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Contributions of fault gouge mineralogy on aseismic creep of active faults: the East Anatolian Fault (Eastern Turkey) as a case study

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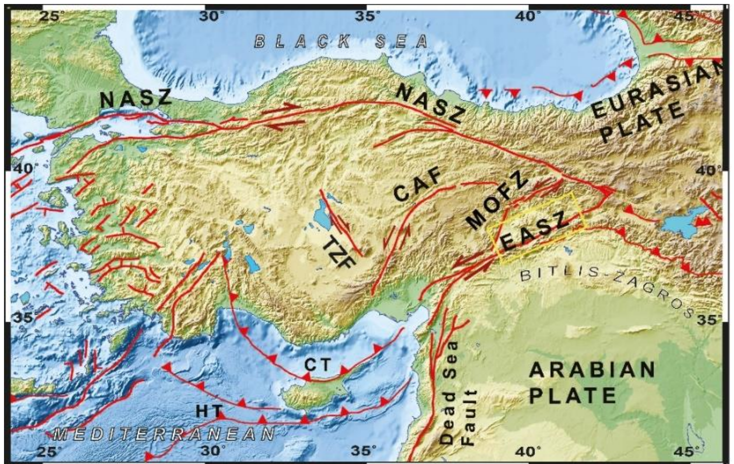
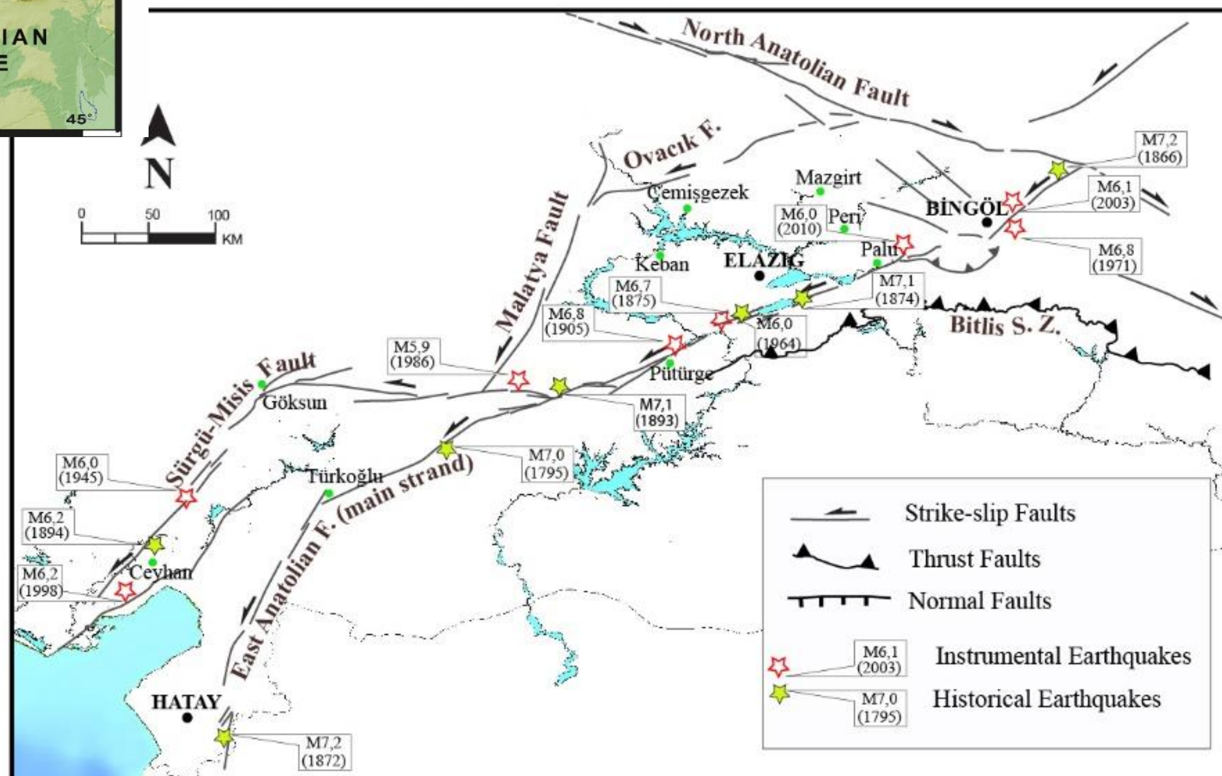
The East Anatolian Fault



