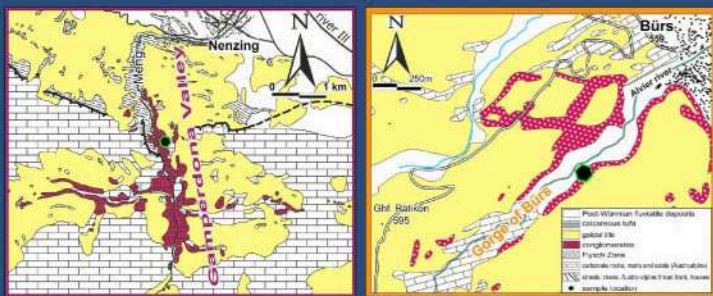
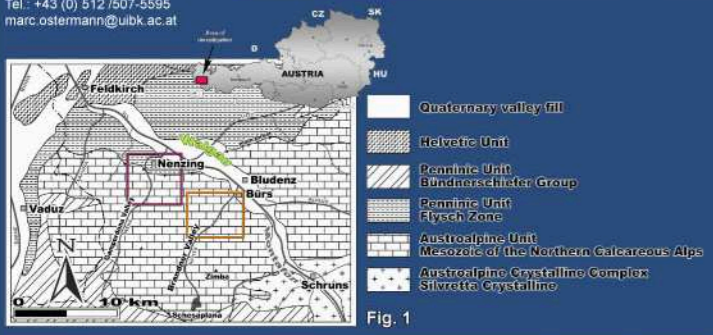


# Th-U age-dating of two spectacular proglacial valley fills of the Riss Glacial: the Bürs-Gamperdona conglomerates, Austria.

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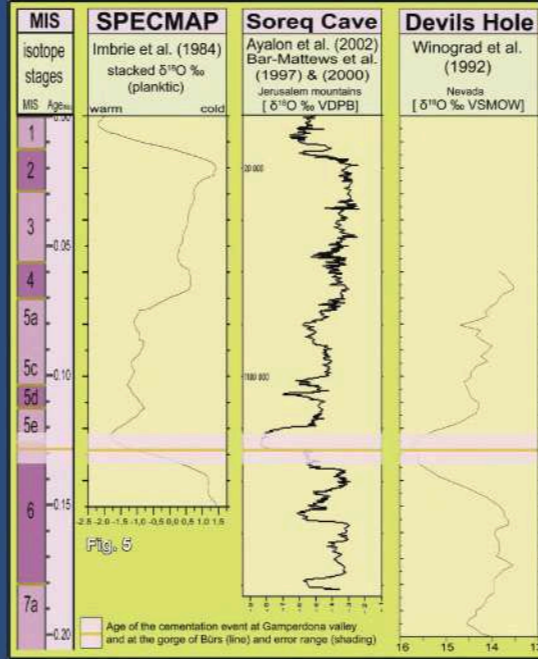
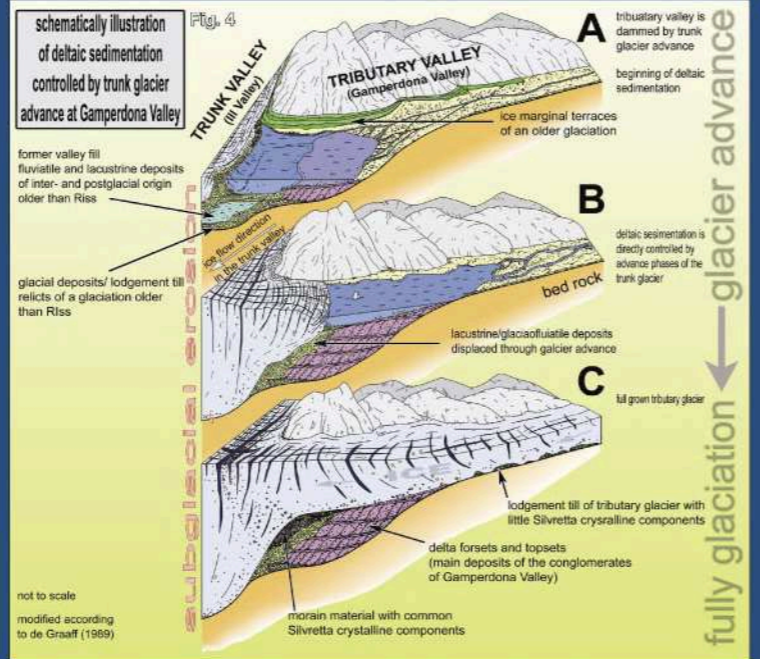
The age-dated successions are situated near the villages Bürs and Nenzing, Vorarlberg, Austria (Fig. 1). In the lower and middle reaches of the Gamperdona valley, a lithified Quaternary succession hundreds of meters thick mainly of fluvial conglomerates is preserved, and is incised by a deep gorge of the Mengbach (Fig. 2A). The succession consists of stacked bottomset-to-topset packages, each typically a few tens of meters thick, of Gilbert-type deltas that prograded into proglacial lakes (Fig. 3A, B, 4). The proglacial lakes originated by blocking of the Gamperdona valley when the Ill-valley glacier advanced and built up [1], [2]. In its lowest reaches, Brandner valley contains the Bürser Konglomerat, a fluvial succession up to about 140 m thick of gravely to cobbly conglomerates and, subordinately, of carbonate-lithic arenites [3] (Fig. 2B). The Bürser Konglomerat is underlain by a lodgement till with striated clasts derived from the Central Alps. The Bürser Konglomerat was compared and tentatively chrono-correlated with the conglomerates in Gamperdona valley [3], [2]. In absence of other evidence, this correlation is justified in view of the overall similar aspect of both successions, and by their identical position as thick „cloggings“ of valley debouches that were blocked by an ice stream along the trunk valley.



