Helgafell Pollen Analysis: Sample KLI-2014-16-02

Monasticism in Iceland

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February 2015

1. INTRODUCTION

The key aim of the Monasticism in Iceland project is to discern the development of a European institutional framework within Iceland and its impact on Icelandic society during the medieval period. As part of the investigative process, a pollen sample was acquired from a soil sample (KLI-2014-16-02) derived from an archaeological context at Helgafell, the site of a medieval monastic complex. Pollen analysis is able to provide an indication of plant species or taxa present during a period of the monastery's occupation of the island and thereby allows for the archaeological context to be set within an ecological context (Whittington & Edwards 1994). This in turn can inform on land management practices within the immediate locale of the archaeology as well as allowing for the identification of species that may have been utilised for specific purposes in the past e.g. edible or medicinal plants (Kristjánsdóttir *et al*. 2014).

This pollen analysis was commissioned by Dr Steinunn Kristjánsdóttir (Monasticism in Iceland Project) and laboratory facilities were provided by the Faculty of Life & Environmental Sciences, University of Iceland.

2. SAMPLE SITE

Helgafell is situated on the north coast of the Snæfellsnes peninsula in western Iceland (Fig. 1). Soil sample KLI-2014-16-02 was acquired from an archaeological context (Trench 3) at ISNET 93: E 324.481, N 509.752 (Fig. 2). The sample is derived from what is believed to have been a floor layer within a building. No date is currently available for the context (Kristjánsdóttir & Gunnarsdóttir 2014).

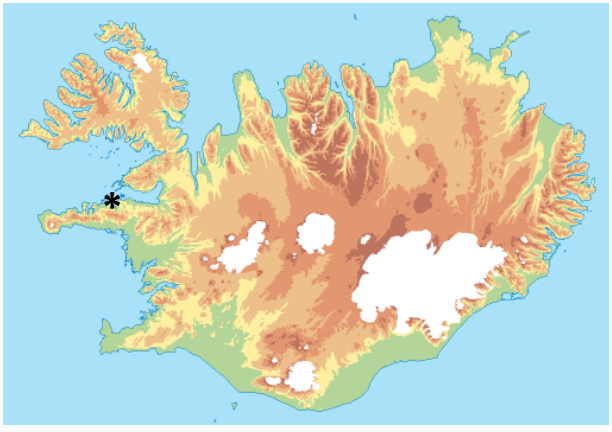

Fig. 1: Map denoting the general location of Helgafell in Iceland (asterisk).

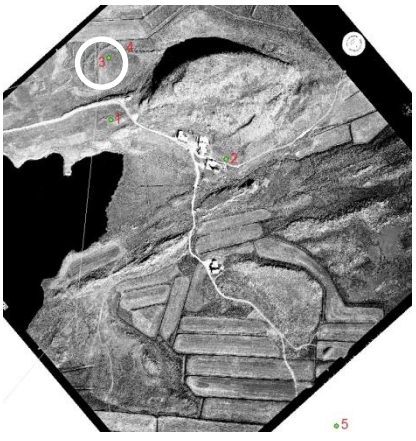

Fig 2: Trench 3 from where Sample KLI-2014-16-02 was acquired (circled).

3. METHODOLOGY

A 2 cm^3 sub-sample was taken from the bulk sample acquired from the archaeological context. Volume of pollen samples was determined by displacement in 10% hydrochloric acid (HCl) (Bonny 1972).The samples were subjected to further treatments in 10% sodium hydroxide (NaOH), sieved (150 µm) and subjected to acetolysis mixture. After washing in NaOH the samples were subjected to dense media separation using LST Fastfloat liquid with a density of 1.92 g/cm^3 to separate organic and inorganic components. One *Lycopodium clavatum* tablet (Batch No. 1031) was added to each sample (Stockmarr 1971). Each tablet contains c. 20848 spores and provides a control for the calculation of palynomorph concentrations. Pollen grains were slide mounted with silicone oil (Moore *et al*. 1991).

Pollen counts were conducted using a microscope at 400x magnification (at 600x and 1000x magnification for specific detail). A minimum of 300 pollen grains were counted (Moore *et al*. 1991). All Poaceae pollen were evaluated as potential *Hordeum*-type i.e. grain size >37 µm, annulus diameter >8 µm (Andersen 1978). Coprophilous fungi were counted as it has been shown that there is a relationship between spore concentration and grazing intensity (Cugny *et al*. 2010). Pteropsida and bryophyte spores were also counted. In order to maximise the opportunity to identify a range of plant species, especially those associated with cultivation, medicinal purposes or other utility, a rapid scanning method was applied following the standard count (Tweddle *et al*. 2005). This entailed examining an estimated minimum of 1500 pollen grains at 200x magnification.

