

GEOTECHNICAL DAMAGE ON THE 2017 IRAN – IRAQ EARTHQUAKE

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Survey

Geotechnical damage was found in the following location:

- Piran waterfall (Rock fall) - A
- Ban Zardeh Village (Rock fall) - B
- Maskane Mehr & Fooladi District, Sarpol-e-Zahab City (liquefaction-induced ground deformation) – C
- Palan-e Olya Village, close to Salas-e-Babajani Town (Soil surface rupture, ground subsidence) – D
- Mela Kabod & Goorchi Bashi Villages (Massive landslides) - E

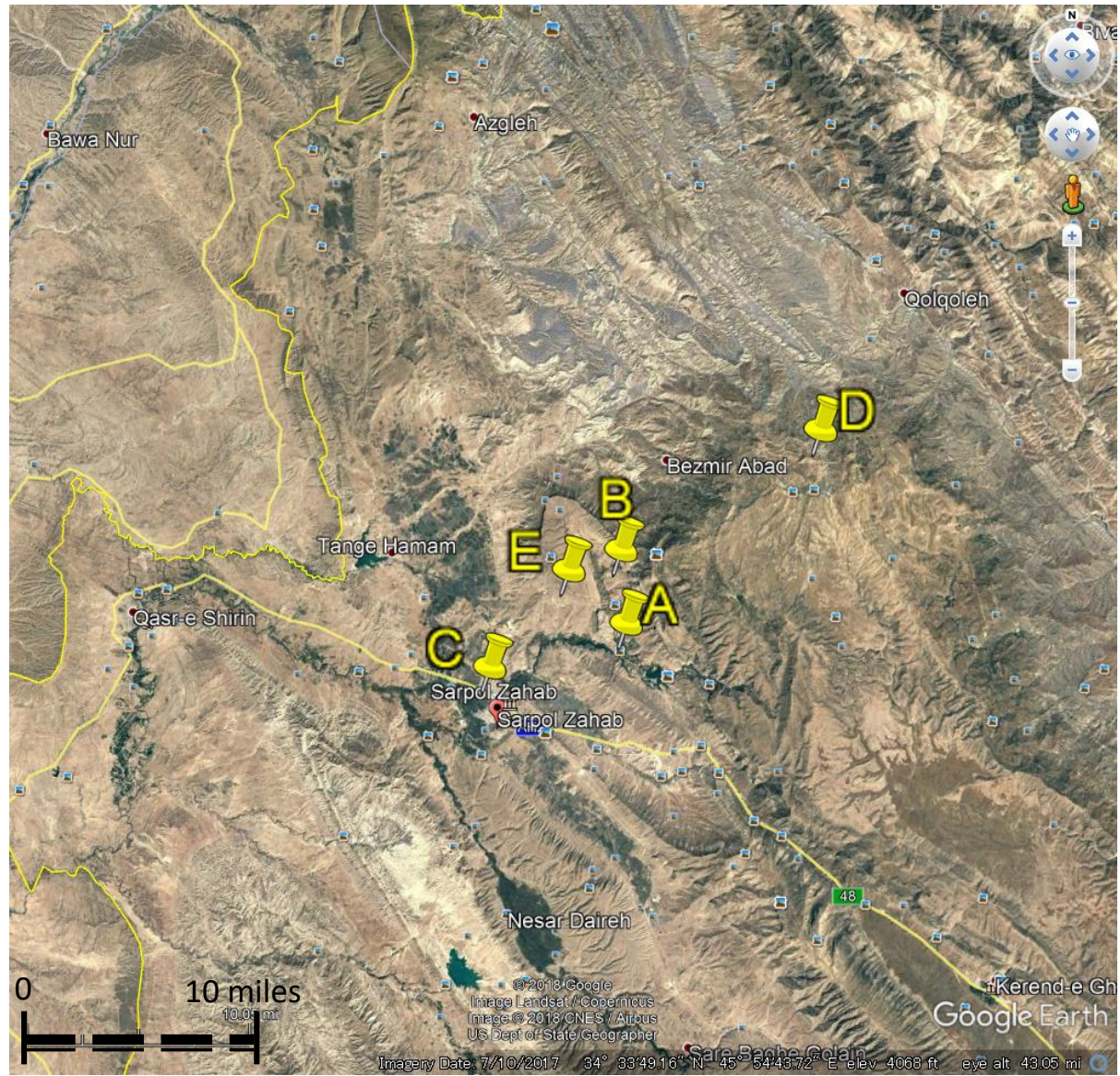


Fig. 1 Location of geological damage occurred

□ The average shear wave velocity for the top 30 m (V_{s30}) map

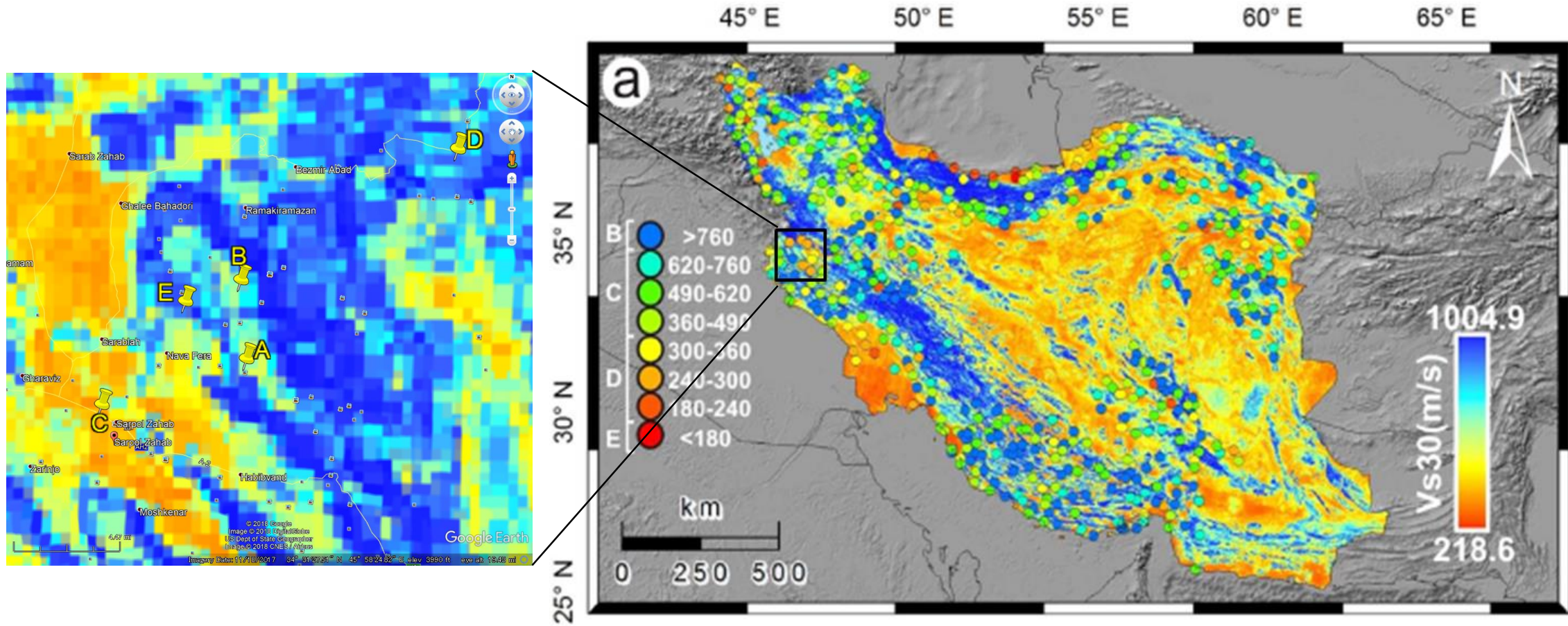


Fig. 2 V_{s30} map of Iran deduced from ASTER digital elevation model.

