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Style, rate and pattern of erosion on stratovolcanoes and ignimbrite surfaces in the Central Andes

D. Karátson (1,3), T. Telbisz (1), B. Székely (2,4), and G. Wörner (3)

(1) Eötvös University, Dept. of Physical Geography, Budapest, Hungary, (2) Vienna University of Technology, Institute of Photogrammetry and Remote Sensing, Vienna, Austria, (3) Georg August University, Geoscience Center, Göttingen, Germany, (4) Eötvös University, Dept. of Geophysics and Space Science, Budapest, Hungary

In our work, erosion of active and extinct (Holocene to Miocene)stratovolcanoes (18-24° and 70-67° W) and various-aged (22-2 Ma old) ignimbrite surfaces (16-20° deg S, 72-69° W) of the Central Andes in Peru-Chile-Bolivia-Argentina have been studied by DEM analysis. Starting from the SRTM data base, we created various maps including slope, ridge and aspect maps, in order to see how erosion operates with time and what kinds of erosion pattern result. Style and pattern of erosion of Central Andean stratovolcanoes strongly depend on climate, elevation and latitudinal position. Valley development, enhanced by episodic glaciations, play a key role in the typical evolutionary scheme of stratocones. We can distinguish crater-topped active volcano, cone-shaped volcano with initial planezes without crater or enlarged erosion crater (depending on the presence or absence of glaciation), remnant cone with well-developed planezes at the periphery, and a final "valley-stage" where headward erosion of large valleys result in a flat-topped, lowered cone. These stages can be quantified by morphometric variables such as ridge pattern analysis, surface roughness, cone shape ratios, etc. Original landforms can be reliably reconstructed by using planeze remnants that can survive in the long term especially under arid climates. Missing volumes of valleys and eroded summit help to calculate erosion rates of stratovolcanoes.
Valley incision and landscape evolution can also be studied quantitatively on large ignimbrite sheets, that are especially well-preserved along the arid to hyperarid Western Andean Escarpment. At these areas, long-term landscape evolution include gully incision (parasol ribbing), quebrada retreatment by sapping and headward erosion, as well as large-volume landslides, all these types controlled by episodic, long-term uplift and various climates in the
Central Andes during the past 20 Ma. Valley volumes can be calculated by using ridge pattern and restored valley infill. By using these valley volumes, as well as age constraints (i.e. ignimbrite eruptions) and paleoclimate data, rates of valley erosion and related landscape
denudation change are assessed.