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Reconstruction of Early Holocene jokulhlaups along the Hvita River and Gullfoss waterfall, Iceland

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Glacial lake outburst floods (GLOFs) have occurred across the planet throughout the Quaternary and are a significant geohazard in Arctic and alpine regions today. Iceland experiences more frequent GLOFs—known in Icelandic as jökulhlaups—than nearly anywhere on Earth, yet most research focuses on floods triggered by subglacial volcanic and geothermal activity. However, floods from proglacial lakes may be a better analogue to most global GLOFs.

As the Icelandic Ice Sheet retreated across Iceland in the Late Pleistocene-Early Holocene, meltwater pooled at ice margins and periodically drained in jökulhlaups. Some of the most catastrophic floods drained from ice-dammed Glacial Lake Kjölur, surging across southwestern Iceland from the interior highlands to the Atlantic Ocean. These floods left extensive geomorphologic evidence along the modern-day course of the Hvítá River, including canyons, scoured bedrock, boulder deposits, and Gullfoss—Iceland's most famous waterfall. The largest events reached an estimated maximum peak discharge of $300,000 \text{ m}^3 \text{ s}^{-1}$, ranking them among the largest known floods in Iceland and on Earth.

Yet, all our evidence for the Kjölur jökulhlaups comes from only one publication to date (Tómasson, 1993). My research employs new methods to better constrain flood timing, routing, magnitude, and recurrence interval at this underexplored site. This talk presents new and synthesized jökulhlaup geomorphologic evidence; HEC-RAS hydraulic modeling results of flow magnitude and routing; and ongoing geochronological analyses using cosmogenic nuclide exposure dating and tephrochronology. It also situates these events within Icelandic Ice Sheet deglaciation chronology and environmental change at the Pleistocene-Holocene transition. Finally, it examines the Kjölur floods as an analogue to contemporary ice sheet response, proglacial lake formation, and jökulhlaup processes and landscape evolution in Arctic and alpine regions worldwide, where GLOFs pose an increasing risk to downstream communities due to climate-driven meltwater lake expansion.

Citation: Tómasson, H., 1993. Jökulstífluð vötn á Kili og hamfarahlauþ í Hvítá í Árnassýslu. Náttúrufræðingurinn 62, 77-98.

