# MIDDEN INVESTIGATIONS AT GJÖGUR AND AKURVÍK, ÁRNESHREPPUR, STRANDASÝSLA, NORTH WEST ICELAND

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## Introduction

Gjögur and Akurvík are costal sites situated at the northern mouth of Rekjafjörður in the district of Árneshreppur, Strandasýsla county, north-west Iceland (Map 1).

In 1990, excavations at Gjögur and Akurvík were conducted by a team from Hunter College as part of the Icelandic Palaeoeconomy Project (IPP), which was embedded in a wider archaeological survey covering various sites in the North and Northwest of Iceland. In 2003, a team from the Institute of Archaeology, Iceland, (Fornleifastofnun Íslands) conducted a survey of the Árneshreppur region and included both sites. In 2010, the middens of Gjögur and Akurvík were further investigated as part of a PhD, *Human Ecodynamics in the North Atlantic: environmental and interdisciplinary reconstructions of the emergence of fish trade in Iceland and the Faeroes, c. 800-1480* (Dufeu, 2011).

The sites of Gjögur and Akurvík are well known for their fishing activity: Akurvík was described as a seasonal fishing station belonging to Gjögur, and Gjögur being described as a potential 'high status' farm that 'would have controlled and integrated Akurvík catches into the larger regional arena of Northern Iceland' (Krivogorskaya *et al,* 2005; Norsec report No.15). Both sites were identified as case studies in Dufeu' thesis, which aim was to propose socio-economic models on how fishing might have developed from subsistence to small scale market-driven internal fish trade to overseas fish trade. Dufeu's work at Gjögur and Akurvík involved opening up some of the 1990 trenches to facilitate soil sampling for micromorphological analysis, targeting specific anthropogenic cultural deposits. The micromorphological analyses yielded results, which allowed for a better understanding of the development of commercial fishing as well as the economic destination of Gjögur and Akurvík.

**Map 1.** Reykjarnes, Gjögur and Akurvík. (Map: Landmælingar Íslands, National Land Survey of Iceland)

## Methodology

Archaeological profiles from the chosen sites were sampled with Kubïena tins. The sampling strategy consisted in overlapping tins to cover all the layers for each profile in order to get undisturbed samples, which would help building a chronology about the farm mounds formation.

Thin sections were processed by the author at the Micromorphology Laboratory, University of Stirling. All the water was removed from the soils samples by acetone exchange and confirmed by specific gravity measurement. Samples were impregnated using polyester crystic resin ‘type 17449’ and the catalyst ‘Q17447’ (methyl ethyl ketone peroxide, 50% solution in phthalate) The mixture was thinned with acetone and a standard composition of 180 ml resin, 1.8 ml catalyst and 25 ml acetone used for each Kubïena tin. The samples were impregnated under vacuum to ensure out gassing of the soil. The blocks were sliced, bonded on a glass slide and precision lapped to 30□m, with cover slipping. Thin sections were described using a petrological microscope -Olympus BX-50-. Systematic descriptions of soil structure, pedofeatures, coarse mineral and organic materials following the procedures of *Guidelines for Analysis and Description of Soil and Regoliths Thin Sections* by George Stoops (2003) and the *International Handbook for Thin Section Description* by Bullock *et al.* (1985) are available on request. Images of specific features in thin sections were captured and are presented in this report.

**Gjögur**

The farm Gjögur is located on the northern coast at the mouth of Reykjafjörður (Map 1).

During the 2010 fieldwork, it was not possible to reach the bottom of the midden at Gjögur due to a high water table. However, the profile was sampled for micromorphological analysis from the lowest visible layer SU63/64 and one horizon dug below [63/64], dating from the twelfth century and earlier, to SU80, which corresponds to the upper part of the profile with dates spanning from thirteenth to fifteenth centuries (Norsec report No.15, 2004).

