INTRODUCTION

Modern systematic studies on the record of the Alpine Lateglacial (~ 19 – 11.7 ka) are missing for the Eastern Alps east of the Hohe Tauern mountain range. In order to fill this gap, a study has been started in the Niedere Tauern mountain range, which reaches 2862 m in altitude and comprises crystalline rocks. The recently non-glaciated mountain range is famous for a glacially shaped morphology with a series of cirques. During the Last Glacial Maximum (LGM), it was part of the transection glacier complex, which covered the western and central parts of the Eastern Alps (Fig. 1A). Thus, the conditions for studying the In recent decades, three phases of glacier advances from cirques or higher altitude in three cirques in the Großsölk valley.

valleys have been distinguished within the Alpine Lateglacial (Reitner et al., 2016), i.e. phase of ice-decay (immediately after the breakdown of the large valley glaciers like the Enns glacier; Fig. 1B), Gschnitz Stadial (correlated with the Heinrich 1 ice rafting event) and Egesen Stadial (marking the beginning of the Younger Dryas). A first step for additional paleogeographic, geochronological and palaeoglaciological studies in the Niedere Tauern is the identification and characterisation of the legacy of these three glacial phases within the Großsölk valley. In this presentation, we deal with the Egesen Stadial. New fieldwork glacial chronology after the LGM are excellent. reveals geomorphological and sedimentological evidence for glacier advances

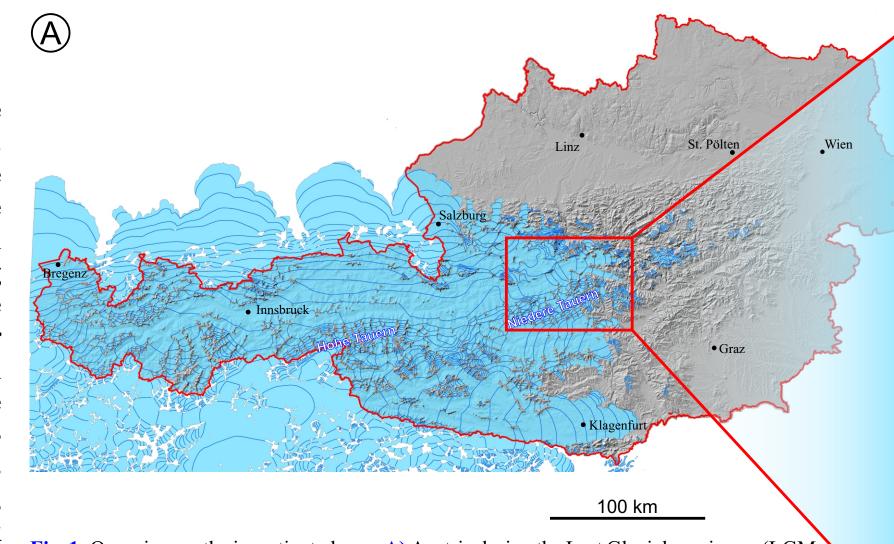
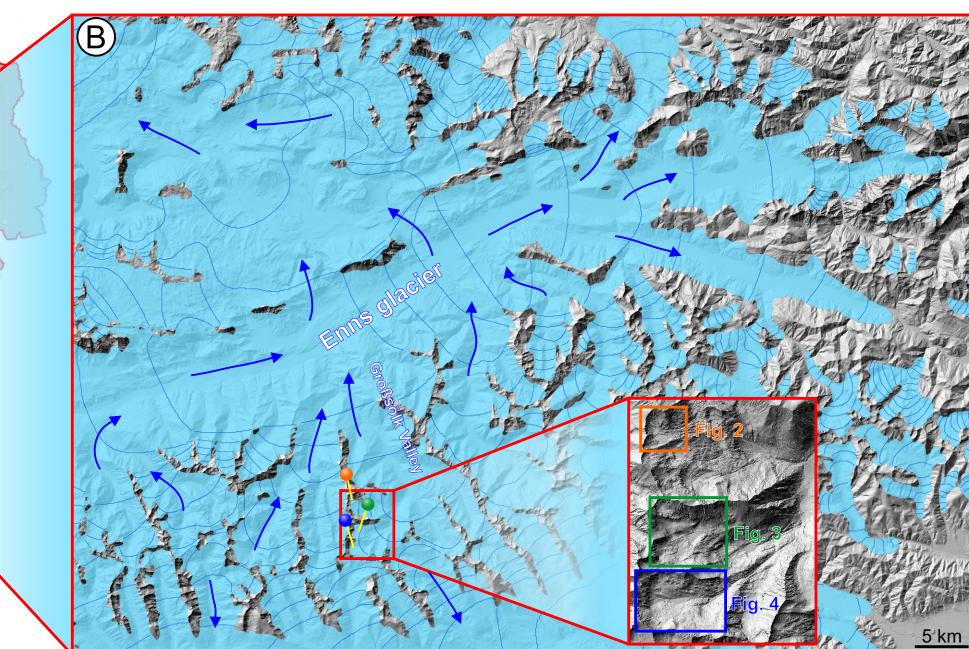


