



Abstract

Dental calculus from a medieval Icelandic cemetery is analyzed to identify plant foods in the diet. Although Iceland was settled in the 9th century, it lacked written records until the 13th and 14th centuries, when early sagas were written. This leaves room for archaeological investigation in the region to more fully describe the lives of early Icelanders. Most information on diet in the region is concerned with meat, leaving the plant portion of the diet unaccounted for. While there is relatively little archaeological evidence for cultivars after conversion to Christianity at the turn of the 11th century AD, wild edibles like angelica are of ethnographic and historical importance. Around this time, environmental changes, both natural and manmade, led to socioeconomic shifts that inevitably affected diet. Dental calculus from teeth from recently excavated individuals from Keflavík cemetery in Skagafjörður, Northern Iceland was analyzed for entrapped plant starches. Starches were categorized and source plants were identified from an experimental reference collection made of known Icelandic and Ohio-based plants. Some modified fibers are also examined *in situ*. Study was conducted as part of a larger systematic analysis of calculus from multiple cemeteries in the region investigating potential differences in sex, age, and status in diet.

Site Background

The Skagafjörður church and settlement survey (SCASS) has led to thorough investigation on settlement in the area. Keldudalur and Keflavík are household cemeteries and accompanying churches that span the transitions from the 11th to 12th centuries (Zoëga, 2015). They are only in use for a short time before being discontinued. Both cemeteries are segregated by sex, with females north of the church and males to the south, with Keldudalur housing 62 individuals, and Keflavík containing 50. Individuals range from infants to full adults. Many individuals have large amounts of dental calculus.

