ASU (GLS 494/598) UNR (701J) Main Mapping assignment

Over the first part of the semester, we have discussed and demonstrated fault zone geomorphology and fault mapping in several tectonic contexts. For the rest of the semester, you will apply your new mapping skills in individual projects. We plan to use your fault maps in subsequent analysis to understand probabilistic fault displacement hazard. We plan on writing a peer-reviewed manuscript which includes the mapping and subsequent analysis. Students who complete this mapping assignment will be coauthors.

We anticipate that students will each perform their mapping assignments in two locations, spending an average of 4 hours a week for 5 weeks on each project (~20 hours total). It is much more important to produce high quality and well-documented mapping over a small location than have less complete and lower quality mapping over a large portion of fault length. See below for guidelines on fault mapping.

Fault options in the PPT: These earthquakes and/or faults have pre-earthquake imagery for fault mapping.
Please rank your top three choices and send to Chelsea Scott (cpscott1@asu.edu). We plan to have everyone map at least one of their top ranked areas. The ranking an assignments will ensure that all of the target pre-earthquake areas will be mapped by 1-2 people.

What to include in your mapping project:

- At the beginning of each project, emphasize mapping the morphology and/or geomorphology to gain context to the area. Pick an area that will take two hours to map. Create an explanation with a description of your mapping notation and units. Once you have completed this two hour mapping, it is your choice if you think this scale of mapping is beneficial to mapping the faults.
- Fault mapping: In a shape file, include line work showing the fault, and attributes indicating which dataset you made the observation from, quality ranking, and primary vs. secondary faulting. You may use other shape files for other lines or polygons that you map. But, you must provide the fault line shape file.
- Quality Ranking: Develop a numerical scale for ranking mapping quality. At a minimum use a scale like this one, (4) strong, (3) distinct, (2) weak, (1) concealed. In your report, include a description about what qualities in the fault, landscape, the base data, and other observations are indicative each of the quality rankings.
- Primary vs. secondary:
    - Primary: Long, along-strike continuity. Primary faults are continuous at depth but at the surface can be en echelon splays, flower structures that represent shallow complexity in push/ pull-aparts, and parallel traces. Primary faults can be conjugate.
    - Secondary: Offset from the primary, may be antithetic, along the hanging wall of the primary rupture, synthetic fault unconnected to the main fault
- Other features: Is anything else appropriate for the landscape and fault that you are mapping?

Progress check:

- We will spend at least 45 minutes each Thursday discussing the mapping. Each student will present their work every other week.
- When you present, prepare a 2-3 slide presentation showing a location where your mapping is going well and an area where you have a question or are less sure how to map.
- Please do not be hesitant to show areas where you have questions about the mapping. You and your classmates will benefit from the discussion that comes from your questions.
- If you have questions, please do not hesitate to get in touch with an instructor. This is a research project where we do not know the answers a priori and cannot anticipate all the questions. We do not want you wasting time because you hit a road block.

Guidelines:

- We certainly may have missed good pre-earthquake datasets. Please speak to us if you find additional datasets that you would like to use.
- Do not look at post-earthquake imagery, including basemaps in GIS programs. This completely defeats the point of the exercise, is not necessary, and will probably be obvious in your results.
- Do not research the earthquake. It is important that you remain unbiased by observations of how the earthquake ruptured the surface. Please speak to an instructor if you think particular knowledge about the earthquake would benefit your mapping.
- You must work individually. We will discuss mapping in class, but do not discuss mapping with classmates out of class. We fully expect mapping to vary by individual and need to capture these differences.
- Some of the datasets are publicly available. Others, colleagues have shared with us prior to the publication of the dataset under the expectation that we do not share the datasets beyond this class. Do not share any of the data that we give you.

Datasets:

- We will indicate where to access the data
- USGS: https://earthexplorer.usgs.gov
- Google Earth: Use the clock to get older imagery and scan for datasets that have relatively high resolution
- OpenTopography (https://opentopography.org)
- For larger datasets we will provide a shape file indicating regions to concentrate the mapping.

Report:

- A one paragraph discussion of the tectonic setting and climate of the area. Do a short literature review and cite relevant papers.
- Datasets: Include basic metadata like where you accessed the data, what type of data you have used, data resolution, acquisition date. If you have multiple datasets, this

information may be best displayed in a table. What specific qualities of the data helped or hindered your mapping?

- Show the full mapping linework.
    - Morphology and/or geomorphology: Map and legend
    - Fault mapping
    - Describe the quality ranking
    - Describe designation of primary and/or secondary faulting
    - All maps should have a scale bar, legend, north arrow and a caption
    - Indicate the coordinate reference system that you have used to save your line work
- Show and discuss three zoomed areas of your mapping with varying features. For example, you can show areas with primary versus secondary deformation, and areas where the quality of the fault exposure varies. The examples should not only highlight area where the mapping was easy but you should also discuss more challenging areas and maybe demonstrate your different quality metrics. For each area, describe the observations and then your interpretations in about one-half a page of text.