

The Glacial History of the Pindus Mountains, Greece

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ABSTRACT

Geomorphological evidence for Pleistocene glaciation has been mapped in the Pindus Mountains of northwest Greece, and the chronology of glaciation in this area has been established through soil profile analysis and U-series dating of secondary carbonates (calcite) formed within glacial deposits. Three glacial stages are evident in the sedimentological and geomorphological records. The earliest and most extensive recorded glaciation predates 350,000 yr B.P. and was characterized by extensive valley glaciers and ice fields. A more recent glaciation occurred before the last interglacial and was characterized by glaciers that reached midvalley positions. The last phase of glaciation in Greece is recorded by small cirque glacier moraines and relict periglacial rock glaciers. The glacial and periglacial sequence on Mount Tymphi has been used in conjunction with a reference parastratotype, the long lacustrine sequence at Ioannina, to provide a chronostratigraphical framework for cold-stage deposits in Greece. The three glacial stages are formally defined: the Skamnellian Stage, equivalent to the Elsterian Stage of northern Europe and marine isotope stage (MIS) 12; the Vlasian Stage, equivalent to the late Saalian Stage of northern Europe and MIS 6; and the Tymphian Stage, which is equivalent to the Weichselian/Würmian stages of northern Europe and the Alps, respectively, and MIS 5d-2. This is the first formalized chronostratigraphical framework based on the glacial record to be established for cold stages in the Mediterranean and provides a new platform for paleoclimatological investigations in the region.

Online enhancement: table.

Introduction

One of the earliest articles reporting evidence of glaciation in Greece was by Niculescu (1915), who noted the moraines and cirques on Mount Smolikas in the northern Pindus Mountains. Later researchers reported glacial features elsewhere in this region (Sestini 1933; Mercer 1963), as well as in areas further south in Greece (Mistardis 1952; Pechoux 1970). More recently, glacial research has been pub-

lished from the uplands of the Peloponnese (Mastroruzzi et al. 1994), Mount Olympus (Smith et al. 1997), Mount Smolikas (Boenzi et al. 1992), and Mount Tymphi (Palmentola et al. 1990; Woodward et al. 1995; Smith et al. 2000; Woodward et al. 2004; fig. 1).

The timing of Pleistocene glaciation in Greece remained unknown until recently, when Woodward et al. (2004) presented uranium-series (U-series) dates from secondary carbonates formed in glacial deposits on Mount Tymphi. These dates showed that the earliest glacial deposits formed before 350,000 yr B.P. and that a later phase of glaciation took place before the last interglacial. This represented a marked shift from the common view for Greece put forward by many workers that the glacial sequences formed during the last glacial stage (Weichselian/Würmian; e.g., Messerli 1967; Palmentola et al. 1990; Boenzi and Palmentola 1997).

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