Aggregated geology map

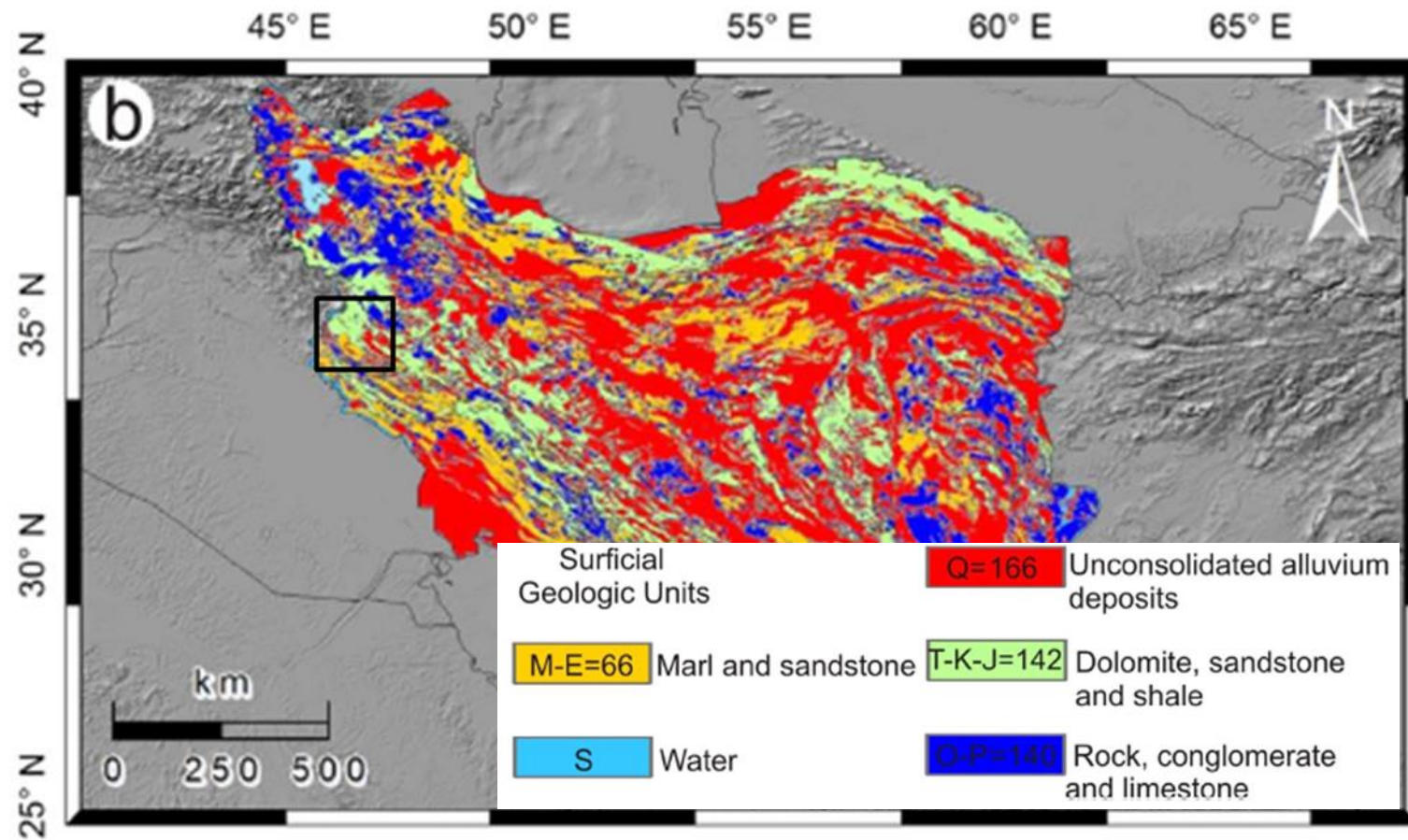
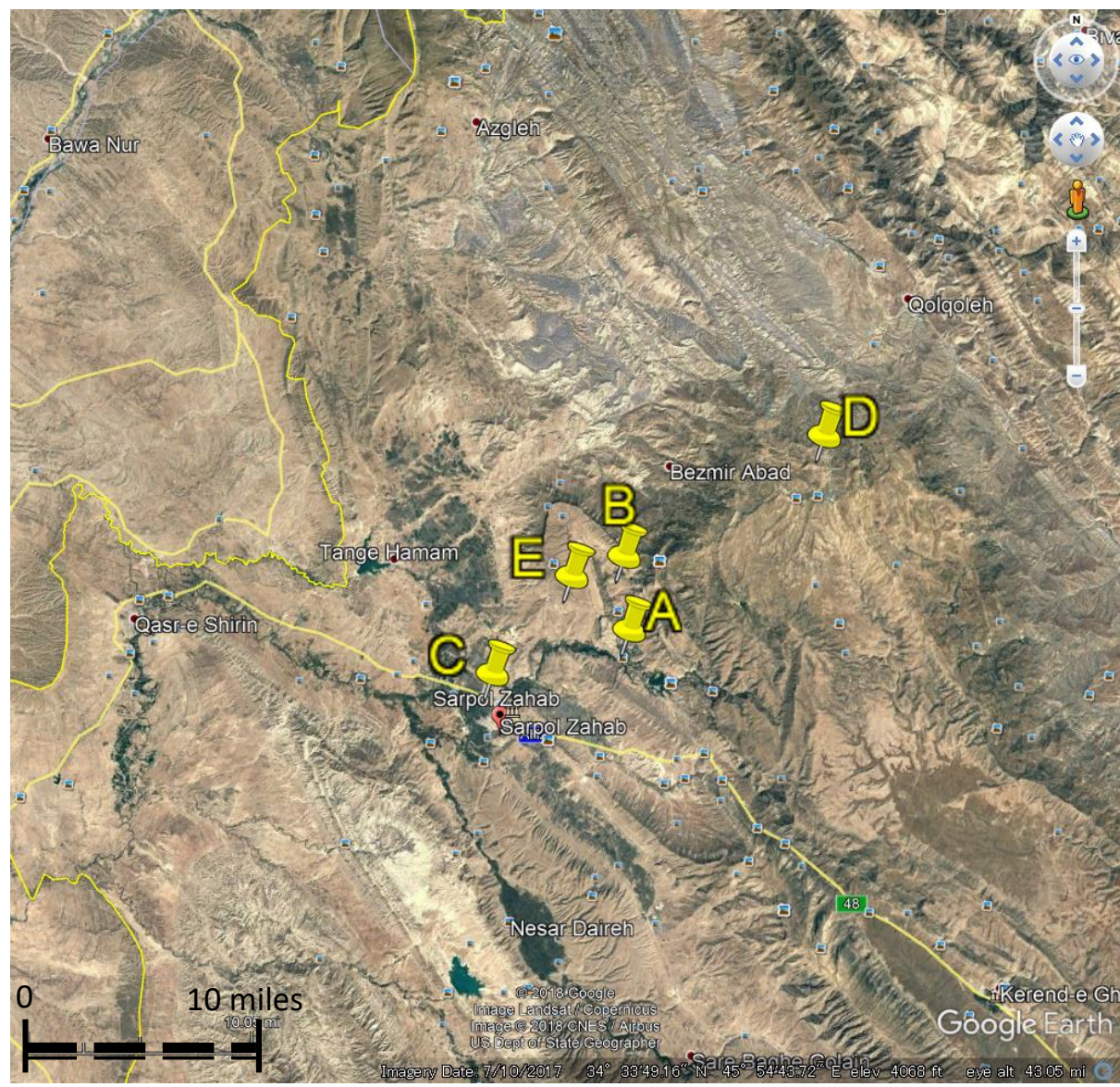


Fig. 3 aggregated geology map of Iran

□ Piran Waterfall (A)