In the lower reaches of two tributary valleys of the Ill valley (Vorarlberg, Austria), thick successions of pebbly alluvium that accumulated upon blocking of the valleys by the advancing Ill ice-stream were minimum age-dated, for the first time, by the thorium-uranium method to the Riss Glacial. Previous age assignments by other authors ranged from the Mindel-Riss Interglacial to the early Würmian.

## Conclusions

1. Th-U ages of calcite cements of Bürser Konglomerat and of a thick conglomerate succession in Gamperdona valley indicate that both successions accumulated during the Riss Glacial, during blocking of the valleys upon advance of the trunk-valley glacier of the river Ill.
2. At least the lower, V-shaped reaches of both the Alvier valley (Bürser Konglomerat) and Gamperdona valley, overlapped by the conglomerate successions, were largely shaped before the Riss glaciation.
3. The gorges incised into both conglomerate successions may have been cut, in part at least, during the Riss-Würm interglacial, and became further shaped mainly during the Late-Glacial to Holocene.



## <sup>230</sup>Th/<sup>234</sup>U age-dating of impure calcite cements:

For absolute age-dating, samples of conglomerates lithified by isopachous fringes of cement were taken in the field. The sample of Bürser Konglomerat was taken from a huge boulder collapsed from the cliff into the gorge. The sample from Gamperdona valley was taken from the outcrop along the road along the right flank of the gorge. Thin sections of age-dated samples provided documentation of the cement. For Th-U age-dating, the fringes of calcite cement were sampled with a microdrill under the microscope. Organic material was removed physically as far as possible. To correct for detrital contamination, the main problem in age-dating authigenic carbonates [1]:[2], we chose the isochron method with several sub-samples (cf. [3]: [4]: [5]: [6]: [7]: [8]) plotted in <sup>230</sup>Th/<sup>232</sup>Th vs. <sup>234</sup>U/<sup>232</sup>Th activity diagrams [9] („Rosholt diagrams“). In the Rosholt diagrams, the plotted <sup>230</sup>Th/<sup>232</sup>Th - <sup>234</sup>U/<sup>232</sup>Th activity ratios of sub-samples then are connected, or approximated, by a regression line that can be considered as an isochron. Thus, for each calcite cement, samples were treated in sub-samples. In the Rosholt diagrams, the slope of the regression line among the measured values of <sup>230</sup>Th/<sup>232</sup>Th - <sup>234</sup>U/<sup>232</sup>Th activities (of sub-samples) yields corrected activity ratios; these corrected ratios are used to calculate the absolute age. For age calculation, the corrected activity ratios were fed into a Th-U disequilibrium age calculation program (Visual Basic, written by Jan Kramers, according to the equation of Kaufman and Broecker, [10]).

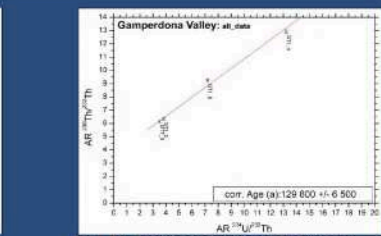
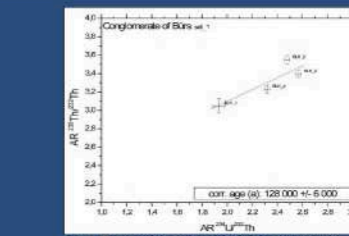


Fig. 6: Th-U age-dated sample of the Bürser Konglomerat

Fig. 7: Isochron (errorchron) plot of the sub-samples from the Bürser Konglomerat

Fig. 8: Isochron (errorchron) plot of the sub-samples from the Gamperdona Valley

## Results:

Thorium-uranium isochron ages of calcite cements of the conglomerates in the Brandner valley scatter within a wide range and required corrections („closed system check“ diagram - <sup>234</sup>U/<sup>238</sup>U AR versus <sup>230</sup>Th/<sup>238</sup>Th AR, fit to isochron lines). They indicate a probable cementation age of 128 ± 10 ka bp. By contrast, for the Gamperdona valley, Th/U-age dating yielded a fairly precise age of 129 ± 6.5 ka bp. We thus consider an deposition of both successions during the late Riss Glacial (130-125 ka bp) as established.