILURIAN
LUDLOVIAN
HABUR GP.
BEDINAN
SHALLOW MARINE
WITH BRACKISH
INFLUENCES
NORMAL MARINE
SHALLOW SHELF
T.D. 2800m (RKB)

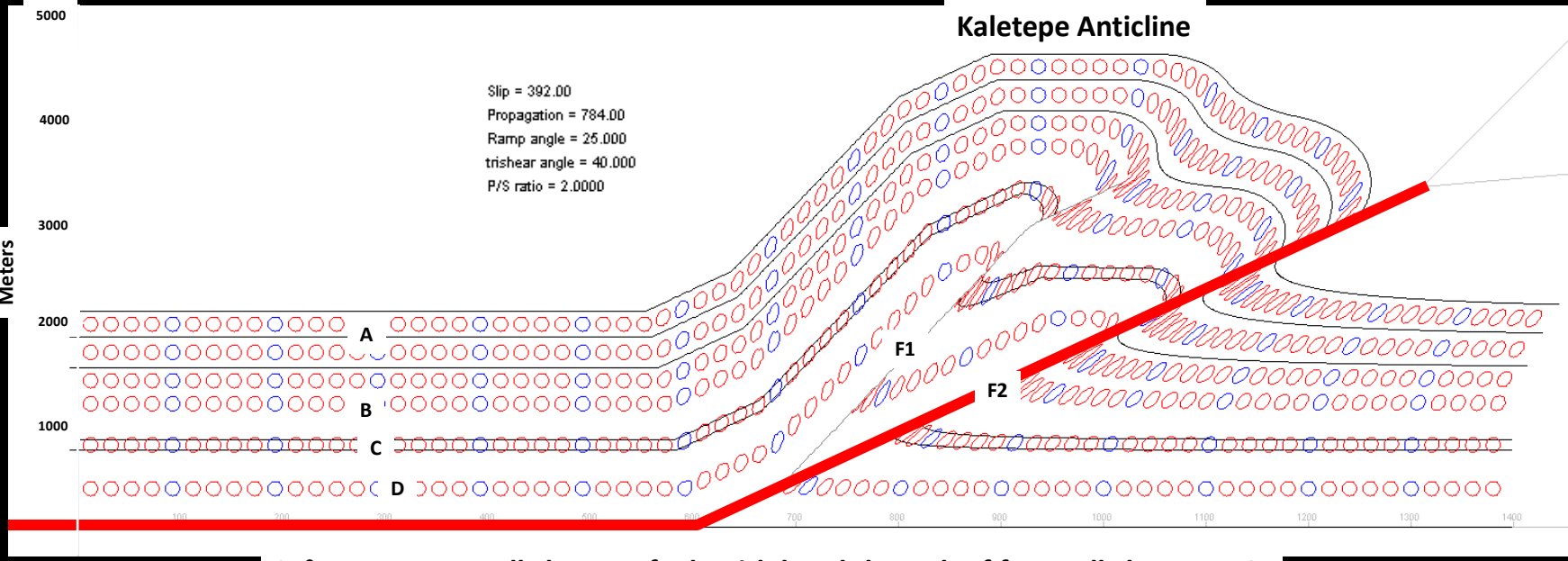

A
B
C
D
Kaletepe Anticline


Kaletepe Anticline
Meters
A
B
C
D
F1
25° Ramp

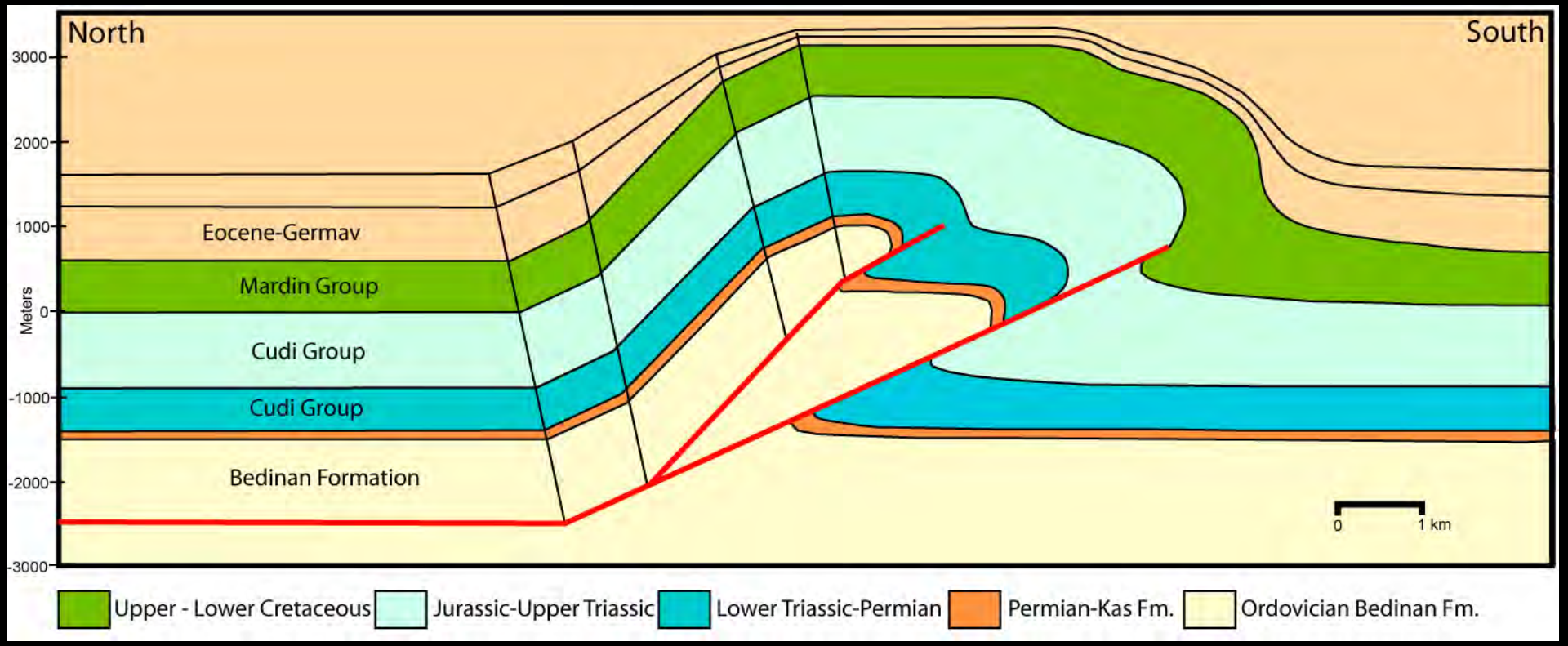

Kalete
A = Cretaceous Mardin Group
B = Triassic Cudi Group
C = Permian Kas Group
D = Ordovician Bedinan
FaultFold by Richard W. Allmendinger
(formerly Trishear)
© 1997 – 2003
Special thanks to Ernesto Cristallini, Alan Zehnder, & Stuart Hardy. DLLs © HP-Compaq Visual Fortran
Meters
3000
2000
1000
A
B
C
D
F1
F2
25° Ramp: F2 = footwall shortcut fault