□ Piran Waterfall



Fig. 4 location of Piran waterfall

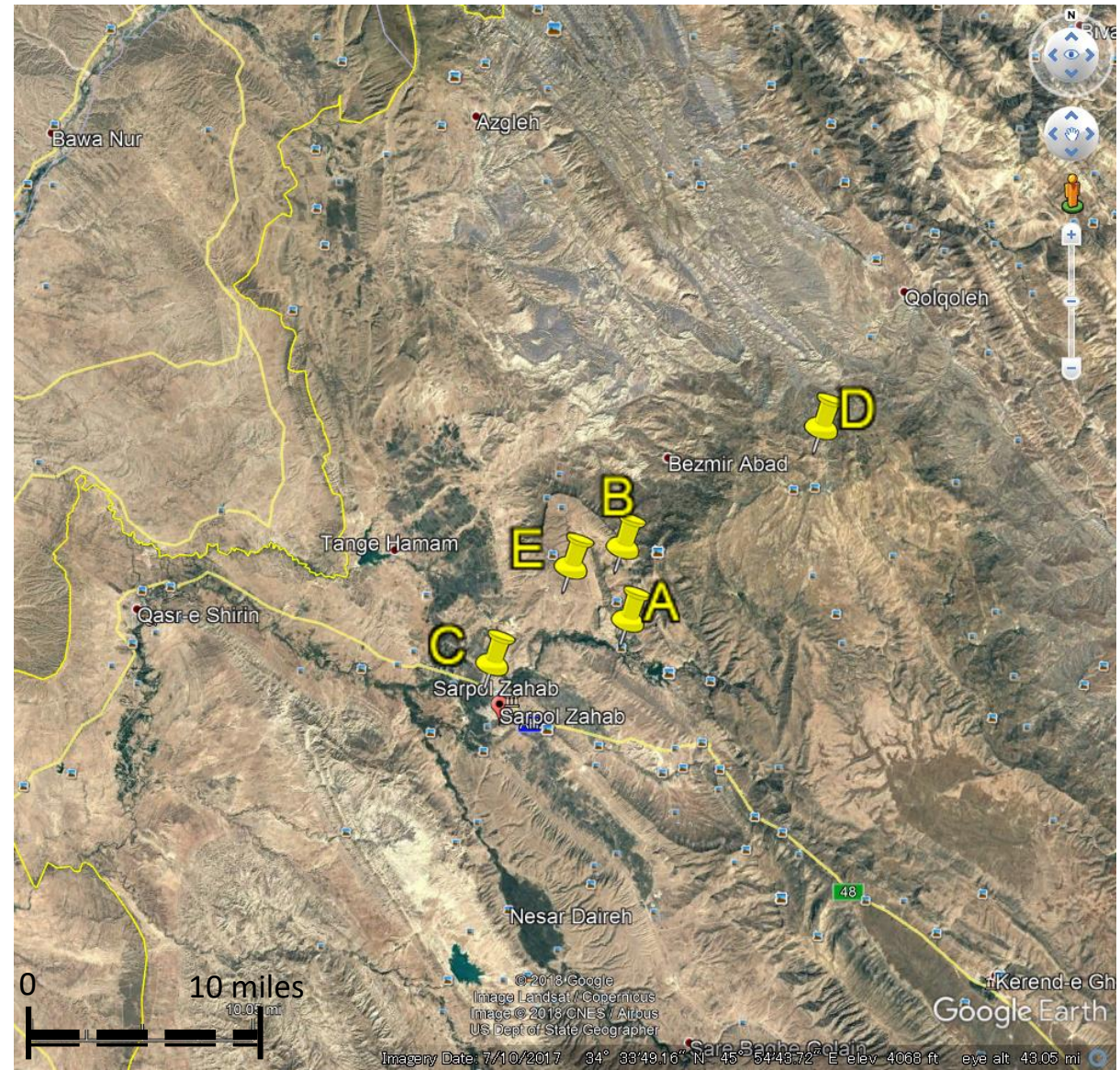
□ Piran Waterfall



Fig. 5 (a & b) Rock fall in Piran waterfall

- Piran waterfall is one of the tallest waterfall in Iran. The height is around 100 m.
- Located around 9 km from Sarpol-e-Zahab city.
- This waterfall is registered in the list of national and natural relics.

□ Ban Zardeh Village (B)



