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The Gröbminger Mitterberg (Austria): A time machine to the pre-LGM?

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The Last Glacial Maximum (LGM) is well understood in many parts of the European Alps, but open questions remain concerning glacial phases prior to the LGM as the record is fragmentary. The Gröbminger Mitterberg (GM), located among the Enns Valley in Styria (Austria) is one such location where pre-LGM glacial and paraglacial processes can be studied. The GM emerges roughly 200 m from the Enns Valley floor and is situated between unmetamorphosed Mesozoic carbonates in the north and crystalline basement units in the south. Strata occur below a cover of up to more than 10 m thick basal till attributed to the LGM. The sedimentary record rests on the phyllites and greenschists that crop out at the steep southern flank of the GM. The sediment consists of an assortment of pebble-sand deposits with individual sand lenses, sand bodies with climbing ripples and undulose bedding, and fine-sand/silt laminated strata. In grain-supported intervals, cracked pebbles occur, which are interpreted to record subglacial loading. Cross-bedding orientations, together with the limited amount of unmetamorphosed carbonate pebbles in the sequence, imply that sediment was sourced from the GM and deposited at its margins, rather than from surrounding mountains towards the centre of the Enns Valley. Three depositional regimes have been recognised: deltaic sediment (both distal sands with ripples and proximal, cross-bedded gravel), lake bottom sediment (laminated fine-sand and silt) and fluvial deposits (channels with basal lag deposits and local cross bedding). The delta facies testify to the presence of lacustrine conditions. By analogy to the Unterangerberg in the Inn Valley (Tyrol, Austria; Starnberger et al. 2013), the following sequence of events is proposed. Before the LGM, sediment derived from the wider catchment area accumulated in the Enns Valley in lakes and rivers. Aggradation within the whole Enns valley resulted in deposition on the present day GM. During the LGM, the large Enns Glacier eroded much of the sediment record, especially around the GM. Deposits on top of the GM were then concealed by > 10 m thick diamicts and thereby preserved. Future age dating of the sediments will provide a better-constrained chronology to the sequence of events proposed above.