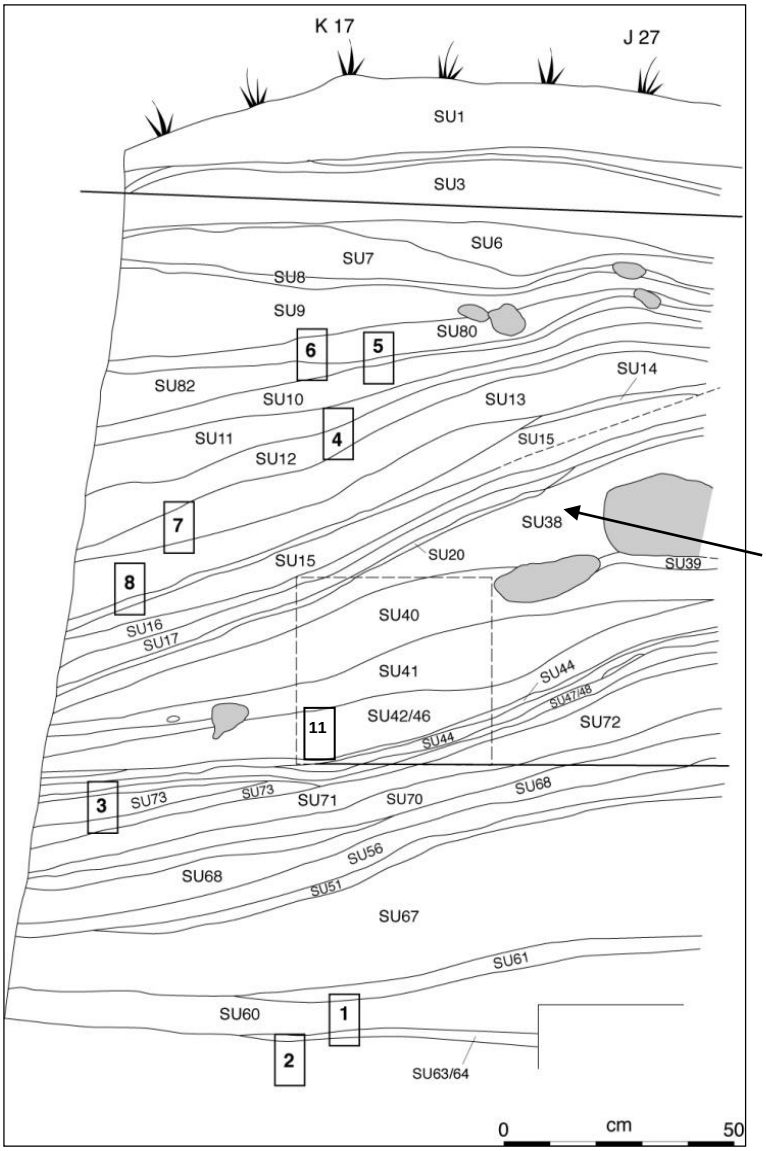


**Plate 1.** 1990 Gjögur stratigraphy, east facing section. (Original drawing: Jim Woollett)

Eight Kubïena tins were taken from the west profile (facing east) of the farm mound (Plate 1) and seven were processed for thin section micromorphology analysis: Gjo1, Gjo2, Gjo3, Gjo4, Gjo6, Gjo8 and Gjo11.[1] The profile has been divided between

[1] The tins were numbered in their sampling order and not according to their place on the profile.

‘Upper midden’, GJO AU 1, which includes the youngest horizons spanning from 1300-1400, and ‘Lower midden’, GJO AU2, dating from 1160 to 1390 based on radio carbon dating (Krivorgorskaya *et al*, 2005). Tins 1 and 2 were sampled in the bottom of the lower midden, there is not stratigraphic context under [SU63/64], the layer above is called ‘Under’.

**Fig. 1.** Gjögur. 2010 sampling of the east facing profile. (Photo V. Dufeu.)

The profile has been chosen according to the archaeological material and animal remains collected in 1990. Radiocarbon dates from bones and artefacts from the lower parts of the midden deposit date to the twelfth century; the bottom of the midden has not been reached as already noted, but there is a strong possibility that cultural deposits from the settlement period rest there. It is estimated that at least 80cm depth is still to be excavated.

The analysis of the cultural deposits speaks of a gradual increase from fish resources towards livestock exploitation and consumption (Krivogorskaya 2005, Dufeu, 2011). Several fragments of mammal bones have been identified in the thin sections, although none was observed from one of the lowest soil samples -from bottom upwards as seen in the stratigraphy- tin 3 [SU97/48]-[SU54]-[SU73]-[SU72]-[SU71], labelled Gjo 3. When mammal bones were absent as in Gjo3 and Gjo11, animal input such as dung confirmed the presence of cattle and the rearing of livestock. However, the large amount of fish bones in the thin sections Gjo 2 (ca.40-50% of the coarse material of biological origin), and Gjo1 (ca. 20-30% of the coarse material of biological origin) combined with the results of the analysis of the fish bone assemblage show that the settlers focused primarily on the exploitation of marine resources although the presence of bones decrease slightly for Gjo1 as shown below (Chart 1).

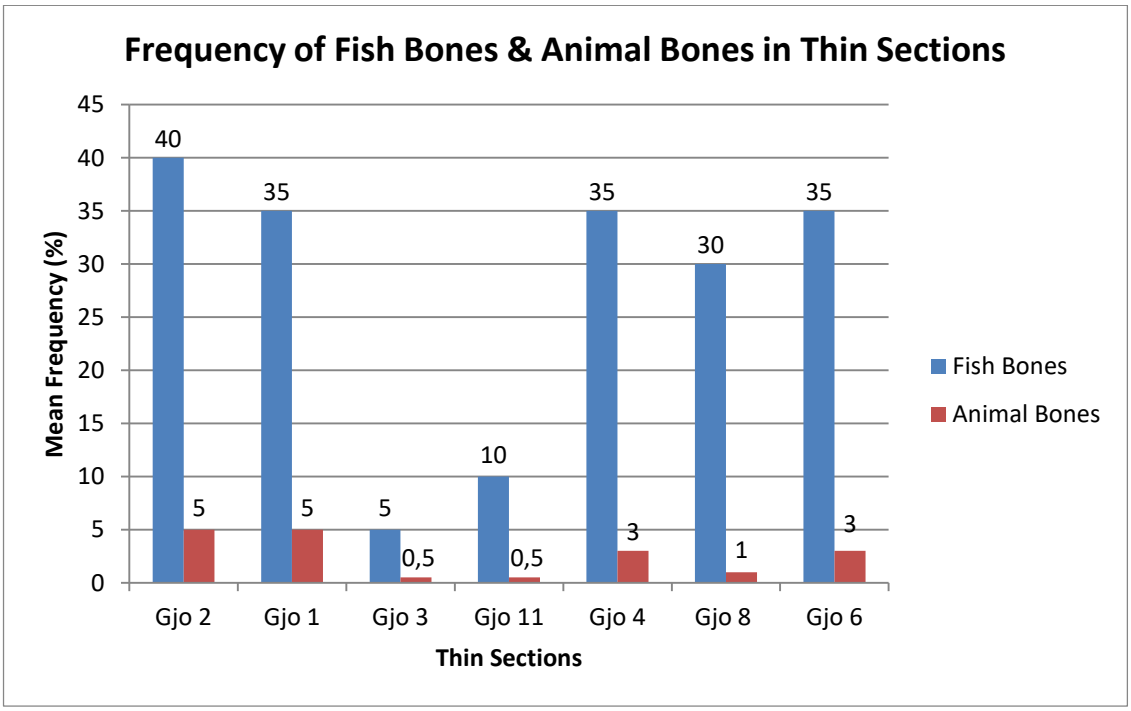


**Chart 1.** Gjögur. Frequency of fish and mammal bones identified in thin sections.

Moreover, as the decrease of animal and fish bones' frequency happened at the same time as seen in Gjo3, this indicates that an extraordinary event took place; the drop in bones frequency will remain unsettled for the time being. However, from Gjo11 onwards, the considerable increase of fish bones frequency gives evidence of the resumption of human economic activity as shown in the zooarchaeological assemblage and discussed below.

