Fieldwork report – Summer 2021

Monolith and moss sampling at Kap Hoegh, Liverpool Land, Greenland.

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The InterArctic 4 years project (start in 2018) focuses on vulnerability, resilience and adaptation of northern societies facing global change. This fieldwork was scheduled in 2020, it has been postponed to 2021 due to the Covid.

The project can be uploaded:

https://chrono-environnement.univ-fcomte.fr/spip.php?page=projet&projet=7

For more information, EGU blog: https://blogs.egu.eu/divisions/cl/2020/09/21/interarctic/

The scheduled fieldwork take place in the WP2 of the project (Landscape and soilscape evolution: natural versus anthropogenic forcing recorded in pedo-sedimentary, peaty and lacustrine archives) and in the task 2.3 of this WP2 (Sea birds dynamic). This multidisciplinary WP is based on a multiscale systemic approach to geomorphological and ecological processes, with special emphasis on the dynamic combinations of biotic, abiotic, and other factors (human, animals) involved in landscape evolution.

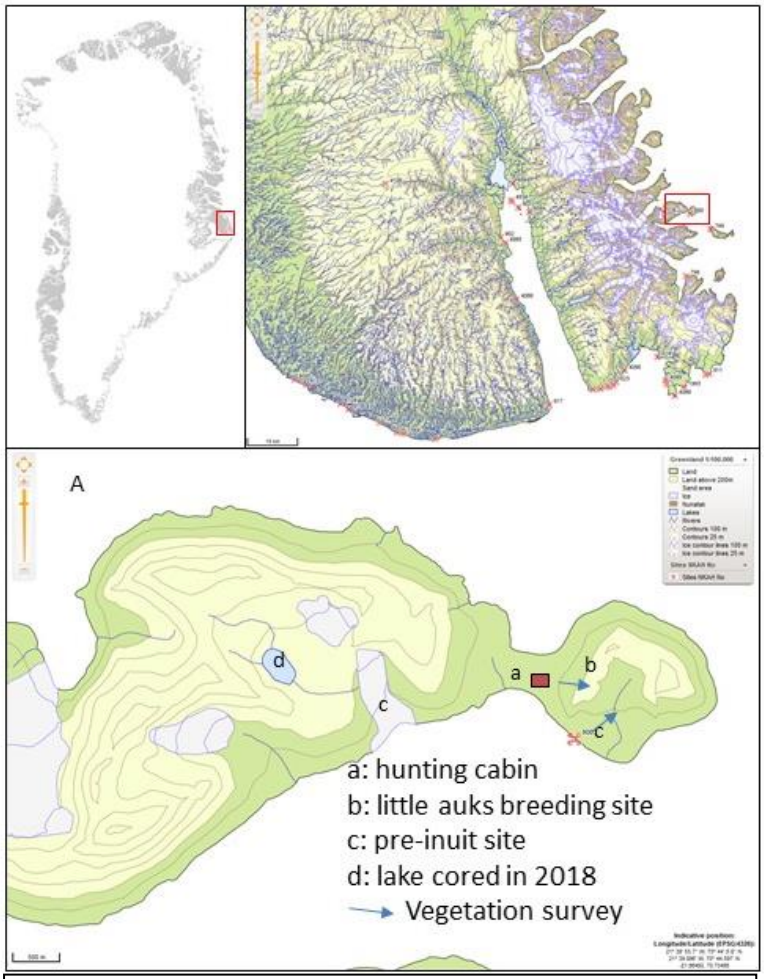


Fig. 1: Location of the study site.

Kap Hoegh (Ukaleqarteq), in the northeastern cost of Greenland is one of our study areas. This site has 2 interesting features: a large archaeological site and a little auk breeding site. Seabirds are essential hunting targets across our study area, and their populations appear to have undergone contrasting dynamics through time. So far, the interactions between humans and animals have mainly been studied though artefacts retrieved during excavations of dwellings and kitchen middens, while animal tracers in the environment have rarely been tracked through palaeoenvironmental studies. In this project, we wanted to use lacustrine cores and multi-proxy analysis to reconstruct the temporal dynamics of seabirds.