Simplified tectonic map of the Eastern Mediterranean

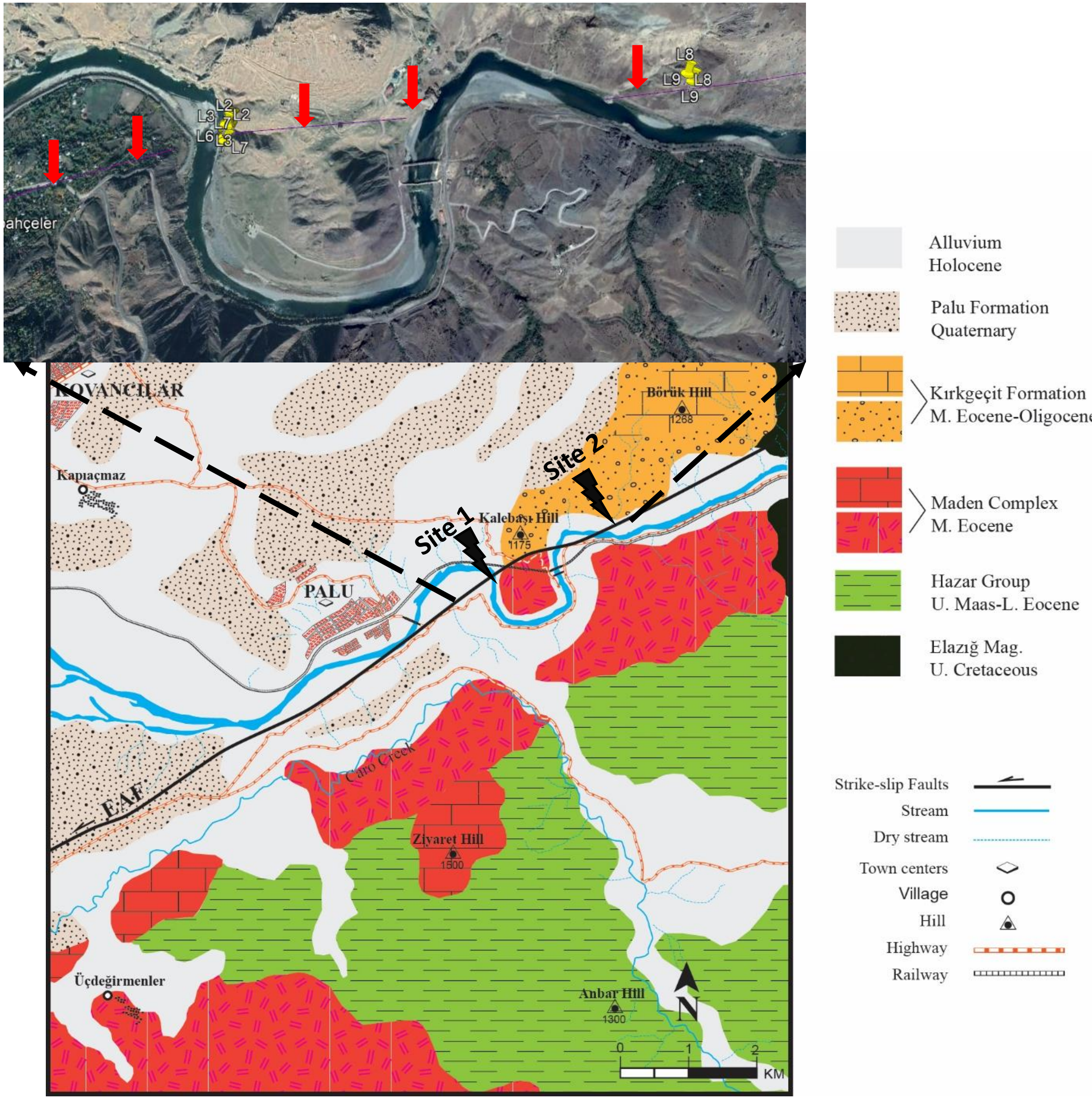
The East Anatolian Fault is the boundary between the Arabian plate and the Anatolian Block, which has 10 mm/yr sinistral slip rate (Reilenger et al. 2006; Ergintav et al, 2019).