□ Ban Zardeh Village

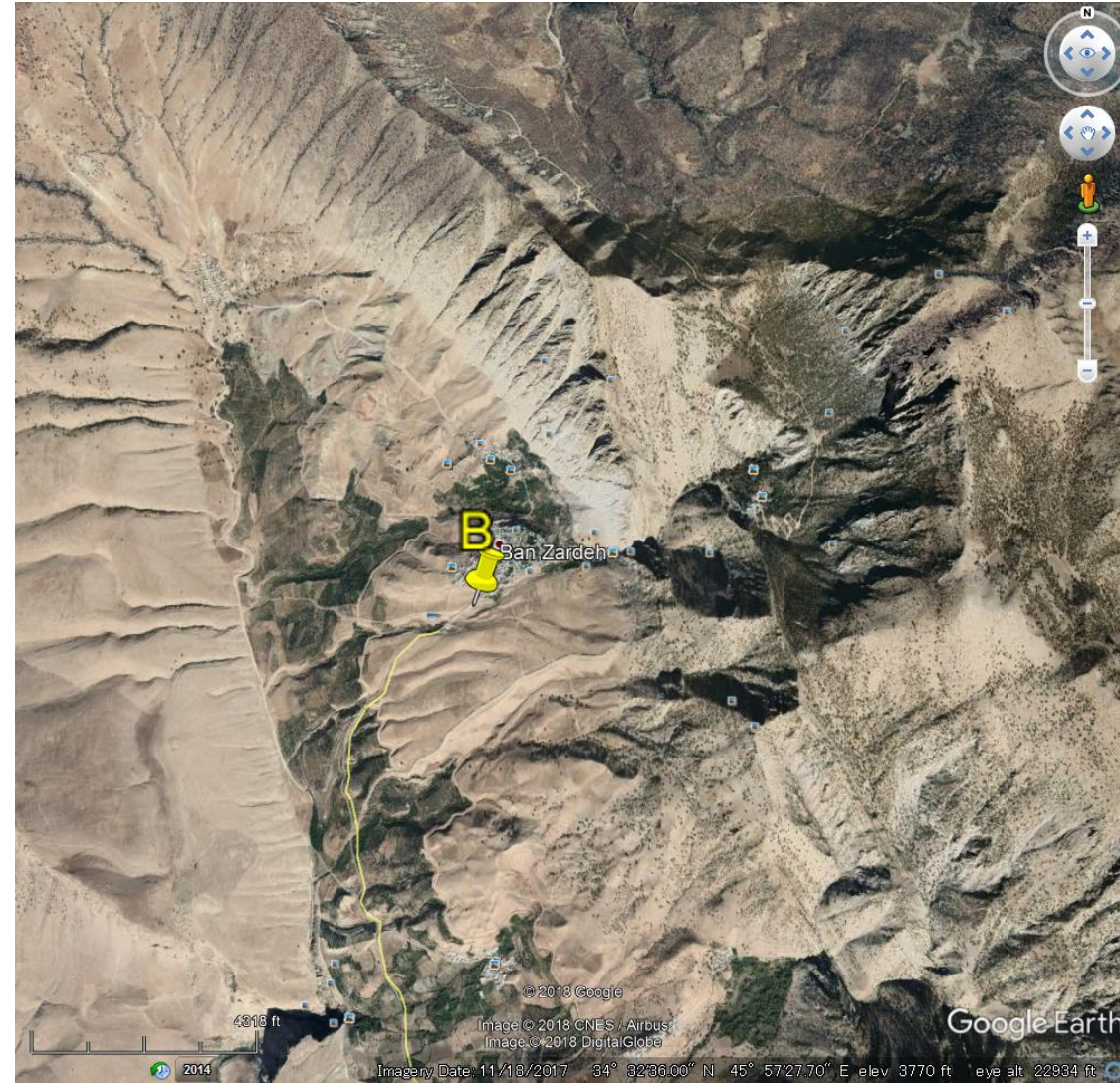


Fig. 6 location of Ban Zardeh village

□ Ban Zardeh Village

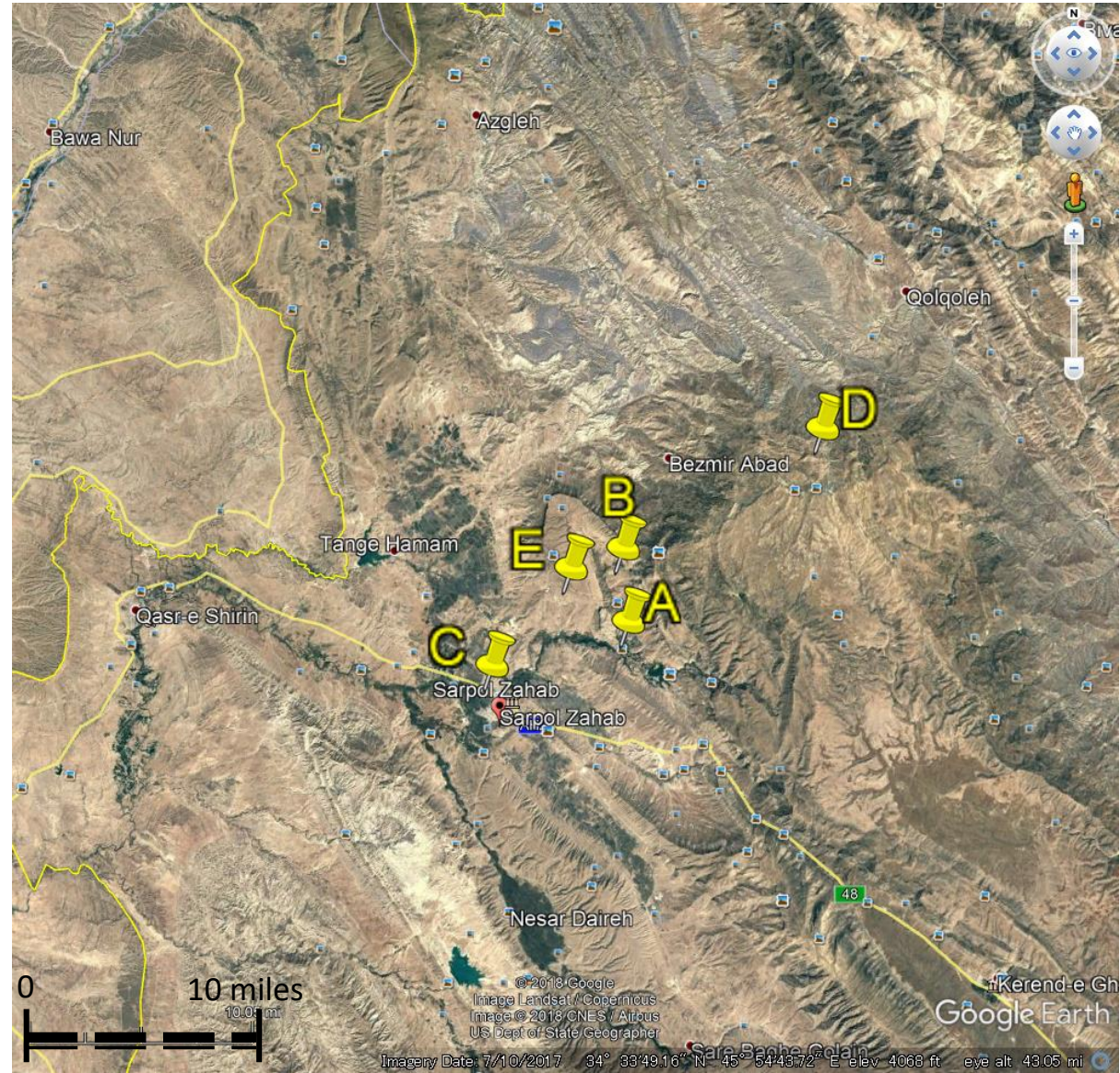


Fig. 7 (a,b and c) Rock fall in Ban Zardeh Village that block the road between the village and Baba Yadegar tomb



Fig. 8 (a & b) Baba Yadegar tomb

Maskane Mehr & Fooladi District, Sarpol-e-Zahab City (C)



□ Maskane Mehr & Fooladi District, Sarpol-e-Zahab City



Fig. 9 Location of Maskane Mehr and Fooladi District, Sarpol-e-Zahab