Fig. 1: Overview on the investigated area. A) Austria during the Last Glacial maximum (LGM; Würm Pleniglacial). Glacier extents in light blue with ice isohypses in darker blue (van Husen, 1987). B) Closer look on the Enns glacier. The studied areas are marked with pin nails. The investigated area serves as one of the major feeder of the Enns glacier. Arrows indicate ice flow



At Lake Weißensee, large angular LEGEND (for all maps) boulders along smoothed ridges testify to a debris-covered glacier in this area, which extended to 2000 m a.s.l. (Figs. 2, 5).

Fig. 2: A) Map of the Weißensee area. The glacier extended towards east and was not shielded in the south leading to more insolation than in the two other cirques. Peaks surrounding the glacier are indicated. B) Panorama picture of the Weißensee. On the right side angular blocks can be ovserved (see also Fig. 2D). In the back, there are small relict rock glaciers (see also Fig. 2C). C) Relict rock glacier consisting of angular blocks. A ridge is evident below the snow. D) Closer look on blocks interpreted as supraglacial debris. Picture was taken near the red ridge indicated in Fig. 2A. E) 3D laserscan image of the Weißensee area. Locations, where pictures (Fig. 2B-D) were taken and viewing direction (arrow) are indicated.

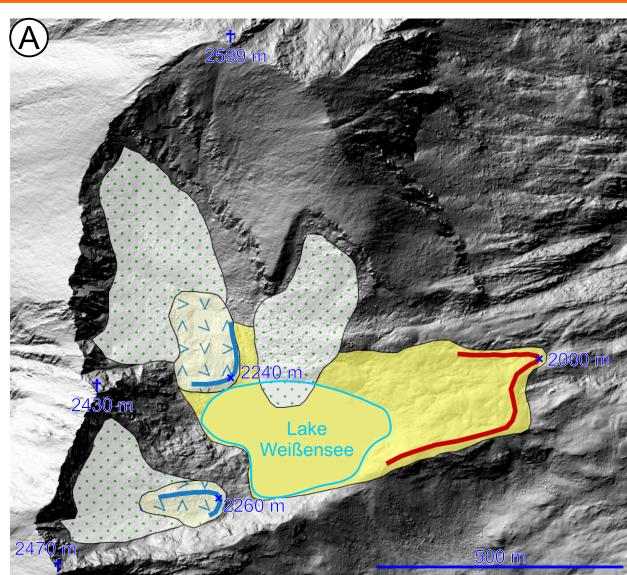
Polished rock

Relict rock glacier; debris, blocks (Lateglacial) Ridge of a relict rock glacier

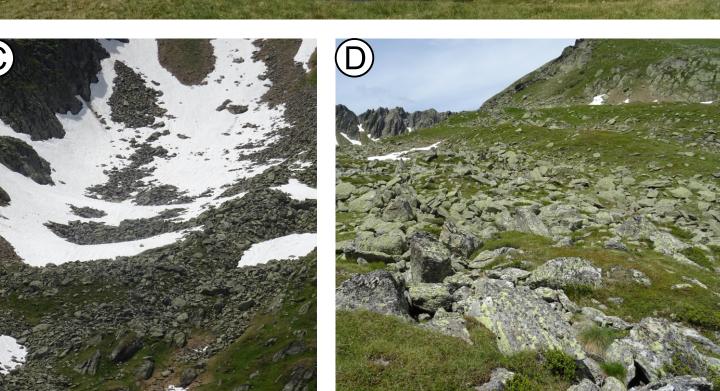
Subglacial and ablation till, till of a latero-frontal moraine; diamictite (Egesen, Gschnitz) Ridge of a latero-frontal moraine (Egesen

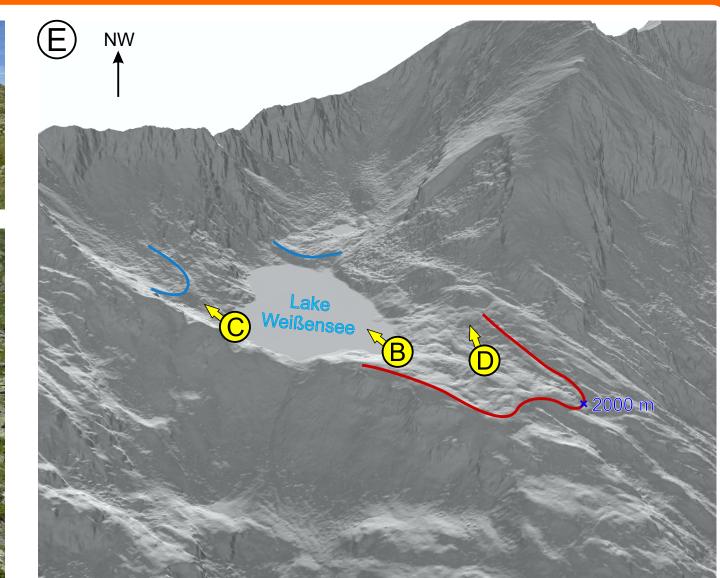
Ridge of a latero-frontal moraine (Gschnitz) Subglacial till, ablation till; diamictite (LGM)

Subglacial ridge (at Schwarzensee)



