Cinder Cone Degradation Field Trip

Problem:

This field trip is the first part of a project on the erosional evolution of cinder cones. We will visit the area around SP Mountain in the San Francisco volcanic field just north of Flagstaff, AZ. Our objective is to observe and map the spatial distribution of active erosion and transport processes on four cinder cones of differing age. Key interrelated questions are: (1) what are the active erosion and transport processes?, (2) does the suite of active processes change with position on a cinder cone and with time?, (3) if so, why?, (4) how does the morphology of cinder cones change through time and why?, and (5) how is the suite of active processes related to the morphology of the cinder cone. Your observations and map of process and morphological domains (see below) will be the basis for developing answers to these questions.

In lab in the weeks following the field trip, you will conduct an analysis of cinder cone morphology as a function of age in the broader region of the San Francisco volcanic field using available 10m DEMs, ArcGIS and Google Earth images. Together with your field observations and maps, this GIS analysis will form the basis of a project report: a 4 page (max., with 1.5 spacing and 12 point font) discussion of what you have learned about cinder cone degradation, complete with maps, results of your GIS analysis, photos, and/or sketches (figures do not count against the 4 page limit).

As this project is not due until **Wed. Oct. 2**, make sure you take detailed notes in the field so you don't forget what you saw. Also you will need to provide the evidence, the logic behind interpretations that you make. As with the first project, there will be two interim deadlines for the results of key steps in your analysis that must be met.

Data Available:

- 1-meter resolution Digital Ortho-photographs (with 10m contours)
- 1:24,000 scale topographic maps
- 10-m pixel Digital Elevation Models co-registered with the orthophotos (used to place contour lines over the orthophoto images.
- One or more field laptop computers

The Field Project:

We will subdivide into 4 groups for field observations and data collection. Each group will have *primary* responsibility for making detailed observations, taking photographs, and conducting a topographic survey of 1 of the 4 cones (day 1). Each team will prepare a presentation for the full group on their detailed observations of day one (supported by survey results, photos, and interpretation of observations).

At camp after dinner, each group will report out with a powerpoint presentation (prepared on personal PC or one of two field tablet PCs) – we will have a projection system.

Each team will more briefly make observations on all three other cones (one day 1, the others day 2). Day 2 is your chance to follow up on ideas and questions raised during the group presentations – this is your chance to really figure out the geomorphology of the field site.

Complete the Following Tasks in the Field:

