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# Glacier activity at the Lateglacial / Holocene transition inferred from the Swiss Alps

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High-alpine environments react sensitively to changes in climate. Depending on size, catchment area and valley topography, mountain glaciers response relatively fast with advances and recessions to shifts in temperature and precipitation (e.g. Oerlemans, 2005). About half of the present glaciers in the Swiss Alps are located in the highest mean altitudes areas. Past glacier activity beyond actual glacier extent is sometimes easily identified, such as the moraines related to the Little Ice Age. Records of older glacier activity, however, are usually less abundant. Lateglacial glacier advances are often documented by moraine complexes.

By comparing geomorphological characteristics within and between several investigated sites across the Swiss Alps, a relative chronology of glacier oscillations and re-advances was established. A cross-correlation of moraines in the same high-alpine climatic region allows to conclude that moraine ridges in comparable relative positions with similar morphologies and characterized by similar equilibrium line altitude depressions (Gross et al. 1977; Maisch, 1987), may be allocated to the same supra-regional trends in climate change. Surface exposure dating on well defined moraines gives the absolute chronology for the relative framework. More than 50 samples from erratic boulders on the crestline of moraines and glacially abraded bedrock were dated using the radionuclide $^{10}$Be. According to the results on boulders of the outer moraines, the oldest ridge coincides in time with the initial phase of the Younger Dryas (e.g. Gerzensee Oscillation). In addition, a number of Lateglacial and early Holocene advances have been identified (Preboreal Oscillation, Younger Dryas and Gerzensee Oscillation). $^{10}$Be exposure ages on moraines of the innermost Lateglacial complexes, but distinctly downvalley from Little Ice Age moraines point to cold conditions in the Alps during the early Holocene.

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