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Applying 3D Dynamic Visualisation to (Palaeo) Geomorphic Reconstruction: Modelling a Tenth Century Jökulhlaup at Sólheimajökull Glacier, South Iceland.

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Jökulhlaup (glacial outburst floods) are caused by subglacial geothermal activity melting overlying ice, or by draining of ice-dammed lakes. They pose a recurring hazard along Iceland's south coast where volcano-glacial interactions create often unpredictable, high-magnitude floods. Gathering information about past floods is crucial for projecting findings to present day scenarios and developing future predictions for contemporary flood routes. Understanding the physical setting or surrounding environment is essential in palaeo-flood reconstruction as drainage routes are ultimately defined by local topography and changing ice cover.

At Sólheimajökull glacier, which drains the southern portion of Mýrdalsjökull ice cap, field evidence has been collected of a Tenth Century flood, recorded in the Icelander's Landnámabók (Book of Settlements). It was an exceptional event in terms of generation, magnitude and geomorphic impact. Although now fragmented and piecemeal, many of its direct (and indirect) geomorphological and sedimentary markers are still relatively well preserved and have been identified, mapped and dated to unravel the sequence of events played out during this significant episode in the glacial history and complex regional flood chronology.

VolcVis, an innovative, bespoke visualisation platform, is developed and applied for the first time in visualising volcanic jökulhlaup. The platform is created using the Microsoft XNA game development framework, which facilitates rapid game engine production by providing a set of tools utilising a managed runtime environment. VolcVis can render large amounts of data efficiently and still provide an extremely high level of interaction with the data being presented, including full freedom of motion. This enables synthesis and presentation of field results from Sólheimajökull in a novel way, creating an interactive, multi-perspective, three-dimensional (3D) prototype model.

The platform combines Digital Elevation Models of the area with aerial photography to create a 3D virtual environment, which provides the basis for entering field data to the geomorphic reconstruction. The result is a visual simulation of Sólheimajökull's Tenth Century physical environment which places the flood into geomorphic and topographic context.

The wider implications of developing this tool are many when considering its ease of use and first-person navigational controls. The animations allow immediate exposure to environments that are otherwise lost in reality. VolcVis is a powerful tool in bringing reconstructed palaeo-environments back to life, albeit in the virtual sphere. It allows a uniquely contemporary appreciation of an elapsed event; yet which was a critical episode in the geomorphic evolution of this dynamic region. When field data are pieced together into a simulation, they hold a greater cohesive strength, giving the results wider applicability and relevance to a range of users and decision-makers, serving both technical and nontechnical perspectives. VolcVis' ability to dynamically display field data presents new possibilities for generating hypotheses, and for data sharing with Icelandic hazard mitigation authorities and the general public.