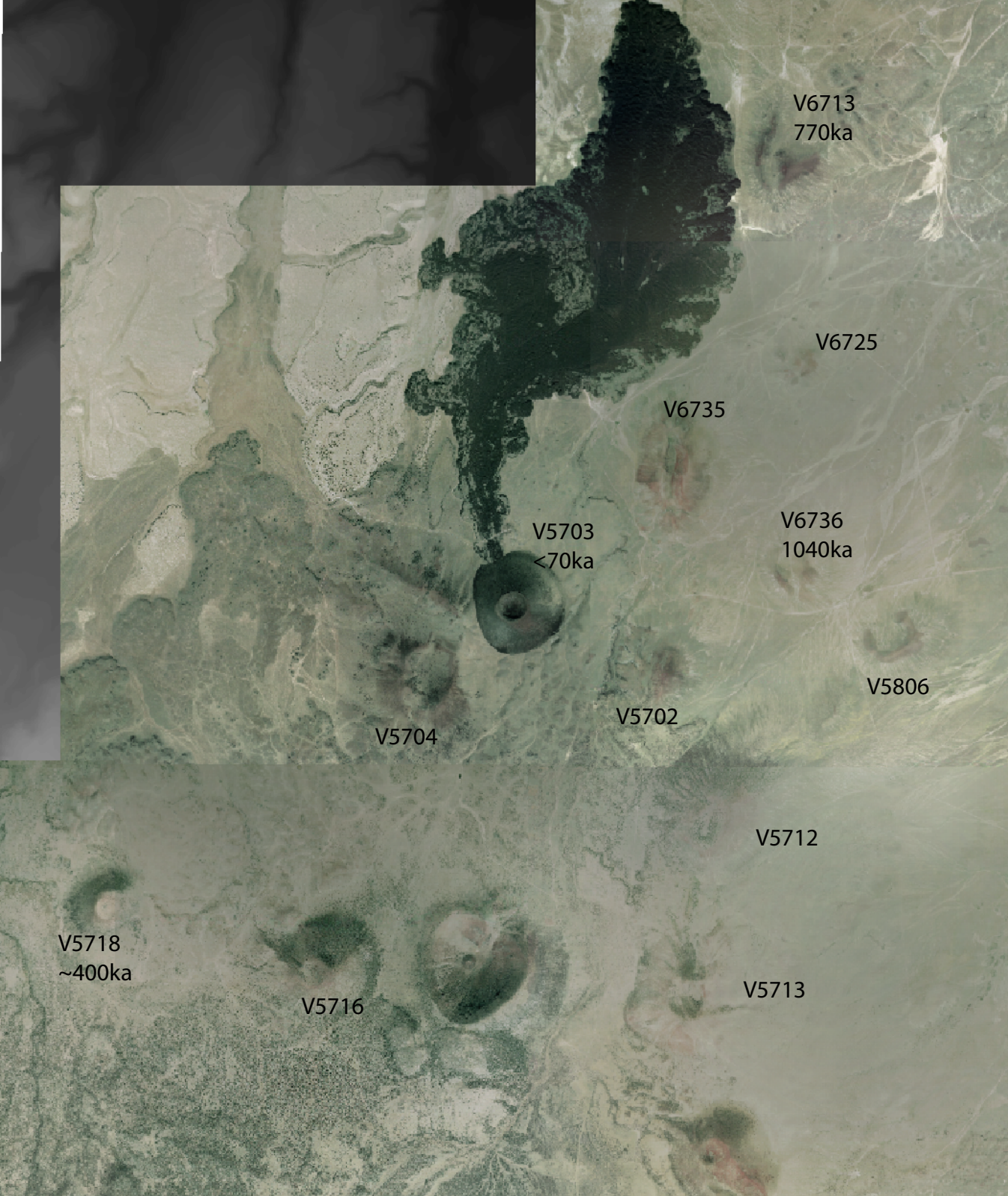
1. Using the orthophotographs and 1:24,000 scale topographic maps as a mapping base, on each of the four cinder cones:
    - Make detailed observations to ascertain what suite of erosion and transport processes are active and think about why these are the active processes. Consider:
        1. Runoff – does it occur? what runoff generation process is active? Why? – do you see evidence for rilling, gullying or sheetwash? Do you see evidence for other processes infilling former rills or gullies? What sets the position of channel tips?
        2. Stream transport and/or deposition
        3. Dry ravel – loose rolling of individual clasts
        4. Weathering and soil formation
        5. Soil creep
        6. Bioturbation
        7. Landslides, grain flows or rock avalanches
        8. Erosion or deposition by Wind

    - Map the spatial distribution of "morphological domains": convex up, straight, and concave up landforms. Think about what are the main controls on these forms.
        1. As part of this, conduct at least one topographic survey of the flank of each cinder cone (we will discuss the form of the steep SP cinder cone and probably not venture to the top or attempt a detailed field survey) – you will be shown how to conduct a simple topographic survey with a clinometer and tape.

    - Map the spatial distribution of active processes and the degree to which this coincides with the distribution of morphological domains
    - Ask your self what the relative roles of erosion and deposition are in the morphological evolution of cinder cones through time
    - Make sure to focus on what differences there may be in the morphology, soil characteristics, and active processes as a function of cinder cone age and ponder why this should be so and how this plays into the long-term evolution of cinder cones. Think about what controls the rate of cinder cone degradation.

Lab Report

Your report, due **Wed. Oct. 2** (total 4 pages, 1.5 spacing, not including references, calculations, figures and any appendices) will be described in more detail in the handout detailing the computer lab analysis that will be companion to this field exercise.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Geomorphology: Cinder Cones Field Trip

Van Ride Discussion Topics

Erosion/Transport Processes	***Evidence to look for***

Circumstance	***Contributing Factors***
No Channels, Rills, or Gullies observed	
Channels, Rills, Gullies established and maintained	
Landslides or Other Mass Movements	