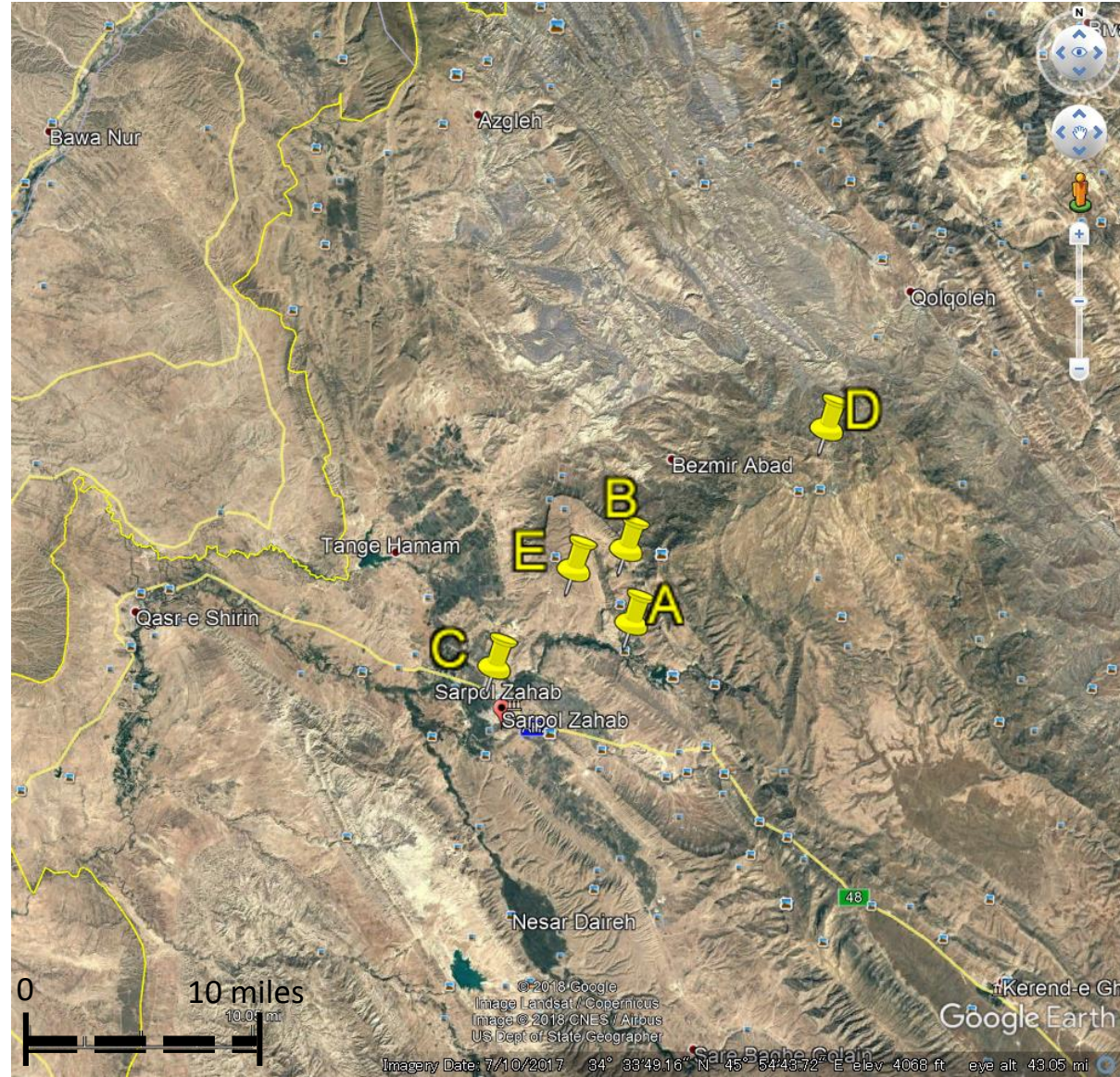
□ Maskane Mehr & Fooladi District, Sarpol-e-Zahab City



Fig. 10(a and b) Ground deformation in Maskane Mehr/Fooladi District

- There is a river in this area, close to ground deformation location.
- According to the residents, before the earthquake, City government planned to relocate the residents due to the shallow ground water table in this area.
- It is likely that this ground deformation appeared due to liquefaction occurrence in the subsoil layer.