The animal bones frequency shows that although they raised livestock, they certainly used them as dairy cattle rather than 'meat' cattle as shown above (Chart1) (Dufeu, 2011). Indeed, the low frequency of mammal bones in the thin sections (5%) indicates that very few animals were slaughtered for consumption and this is interpreted as a keeping of animal for milk producing. This also complies with the legal regulation, which required up keeping of milking cattle or sheep on site in order to fulfil the fasting days when only 'foods from milk' were allowed (*Grágás* I, Christian Laws Section). This ratio is also visible in the bone assemblage (Norsec Laboratory Report 15). Occupation of the site is dated between AD1160 and AD1470 -$^{14}$C on bones- (Krivogorskaya, 2005) although it is reported that structures on the farm mound were occupied until 1860 (Lárusdóttir et al, 2003). The bone assemblage yielded a great percentage of fish although domestic mammals, sea mammals, molluscs and birds were also present (Chart 3). Concerning the fish bone assemblage, the skeletal elements -caudal, thoracic and precaudal vertebraes- together with the reconstructed length of fish suggest that fish were processed for both consumption and commercial purposes (Krivogorskaya, 2005). The amount of very well preserved fish bones (Fig. 2) together with the skeletal elements collected during the 1990 excavation in the lowest part of the profile, GJO AU2, are indicators that fish processing happened at least in the twelfth century.

**Fig. 2.** Fish vertebrae from Gjögur. Photo from the lower part of the midden. (Photo V. Dufeu.)

The fish elements in the cultural sediments exhibit various stages of conservation from very well preserved to totally decomposed and recrystallized. The well-preserved fish bones are easily recognisable in thin section: contrary to mammal bones, they do not present haversian canals (blood canals) as shown below (Fig 3).

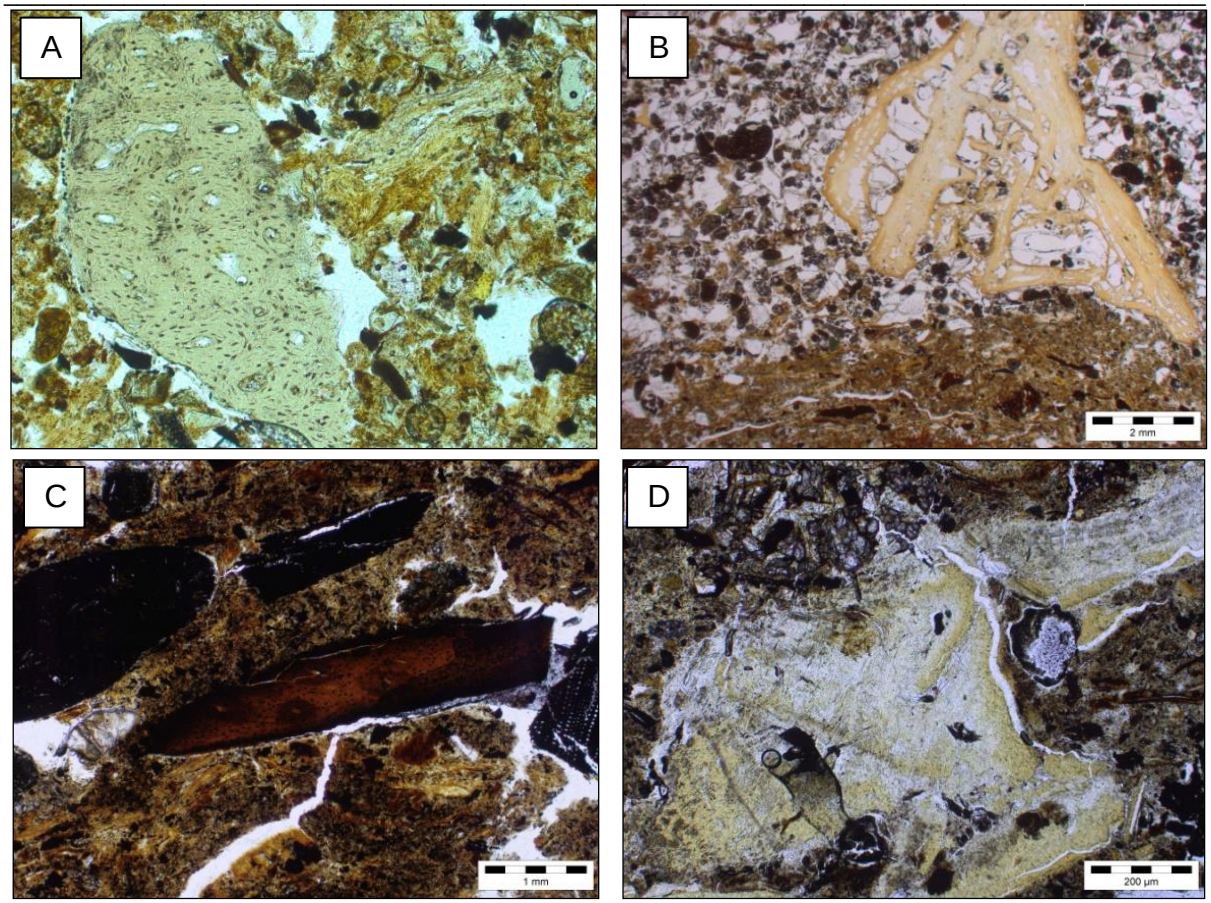


**Fig. 3.** (A) Mammal bone and blood canals. (B) Fish bone. (C) Charred animal bone, fragments of charcoal and coal. (C) Altered fish bone showing beginning of diagenetic process with very pale yellow decolouration of the bone. (Photo V.Dufeu)

While it is difficult to identify such diagenetic process on micromorphological observations only, the presence of the whole sequence of alteration from unaltered fish bone, slightly altered, heavily altered and finally amorphous paths, are indicators of decomposed and recrystallized fish bones.

