VALLEY EVOLUTION, UPLIFT, VOLCANISM, AND RELATED HAZARDS IN THE CENTRAL ANDES OF SOUTHERN PERU

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KEY WORDS: Andes, Peru, valley history, volcanoes, ignimbrites, uplift, canyons, downcutting, hazards.

INTRODUCTION

Interpretation of satellite images, field work, and geochronology identify three principal types of volcanoes in the areas of Rio Cotahuasi-Rio Ocoña, and Arequipa in southern Peru (Figs. 1-3): (1) relatively youthful stratovolcanoes of Pleistocene to Recent age e.g. El Misti (≤0.8 Ma) and older, larger complexes such as Nevado Coropuna, (2) deeply eroded stratovolcanoes of Plio-Quaternary age (4-1.5 Ma) such as Nevado Solimana and Chachani, and; (3) subdued 'shield' volcanoes of Late Miocene age. While the former are rather varied in petrography and hence chemical composiotion of erupted magmas, the latter tend to be comprised more of monotonous mafic andesites. Ignimbrites form of several hundreds of km^2 in area and several tens of km^3 in volume are also observed and have been dated at middle Miocene (13-14 Ma), Pliocene (5-2 Ma), and Pleistocene age (~1 Ma) (Thouret et al., 2001).

In the area of Arequipa, 13-14 M ignimbrites outcrop above the Jurassic basement in the Rio Chili valley that cuts the flank of the Western Cordillera (Fig. 2). The upper flanks of Rio Chili valley are built in part by lava flows and volcaniclastic sediments of Plio-Quaternary age, whose sources are the Chachani massif and El Misti. Downcutting by 250 m has been achieved within the past 3 My (Fig. 2).

In contrast, the headvalleys of the deepest canyons on Earth of Rios Ocoña, Cotahuasi and Colca NW of Arequipa, have been cut 2 km down in Miocene volcanic rocks and 1 km further down in Cretaceous intrusive and Jurassic sedimentary rocks. The headvalleys were repeatedly filled by pyroclastics and lava flows of Neogene age (< 1 Ma, Fig. 3) and have subsequenty been recut below their original thalweg. These canyons are thus much deeper and older (middle Miocene) than Rio Chili.

Huaylillas plateau near Chuquibamba (Fig. 3). Downcutting also triggered flank failures on the Plio-Quaternary volcanoes, such as the southwest flank of Nevado Solimana. Subsequent debris avalanches have dammed the upper course of Rios Cotahuasi and Rio Huarcaya in Pleistocene time. Downcutting continues and valley flanc and volcano instabilites pose a major hazard in these ultr-deep canyons. Further hazards are also related to potential dam breakouts that may trigger devastating debris flows toward the populated lower valleys.

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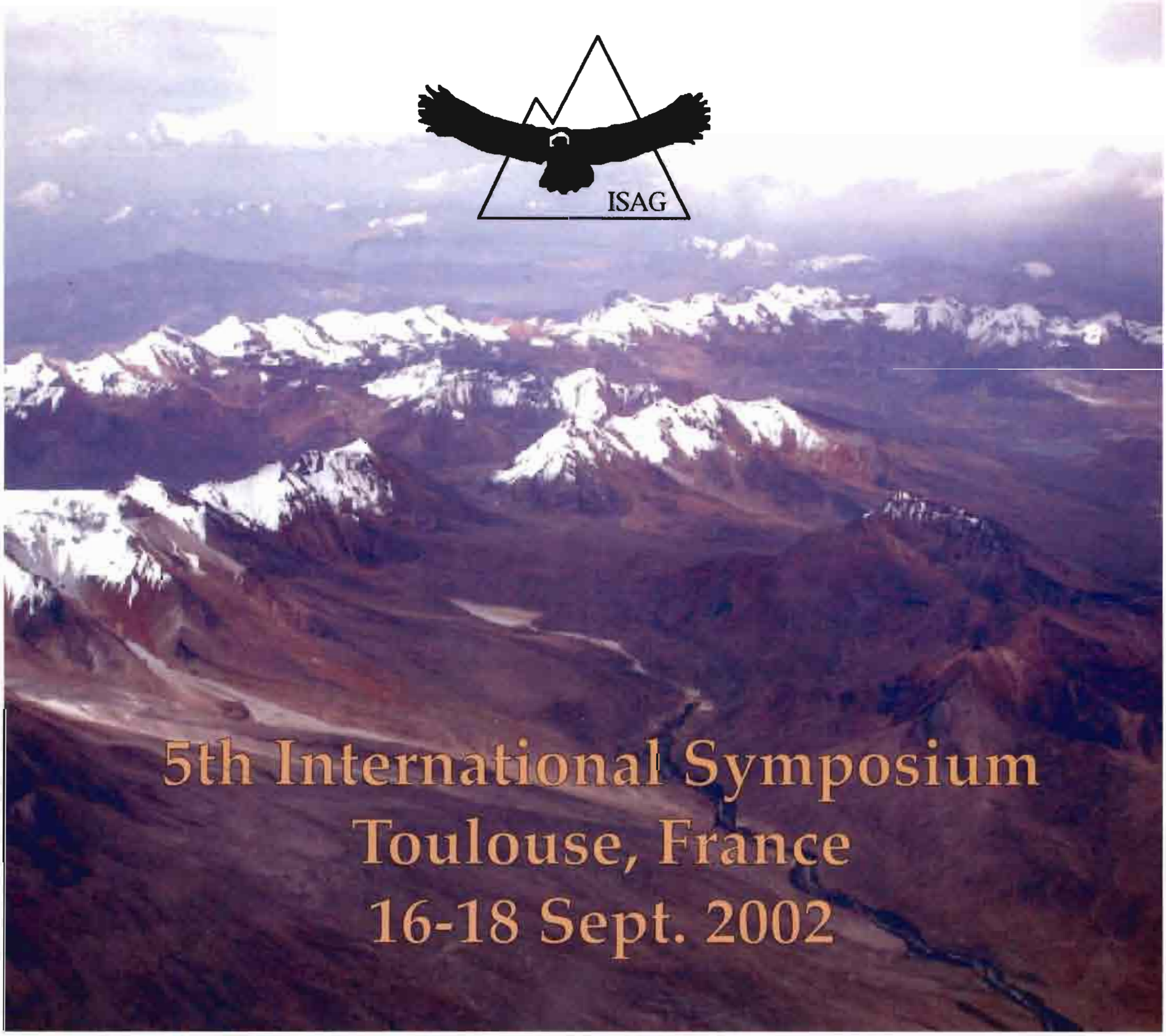

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