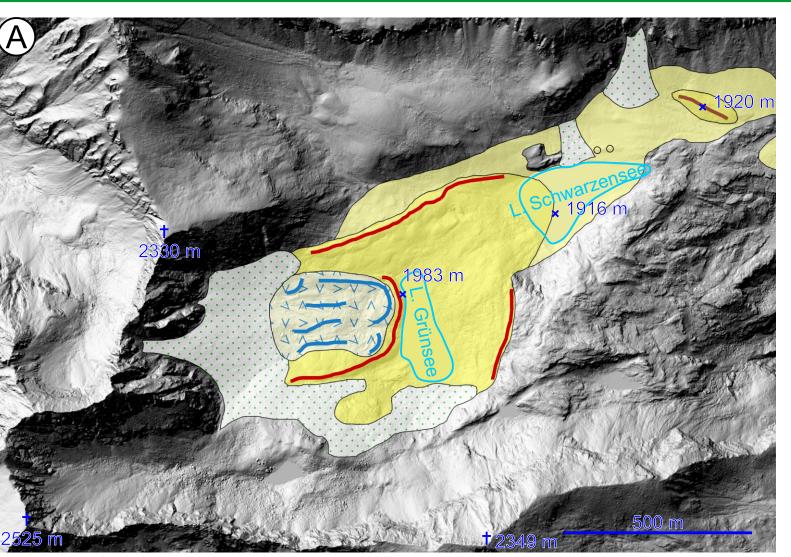






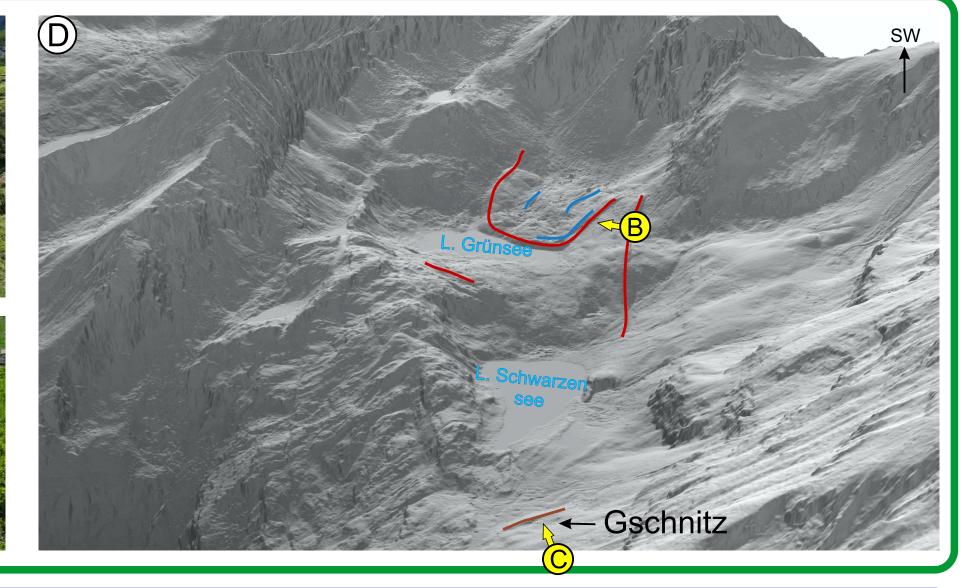
A glacier at Lake Grünsee that extended (A) down to 1916 m and underwent two stabilisation phases is interpreted. An end moraine ridge is not observable, because in the suspected position there is a lake today (L. Schwarzensee). Evidence for the second stabilisation phase is partly overprinted by a relict rock glacier (Figs. 3, 6)

Fig. 3: A) Map of the Grünsee area. Mark the brown indicated ridge in the upper right corner. This ridge is interpreted to having been built during the Gschnitz stadial. The supposed maximum extent of both stabilisation phases of the Egesen stadial are marked by altitudes. B) Picture of the ridge of the second Egesen stabilisation phase (overgrown by pinus). It is overformed by a relict rock glacier. C) Picture of the supposed ridge of the Gschnitz stadial. D) 3D laserscan image of the Grünsee area. Locations, where pictures (Fig. 3B, C) were taken and viewing direction (arrow) are indicated.



