



## The importance of poligenic moraines in the paleoclimatic interpretation from cosmogenic dating

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The dating of moraine boulders by the surface exposure dating technique is increasingly frequent but does not always achieve homogeneous results. In the Iberian Peninsula, the use of this method has suggested several glaciations in the North and in the South, when in the centre only the last glaciation was identified. Moreover, the date of the last maximum advance of the Pleistocene in the Iberian Peninsula varies by more than 30 ka depending on the results obtained in different mountain ranges. This chronological discrepancy has been explained by the regional climatic behaviour during the glacial phases, especially in relation to precipitation. However, over the last years, as new results are known, the hypothesis of the regional climatic diversity is more difficult to accept.

A similar pattern occurred in the tropical Andes where, as in the Iberian Peninsula, several glaciations were dated in some mountain ranges and just the last glaciation in others. Moreover, the dating results of the last maximum glacial advance of the Pleistocene give a difference of more than 20 ka. First, this advance was seen as much earlier than the global; then, the advance was suggested to be diachronic but consistent with its latitude; and finally, the different regional distribution of precipitation became the accepted explanation. As new results appear, the hypotheses which try to provide a general explanation of the glacial behaviour during the Pleistocene in central Andes loose consistency.

In this work we analyse various cases from both geographic areas and we achieve a double-conclusion: cosmogenic methods only indicate a minimum age of the moraine forms and, in many cases, a moraine formation does not indicate a specific glacial phase but is the results of the overlapping during different phases. Thus, we can observe that in some valleys multiple glacial phases form a unique polygenic moraine and, in adjacent valleys, every glacial advance deposits its own moraine ridges. This uneven behaviour, most of all in ice caps, obeys to local factors, both microclimatic and derived from the specific glacial dynamics.

The cosmogenic dating results are very diverse and diachronic on moraine formations in both study areas but, on the other hand, the results within the same areas and using the same methods are absolutely homogeneous and isochronic, reinforcing the hypothesis here presented.

Research funded by CGL2009-7343 project, Government of Spain.