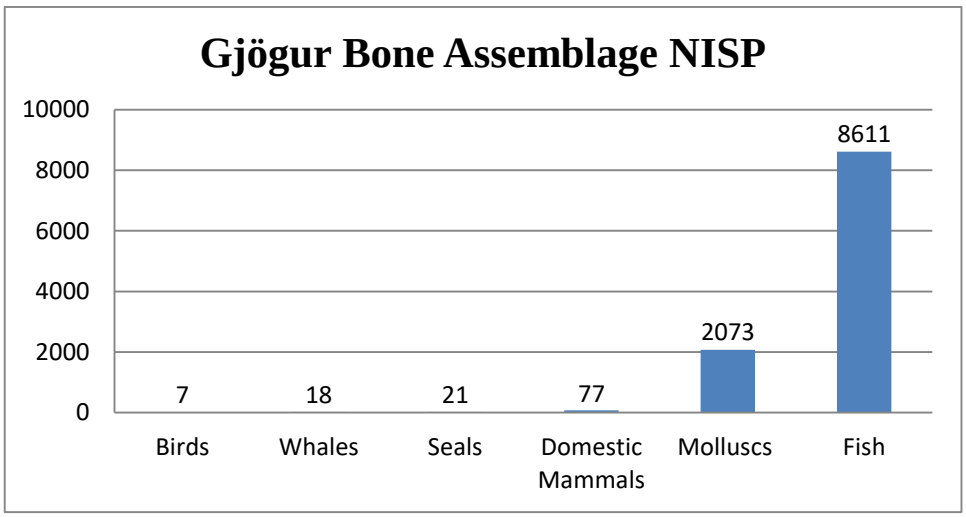


**Chart 2.** Gjögur. Total Number of Bones per Species. (Original data: Norsec Laboratory Report 15.)

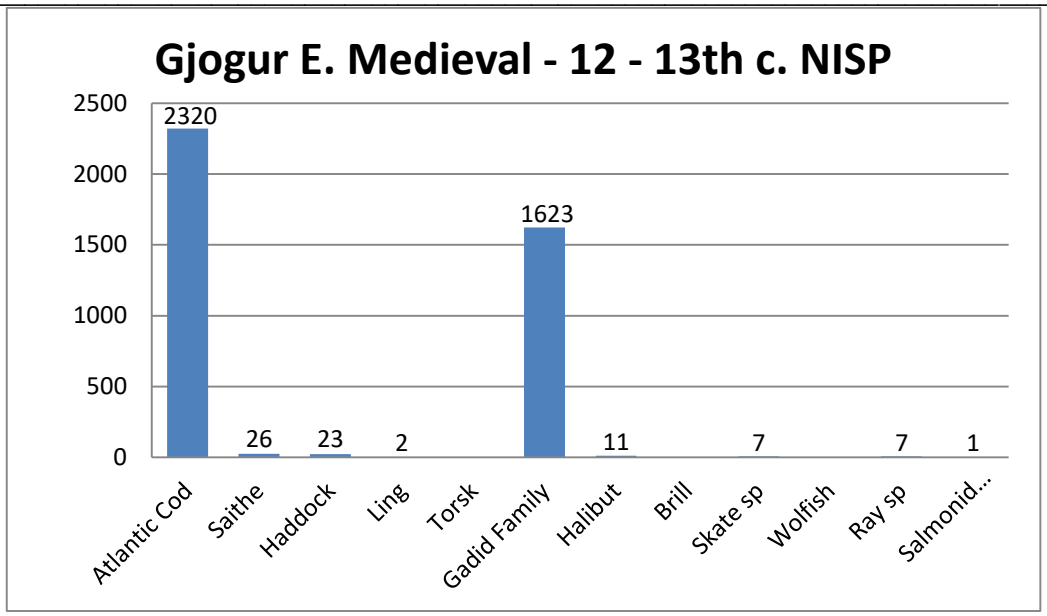


**Chart 3.** Gögur.Total Number of Bones per Fish Species.(Original data: Norsec Laboratory Report 15.)

Overall, Gjögur farm mound proves to be a very rich midden retaining numerous anthropogenic data with regards to the medieval period and the economy developed at that time.

The thin sections show a density of organic matter (plant residues, fragments of charcoal, charred wood, burnt bones and animal waste) but no wastes of construction debris or ashes, which indicates that materials whose origin is the product of cattle pastoralism, manuring, fish production as well as household clearings form this midden (Fig.4).

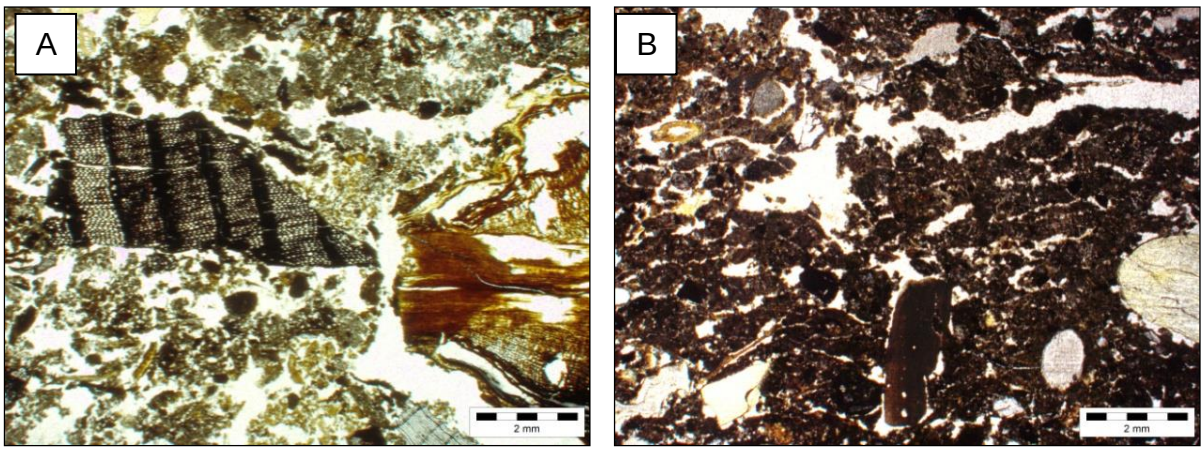


**Fig. 4.** (A) Fragment of charcoal, fragmented bone (top left), plant tissues. (B) Lenticular structure, with a strongly expressed parallel oriented coarse organic matter. The channels and chambers are due to faunal activity. Charred bone The different groundmass colouration between light to dark brown is due to the amount of organic matter. The darker the colour, the more organic matter is present. (Photos V.Dufeu)

The presence of biogenic opal -phytoliths and diatoms amongst others- in the groundmass and infillings (Shack-Gross *et al*., 2008) is indicative of soil amendment

through animal manure and therefore animal husbandry, as well as crops cultivation. Phytoliths are silica bodies produced by decomposed plants and grasses, and diatoms -single-celled algae formed in soils, lakes, rivers and marine environments-, phytoliths are present in animal dung as part of their diet (Fig. 5).