Palan-e Olya Village (D)



Palan-e Olya Village



Fig. 11 location of Palan-e Olya village

Palan-e Olya Village



Fig. 12 (a, b and c) Ground subsidence in Palan-e Olya village

□ Palan-e Olya Village

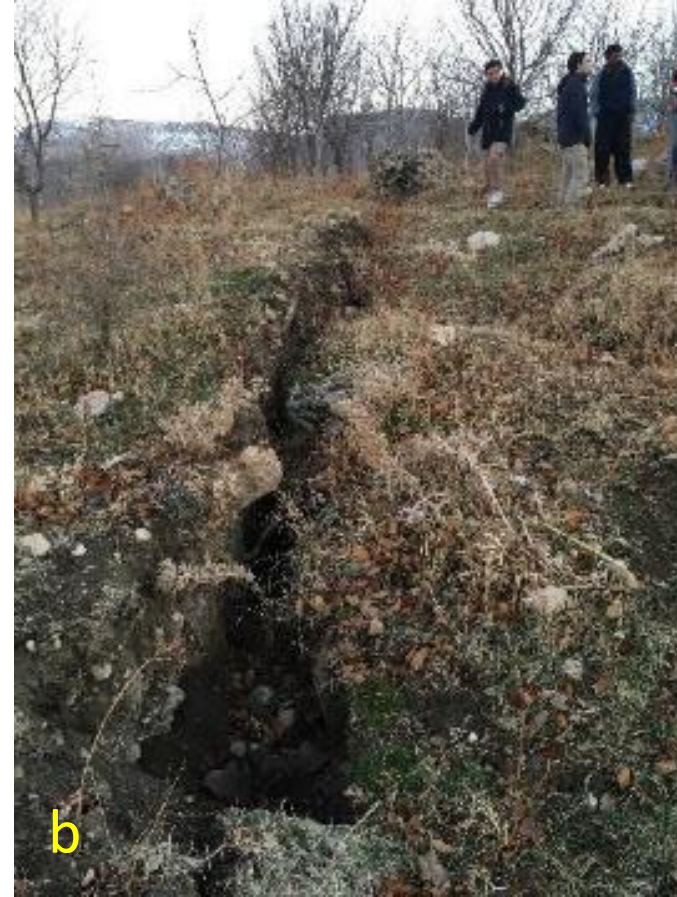
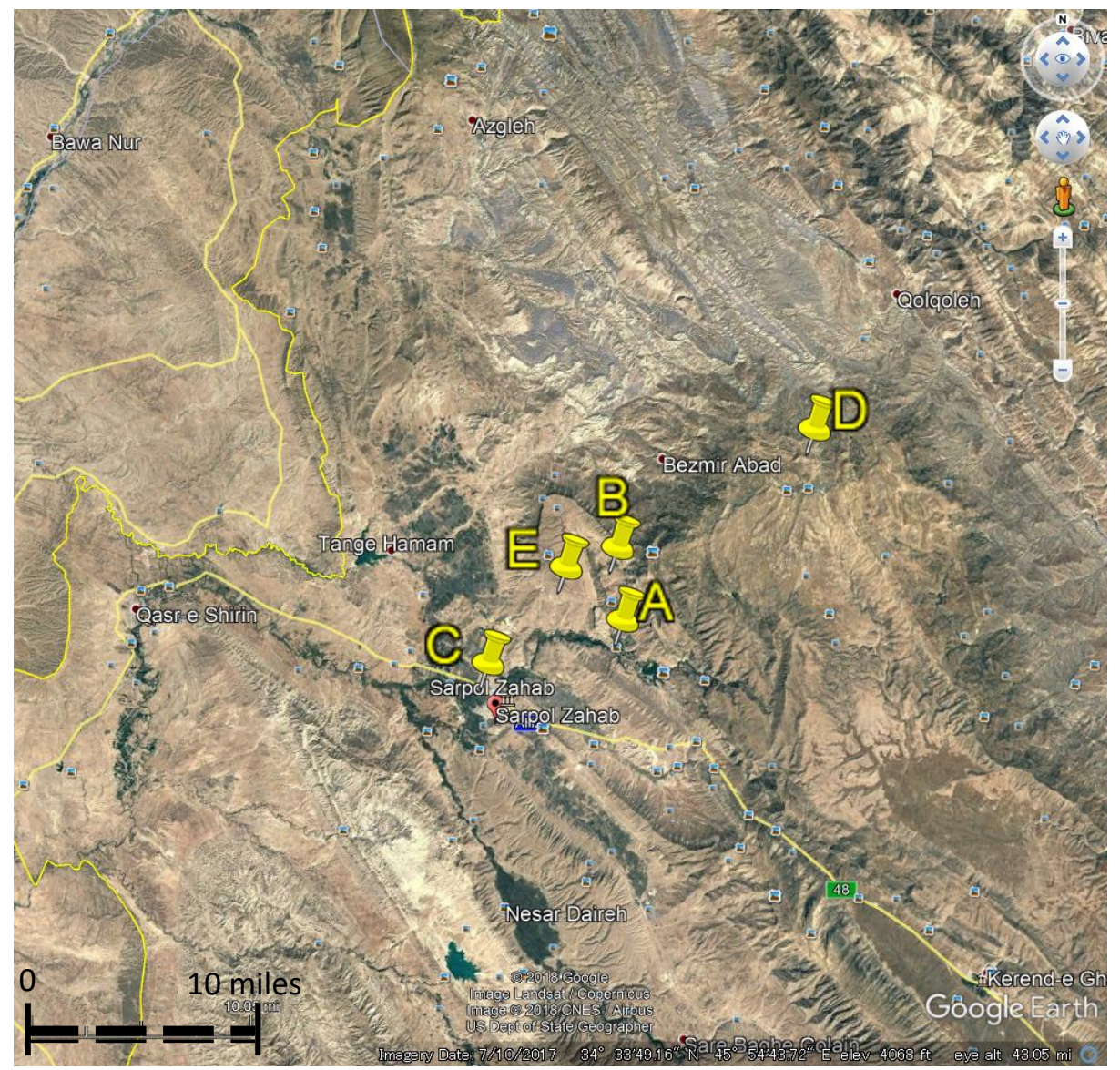