The lack of seismicity and surface rupturing earthquakes rise a question; Is there a seismic gap or an aseismic motion at the ~80 km length Palu Segment



The historical and instrumental seismicity along the EAF. Historical earthquakes modified from Duman and Emre (2013) (Ambraseys, 1989; Ambraseys and Finkel, 1995; Ambraseys and Jackson, 1998; Tan et al., 2008; Palutoğlu and Şaşmaz, 2017). Instrumental seismicity (http://www.koeri.boun.edu.tr/sismo/zeqdb). From : Köküm, M., Özçelik, F. 2020.

The Palu segment



Recent geodetic measurements show significant aseismic creep.

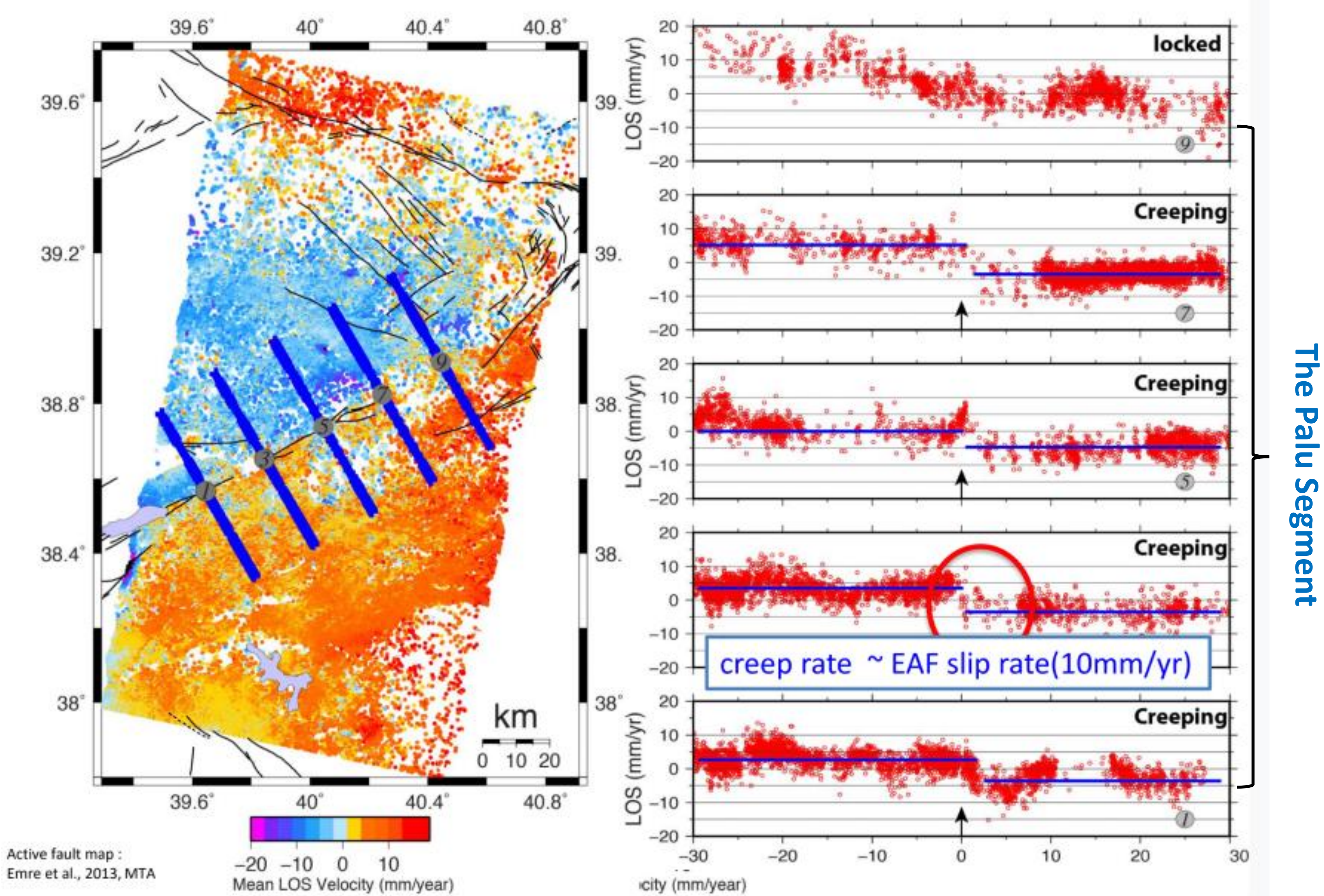
QUESTION

Can we understand the mechanical signature of the creep from the petrography of the fault zone.

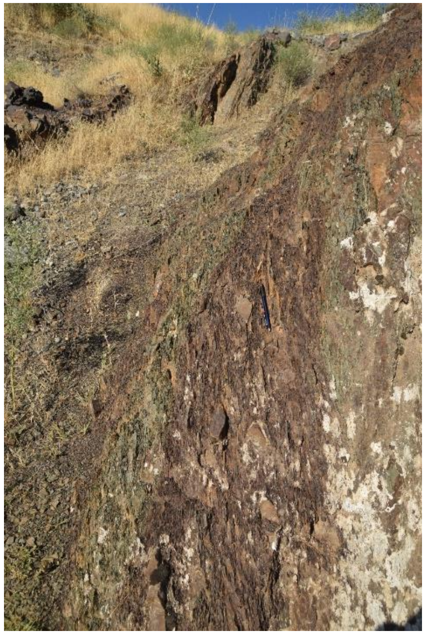
THE WAY

We took 22 fault rock samples from 2 sites where the creep signals are continuously recorded in between by a creepmeter (~38,6975˚ / 39.9503˚).

Geodetic observations ➡ **for more information see** (Ergintav et al. 2018, EGU)



Fault rocks along the Palu segment



Samples were collected by using 20cm length 4 cm wide steel pipe from the clay rich fault gouge of the Palu segment.

