TEMPORAL CHANGES IN HIGH MOUNTAIN ECOSYSTEMS AND ECOHYDROLOGY: TWO CASE STUDIES FROM THE AUSTRIAN ALPS AND THE CHILEAN ANDES

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INTRODUCTION

High mountain ecosystems are very sensitive to climatic changes. Much is known about the consequences of Holocene climatic variations on vegetation and glacier dynamics. However, there are scarce data concerning the Holocene hydrological evolution. Two case studies, from the Austrian Alps and the Chilean Andes, show frequent reactions of the fluvial dynamics within a wide altitudinal range, even to minor climatic changes. Due to different environmental conditions in both areas, the causes of fluvial variability are not identical. Whereas in the Alps temperature seems to be the major factor, precipitation variability appeared more important in the Chilean Andes.

AUSTRIAN ALPS

Paleoecologically the Alps belong to the best studied high mountain regions of the world. Fig.1a shows the periods of glacier advances in the eastern Alps and the occurrence of at least two pronounced fluvial accumulation phases in eastern Tyrol (Fig. 1c), which are separated by an intense phase of erosion (Veit and Höfner 1993). The Early Holocene was apparently dominated by linear erosion and soil evolution, at least during the Holocene Climatic Optimum. The fluvial accumulation in the valleys is interpreted as a consequence of the decline of the periglacial ecotone in relatively winter dry-cool phases, characterised by a reduced vegetation cover (Fig. 1b, 1c, Veit 1993a). Monitoring of fluvial erosion and periglacial processes in a high alpine/subnival environment during the last years supports this interpretation and may lead to quantitative modelling.

NORTHERN CHILEAN ANDES

During the Holocene period, the northern Chilean Andes were characterised by a frequent change in fluvial dynamics (Fig. 2). Because of high aridity, temperature variations played a minor role. The variable influence of the southern hemisphere westerly storm tracks has been considered one of the main reasons (Veit 1993b, 1993c). Therefore, fluvial accumulation and alluvial fan activity might be correlated with intense winter snowfall and a corresponding snowmelt during springtime, associated with intensified westerlies. The chronology shows parallels to the Holocene fluvial evolution on the Bolivian-Peruvian Altiplano and to the water-level fluctuations of Lake Titicaca.

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Figure 1. Holocene chronology of glacier advances (a), solifluction phases (b) and fluvial dynamics (c) in the central eastern Alps (Patzelt 1977, Veit 1993a, Veit and Höfner 1993)

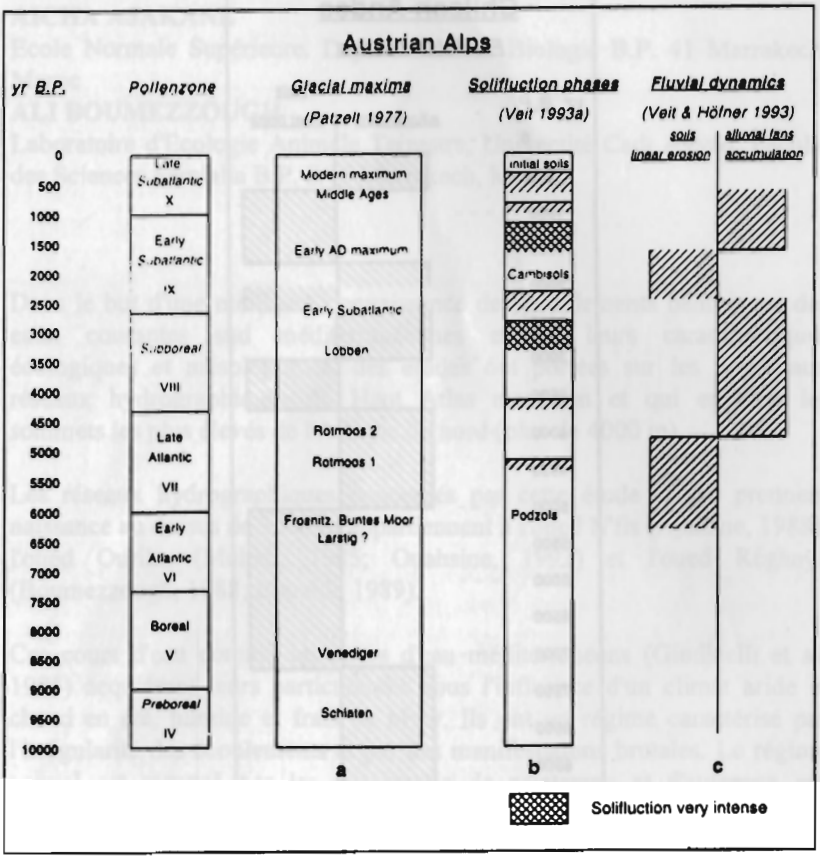

Figure 2. Holocene fluvial chronology of the Chilean Andes between 27-33_ S (Veit 1993b, 1993c)