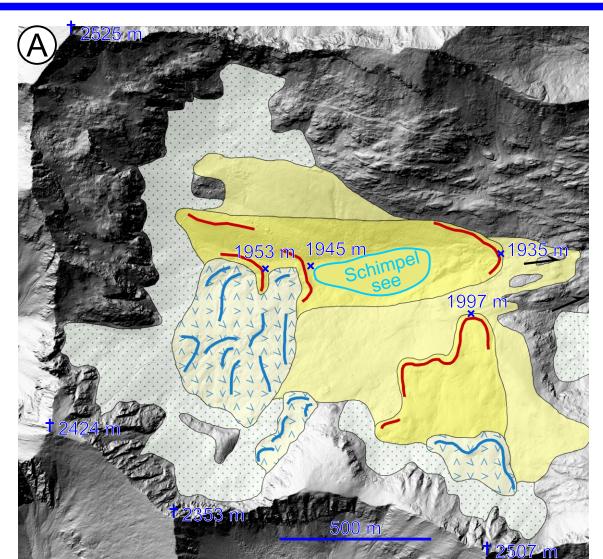


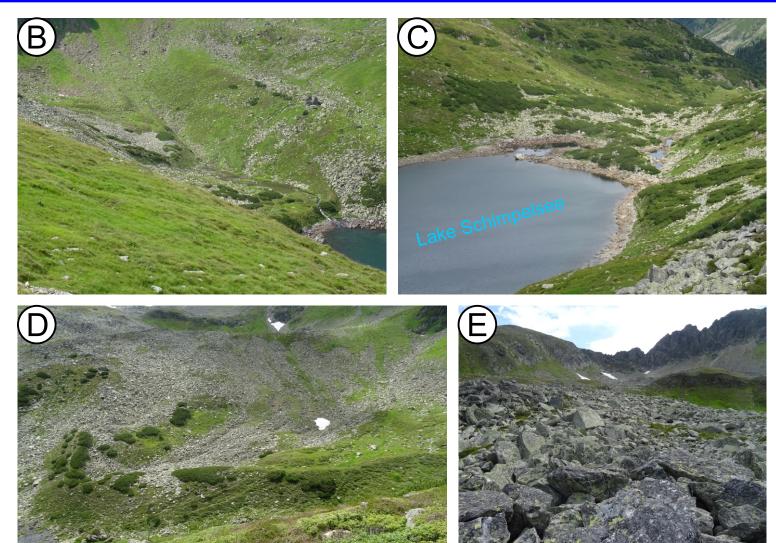


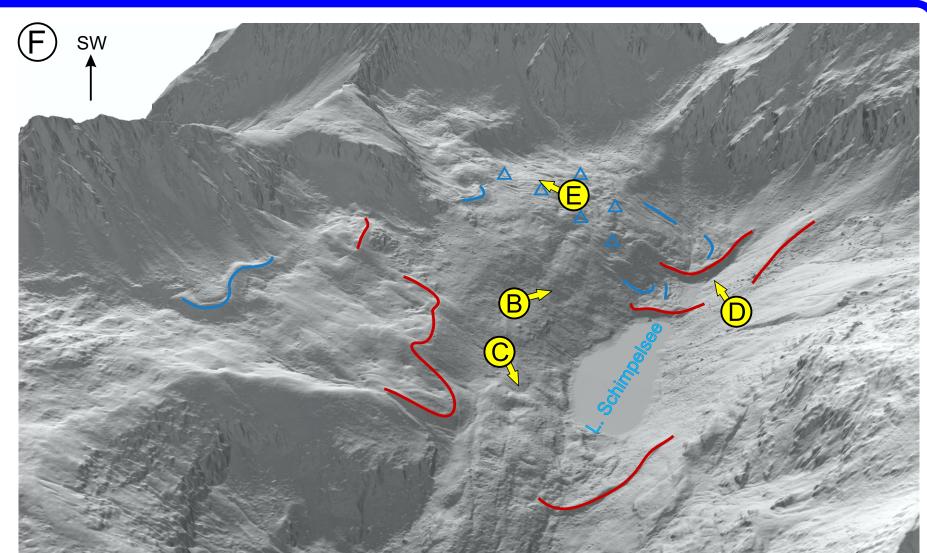


A debris covered glacier at L. Schimpelsee extended down (A) to 1930 m and deposited three sharp crested end moraine and one marginal moraine ridges during three stabilisation phases. A second glacier reached 1997 m (Figs. 4, 7).