Sampling

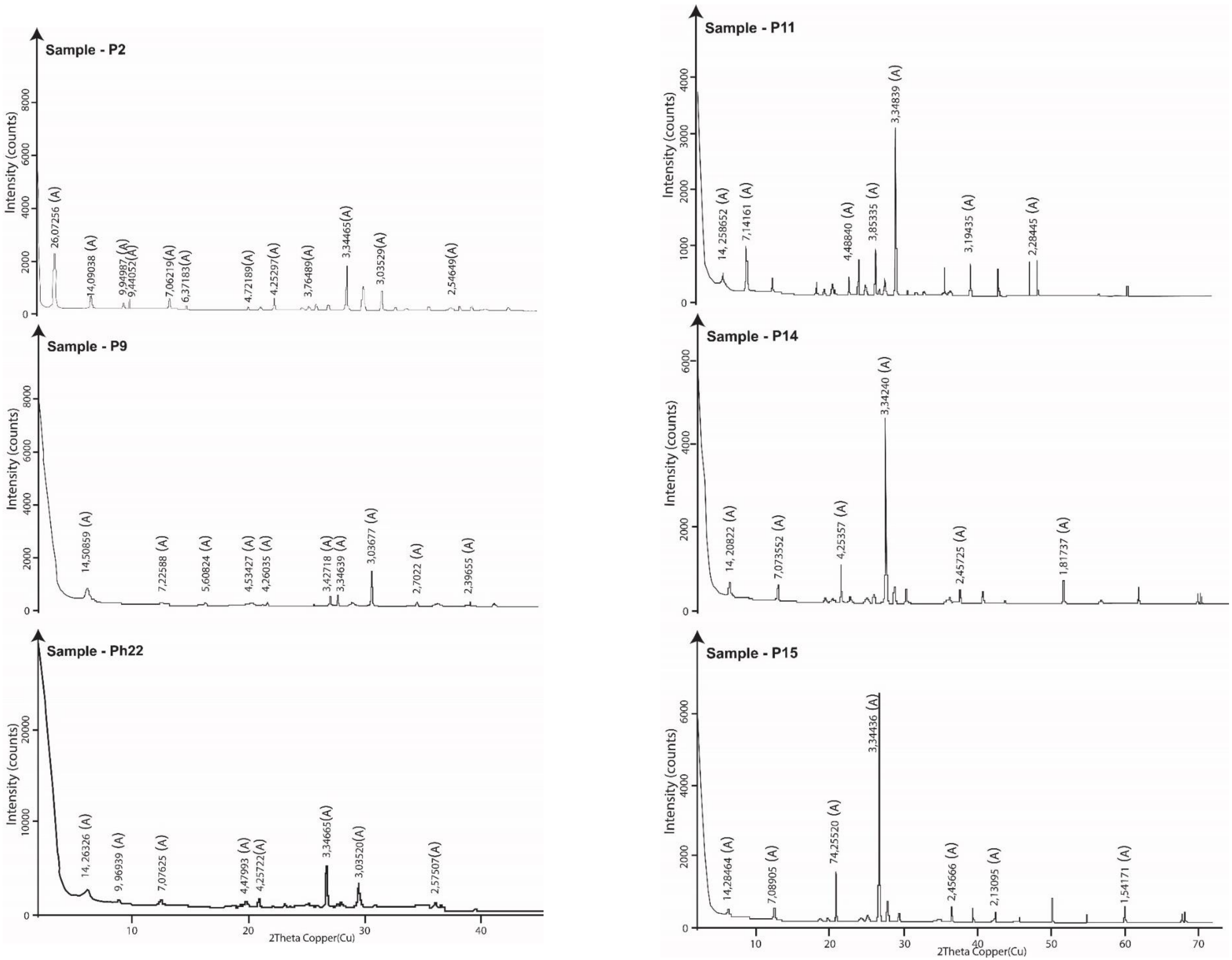
Collected fault gouge samples were hand-crushed to powder for bulk-rock X-ray Powder Diffraction (XRD) analysis.

We followed the method of the Moore and Reynolds (1997) for the XRD analyses.

Moreover, we follow the methodology of similar studies along the San Andreas Fault and the North Anatolian Fault (Kaduri et al., 2017; Moore and Rymer, 2012; Schleicher et al., 2012; French et al., 2014).

Location No	Sample No
L1	P1, P2
L2	P3, P4, P5
L3	P6, P7, P8, P9
L4	P10, P11, P12
L5	P13
L6	P14
L7	P15
L8	Ph16, Ph17, Ph18, Ph 19
L9	Ph20, Ph21, Ph22

The XRD-spacing



Preliminary Interpretations

The bulk-rock XRD results reflect the presence of smectite as the main clay mineral in addition to albite, chlorite-kaolinite and illite-mica minerals within the fault rocks, where aseismic creep was measured by creepmeter.

This preliminary result suggests a linkage between the creeping and petrophysical properties of fault rocks, where existence of smectite minerals can effect the frictional properties of the fault.

