Holocene jökulhlaups along the Hvítá River, Iceland: geomorphology, chronology, and hydrology

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Glacial outburst floods (jökulhlaups) have significantly modified landscapes across Earth throughout the Quaternary and are a contemporary geohazard in glaciated regions worldwide. Iceland experiences more frequent jökulhlaups than nearly anywhere on Earth, though research has focused on floods triggered by subglacial volcanic eruptions. However, floods from ice-marginal lakes may be a better analogue for most global jökulhlaups because both occur during rapid global warming. As the Icelandic Ice Sheet retreated in the early Holocene, meltwater lakes accumulated at ice margins and periodically drained in jökulhlaups. One such lake formed in the Kjölur highland region and drained along the Hvítá River in southwestern Iceland, leaving behind abundant geomorphologic evidence including 50-meter-deep canyons, bedrock channels, and boulder deposits. Yet, only one previous publication has investigated these events.

This project uses a suite of field mapping, geochronological, paleohydraulic, and modeling techniques to better constrain flood timing and dynamics. It introduces new lines of geomorphologic evidence, revises drainage route maps, provides estimates of flood magnitude, and discusses ongoing cosmogenic nuclide dating analysis to reconstruct flood chronology. Finally, it interprets results to present hypothesized scenarios of ice margin position, glacial lake formation, and jökulhlaup drainage during Icelandic Ice Sheet deglaciation. The Hvítá jökulhlaups are also an excellent case study for extreme flood impacts in bedrock terrain and drainage processes from ice-marginal lakes, helping to close a research gap in Iceland and advance understanding of links between climate change, ice response, and hydrology in other Arctic and alpine regions.