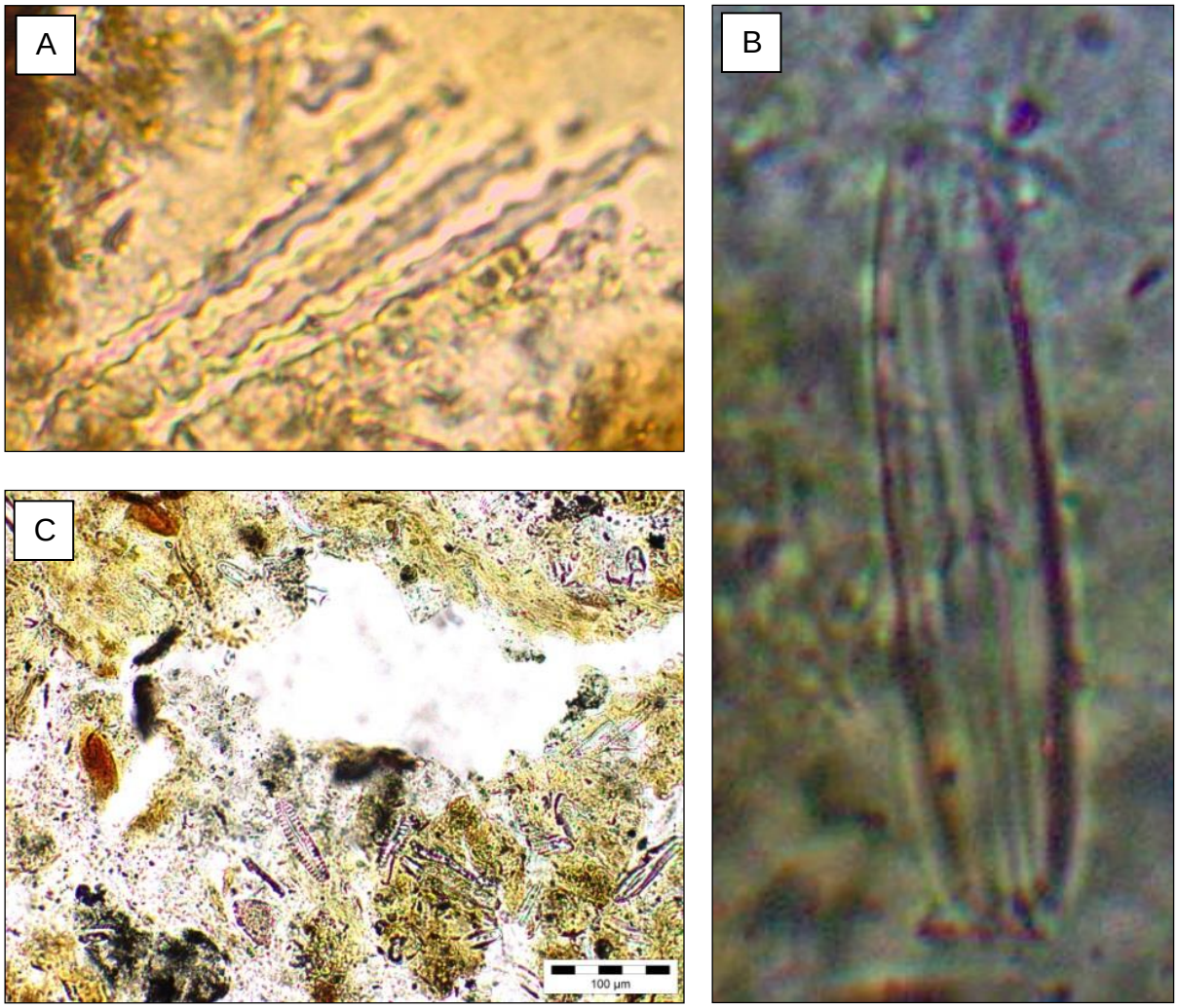


**Fig. 5.** (A) Husk epidermis. (B) Diatom. (C) Diatoms and rectangular phytoliths (top left) within an heterogeneous pale yellow organo-mineral mass. (Photo V.Dufeu)

It must also be noted that the presence of biogenic opal has been recorded in poorly-drained soils, which is the case for soils developing on volcanic materials (Clarke, 2003). While tephra is seldom recorded for the Westfjords, the amount of volcanic rocks, glass and tuff observed in the thin sections indicates that soils developed on volcanic material (Dufeu, 2011).

With regards to the fish remains, it seems that the amount of fragmented bones and calcium-iron features, together with the bone assemblage, definitely ascribe Gjögur as a mid rank farm whose main economic activity was the production of fish for mercantile purposes, and possibly for the overseas markets. Such interpretation is supported by the large amount of Atlantic cod and gadid fish bones, which were the species most commonly internationally traded as discussed above. In addition, there remains the likelihood that catches landed at Akurvík were processed both at

the station and at Gjögur. Overall, both the quantity of fish bones added to the variety of species speaks for both domestic and fish trade, possibly overseas, starting in the twelfth century. Indeed, fish bones from the skull were observed in layers located in the water table; this indicates that fish was processed there at an earlier period.

**Akurvík**

Akurvík is a beach site, 3km north from Gjögur (Map 1). In the modern era, Gjögur inhabitants created vegetable gardens on the shallow sandy soils (Fig.6).

During the 2003 survey, four structures were identified as booths, most certainly dwellings for fishermen and their gears. These structures were interpreted as a 'series of superimposed seasonal fishing booths' rather than a permanent settlement (Krivogorskaya *et al*., 2005). This impression was also built upon the presence of windblown sand layers in the profile.