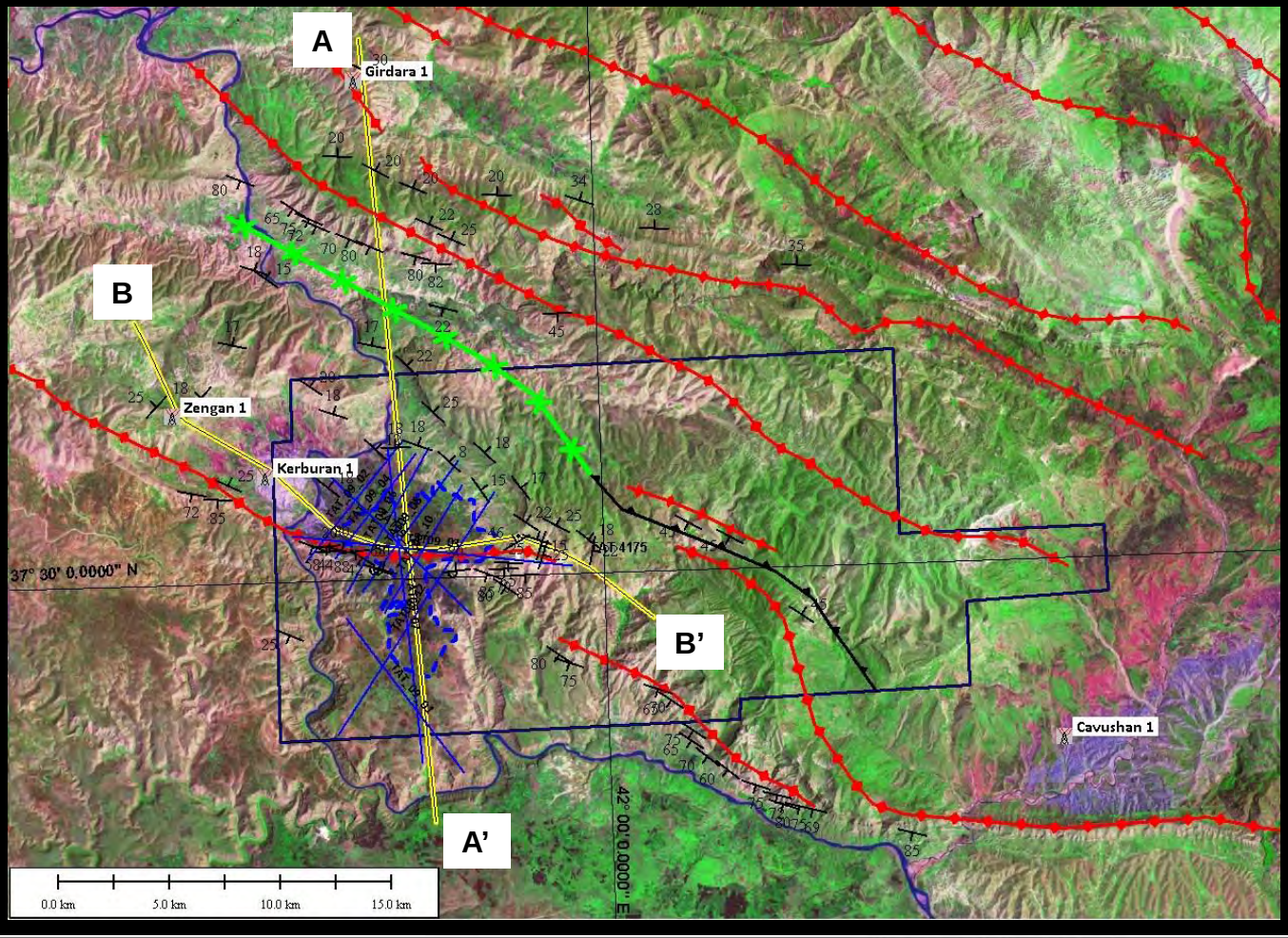


25° Ramp, Footwall shortcut fault



25° Ramp, Footwall shortcut fault with breakthrough of footwall shortcut F2


North
South
3000
2000
1000
0
-1000
-2000
-3000
Meters
Eocene-Germav
Mardin Group
Cudi Group
Cudi Group
Bedinan Formation
0
1 km
Upper - Lower Cretaceous
Jurassic-Upper Triassic
Lower Triassic-Permian
Permian-Kas Fm.
Ordovician Bedinan Fm.



NORTH

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FaultFold by Richard W. Allmendinger
(formerly Trishear)
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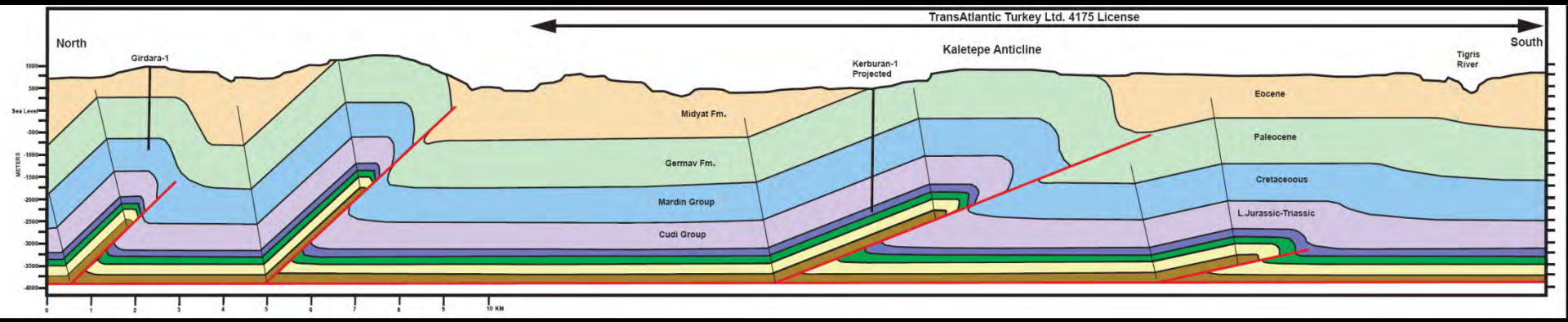
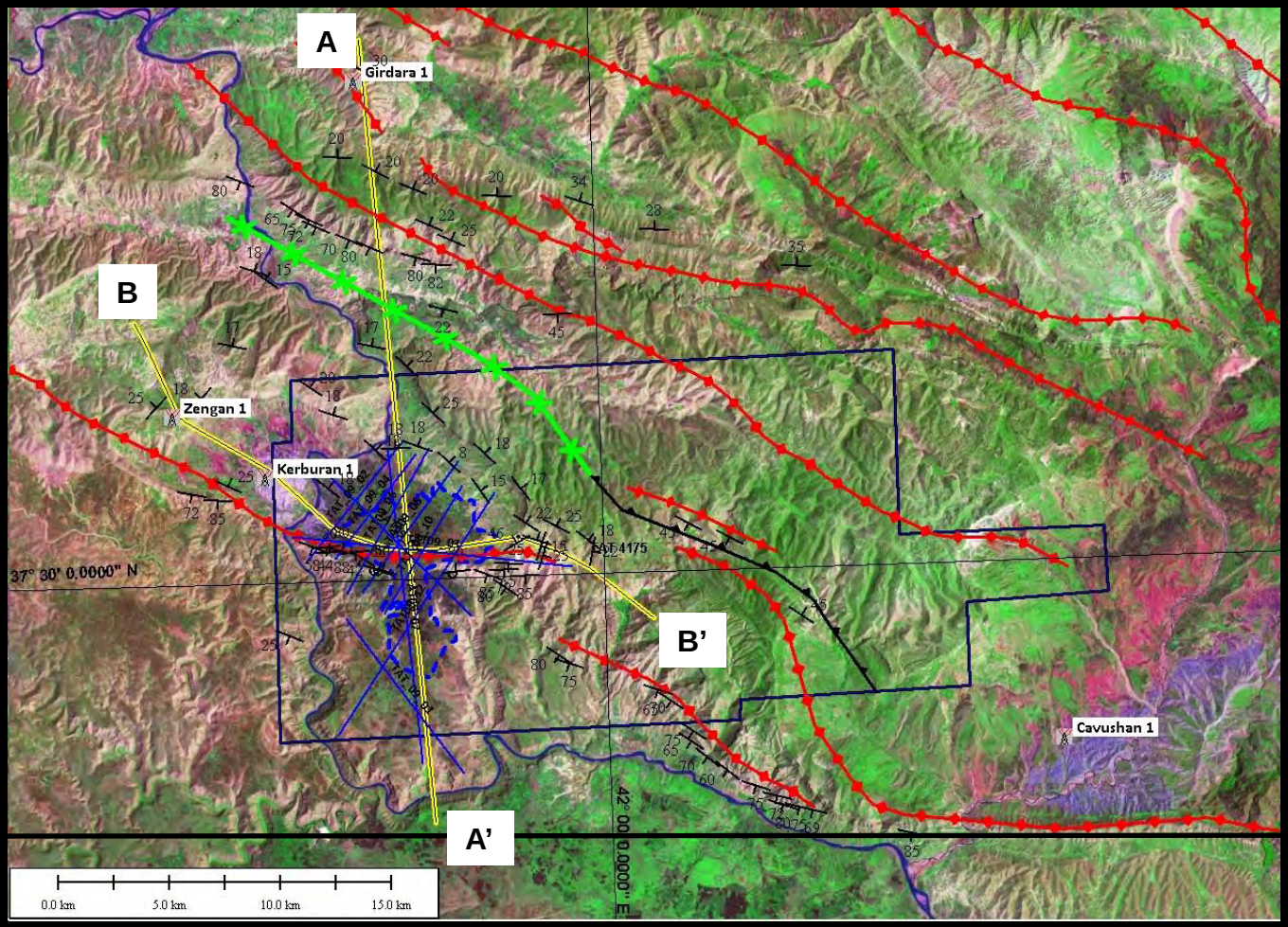
Special thanks to Ernesto Cristallini, Alan Zehnder, & Stuart Hardy. DLLs © HP-Compaq Visual Fortran

