

Understanding the role of strike-slip faulting as oceans close in north central Turkey

Bridget S. Pettit*, Elizabeth J. Catlos, and Brent Elliott

The University of Texas at Austin - Jackson School of Geosciences

*bridgetpettit@utexas.edu

Thesis

- The goal of this project is to compile and interpret remotely sensed imagery and produce maps intended to lessen hazards associated with Turkey's North Anatolian Shear Zone (NASZ) in north central Turkey. These hazards include landslides and rock falls due to seismic activity.

Introduction

- The Erzincan earthquake was a magnitude 8 that broke along a 360 km long zone to the south of Amasya (Barka 1996). A chain of magnitude 6.5 earthquakes since then has led to more than 65,000 casualties (USGS Worldwide Earthquake List, 2013).
- The city of Amasya is an ideal location to study the NASZ as it is exposed on land.
- By looking at surface fault expressions, it is possible to identify the extent of each fault and their relationship to one another; the resulting maps will help understand the tectonic history and identify geohazards of the region.

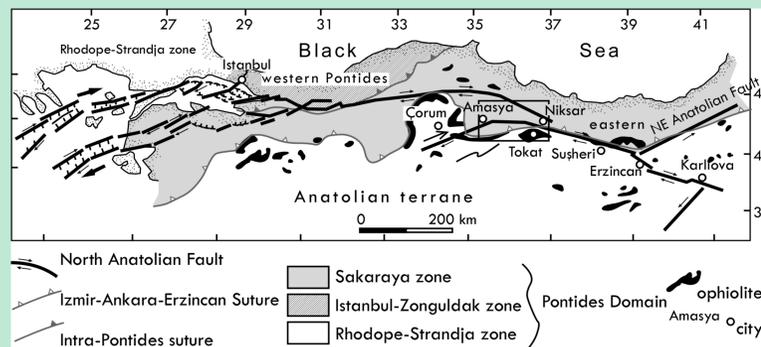


Fig. 1. Geometry and location of the North Anatolian Fault after Barka (1992), (1996) and Akyuz et al. (2002). Ophiolites (ocean floor rocks), sutures, and location of the Pontides Domain after Moix et al. (2008). Box shows study area.

Geologic Background/Study Area

- The North Anatolian Shear Zone (NASZ) is a system of faults formed in the late Miocene or Pliocene (Sengor et al. 1985; Hubert-Ferrari et al. 2002; Westaway 2004). The shear zone is the result of the Arabian plate striking the westward moving Anatolian plate, closing ocean basins.
- The NASZ in the study region is comprised of 5 fault strands: Erbaa, Tosya-Ladik, Niksar-Kalekoy, Erzincan, and Tasova-Tekke faults with a combined displacement of about 80 km (see Fig. 6).
- The region contains Amasya, a city of historical and cultural significance and high population density.

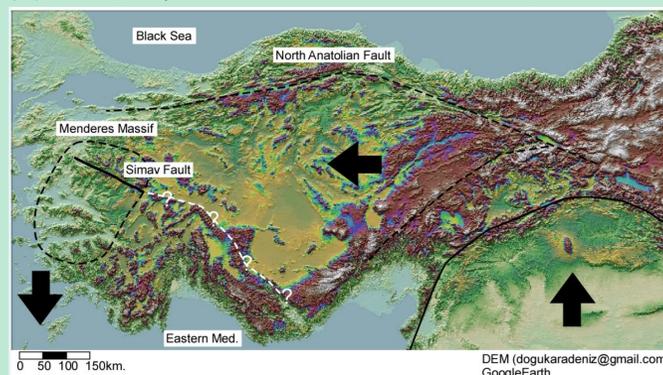


Fig. 2. A schematic diagram illustrating the Arabian plate striking the westward-moving Anatolian plate, resulting in the North Anatolian Shear Zone (NASZ).

Research Method #1

- Compile aerial photographs, Digital Elevation Models (DEMs), geological maps, and strike and dip data of the field area.



Fig. 3. A Google Earth image of the field area. Identifying surface expressions such as changes in vegetation helps to indicate fault structures.

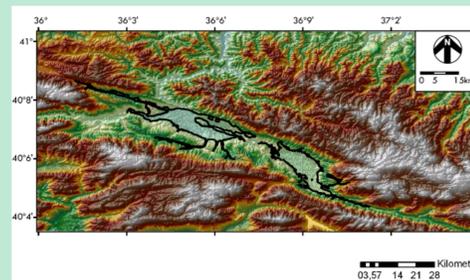


Fig. 4. A digital elevation model outlining the Niksar and Erbaa Basins.

Research Method #2

- Propose locations, extent, and type of faulting based on data visible on the maps.
- Identify faults by their surface expressions.
- Quantify the length, extent, depth, and relationship of new and old faults.

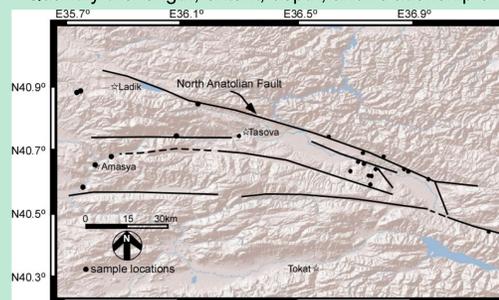


Fig. 5. A digital elevation model outlining some of the major fault strands in the study region by surface expression alone. The dots indicate sample locations with known orientations.

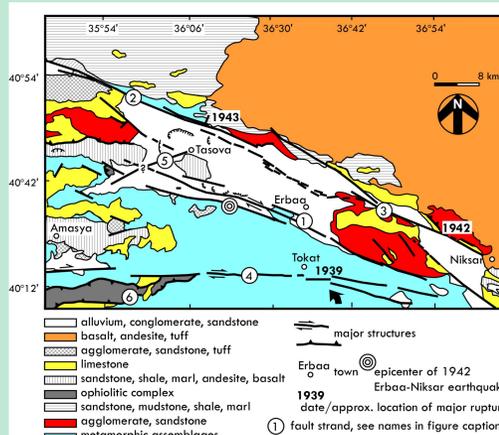


Fig. 6. Schematic geological map of the field area after Aktimur et al. (1990), Yoshioka (1996) and Barka et al. (2000). See geologic background section for discussion. Fault names (may vary, after Aktimur et al. 1990 and Tatar et al. 1995) 1: Erbaa, 2: Tosya-Ladik, 3: Niksar-Kalekoy, 4: Erzincan, and 5: Tasova-Tekke. Epicenter of the 20 December 1942 Erbaa-Niksar (Ms= 7.1) earthquake after Barka (1996).

Research Method #3

- Visit these proposed fault locations in outcrop and update the map according to the results.



Fig. 7. Geologists Karen Black and Aykut Akgun in the field.

Outcomes

- Create a series of maps focused around the city of Amasya.
- Provide the results to Turkish colleagues.
- Communicate the risks in the area due to earthquake-induced slope failures.



Fig. 8. Landslide damage sustained on mudbrick houses in Amasya.

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Fig. 9. View of the Erbaa basin.