The location of the site, facing the North Atlantic has exposed it to rapid erosion and the profile surveyed and described in 1990 was no longer existent in 2010 (Fig. 7).[2]

**Fig. 6.** View of Akurvík beach. (Photo V. Dufeu)

[2] As part of the Icelandic Palaeoeconomy project, a team of archaeologists from Hunter College, New York, lead by Pr. McGovern surveyed and described the profile mentioned above. The profile drawings were given to the present author par Pr. McGovern.

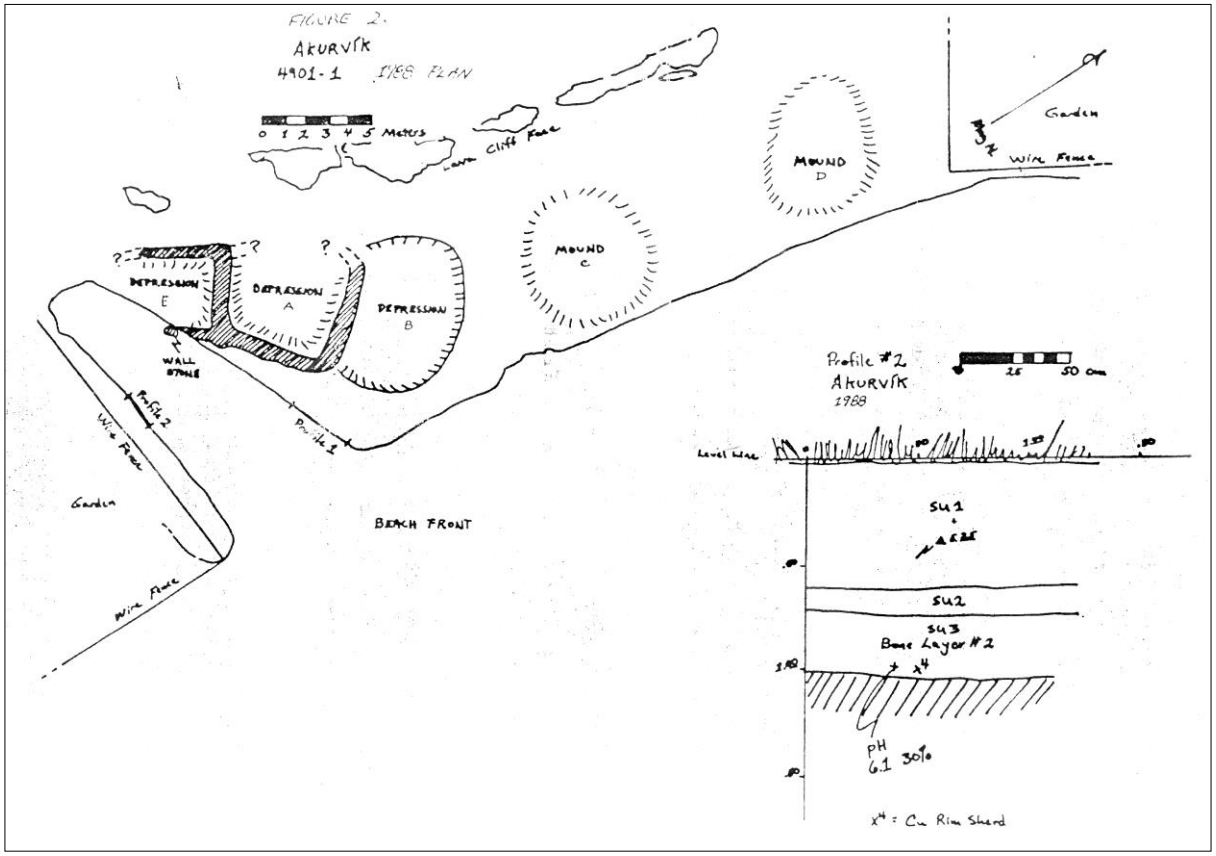


**Plate 2.** 1988 plan of the Akurvík fishing station.

**Fig.7.** (A). View of the 'horse shoe' as seen in plate 2. (B) Possible location of the 1990 profile now fully eroded and 2010 profile location (Photo V. Dufeu).

The planned fieldwork strategy consisted of re-opening the 1990 section but due to erosion it had to be amended and a profile was open on the eroded face. Fortunately, horizons showing anthropogenic features and what resembled the 'fish layer' described in 1990 were found as shown above (Fig. 7).

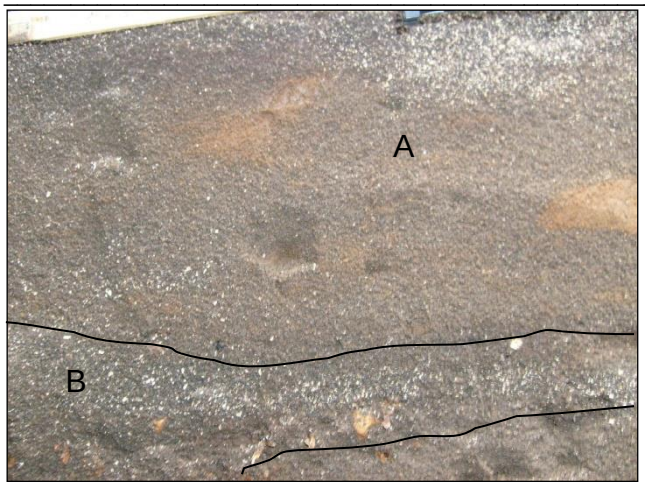


**Fig. 8.** Cultural deposit, A, and 'fish layer', B, corresponding to the description in the 1990 field report. (Photo V. Dufeu.)

The cultural deposits show orangey patches as shown above (Fig.8), while fish bones from both these horizons and the 1990 'fish layer' were still visible but not collected since there is no zooarchaeological programme for this site.

Five samples for micromorphological analysis were taken and three were processed, the two other being security 'doubles'. The horizons were numbered from bottom to top. The targeted horizons for sampling were the 1990 'fish layer', [6] and a cultural deposit, [8] (Plate 4).