A

A'





NORTH

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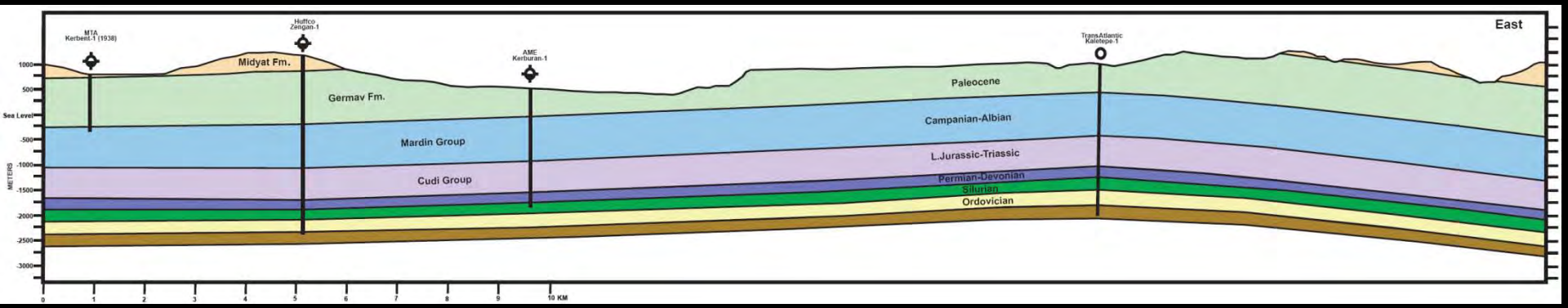
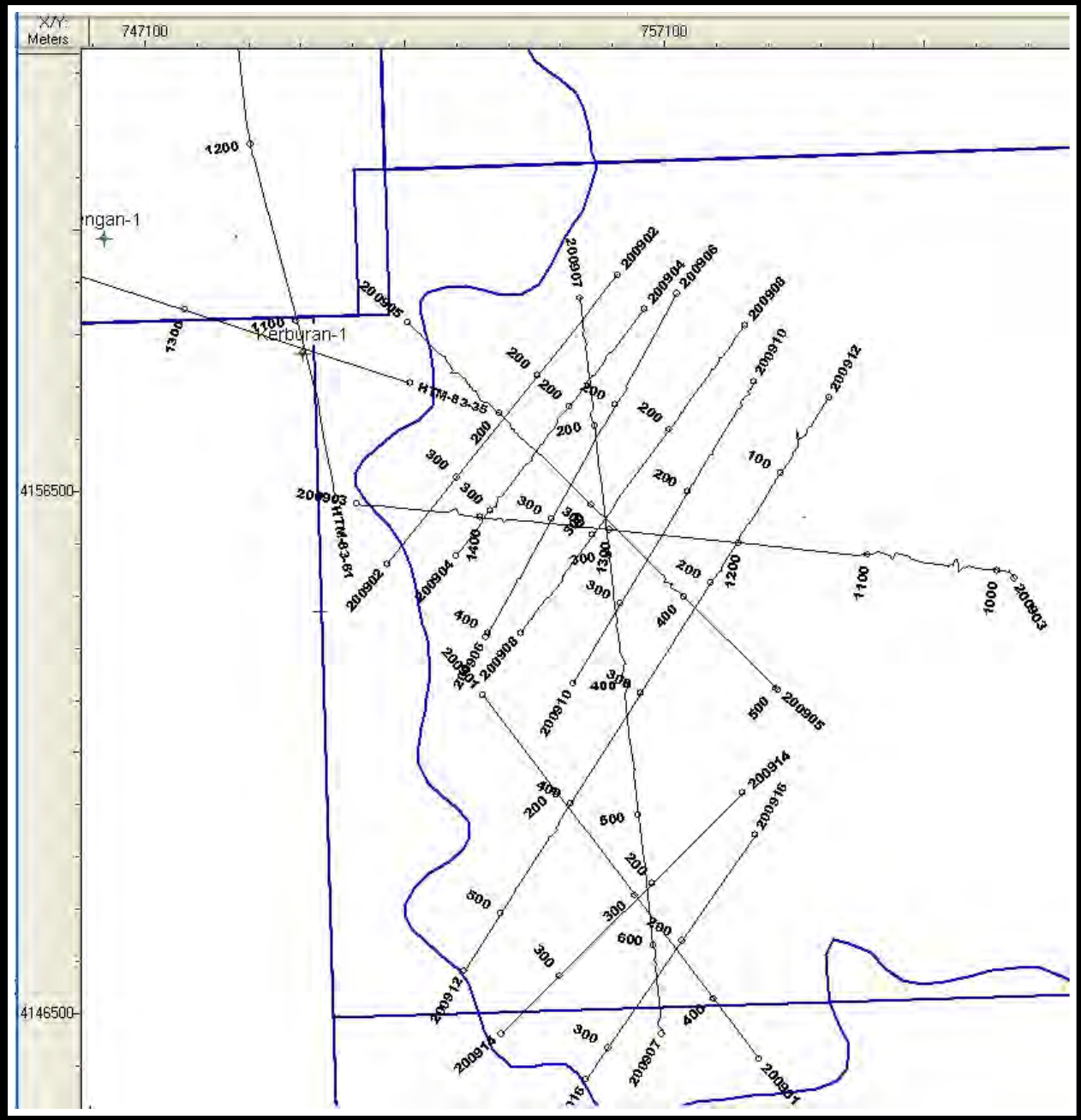
B

B'



Paleocene Germav shales in foreground. The top of the ridge in the background is the top of the Paleocene Germav fm. /base of the Eocene Midyat fm.

