



The presence of the Oldest Dryas in Spanish mountain landscapes

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The important advances in our understanding of the Oldest Dryas (OD) in the evolution of the continental ice caps and the oceanic basin have not yet reached the European mountains, or have only affected a small part of them. In practice, research into the impact of this period on European mountains has focused on the Alps, where the Gschnitz stadial, a glacial re-advance phase, has been clearly differentiated. This is shown in the landscape by families of moraines present in many valleys, above all in small and medium ones, with minimum age 15.9 ka, but which may represent glacial advances of at least a thousand years older. Traces of this same phase are gradually appearing in other European mountains, including some mountains in Spain.

The aim of this paper is to emphasise the importance of the Oldest Dryas in the configuration of high mountain landscape in Spain: (Sierra Nevada, Central System and Pyrenees), through the analysis of the latest studies of glacial chronology.

In Sierra Nevada, in the SE sector of the Iberian Peninsula, the definitive deglaciation occurred just at the end of the OD, between 15 and 14.5 ka, according to dates obtained from many polished thresholds. There are moraines which obtain dates between 17 and 16 ka, very close to those of the Maximum Ice Extent (MIE), although as there are still only a few of these and because of slope instability they may be morainic boulders from the MIE phase which have been destabilized, disturbed or exhumed, so that more detailed research is required. Nevertheless, it is known for certain that the end of the OD was accompanied by the massive formation of rock glaciers, resting on the polished thresholds mentioned above and with their fronts stabilized at the end of the OD, around 14.5 ka, although their roots remained active until the Holocene.

In the Central System, in both Gredos and Guadarrama, the OD was a phase of great advance after almost disappearing after the MIE. During the OD the glaciers advanced so much that at times they collided with the MIE moraines or came very close, although often this was simply a string of boulders. A rock glacier associated with the end of the OD has only been found in Guadarrama.

The presence of OD traces is evident in the Central and Eastern Pyrenees with very similar characteristics in both sectors. Here, just as in the Central System, the OD meant a great re-advance after the collapse of the glaciers which followed the MIE. The glaciers started to flow down the valleys again, although they remained several kilometres from the moraines related to the MIE. The end of the OD meant the definitive retreat of the glaciers to the valley headwalls, but before this occurred a series of rock glaciers formed in the interior of the cirques, under the most geomorphologically active walls. As also occurred in Sierra Nevada, the end of the OD meant that these glacial fronts became completely stabilized around 14.5 ka, but their roots continued active until the Holocene.

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