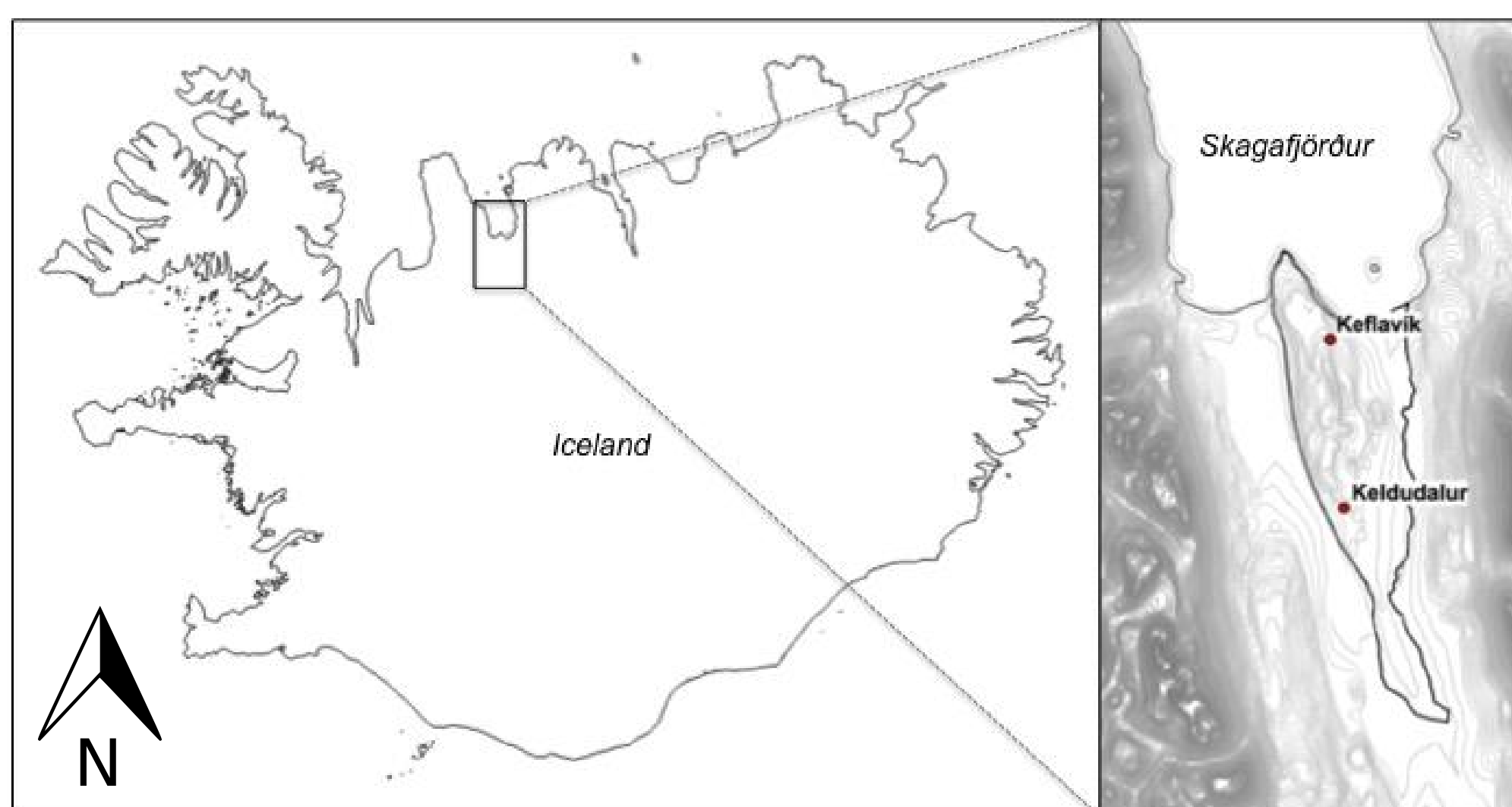


Figure 1: Drawing showing location of cemeteries within Skagafjörður, Iceland. Keflavík and Keldudalur Cemeteries are shown. Hegrans region is outlined on detail map.

Project Goals

- Identify important dietary plants in Iceland, create a reference collection of starches.
- Extract and identify starches and cultural material (such as fibers) from dental calculus, using the reference collection, to reconstruct diet and activity.
- Compare reconstructed diets with recorded histories, between individuals in one cemetery, and between cemeteries.



Figure 2: Extreme calculus deposits on molars of adult female from Keflavík. Teeth are also very worn.



Figure 4: Dental wear on adult female from Keldudalur similar to modifications in Greenlanders (Scott and Jolie, 2008). Suggests fiber production from wool.