South limb of the Kaletepe anticline showing Paleocene Germav fm overlain by Quaternary basalts unconformably



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Location of TAT 2008-2009 seismic acquisition. 12 seismic lines (106 km) were acquired in the western area of license 4175

Geophones:
Group Interval: 25m
Phones per Station: 24
Geophone Array: 24 in X pattern 2.5m apart.
Minimum Offset: 12.5m
Maximum Offset: 5987.5m (240 channels at 25m spacing).

Source:
Shot Point Interval: 50m
Source Array: Single hole
Energy source 4Kg/hole and 6Kg/hole
Blast-hole depth: 6m

Recording
Instrument: ARAM-ARIES
Tape Media & Format: HP invent Model Ultrium 2 LTO, 400GB, SEG D

Acquisition Parameters

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Line clearing for 2D dynamite acquisition

Line clearing for 2D dynamite acquisition

Mine surveillance during acquisition

Shot hole drilling

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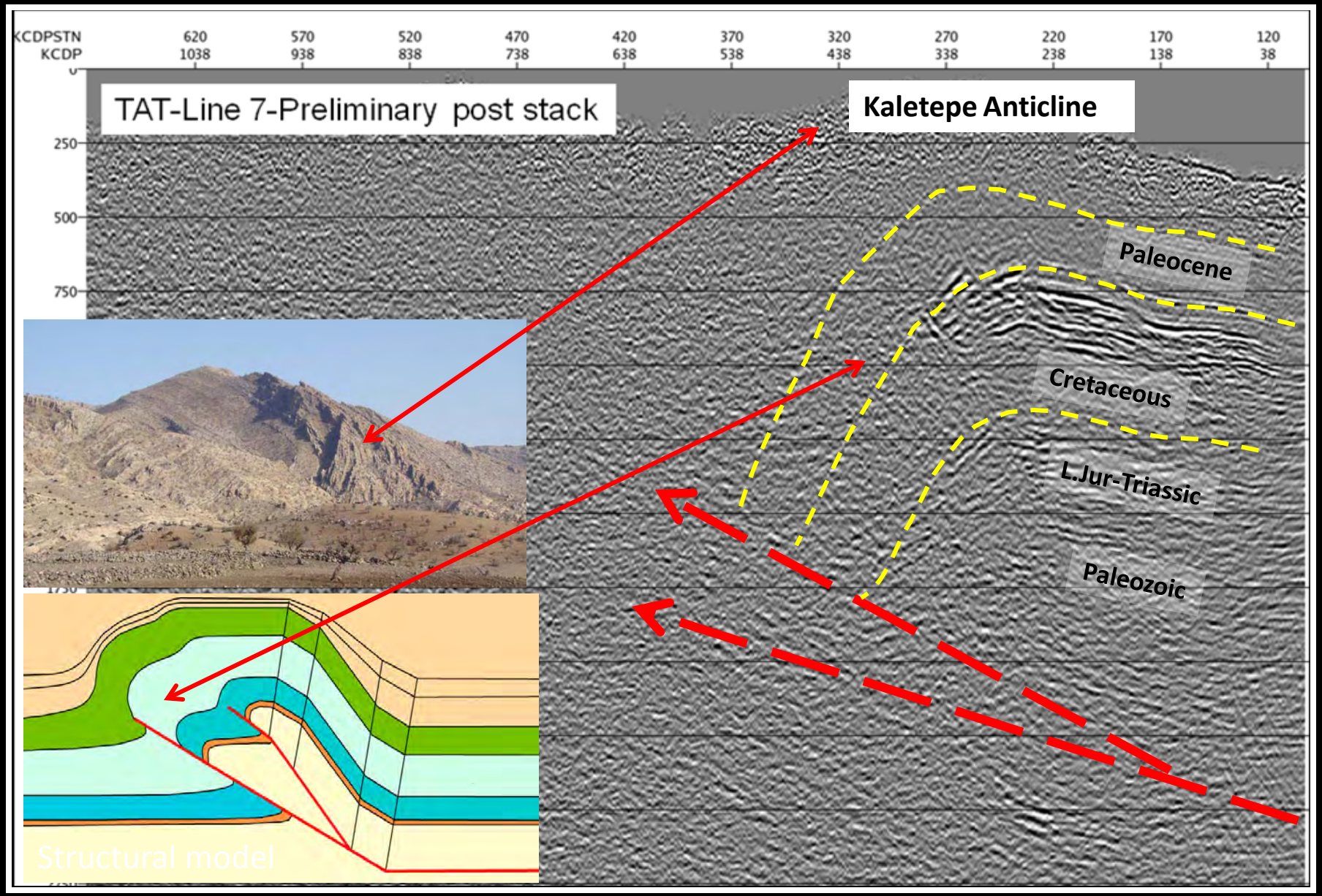
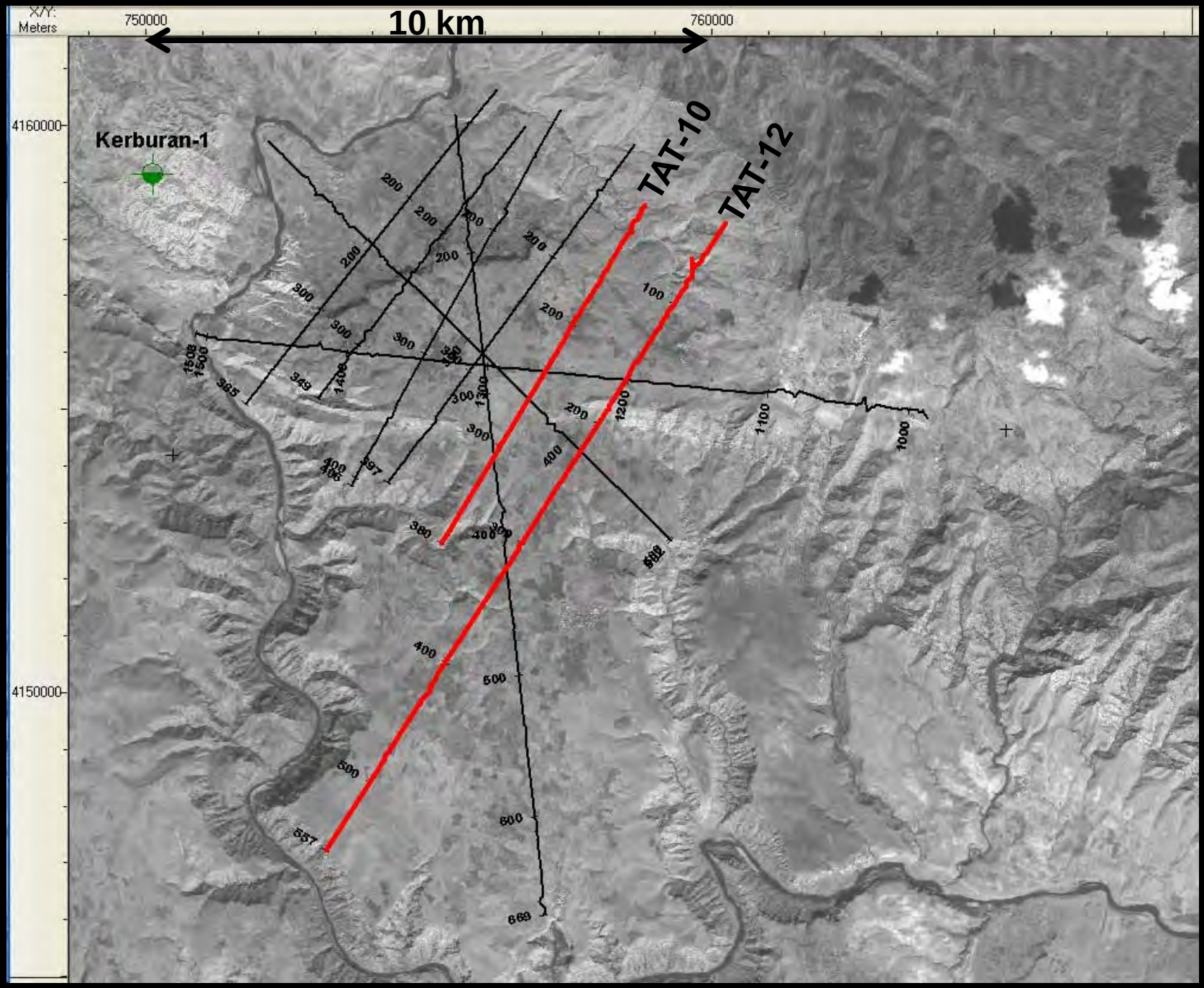
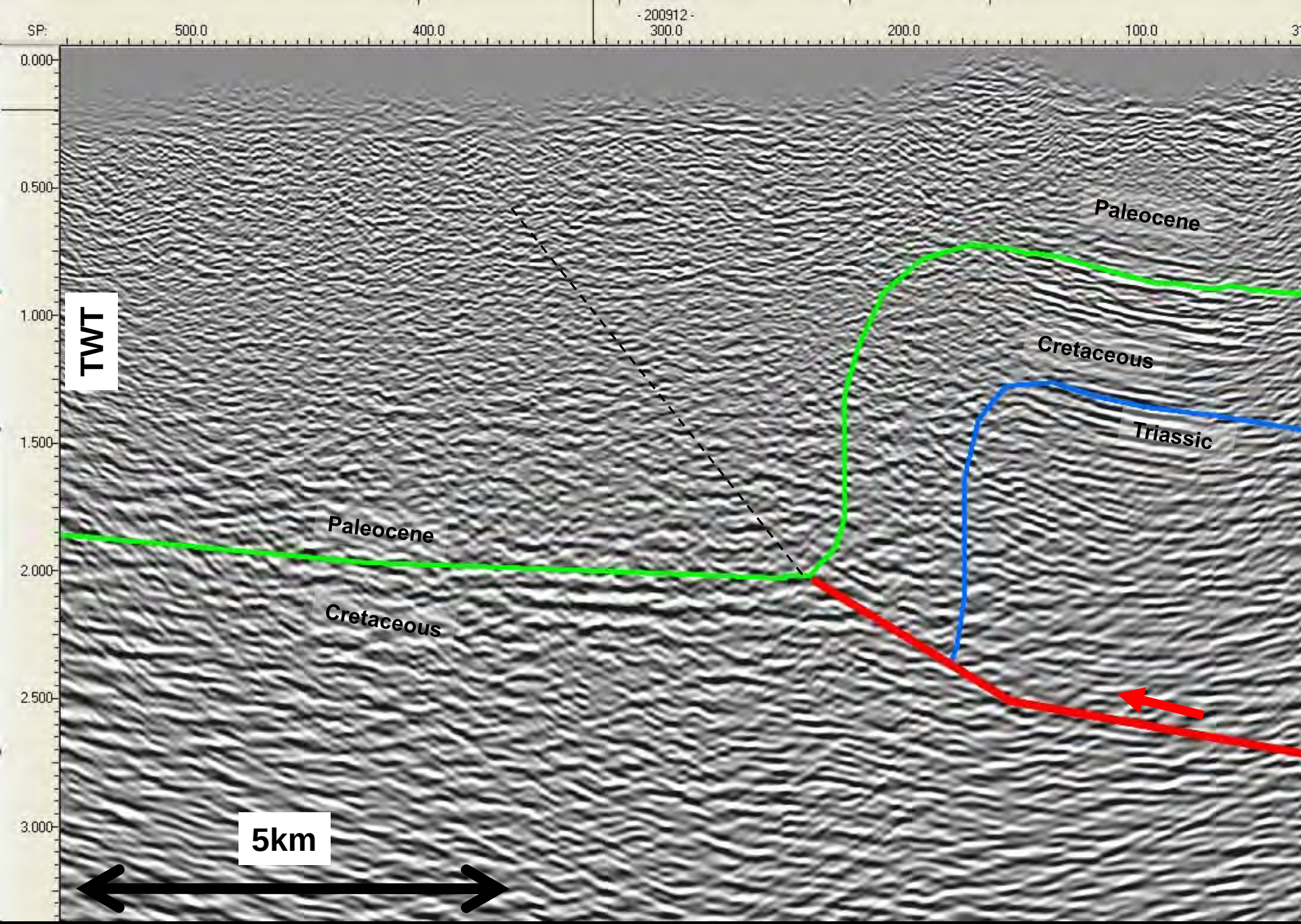


