Late Holocene and modern glacier changes in the marginal zone of Sólheimajökull, South Iceland

Anders Schomacker 1, Ívar Örn Benediktsson 2, Ólafur Ingólfsson 2, Bjarki Friis 4, Niels Jákup Korsgaard 3, Kurt H. Kjær 5 and Jakob Kløve Keiding 6

1Department of Geology, Norwegian University of Science and Technology (NTNU), Sem Sælends Veg 1, N-7491 Trondheim, Norway
2Institute of Earth Sciences, University of Iceland, Askja, Sturlugata 7, IS-101 Reykjavík, Iceland
3Department of Geology, Lund University, Sölvegatan 12, S-223 62 Lund, Sweden
4Store Norske Spitsbergen Grube Kompani AS, Postboks 613, N-9171 Longyearbyen, Norway
5Centre for GeoGenetics, Natural History Museum of Denmark, University of Copenhagen, Øster Voldgade 5-7, DK-1350 Copenhagen K., Denmark
6GFZ German Research Centre for Geosciences, Telegrafenberg, D-14473 Potsdam, Germany

Corresponding author: anders.schomacker@ntnu.no

Abstract – The forefield of the Sólheimajökull outlet glacier, South Iceland, has a variety of glacial landforms and sediments that are products of late Holocene and modern glacier oscillations. Several sets of moraine ridges reflect past ice front positions and river-cut sedimentary sections provide information about past environments. Here, we describe sediments and landforms deposited during the late Holocene. Chronology is obtained by 14C dating and cosmogenic exposure dating. The age determinations suggest that Sólheimajökull had major advances in the late Holocene prior to the Little Ice Age, and more restricted advances during the Little Ice Age, after AD 1539. Oscillations of the Sólheimajökull ice margin between 1938 and 2010 are documented by aerial photographs. Digital elevation models were produced from selected years in order to quantify ice thickness changes at the glacier margin over the last 50 years. The glacier margin thickened 70–100 m from 1960 to 1996 and then thinned 120–150 m between 1996 and 2010. In 2010, the glacier snout was 20–40 m thinner than in 1960. Additionally, the DEM time-series detect areas of erosion and deposition in the forefield.

INTRODUCTION

Research at Sólheimajökull (Figure 1) has mainly focused on the glacial and climate history of the Holocene (e.g. Dugmore, 1989; Dugmore and Sugden, 1991; Dugmore et al., 2000; Mackintosh et al., 2002; Casely and Dugmore, 2004; Grove, 2004), and glacial and sedimentary processes and landforms (e.g. Maizels, 1991; Lawler et al., 1996; Roberts et al., 2003; Le Heron and Etienne, 2005; Russell et al., 2010; Schomacker et al., 2010). Dugmore (1989), Dugmore and Sugden (1991), and Dugmore et al. (2000) applied tephrochronology and 14C dating and concluded that Sólheimajökull experienced its Neoglacial maximum 7–4.5 kyr BP, reaching the mouth of the valley. They also identified subsequent and more restricted pre-Little Ice Age (LIA) advances at >3.1 kyr BP, 1.2–1.4 kyr BP and 1 kyr BP. However, all were larger than the LIA advances. These advances are asynchronous with other recognized advances of outlet glaciers in southern Iceland (Björnsson and