Field identification guides were used to identify the habitat associations of the various plant species found within the pollen sample (Rose 1981; Kristinsson 1986; Fitter 1987). Plant nomenclature follows that of Kristinsson (1986). Pollen and spore nomenclature follows Bennett (2007) but is amended to better reflect the Icelandic flora (Erlendsson 2007). Indeterminate pollen is defined as material that was identifiably pollen but could not be assigned to a family, genus, species or –type of pollen. The identification of coprophilous fungi follows Van Geel *et al*. (2003). The presence of charcoal was noted.

4. RESULTS

In total, approximately 6601 pollen grains were surveyed from sample KLI-2014-16-02.

4.1 Standard Count

The standard count evaluated 337 pollen grains, marginally more than the 300 required as a minimum (Table 1.). Details of mosses and ferns are to be found in Table 2. Only a single spore of coprophilous fungi, *Sordaria*-type (HdV 55a) was identified in the standard count.

Table 1: Vascular plant pollen identified in Sample KLI-2014-16-02 (Helgafell), standard count.

Latin	English	Icelandic	No. of Pollen
Betula	Birch	Birki	39
Brassicaceae	Cabbage	Krossblómaætt	1
Caryophyllaceae	Campion & catchflies	Körfublómaætt	1
Cerastium-type	Mouse-ear	Músareyra, fræhyrna	1
Lactuceae	Dandelions & hawkweeds etc.	Fíflar	3
Cyperaceae	Sedge	Starir	180
Drosera-type	Sundew	Sóldögg	2
Empetrum nigrum	Crowberry	Krækilyng	2
Filipendula ulmaria	Meadowsweet	Mjaðjurt	3
Poaceae	Grass	Gras	52
Ranunculus acris-type	Buttercup	Sóley	5
Salix	Willow	Víðir	1
Thalictrum alpinum	Alpine meadow rue	Brjóstagras	6
Indeterminate pollen grains			37
Total no. of pollen grains			**337**

Table 2: Pteridopyhte (fern) spores identified in Sample KLI-2014-16-02 (Helgafell), standard count.

Latin	English	Icelandic	No. of spores
Diphasiastrum alpinum	Alpine clubmoss	Litunarjafni	1
Equisetum	Horsetail	Elfting	4
Pteropsida (monolete) indeterminate	Fern	Byrkningar	5
Total no. of spores			**10**

4.2 Rapid Scanning

Following the standard count a further c. 6264 pollen grains were examined using the rapid scanning method. Taxa and species that were not identified during the standard count are detailed in Tables 4 & 5. Additional coprophilous fungi spores belonging to *Sordaria* (HdV 55b) and *Sporormiella*-type were identified.

Table 4: Additional vascular plant pollen identified in Sample KLI-2014-16-02 (Helgafell), rapid scanning.

Latin	English	Icelandic
c.f. *Artemesia*-type	Mugworts & wormwoods	Malurtir
Caltha palustris	Marsh marigold	Hófsóley/lækjasóley
Cornuis suecica	Dwarf cornel	Skollaber
Galium	Bedstraw	Maðra
Parnassia palustris	Grass of Parnassus	Mýrasóley
Plantago maritime	Sea plantain	Kattartunga
Polygonum viviparum	Alpine bistort	Kornsúra
Rumex acetosa	Common sorrel	Túnsúra
c.f. *Hydrocharis morsus-ranae*	Frogbit	Froskabit

Table 5: Additional pteridopyhte (fern) spores identified in Sample KLI-2014-16-02 (Helgafell), rapid scanning.

Latin	English	Icelandic
Botrychium	Moonwort	Tungljurt
Polypodium vulgare	Common polypody	Köldugras
Lycopodium annotinum	Interrupted clubmoss	Lyngjafni
Selaginella selaginoides	Lesser clubmoss	Mosajafni

5. DISCUSSION

5.1 Habitats

The pollen assemblage presents a diverse landscape largely occupied by a wetland vegetation community dominated by Cyperaceae, perhaps interspersed with small stands of *Salix*. Wetland forbs such as *Caltha palustris* and *Filipendula ulmaria* may represent further pockets of wetland habitat diversity on the mire margins. Similarly, grassland characteristics possibly mirror a matrix of micro-habitats in turn reflecting a range of soil moisture conditions. Less damp environments may be apparent with Lactuceae, *Parnassia palustris Ranunculus*-type and *Thalictrum alpinum* with the acid context perhaps further reflected in the presence of *Galium*, *Rumex*-type, *Rumex acetosa* and *Potentilla*-type. At the other end of the spectrum, free-draining, sparse soils are suggested by *Plantago maritima*, *Polygonum viviparum*, *Botrychium* and *Selaginella selaginoides*. Both *Plantago maritima* and *Botrychium* favour a cropped grassland sward and may be benefitting from the presence of grazing livestock, apparent through the presence of coprophilous fungi. Values for coprophilous fungi are low but this may be a consequence of the sample originating from within a built structure.