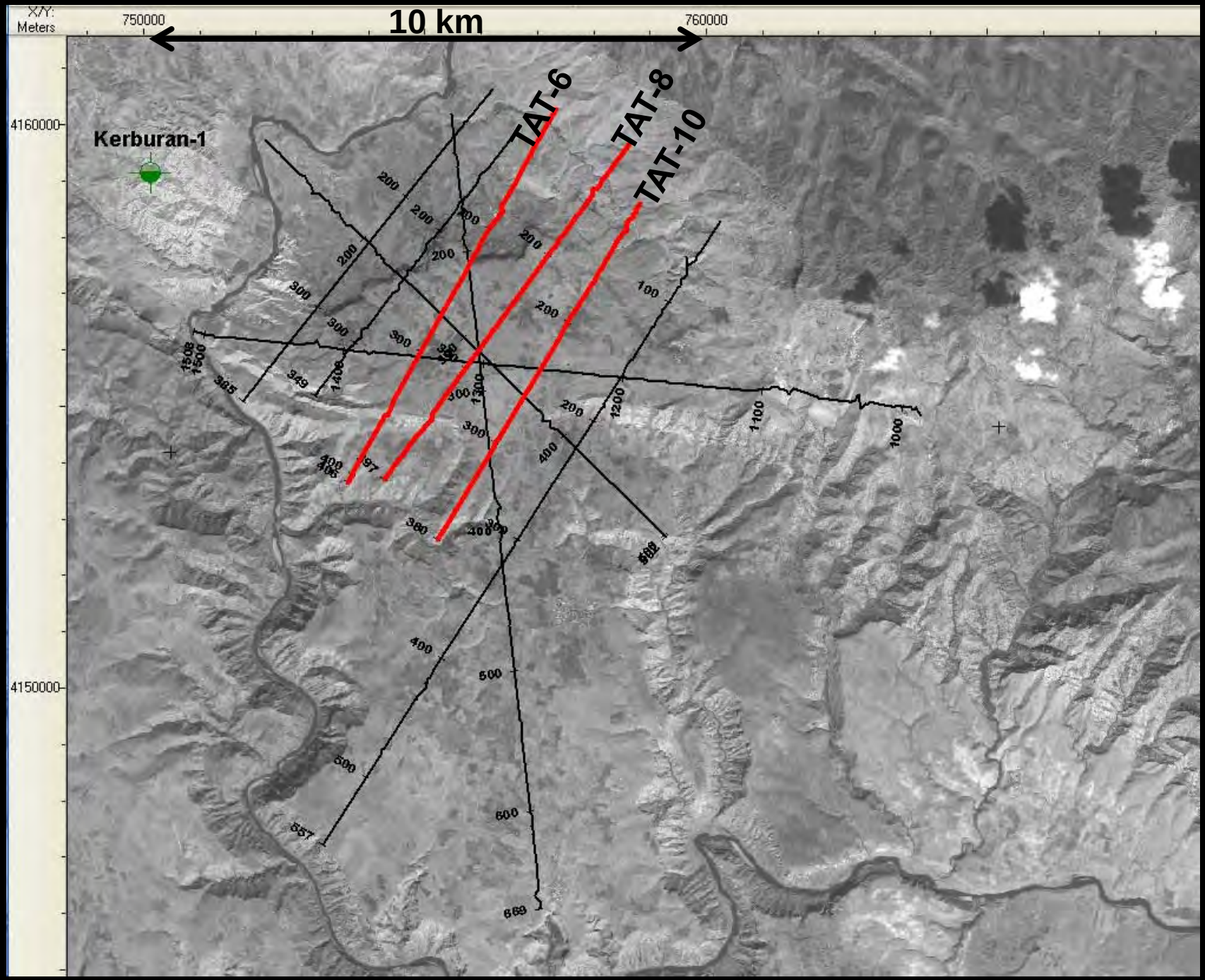
Preliminary post-stack migration of Line 7- 4175 license.
The Kaletepe anticline is seen imaged on the right (North) end of the survey