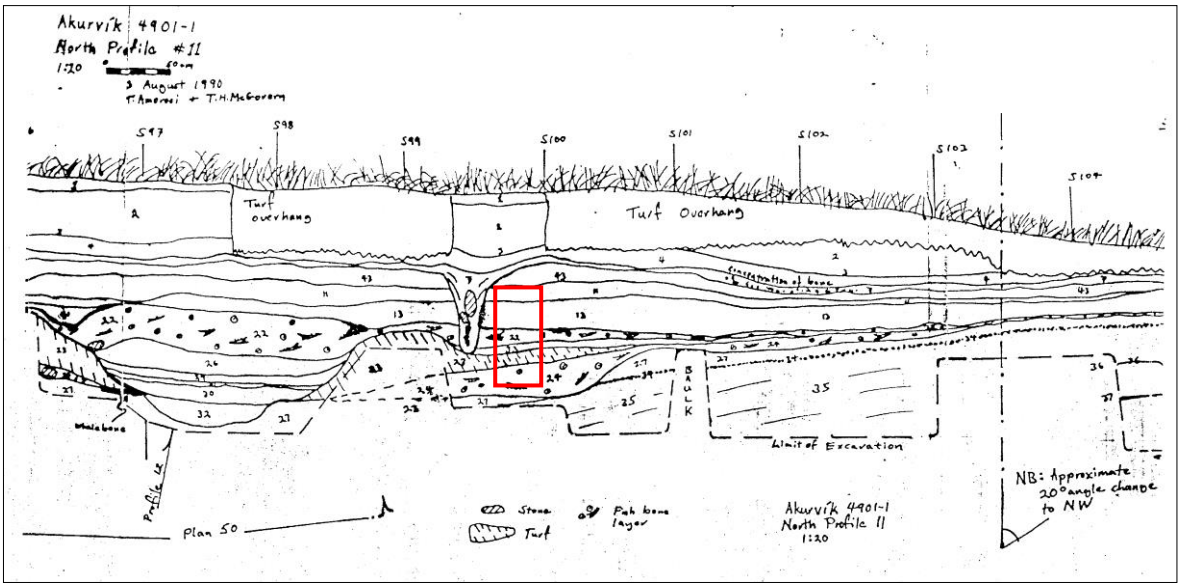


**Plate 3.** Akurvík 1990 stratigraphic drawing. The red triangle shows the area of the 1990 section where the 2010 sampling section is believed to mach. (Original drawing, Jim Woollett)

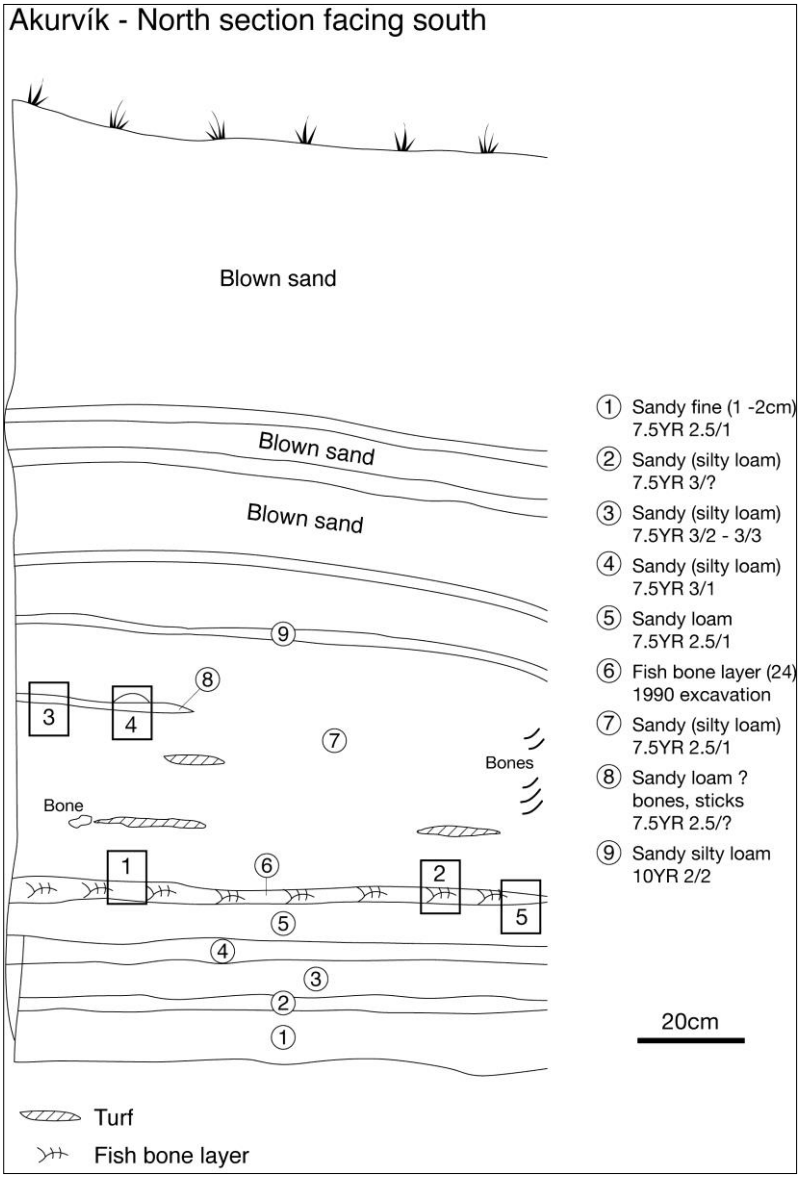


**Plate 4.** Akurvík 2010 stratigraphy (Drawing V.Dufeu)

**Fig. 9.** Akurvík 2010 profile. Note the blown sand layers above the horizontal line. The ‘fish’ layer is on the lower part of the profile, the first light coloured layer below the line. (Photo V. Dufeu.)

The micromorphological analysis of Akurvík thin sections did not retrieve much data about human occupation of the site. The thin sections mainly consist of blown sand, although there are anthropogenic inclusions and micro strata such as soil organic matter, mainly amorphous brown and reddish, and very rare plant remnants, mostly cell, cells residues and parenchymatic tissues (Fig.10).