Betula pollen includes both large and small grains that were generally in very good condition with only a small number of the larger grains displaying evidence of damage e.g. degraded or corroded. On the basis of the range in sizes, it is possible to distinguish between *Betula pubescens* and *Betula nana* and infer that both are represented in the pollen assemblage (Karlsdóttir 2014). Furthermore, two birch pollen grains featured four pores rather than the usual three (Moore *et al*. 1981). Another, small, birch pollen grain featured prominent, protruding, annuli. Both features imply that there was a degree of hybridisation between the two species (Karlsdóttir 2014). It is therefore reasonable to conclude that both species were present in relatively close proximity to Helgafell. *Betula pubescens* could represent

woodland with *Betula nana* perhaps representing a heath-type vegetation community, also apparent via low pollen values for *Cornus suecica, Empetrum nigrum*, *Diphasiastrum alpinum* and *Lycopodium annotinum.*

The balance between the primary habitat components of wetland, grassland, heathland and woodland suggests that the pollen sample from Helgafell may derive from a period of landscape transition i.e. grassland is not dominant and woodland is present. In order to provide some context, retreat of woodland and grassland expansion are both features of the developing agricultural landscape that followed Iceland's settlement c. AD 871 although there are instances where woodland survived into the later medieval period e.g. until the 14th century in upper Mosfellsdalur, the 15th century in Örnólfsdalur (Borgarfjörður), the early 18th century in Þjórsárdalur, and even down to the present e.g. Þingvallaskógur (Einarsson 1962; Hallsdóttir 1987; Vésteinsson & Simpson 2004; Erlendsson 2007, Edwards *et al*. 2011; Gísladóttir *et al*. 2011; Pétursdóttir 2014). It is perhaps worth noting that woodland is recorded at Helgafell in the early 18th century. The extent and condition of this woodland is unknown although it was deemed sufficient enough to provide charcoal and firewood for the farm (Magnússon & Vídalín 1931-33). By the early 20th century this woodland had completely disappeared (Geodætisk Institute 1911). Charcoal fragments were present throughout the entire sample, some relatively large. This is perhaps to be expected given that the sample is derived from a floor layer within a structure.

5.2 Utility & Medicinal Plants

A range of taxa contained within the assemblage may be deemed of value with regard to their utility as edible and medicinal plants e.g. *Polypodium vulgare, Empetrum nigrum, Galium* and *Filipendula ulmaria* (Kristjánsdóttir *et al*. 2014). Unfortunately, as native plant species they are commonly represented in pollen assemblages for Iceland and it is impossible to connect their presence at Helgafell specifically to medicinal practices and/or monastic traditions (Kristinsson 1986; Þórhallsdóttir 1996; Edwards *et al*. 2011). With regard to some taxa e.g. Brassicaceae, it is impossible to distinguish cultivated, edible plants from wild, non-edible members of a family palynologically (Moore *et al*. 1991). However, it is perhaps worth noting two exotic species present within the pollen assemblage for Helgafell (Sections 5.3 & 5.4).

5.3 c.f. *Hydrocharis morsus-ranae*

As far as the author is aware, *Hydrocharis morsus-ranae* has never previously arisen within a pollen profile in Iceland, it is not a component of the native Icelandic flora and nor is it present as an introduced non-native species (Kristinsson 1986; Þórhallsdóttir 1996; Wasowicz *et al*. 2013). Its occurrence may be the result of long-distance pollen air transport although it is also possible that this pollen grain is

actually a spore derived from a bryophyte, fungus or alga, which it closely resembles (Moore *et al*. 1991).

5.4 *Artemisia*-type

There are no plant species belonging to the *Artemisia* genus currently extant in Iceland (Kristinsson 1986). Mugwort (*Artemisia vulgaris*) has occasionally been recorded from 1945 (most recently in 2005) in the north and west of Iceland (Wasowicz *et al*. 2013). Both the pollen and the seed of *Artemisia vulgaris* are wind-dispersed and the species has the capacity to survive within the seed bank encapsulated within the soil (Barney & DiTommaso 2002). However, the *Artemisia* genus has never become naturalised in Iceland and the recent presence of *Artemisia vulgaris* is attributed to accidental introduction (Wasowicz *et al*. 2013). It is curious that the genus remains absent from Iceland given that some species of *Artemisia* have colonised areas at similar latitudes elsewhere i.e. Greenland and Alaska (Edwards *et al*. 2011).