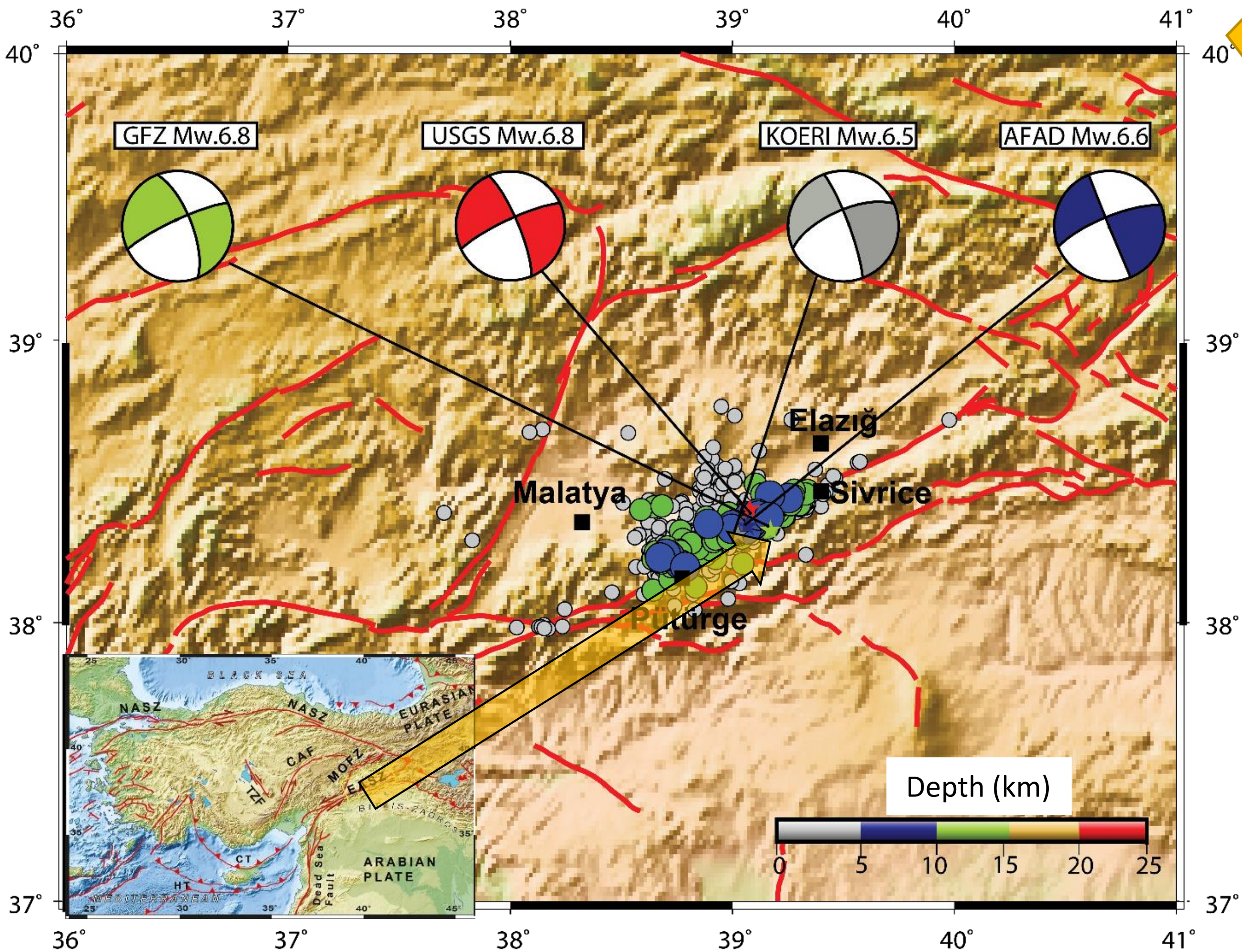
Future Work

Our lab work is interrupted by the COVID-19 outbreak, however, clay fraction will be done to examine the properties of clay minerals hopefully after relaxation.

Electron microscope (SEM) analyses will be done to see the microstructure of the fault gouge and will correlate with the creeping.

The number of samples can be increased.

BONUS: The importance of 'ephemeral' structures in ultra-precise mapping of the earthquake fault *(24 January 2020 Mw 6.8 Sivrice Earthquake)*



Mw 6.8 earthquake happened at the Pötürge segment (next to Palu segment)on the EAF.

