Marine algae inform past calving rates of a tide water glacier in western Greenland.

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INTRODUCTION

Greenlandic tidewater glaciers (TWG) have experienced widespread retreat over the last century (Moon and Joughin, 2008; Moon et al., 2012). Currently, information on TWG dynamics is poorly constrained due to a lack of observational data and reworking of terrestrial evidence, particularly since the Little Ice Age (LIA; c. 1250 – 1900 AD; Long et al., 2012). This restricts our understanding of the long-term (centennial-millennial timescale) relationships between climate and calving at the marine terminating margins of the Greenland Ice Sheet. Kangiata Nuna’s Sermia (KNS) is one of the largest and most dynamic TWG in Greenland. In an effort to reconstruct change for KNS over the past 1000 years we collected terrestrial and marine samples within the KNS fjord system, south western Greenland (Figure 1), in summer 2015.

Marine climate proxies have been used to reconstruct glacial melt. The free living coralline algae Lithothamnion glaciale is known to dominate subtidal habitats in the marine and fjord systems of south western Greenland. This is unique species of algae that whose calcified thallus lays down annual bands that can be used in sclerochronology (Figure 2). The ratios of Mg/Ca within the skeletal lattice of the alga aid in recreating temperature of their environment and ¹⁸O is used to calculate salinity for the past 10-100s of years (Kamenos et al., 2012). These data will corroborate terrestrial proxies for calving events of the tidewater glacier (short term, 30-40 years) and temperature records from the skeletons of benthic foraminifera within sediment cores (long term). Here we present temperature data from maerl collected in the Akia peninsula and at the mouth of Kobblefjord.

METHODS

Samples were collected by hand on SCUBA from 10m depth in the Akia Peninsular region and the mouth of Kobblefjord (Figure 1), which respectively represent fjord and marine conditions. Individuals were air dried and transported back to Scotland where branches of three maerl from each site were embedded in resin, polished and then processed using electron probe microanalysis in the School of Geosciences at the University of Edinburgh (for detailed methodology see Kamenos et al., 2008).

Mg/Ca were converted to temperature by calibrating against Simple Ocean Data Assimilation (SODA; Carton and Giese, 2008) temperatures with the technique used to construct other existing Mg-temperature relationships (Kamenos et al., 2008). They were then aligned with existing temperature records from 10m depth in Nuuk which is largely influenced by the marine environment (http://data.g-e-m.dk/).

REFERENCES


Figure 1. Outline of Greenland with inset of the KNS fjord system. Maerl sampling sites in Akia Peninsula and Kobblefjord are highlighted with anchors.

Moving Forward

Collections from Akia peninsula show annual deviations from measurements in Nuuk and Kobblefjord, indicating that they are recording seawater temperatures influenced by abiotic factors outside of the marine environment. Salinity records from ³¹⁸O data should help us determine whether these deviations are due to increased glacial melt.

²⁰¹⁸O measurements will be carried out at Scottish Universities Environmental Research Centre (SUERC) and salinity of the marine environment will be reconstructed following the methods in Kamenos et al. (2012). Carbon dating will accurately age the temperature record from the maerl samples and help us to align these data with temperature records in foraminifera from marine and fjord core collections. We hope to extend this temperature record far into KNS calving history.