Multiple glacier advances during the transient Younger Dryas in the Swiss Alps

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Surface exposure dating of erratic boulders can provide crucial constraints on the dynamics of climatic anomalies [1]. This option creates a broader knowledge of the continental climate response during the Quaternary. The Younger Dryas (YD) cooling event is the last recurrence to proximate glacial conditions prior to the onset of the Holocene. Its onset and termination is characterized by significant shifts in temperature [2], however local evidence of multiple oscillations of the glacier extent during this transient period can be inferred by means of geological features. The Belalp valley, a small tributary to the Great Aletsch valley, enables a distinction between single advances during the YD and the adjacent younger and older glacial deposits, and this is supported by new surface exposure ages using the radionuclide isotope ^{10}Be. At least five repeated glacier advances related to the last Termination and one younger advance most likely according to the early Holocene are traceable. Field evidences combined with cosmogenic dating point to two advances within the Boelling/Alleroed-Interstadial and at least three advances during the Egesen stage, which is assumed to correlate with the YD chron. An increased number of dated glacial deposits related to the Younger Dryas event in the Swiss Alps, within the European Alps, results in a better understanding of the extent and timing of this short, but prominent glaciation in a high-alpine environment.

[1] Ivy-Ochs *et al.* (2007) *Quaternary International* **164-165**, 53-63. [2] Dansgaard *et al.* (1989) *Nature* **339** (6225) 532-534.

Investigating the source and timing of freshwater recharge into saline aquifers in the glaciated Illinois Basin

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Pleistocene climate change profoundly influenced the global hydrologic cycle over the past 2 Ma, including groundwater recharge rates in glaciated regions. Thick wet-based ice sheets and surrounding permafrost zones created the high hydraulic head and impermeable cap necessary to force fresh water deep into basinal aquifers, flushing saline fluids. In addition, unglaciated areas in North America may have received higher amounts of precipitation compared to present day conditions due to increased latitudinal atmospheric temperature gradients, and the established high pressure over the Laurentide ice sheet. This paleo-precipitation may have a distinct δ^{18}O isotopic signature from relatively depleted δ^{18}O values of Pleistocene glacial meltwater recharge (approximately -15 to -25‰), and relatively enriched δ^{18}O values of modern precipitation, making stable isotopes, in combination with age tracers, a potentially useful indicator of recharge source waters. In glaciated areas in the interior United States, and in non-glaciated areas in mid-west North America, several studies have measured a wide range of Pleistocene-aged meteoric δ^{18}O values (-23 to -5‰). In the Illinois Basin, a plume of anomalously low salinity formation waters extends from the basin margin to over 1000 m depth, oriented along the axis of the Laurentide Ice Sheet. These dilute waters have relatively enriched δ^{18}O values (around -8‰), which may result from: 1) recharge of modern precipitation (-11.0 to -4.5‰ δ^{18}O), 2) a mixture of isotopically depleted Pleistocene aged recharge and formational brines, and 3) an isotopically enriched Pleistocene aged source. These hypotheses are investigated by coupling published paleoclimate data for the Illinois Basin area with recent groundwater sampling along probable recharge flowpaths for additional stable isotopes, ^{14}C and noble gases. Results of analyses were used to determine the timing, mechanisms, and recharge rates of freshwaters into saline aquifers within the Illinois Basin.