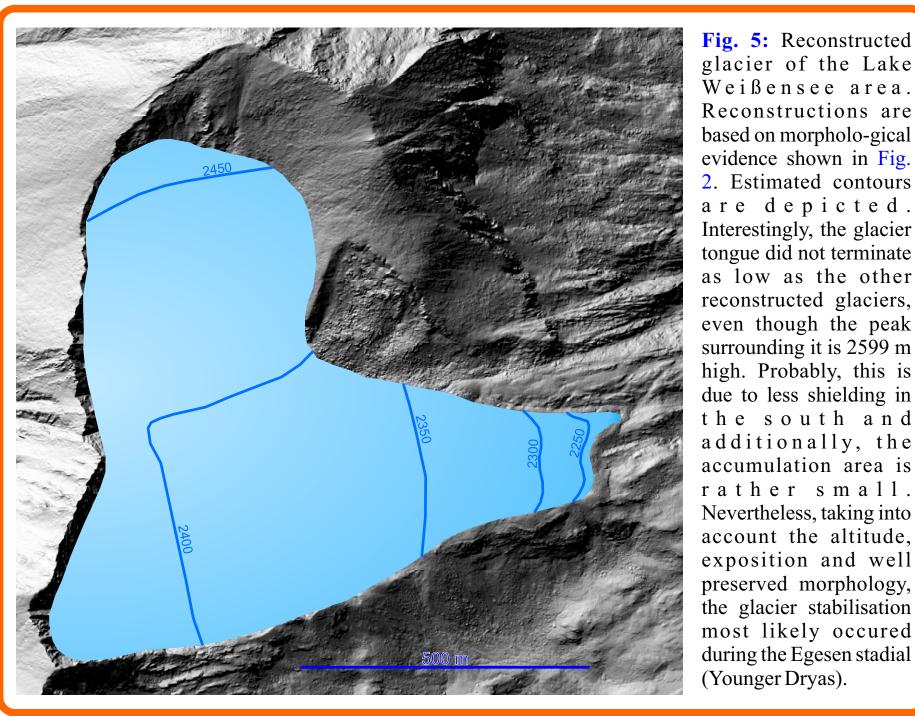
Fig. 4: A) Map of the Lake Schimpelsee area. Two separate glaciers are indicated by latero-frontal moraines. Both are interpreted to having formed during the Egesen stadial. Difference in extent is probably due the accumulation area, which is much smaller at the glacier reaching 1997 m altitude. Relict rock glaciers partly overform the morainic deposits. B) Picture of the two end moraines and the lateral moraine ridge at Schimpelsee. The end moraines are deposited on the margin of the lateral moraine indicating a later development (Fig. 4B). C) Picture of the frontal part of Schimpelsee. The lake is dammed by an end moraine ridge and coarse debris. It is interpreted to having formed along the marginal morain ridge (Fig. 4B). D) Picture of the uppermost end moraine (leftmost ridge in Fig. 4B). Mark the blocky debris behind it, which suggest that the glacier was debris covered. Ridge like structures indicated that it was reworked by a rock glacier. E) Picture of the blocky relict rock glacier and the accumulation area of the palaeoglacier extending to Lake Schimpelsee. F) 3D laserscan image of the Lake Schimpelsee area. Triangles mark the supraglacial debris/relict rock glacier. Locations, where pictures (Fig. 4B-E) were taken and viewing direction (arrow) are indicated.







GLACIER RECONSTRUCTION



glacier of the Lake Weißensee area. Reconstructions are based on morpholo-gical evidence shown in Fig. Estimated contours are depicted Interestingly, the glacier ongue did not terminate as low as the other reconstructed glaciers, even though the peak surrounding it is 2599 m nigh. Probably, this is due to less shielding in the south and additionally, the accumulation area is cather small Nevertheless, taking into account the altitude, exposition and well preserved morphology, the glacier stabilisation most likely occured during the Egesen stadial (Younger Dryas).