This project is strongly linked to the Adamclim project, studying the little auks' breeding site at Kap Hoegh (IPEV project, coord. David Gremillet). A first fieldwork (permit n° 2017/02) took place in summer 2017. A core was taken in the small lake nearby the hunting hut and the result was disappointing, knowing that the stratigraphy was made of sand in which pollen content is not preserved. Then, we couldn't perform a core in the lake about é km west from the hut, because it was frozen. Taking advantage of the InterArctic funding, we went back to Cap Hoegh in 2018, 2 weeks after Jerome Fort and David Gremillet annual fieldwork. We took benefit of this stay to make new cores and

a better survey of the NKAH 800 archaeological site (see the pdf presentation made in September 2021 at Saint-Pierre d'Oléron, at the HOMER congress).

We have obtained satisfying results of the archaeological survey, contrary to cores analysis. Core retrieved in a lake at ca. 2 km (Fig. 1A-d) from the hunting hut, was very short (27 cm) and gave poor results. Furthermore, sediment was full of stones and, without macro-remains, it was impossible to make any radiocarbon date. So, we have sampled a monolith directly below the breeding site, in a peat deposit linked to a coprophilous moss feed of bird's droppings and growing in the surroundings of the breeding site. The pollen analysis of this monolith reveals the presence of bird from the basis. Pollen spectra with an association of *Rumex acetosella, Cerastium alpinum*, Poaceae, Cyperaceae and Coprophilous fungal spores are characteristic of the unique vegetation growing only in the breeding site and due to the abundance of natural fertilizer. The radiocarbon date made à 40 cm (150 ± 30 BP) show a rapid moss accumulation. Because of permafrost, it was impossible to go deeper.

I went back to Kap Hoegh this summer with the hope to find deeper sequences spanning the little auk's presence on this site. I have also taken benefit of this fieldwork to sample monoliths closed to the archaeological sites surveyed in 2018.

Fig. 2: Satellite view from Kap Hoegh – V. Bichet.

Team: Emilie Gauthier (Professor), David Gremillet (senior scientist, ornithologist), Jérôme Fort (senior scientist, ornithologist), Andrea Grunst (Marie Curie post-doc student), Melissa Grunst (Marie Curie post-doc student), Marta Cruz Flores (Marie Curie post-doc student).

July 13

Flight to Akureyri, Iceland

July 14

Flight to Constable Point and to Kap Hoegh, cleaning and installation in the hut.

July 15

The day was dedicated to the installation of the solar panels, the setting up of an anti-bear barrier, rifle training, sorting and putting away the food, painting the new small hut built in the spring to store the food and equipment.

Fig. 3: Moss section for sampling

July 16 to 19

Start of the work of the 5 ornithologists in the breeding site. Concerning paleoenvironmental investigation, I dug a pit (30x30 cm) on the plateau to mesure the depth of the permafrost (KH3 - 30 cm). Then I have found an interesting peat profile on the plateau, under the breeding site. A stream flooding from the scree has been established since 2010. It has opened up the peaty area, allowing access to interesting sections for sampling (KH4 - Fig. 3, 6 and Tab. 1).

July 20

We visited the archaeological site and I surveyed for sequences to be collected. After some pit test, I've collected a first monolith in the lagoon, between the two archaeological sites (KH1 - Fig. 4). It was 30 cm long and had a thick layer of moss of about 5 cm at its base.