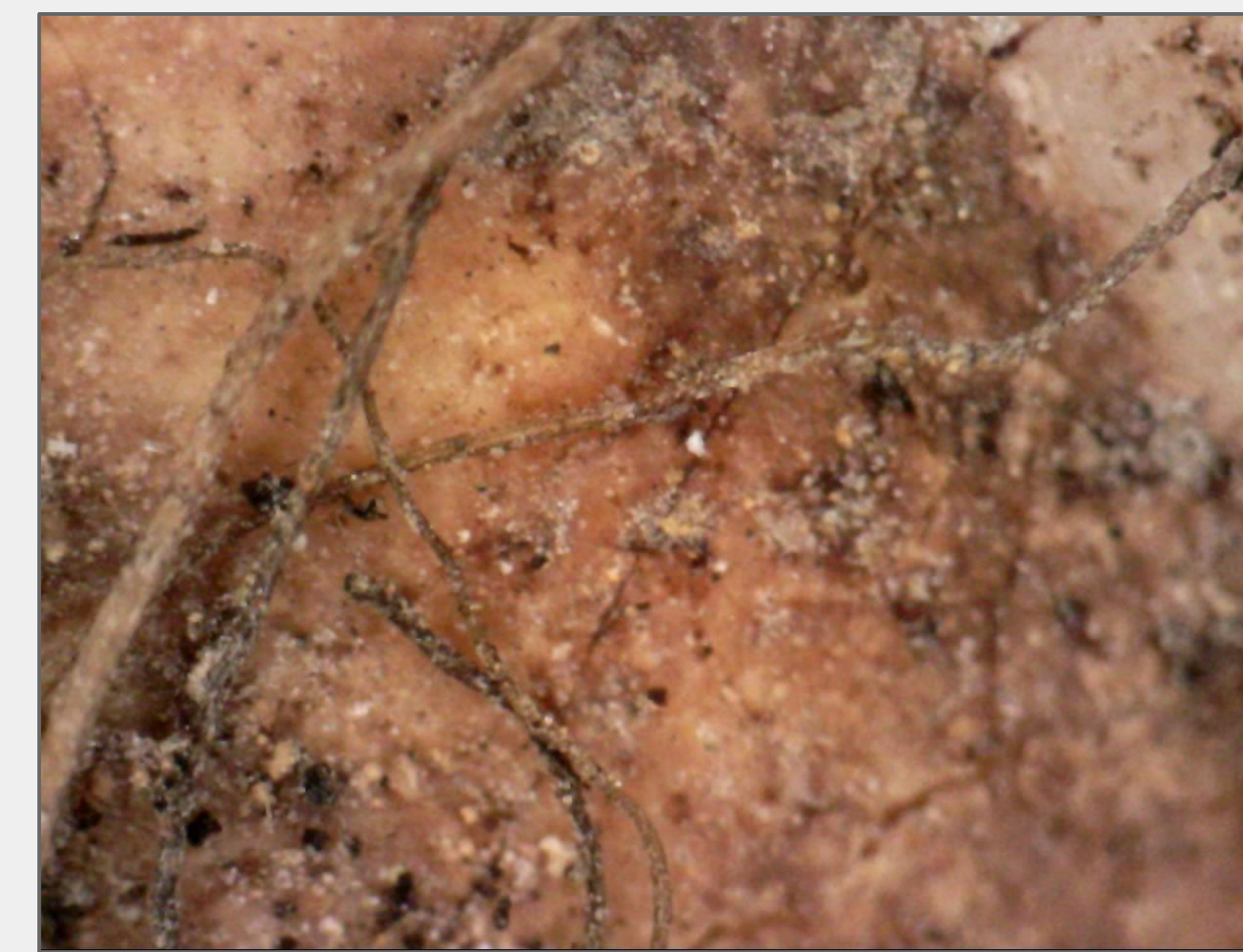


Figure 3: Plant and possible wool fibers observed *in situ* with reflected light microscopy on male from Keflavík.

