The old man of(f) the mountain:
a study of weathering on the Cannon mountain big wall

Introduction

Cannon cliff, in Franconia Notch state park, is one of the largest rock faces in the eastern United States; it was the location of the famous "Old Man of the Mountain" before the landmark fell off in 2003. Cannon is well known for its rockfall, evidenced by the large talus piles at its base. The goal of this project was to use GIS to map vertical features on a portion of the face and the volume of rock at the base of the cliff and correlate the two.

Talus Volume Calculation

From the regional data set, a cliff-scale model was created using clip functions in ArcMap. In ArcScene a slope surface was generated from a 1/3 arc second DEM (NED). The talus pile was separated into 8 sub-pile polygons based on vegetation extent, and in cross section through the corresponding talus piles slope angles were inferred for the base, talus pile, and cliff for each polygon (see below). Next, using the inferred angles and the base length and width of each talus pile as measured in ArcMap, the volume of the talus pile was calculated (see results section).

Joint Mapping

From the Gigapan of Cannon, each joint was mapped using edit functions in ArcMap. The angle of each line was entered into the attributes manually, after several failed attempts at automating the process. When this data entry was complete, each fracture was assigned a polygon number, based on which portion of the talus pile to which it would feed debris. From the fracture map, the trends of fractures on portions of the cliff feeding polygons 1 - 6 were plotted on rose diagrams (see results section).

Results and Discussion

The volume of the talus piles increase toward the center of the cliff, as do the number of joints in the cliff face. The joints in the cliff face occurred overwhelmingly in the horizontal direction, however there were a significant number of vertical joints, particularly on the left portion of the cliff face. The relationship between the number of joints and the volume of the talus piles suggests that the amount of weathering product, and thus the rate of weathering and rockfall, is exponentially related to the number of joints in the cliff face. The rate of rockfall is greatest in the central portions of the cliff. Many people come in contact with steep rock faces for purposes of mining, development of adjacent land, travel, and recreation. In all of these cases, rockfall is a persistent and dangerous issue. In many places mechanical methods of improving safety (netting, blasting, etc) are impractical or impossible to implement. In these cases, knowledge of the rates of rockfall at a cliff face can inform people of relative danger in the area. On Cannon cliff, it is the central area which is most dangerous. Unfortunately, many of these areas host the most frequented climbing routes on Cannon. Climbers should be warned of the increased danger on these portions of the cliff.

GIS software is not only useful for mapping features on aerial and topographic maps. It may be used to successfully map and characterize vertical features, such as joint plane directions.

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