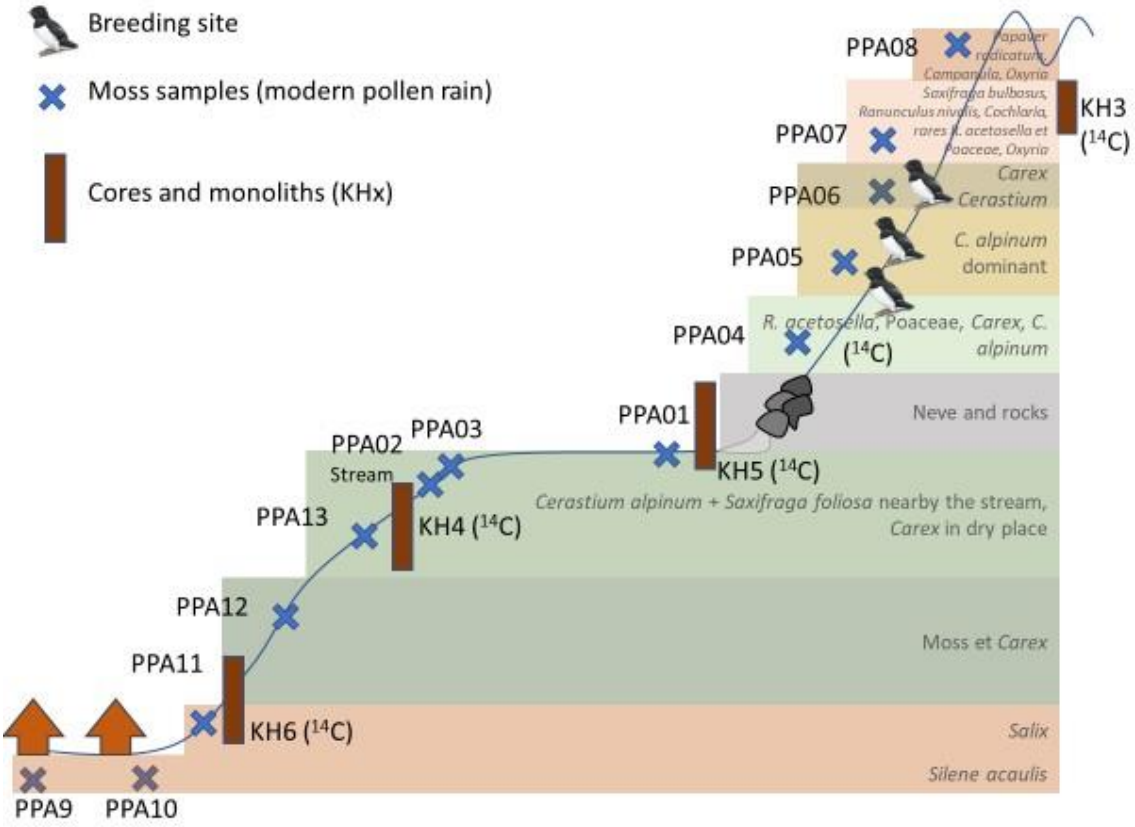
Above the winter dwelling, in the slope of the glacial circus, were several small bogs between 15 and 50 cm deep. A 50 cm sequence was taken (KH2 - Fig. 5 and tab. 1).

Fig. 4: Core performed between the two archaeological sites.

Fig. 5: Core performed above the sod houses.

July 21, 22,23

Back to the breeding site. I have collected 13 sampling sites distributed from the hunting huts to the top of the Kap along a vegetation cover gradient (Fig. 6). I have considered the diversity of vegetation types around the breeding site to provide modern-pollen analogs: percentage cover of herbs species was estimated within a 100-m2 plot (10 m×10 m). For each station plot, five moss samples were pooled in a single sample for pollen analysis (Fig. 6).



July, 24

Sampling of 3 cores. The first one, in the center of the breeding site has revealed a short and dry sedimentary sequence. I didn't keep it; however, I have collected sediment at the basis to make a radiocarbon date. The second one (KH7) was sampled at the beginning of the slope, 30m east from the huts. The last one was performed on the north beach (Fig. 7 and Tab. 1). When the peat layer reaches the beach, erosion provides a peat layer profile easy to sample.

We knew a storm was coming, so in the evening I went back to the colony to sample pits KH3 and KH4 on the plateau. Previous days, I went back almost every day to these pits in order to dig deeper in the permafrost. I have reached a depth of 50 cm for KH3 (40 cm in 2018) and 88 cm for KH4.

Fig. 7: Peat profile on the North beach

Core name	Surroundings description	Location	Length
KH1	Laguna	70 71 97 28 N/ 21 57 02 72 W	35 cm
KH2	Slope above the archaeological site	70 72 09 33 N/ 21 57 20 70 W	50 cm
KH3	Top of the breeding site	70 72 73 54 N/ 21 57 33 92 W	30 cm
KH4	Plateau, foot of the scree, north part	70 72 75 01 N/ 21 58 04 27 W	50 cm
KH5	Stream	70 72 76 15 N/ 21 58 22 38 W	88 cm
KH6	Foot of the slope, hut	70 72 72 28 N/ 21 59 20 54 W	30 cm
KH7	North beach		54 cm, sampling between 14 and 54 cm

Tab. 1: Summary of sampled cores and monoliths

July 25, 26

Bad weather condition, rain and wind, we stayed à the hut.