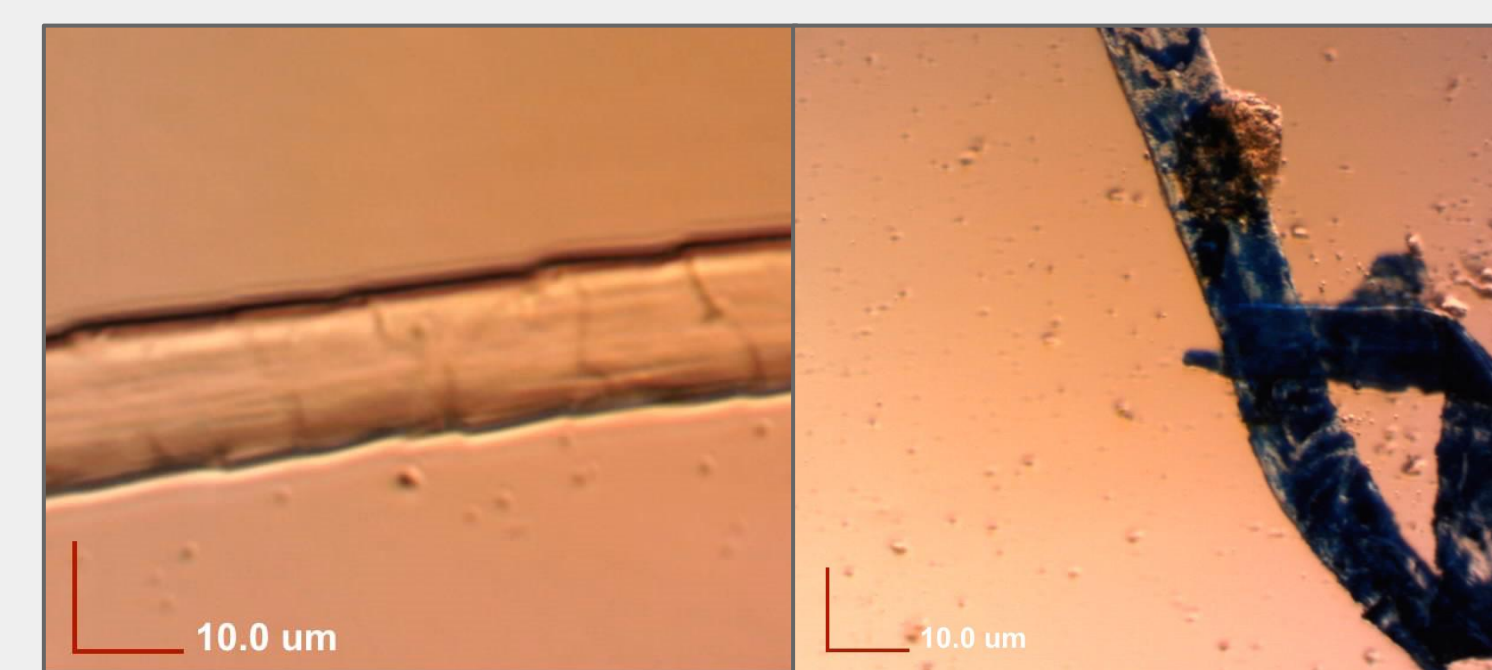


Figure 5: Fibers from dental calculus at 500x magnification. (a) Wool fiber with scales visible. (b) Plant fiber, dyed blue.