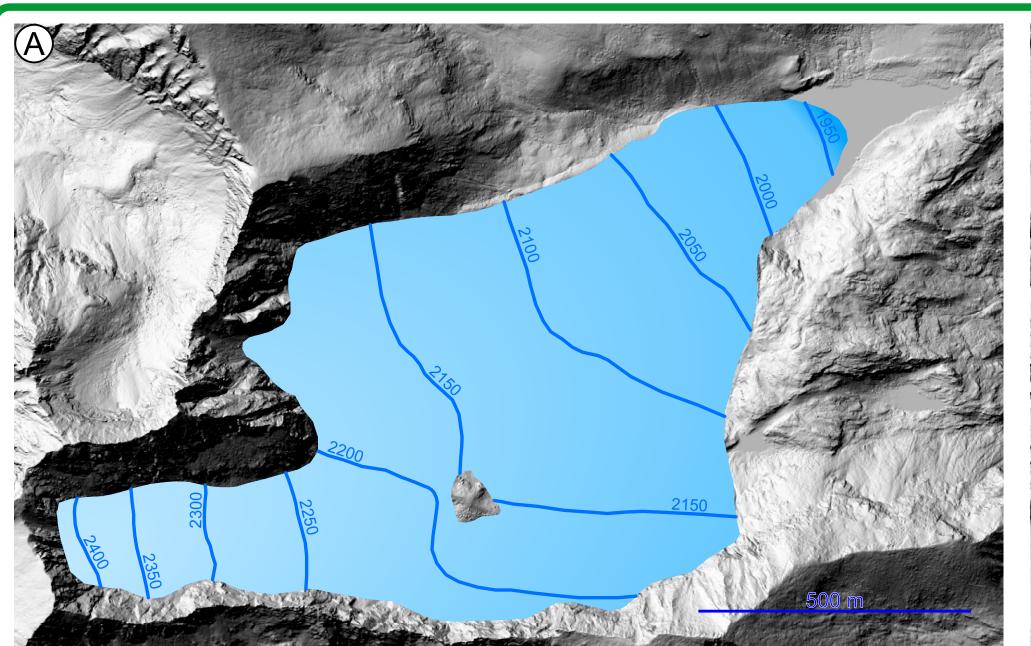


Fig. 7 (below): Reconstructed Egesen glaciers of the Schimpelsee area. Hints on two separate glaciers and three stabilisation phases of the large glacier are given by end moraines (see also Fig. 4). A) During the first phase, the glacier extended to less than 2000 m a.s.l. An age for the maximum extent of the second glacier coming from the south is not known. It seems likely, that it reached its maximum together with the other glacier. **B)** Second stabilisation phase. **C)** Third stabilisation phase.