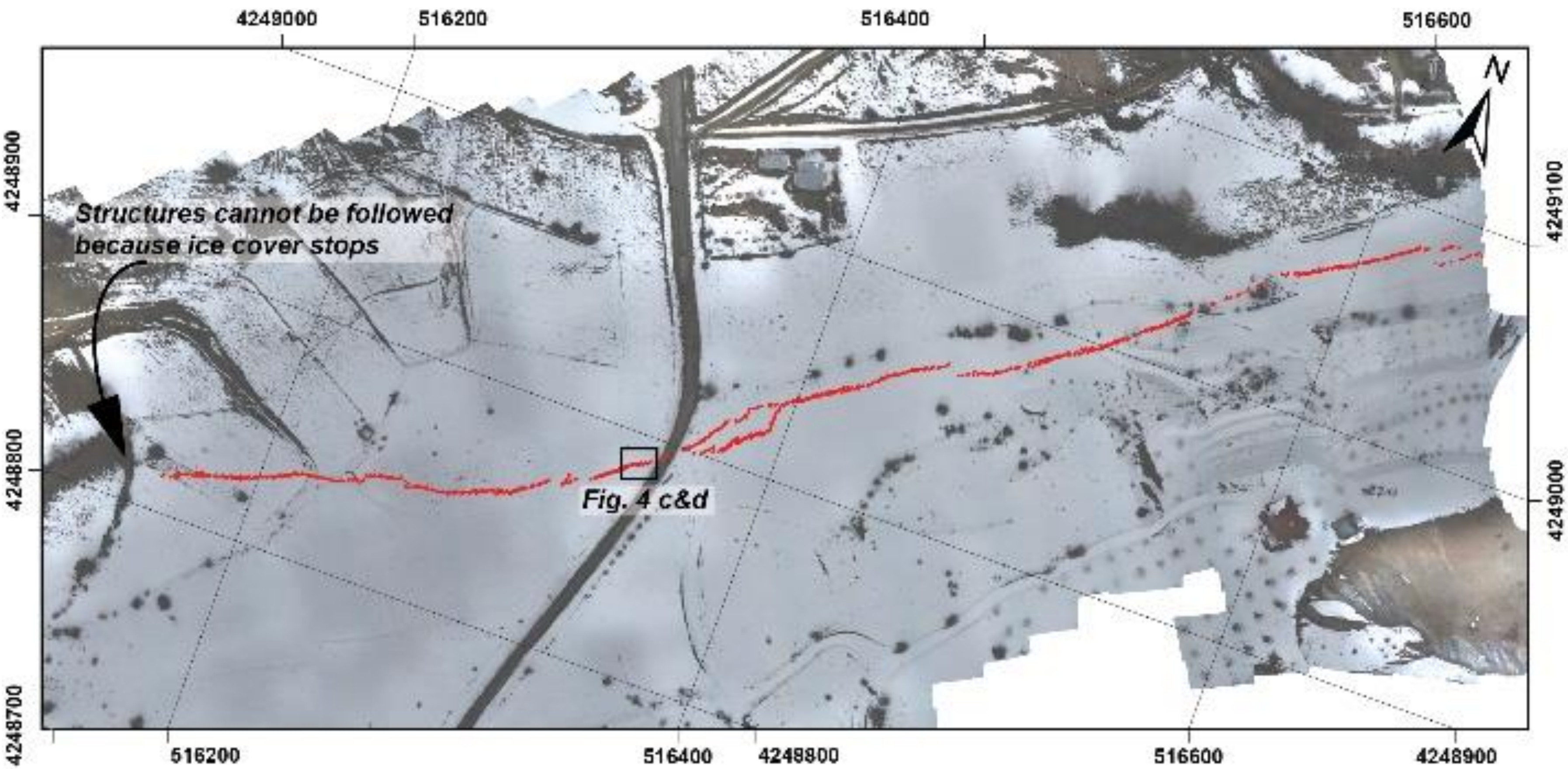
Field Observations just after the earthquake

There we observed many surface cracks along the earthquake segment, however none of them show a clear evidence for kinematic analyses, except ones in the ice cover.

The orientation and opening of tension gashes perfectly fit to a sinistral shear zone!

There are small offsets along these tension gashes, where possibly we can measure the co-seismic deformation.

The measured cumulative 15 cm slip also corresponds the co-seismic deformation measured by the GPS (More info at D1261 |EGU2020-11072).



This study is under review and hopefully will be published (Zabci et al. 2020???)

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Acknowledgements

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