A pollen profile for Skálholt (the seat of an episcopal see), south west Iceland, reveals the presence of *Artemisia*-type pollen from the moment of human settlement c. AD 871 which persists until the 12th century (Einarsson 1962). This has prompted some discussion around the potential utilisation of the genus as an indicator of the arrival of humans in Iceland (Edwards *et al*. 2011). If *Artemisia*-type pollen is to be accepted as an indicator of human settlement, it can only be considered so as part of a suite of anthropogenic indicators in the manner that has been applied to interpreting the presence of *Artemisia*-type pollen at Mosfell (Grímsnes) nearby (Hallsdóttir 1987). It is interesting to note that Skálholt and Mosfell (Grímsnes) both share a similar *Artemisia*-type pollen footprint following human colonisation c. AD 871. *Artemisia*-type pollen reappears in the pollen record at Skálholt and Mosfell (Grímsnes) in the 17th century and at Helluvaðstjörn in the 16th century (Einarsson 1962; Hallsdóttir 1987; Lawson *et al*. 2007). These occurrences in the pollen record are of interest in light of written accounts that report *Artemisia vulgaris* growing in Iceland in the 17th century. Specifically, *Artemisia vulgaris* was cultivated in the neighbourhood of Skálholt in the late 18th century (Thorarinsson 1944; Einarsson 1962; Edwards *et al*. 2011; Kristjánsdóttir *et al*. 2014). *Artemisia*-type pollen is also present in the pollen assemblage for Ketilsstaðir (south) (c. AD 871-1050) and post-settlement at Skallakot in Þjórsádalur (south west) (Thorarinsson 1944; Erlendsson *et al*. 2009).

With regard to the Augustinian monastic heritage of Helgafell, it is of note that a single *Artemisia*-type pollen grain has also been found within a pollen profile for the Augustinian monastic site of Viðey (AD 1226-1500), toward the later part of the chronological sequence. It has been suggested that the presence of *Artemisia*-type pollen may be attributed to it having been utilised by the residents of the monastery for medicinal purposes and for brewing (Bjarnardóttir 1997). As with the association

of *Artemisia*-type pollen with Iceland's settlement, ascribing the plants presence to its utility is not taken in isolation and there are other plant indicators that reinforce the idea that plants were cultivated at Viðey for medicinal purposes e.g. *Valeriana* spp. (Hallsdóttir 1993; Bjarnardóttir 1997; Riddell & Erlendsson 2014).

With all of the above in mind, it should be acknowledged that *Artemisia*-type pollen has been recorded in early Holocene pollen profiles for Iceland e.g. Flateyjarskagi, north Iceland, c. 7700-5250 BC (9700-7250 BP), Helluvaðstjörn, northeast Iceland c. 1300 BC (3300 BP) and pre-settlement (c. 871) for Mosfell (Grímsnes); incidence is attributed to windblown pollen grains (Hallsdóttir 1987; Hallsdóttir 1990; Lawson *et al*. 2007). Similar may apply to *Artemisia*-type pollen grains found in later chronological sequences. It is also difficult to place the single *Artemisia*-type pollen from Helgafell within this framework, especially as it is not set within a time series archaeologically or palynologically. That it is derived from within a structure at a monastic site could imply human agency, alternatively, it may simply be a windblown pollen grain.

6. CONCLUSION

Pollen sample KL-2014-16-02 from Helgafell presents a matrix of habitat types; grassland, heathland and woodland with wetland perhaps the most dominant. Further diversity within vegetation communities is apparent according to the wetness of soils. There is also some evidence to suggest that grazing animals were present i.e. coprophilous fungi. The presence of woodland implies that the archaeological context from which the sample is derived pre-dates the 20th century given that historical records suggest that woodland had disappeared from the locale by this time. Overall, the balance between the various vegetation communities leaves one with the impression of a landscape that was in a period of transition. There is little evidence of plants with the potential for medicinal application or utility except for a single grain of *Artemisia*-type pollen. The review of the literature above (Section 5.4) with regard to *Artemisia*-type pollen is not comprehensive and a consideration of the genus, its biology and presence in the pollen record in Iceland may be worth further assessment.

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