Fig. 12 (a & b) Soil rupture in Palan-e Olya village

- Soil rupture occurred with the length around 1 km

□ Mela Kabood & Goorchi Bashi Villages (E)



□ Mela Kabood & Goorchi Bashi Villages



Fig. 13 Location of massive landslides near Mela Kabood and Goorchi Bashi villages

□ Mela Kabood & Goorchi Bashi Villages



Fig. 14 (a & b) Massive landslides near Mela Kabood and Goorchi Bashi villages

□ Mela Kabood & Goorchi Bashi Villages



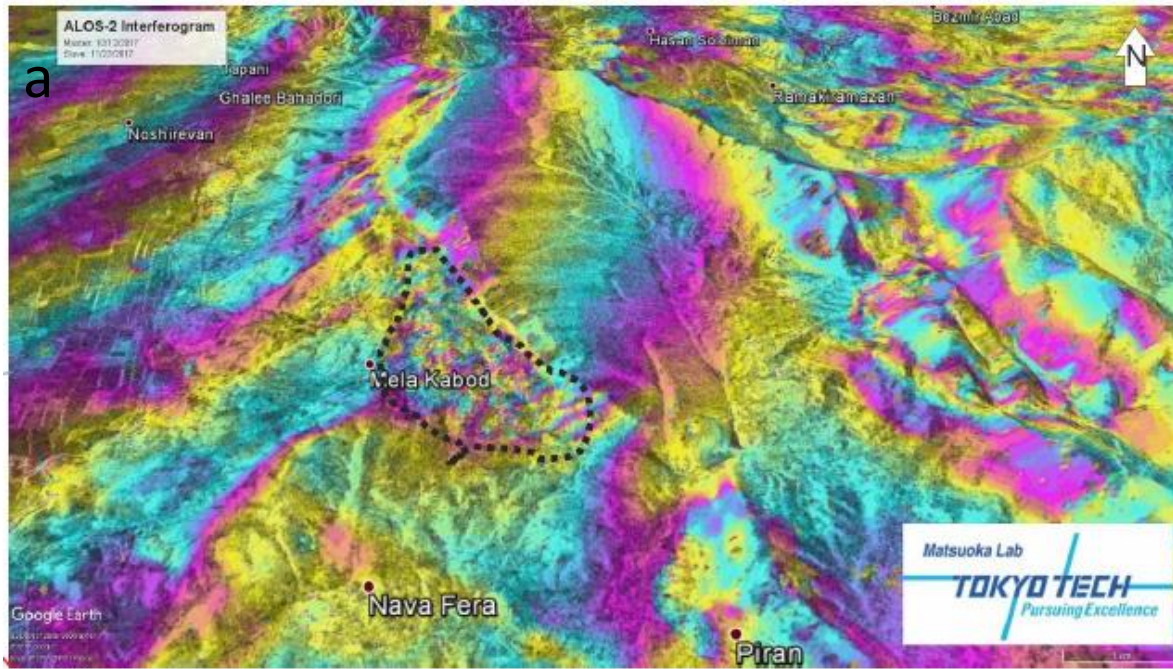
Fig. 15 (a & b) Soil rupture occurred near Mela Kabood and Goorchi Bashi villages

□ Mela Kabod & Goorchi Bashi Villages



Fig. 16 (a, b & c) Ground subsidence

□ Mela Kabod & Goorchi Bashi Villages (Displacement map)



- 7 m of slip related to Mela Kabod landslide triggered by November 12th 2017.
- Areas without clear fringe patterns represent incoherent areas.
- When there is a rugged surface within the pixel or the surface changes by land formation, landslides, two SAR signals cannot interfere with each other and looks like “sprayed sands”.



Fig. 17a Ground displacement using Sentinel-1 and ALOS-2 SAR data (Karimzadeh, 2017)
17b & 17c Ground displacement occurred (Vajedian, Twitter)

□ Mela Kabod & Goorchi Bashi Villages



Fig. 18 (a,b & c) Damaged building due to landslides

THANK YOU VERY MUCH