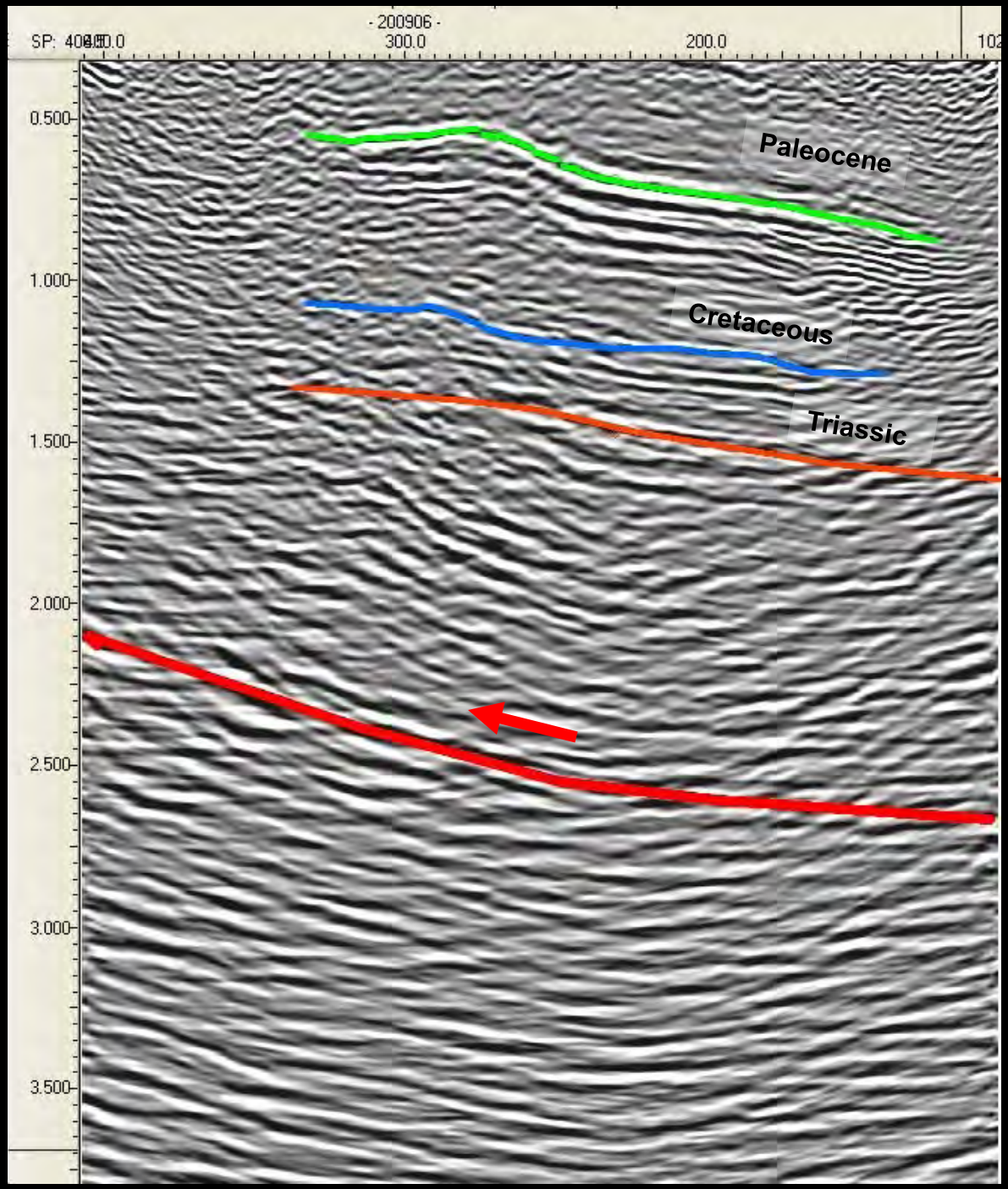


Location of TAT-Lines 10 & 12



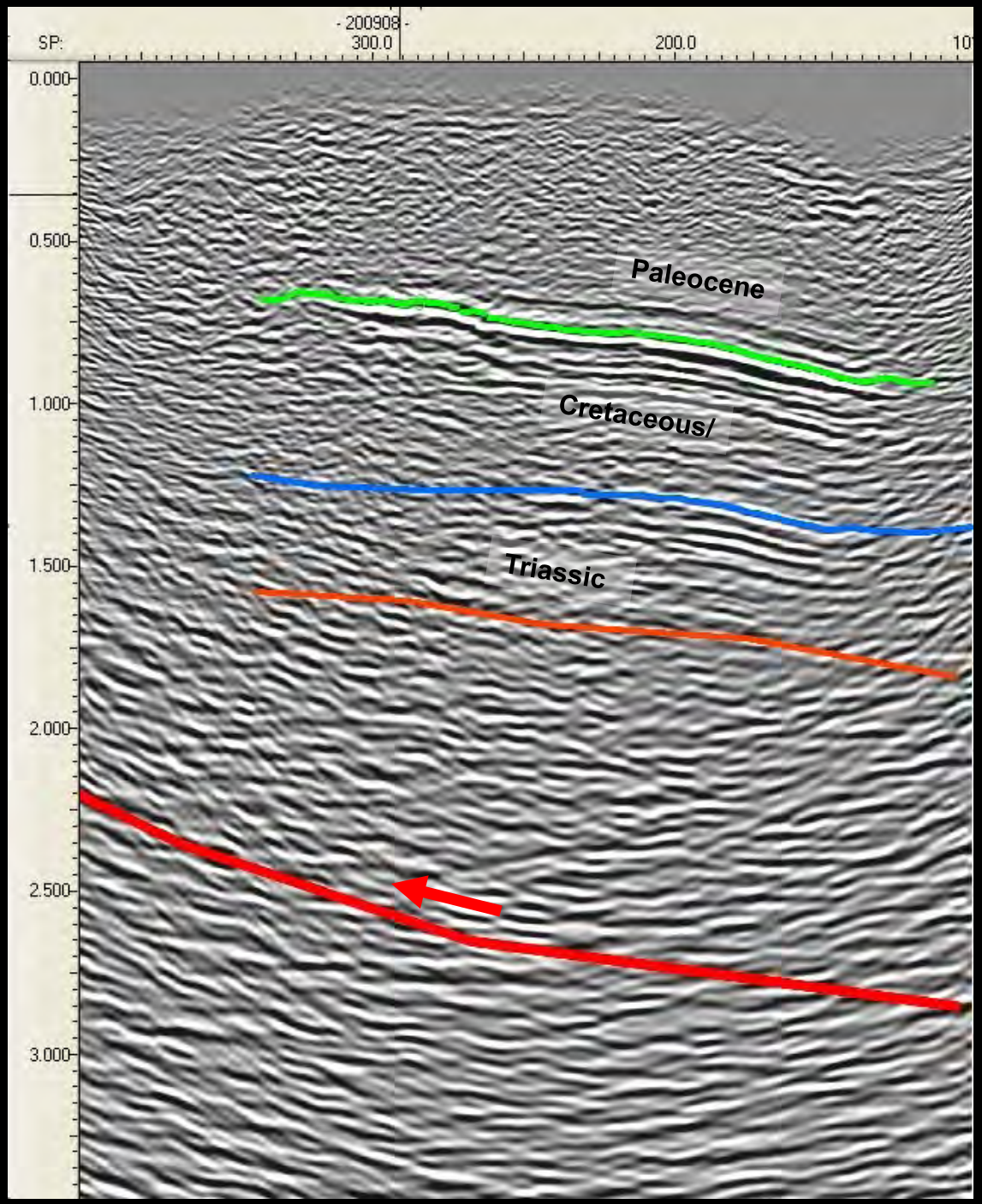
TAT-Line 12 PSTM

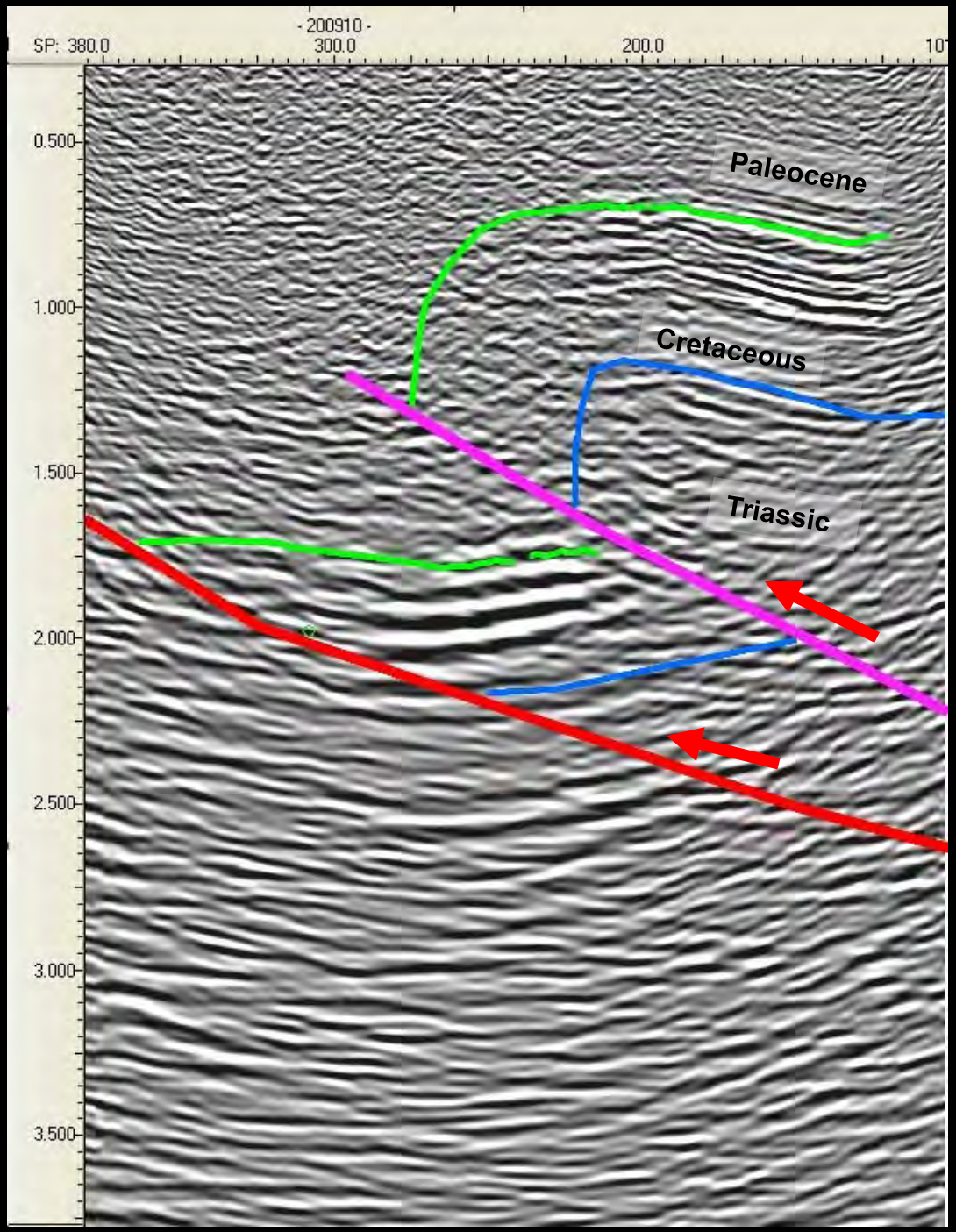

X/Y:
Meters
750000
760000
10 km
4160000
4150000
Kerburan-1
TAT-6
TAT-8
TAT-10



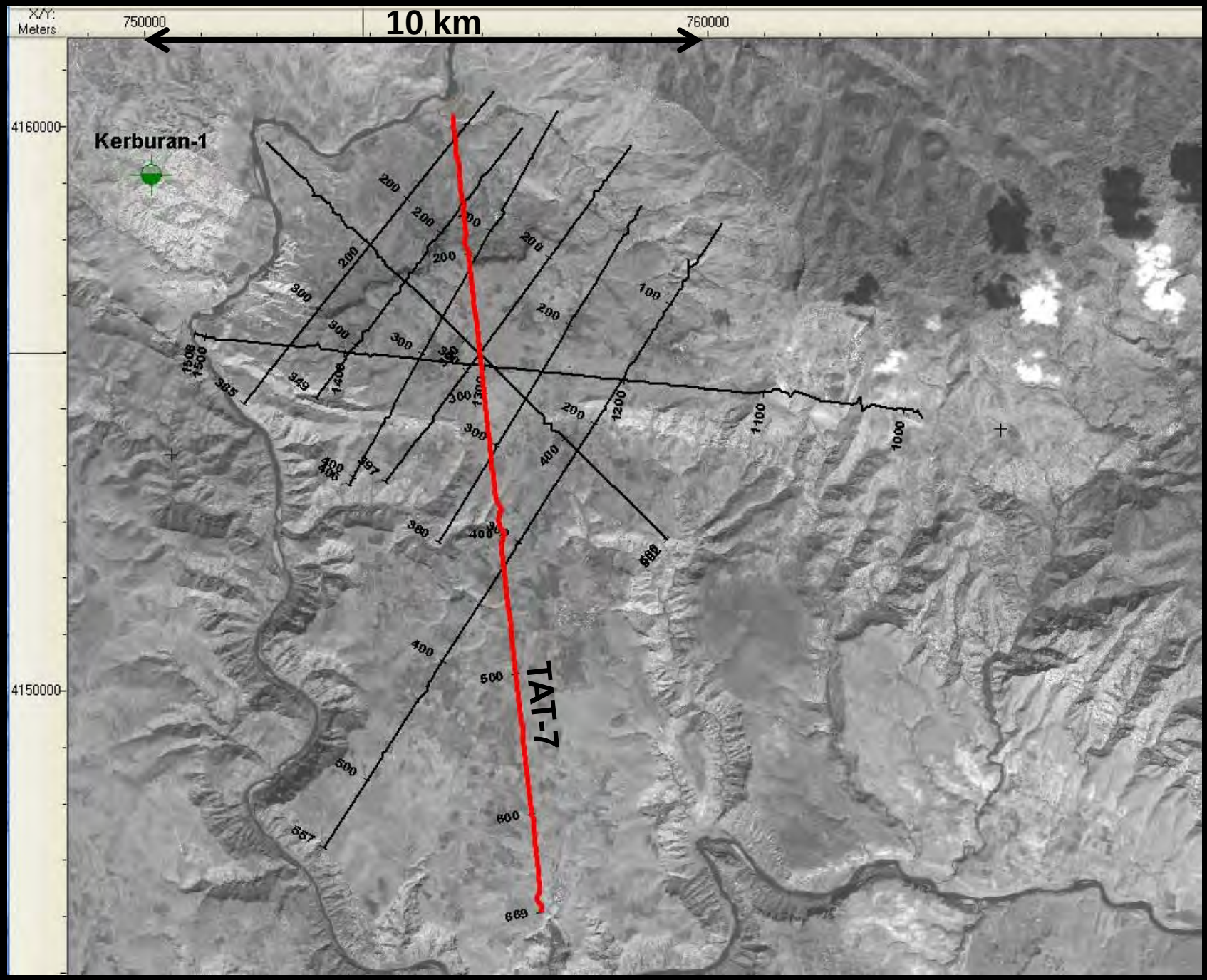
TAT-Line 6
PSTM

TAT-Line 8
PSTM

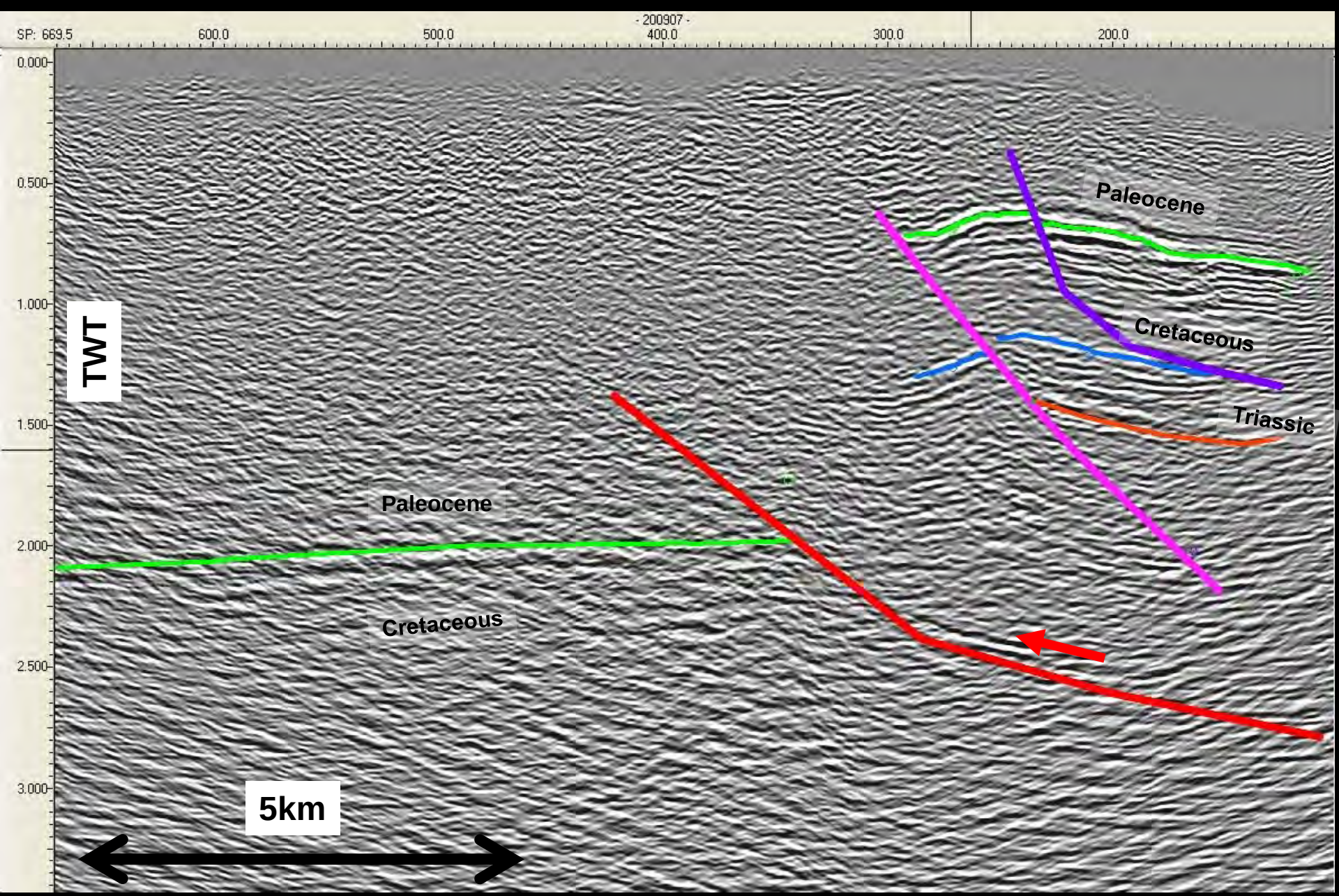




TAT-Line 10
PSTM



Location of TAT-Line 7



TAT-Line 7
PSTM

Conclusions:

•Large south verging fault-related folds in SE Turkey are asymmetrical with steep to overturned southern limbs. These folds are complicated by breakthrough faulting and imbrications.

•2D seismic data acquired over these folds using 6,000 meters offsets are not adequate to image the steeply dipping complex south verging limbs. Longer lines with longer offsets will be required. Possible “sparse” megabin 3D surveys would also be successful

•Surface geologic mapping combined with remote sensing is critical to understanding and mapping the structural geometries in SE Turkey.

•Detachments of fault-related folding appear to occur in the Lower Ordovician-Cambrian age shales.