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ARE TALUS FLATIRONS FROM CENTRAL SPAIN RELATED WITH HEINRICH EVENTS?

ABSTRACT: GUTIÉRREZ M., GUTIÉRREZ F. & DESIR G., *Are talus flatirons from central Spain related with Heinrich events?* (IT ISSN 1724-4757, 2003).

Talus flatirons generate in slopes of arid and semiarid areas by the alternation of accumulation and incision periods. In the Iberian Peninsula talus flatirons are relatively common in the Duero, Tajo and Ebro Tertiary Basins. In these Tertiary Basins talus flatirons have been found in numerous places and up to five stages of slope evolution have been recognised at some locations. Ashes and charcoal remains from the inside of the slope accumulations were dated with ^{14}C and AMS in order to obtain an absolute chronology of the flatiron stages. The second stage (S_2) dated in several places of the Ebro and Duero Basins by ^{14}C range from 2529 ± 52 BP to 3590 ± 40 BP, corresponding to the Iron and Bronze Cold Stages. The third stage (S_3) has yielded 27862 ± 444 BP in the Ebro Basin and 28550 ± 130 BP in the Duero Basin and can be correlated with Heinrich event H_3. The fourth stage (S_4) has been dated in the Ebro Basin giving an age of 35570 ± 490 BP, correlative to Heinrich Event H_4. The obtained temporal data seems to indicate the global cold periods (Heinrich events) control the talus flatirons origin in the studied sector of Spain.

KEY WORDS: Talus flatirons, Heinrich events, Paleoclimatic indicators, Global events, Spain.

INTRODUCTION

Knowledge of slope evolution in arid and semiarid environments is quite scarce. Nevertheless, the understanding of slope processes in these climates has been improved significantly in the last decades by a large number of studies carried out in experimental plots, which in many cases are supported by rainfall simulation experiments. The evolution of slopes in semiarid environments may be easier to study since chronological data can be obtained from charcoal and ashes found inside the slope accumulations. These datable materials are more rare within the slope deposits of arid environments due to the scarce vegetation cover. In areas with old human occupation the archeological remains found inside the slope deposits can also be used to obtain relative ages.

Incision processes affecting debris slopes developed at the foot of retreating scarps may give place to relict slopes, termed talus flatirons, tripartite slopes and triangular slope facets. Talus flatiron sequences generated by the alternation of accumulation and incision periods are relatively common in arid and semiarid area. These relict slopes generally lie parallel to the present scarp of mesas, buttes or cuestas (fig. 1), being the oldest facets the furthest from the scarp indicating a parallel retreat of the scarp edge. In their distal zones they may grade into mantled pediments.

Talus flatirons are relatively common in the Duero, Tajo and Ebro Tertiary Basins in Spain (fig. 2). These three Tertiary basins are filled with continental sediments and constitute the larger depressions of the inner part of the Iberian Peninsula (figs. 2 and 3). In general, their sedimentary fill is made up of alluvial fan deposits at the basin margins that grade into evaporitic and carbonate lacustrine-palustrine facies towards the center. The Neogene endorheic sedimentation ended with the deposition of relatively thick lacustrine limestones that currently cover a significant portion of the Tertiary basins. Semiarid conditions prevail in studied sedimentary-topographic basins, although the climate becomes more humid towards the mountainous margins.

Talus flatirons have been found in numerous places in the mentioned basins and up to five stages of slope evolution have been recognised at some locations. These relict landforms are not very common at a global scale since their generation is restricted to areas with subhorizontal or slightly tilted stratified formations where scarped caprock overlay more easily erodible materials. (Koons, 1955; Everard, 1963; Büdel, 1970; Blume & Barth, 1972; Gerson, 1982; Gerson & Grossman, 1987; Schmidt, 1989a, 1994; Arauzo & *alii*, 1996). The incision of the slope deposits

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