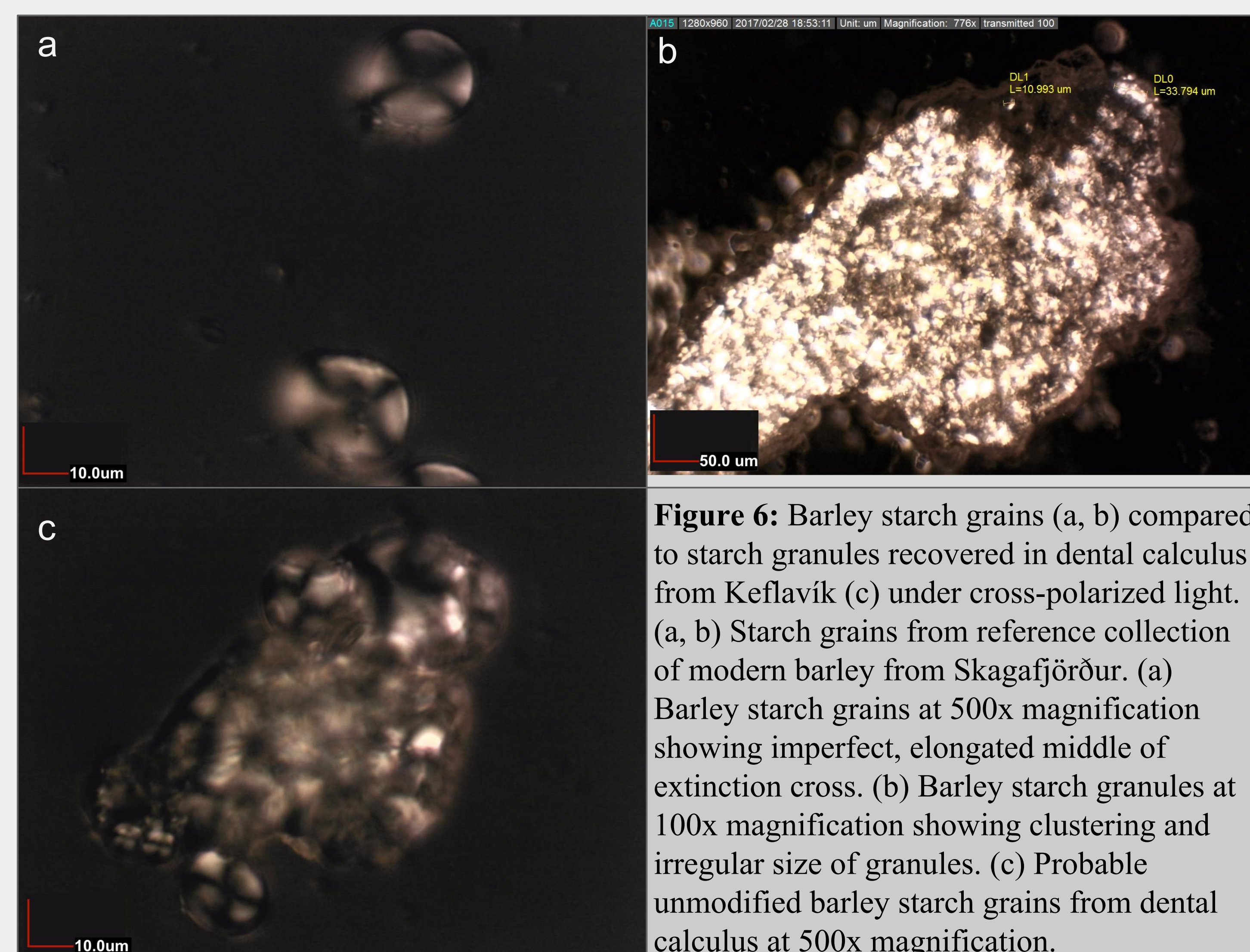


Figure 6: Barley starch grains (a, b) compared to starch granules recovered in dental calculus from Keflavík (c) under cross-polarized light. (a, b) Starch grains from reference collection of modern barley from Skagafjörður. (a) Barley starch grains at 500x magnification showing imperfect, elongated middle of extinction cross. (b) Barley starch granules at 100x magnification showing clustering and irregular size of granules. (c) Probable unmodified barley starch grains from dental calculus at 500x magnification.

Methods

Reference Collection

- Reference plants were selected based on ethnographic and historical work (Bold, 2012; Joseffson, Ramqvist, and Hörnberg 2014; and Svanberg and Ægisson, 2012).
- When Icelandic plants weren't available, proxies were used.
- Plants were ground, dried, and mounted in a 20% glycerol solution and examined under transmitted light microscopy (Olympus BX60 microscope) with attached camera.

Dental Calculus

- 8 individuals with ample calculus deposits were selected (2 male, 2 female from each cemetery), from young adult to mature adult. Anterior and posterior teeth both sampled. In final study, 20 individuals to be sampled, evenly distributed across age groups
- *In situ* microscopy performed on cleaned tooth surface before removal with sterile pick.
- Samples ground and mounted in a 20% glycerol solution and examined under transmitted light microscopy with cross-polarized and unpolarized light, with photomicrographs taken.

Results and Discussion

Starch

- Identifiable starches came from barley (*Hordeum vulgare*), field mustard (*Brassica rapa*), and potentially dandelion (*Taraxacum spp.*).
- Shows consumption of both wild and domesticated plants.
- Barley is of note: It is of importance during early settlement, but disappears from the archaeological record around the 11th and 12th centuries (Trigg et al., 2009).
- Barley's disappearance is thought to be the result of changed land-use practices and a shift towards a more completely livestock-based economy. Potentially response to environmental changes.

Fibers

- Previous study also found multiple dyed fibers.
- Plant fibers common in both men and women.
- Presence in men may not be due to manufacture (though one male has modification like in Fig. 4).

Future Research

- Final study will examine 5 males and 5 females from both cemeteries.
- Examining individuals from earlier pagan and later Christian periods could help contextualize results.
- Further analysis could better identify plant dyes and fibers.

Conclusion

Few studies have implemented starch analysis in this time period. None have done so in the North Atlantic. Preliminary results show late Viking age Icelanders had a broader plant diet than expected, one that is generally missing from early historical sources. Preservation of fibers and other materials can provide a record for materials that otherwise do not survive. Further analysis may provide more information on this transitional period in regards to cultural and environmental practices in the region.

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