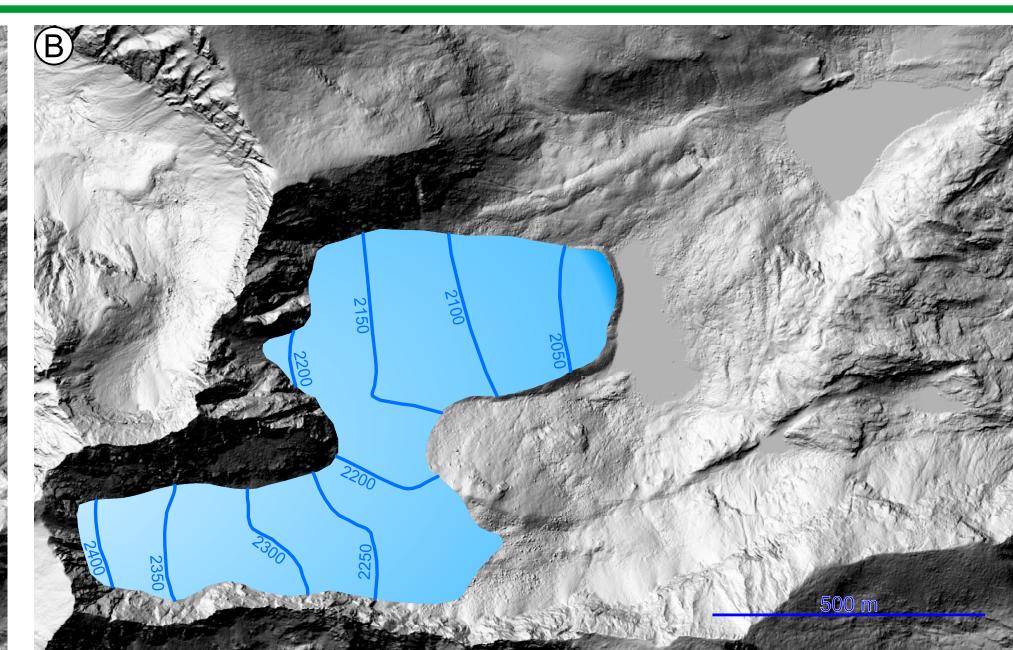
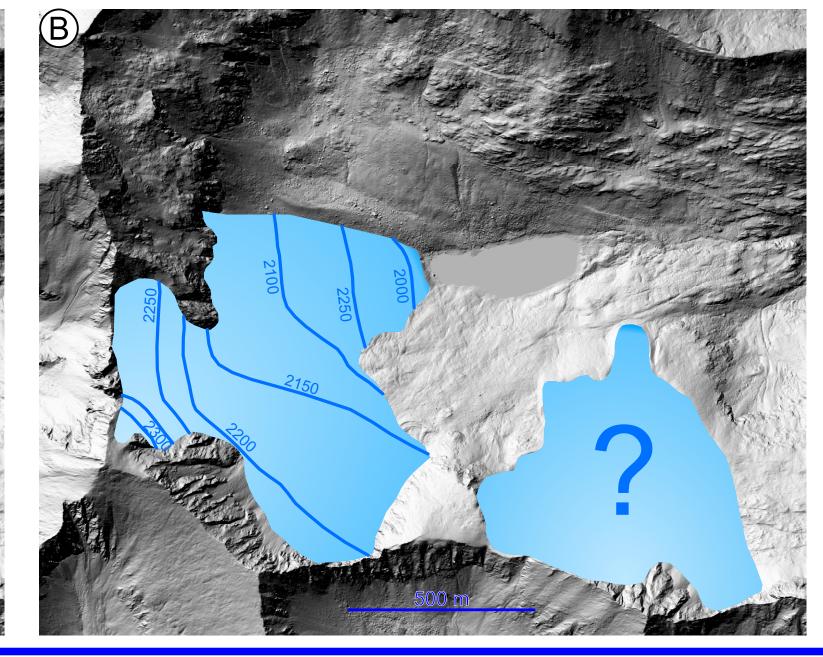
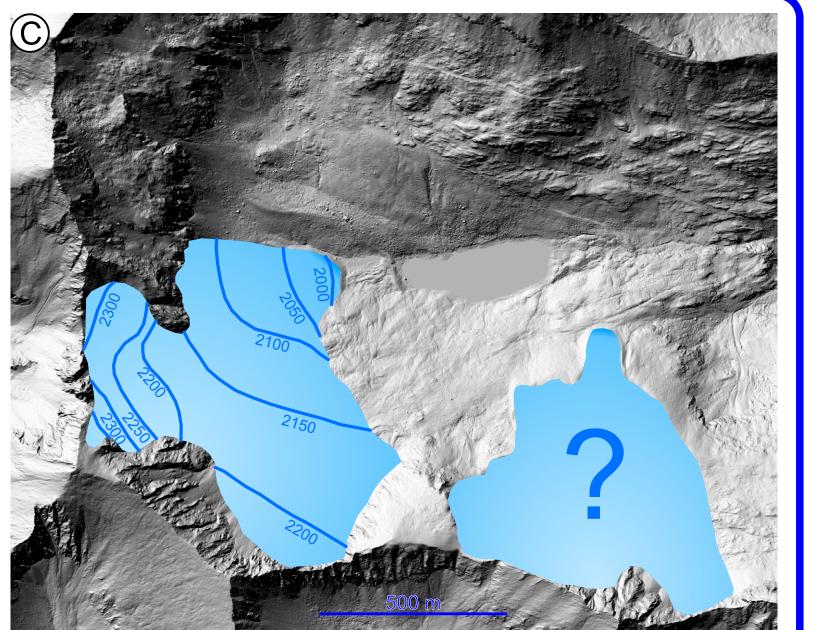


Fig. 6 (above): Reconstructed Egesen glacier of the Grünsee area. A) Maximum extent probably reached the Schwarzensee (lake). Therefore, no end moraine is preserved (see also Fig. 3). B) A second stabilisation phase is well preserved represented by a blocky end moraine ridge. It reached the Grünsee (lake).





CONCLUSIONS

Considering the altitude of the catchment area, the eastward facing orientation, the altitude of the maximum extent of the palaeoglaciers as well as the geomorphologically constrained multiphase glacier stabilisations, we correlate these glacier advances with the Egesen Stadial.

eference: van Husen, D. (1987): Die Ostalpen in den Eiszeiten. Geologische Bundesanstalt Reitner, J.M. et al. (2016). Reconsidering the current stratigraphy of the Alpine Lateglacial: Implications of the sedimentary and morphological record of the Lienz area (Tyrol/Austria). *E & G Quaternary Science Journal*.