July 27

Good weather. Helicopter to Constable point.

July 28

Flight to Akureyri and Reykjavik

July 29

Flight to France.

This fieldwork allowed us to collect 7 sequences for pollen analysis, two near the archaeological site, and 5 on the side of the Kap where the seabirds breeding site is located. The sampling for modern pollen rain will allow us to better assess environmental transformations in relation to the number of little auks. The pollen diagram made in 2018, at the location of KH3, shows the typical vegetation of the breeding site (*Rumex acetosa* and *Cerastium alpinum*) but in varying proportions (Fig. 8). The modern pollen rain survey will help to understand the pollen representation of the vegetation at different points of the site more or less impacted by little auks' droppings. Finally, the cores and sampling for radiocarbon dating will enable us to know the starting of the peat growth in relation with little auks' presence. On the plateau, at the depth of 40 cm, we have obtained the date of 150 ± 30 BP. The peat deposit of the plateau id too deep and frozen to be completely investigated, we now hope that the other cores made in the breeding site and it surrounding will reveal, with the help of pollen and geochemical analyses, and radiocarbon dating, the arrival of little auks in this area.

Concerning the archaeological site, the pollen analysis will help us to understand the environment of the archaeological site, and eventually to detect human impact. KH1 will be analyses by a PhD student, Elia Roulé. KH2 will be sampled for pollen and testate amoeba analysis in collaboration with Edward Mitchell from the university of Neuchâtel (CH).

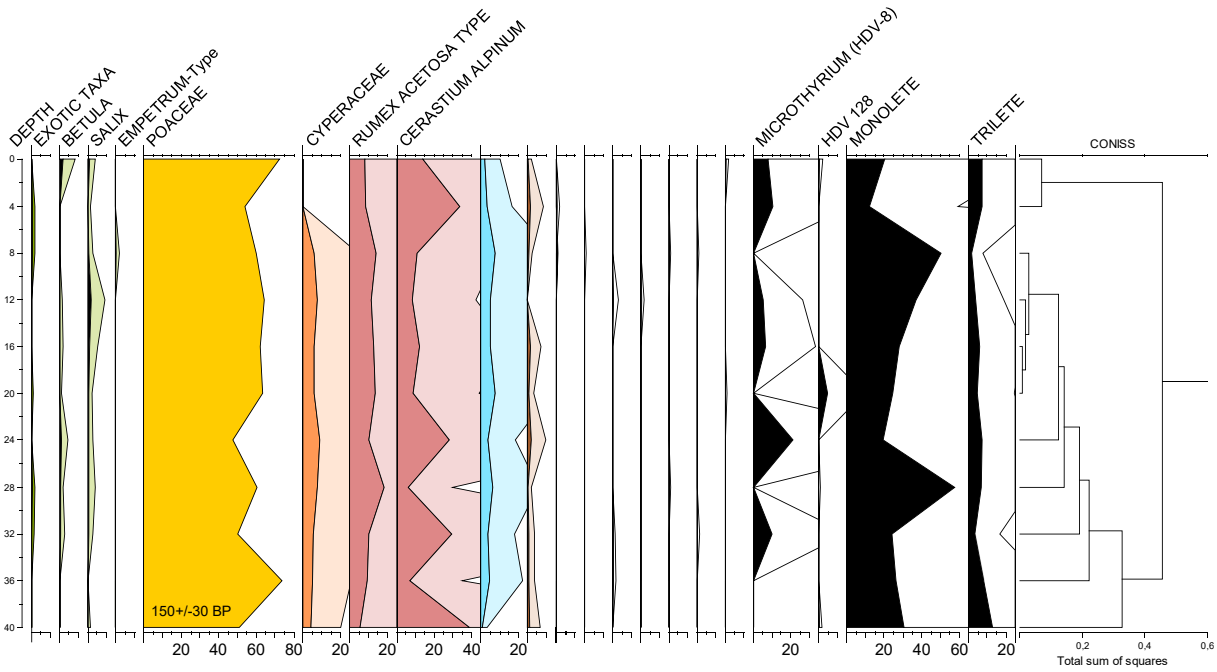


Fig. 8: Pollen diagram 2018.