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Timing of deglaciation and Late Glacial and Holocene infilling of the Ticino valley between Biasca and Lago Maggiore (Southern Switzerland)

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The definition of the timing of infilling and environmental evolution of Alpine valleys is essential in the knowledge of the mountain geomorphological systems response to the climate oscillations after the Last Glacial Maximum. This assessment is necessary in the comparison of a system controlled only by natural factors, dominated by paraglacial and paraperiglacial erosion models, and the increasing role played by anthropogenic factors modifying the environment. In the Southern Swiss Alps, anthropogenic factors start playing a role since the frequentation of the valley bottoms and main Alpine passes during the Middle Mesolithic (8.0–7.0 ka BCE). This role increased significantly since the Lower Neolithic (5.4–4.3 ka BCE), with the first permanent settlements.

Radiocarbon dating in Lago di Monate (Varese, Italy) starts the deglaciation of the Lago Maggiore basin just before 19.93–18.81 ka cal BP (BE 8023.1.1, Rey *et al*. 2020, Clim. Past 16; cf. Kamleitner *et al*. 2022, Quat. Sci. Rev. 279). Complete deglaciation of the Lago Maggiore basin by no later than 16.89–16.34 ka cal BP is indicated by radiocarbon dating of an organic lacustrine deposit in the lower Riviera valley in Castione (north of Bellinzona). ^{10}Be surface exposure dating of three erratic boulders located upslope of Claro (left side of Riviera valley) point to deglaciation slightly earlier. These chronological elements show a 70 km retreat of the Ticino glacier between Lago di Monate and Castione in 2.6 ± 1.0 ka. The deglaciation was followed by a significant debris supply from the slopes to the valley bottoms, contributing to the development of large alluvial fans. Valley bottom damming exercised by rapidly growing alluvial fans allowed the creation of a series of lake basins of increasing level upstream. Radiocarbon dating performed in Castione points out the lake formation just during the deglaciation, and its complete infilling by fluvial deposits between 12.72 and 12.76 ka cal BP, as indicated by the woods found in fluvio-deltaic deposits.

From Castione to Lago Maggiore, the progradation of the Ticino (and Moesa) river delta completely filled the valley bottom step by step. This infilling was dated: in Bellinzona (13.9 km from the actual river mouth) between 13.48 and 13.31 ka cal BP, when the Castione palaeo-lake was still present; in Giubiasco (10.6 km) between 10.70 and 10.49 ka cal BP; in Gudo (7.6 km) between 8.36–8.17 ka cal BP and 7.43–7.26 ka cal BP; in Riazzino (2.9 km) between 3.89 and 3.58 ka cal BP; and in Magadino di Sopra (1.3 km), according to historical information, between 1365 and 1518 CE

(0.59–0.43 ka cal BP).

Both depositional rates in the alluvial plain and delta progradation rates follow the paraglacial erosion model from the Late Pleistocene to the beginning of the Meghalayan. During the Meghalayan, anthropogenic factors, such as deforestation and reforestation, are added to morpho-climatic factors and indicate an increasing human pressure on the erosional/depositional dynamics since the Early Bronze Age (2.20–1.55 ka BCE) and, rising significantly, since the Early Iron Age (0.90–0.45 ka BCE).