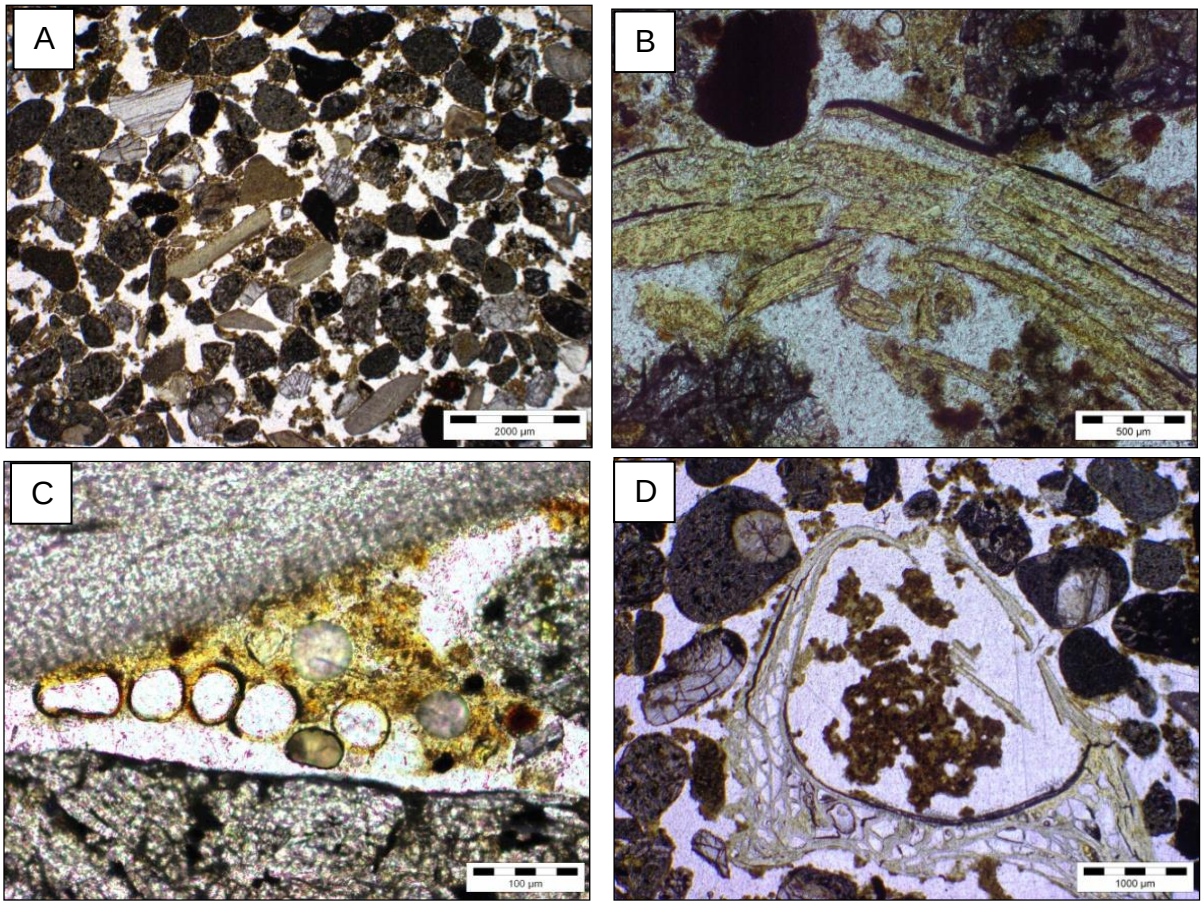


**Fig. 10.** (A) Blown sand. (B) Lignified tissues, wall cell and fine mineral material. (C) Light brown fine mineral material and silt hypocoating of grain mineral with cell residues. (D) Soil organic matter in parenchymatic tissues, granular microstructure with coalescent granular aggregate. (Photo V.Dufeu)

Mesofaunal/microbial activity has been identified in all the samples through re-worked organic matter and depletion (Fig.11). The very rare fragments of charcoal present (less than 0.5%) in the samples has been interpreted as the result of translocated material rather than human activity in the production of fuel (Fig.12).

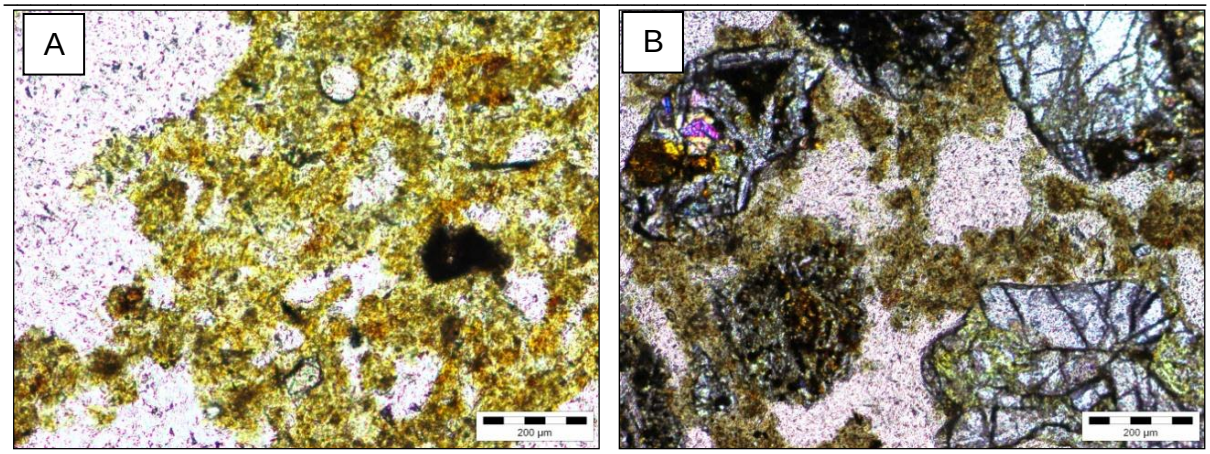


**Fig.11.** (A) Vughy microstructure . (B) Re-worked soil organic matter by soil animals exhibiting vughs and hypocoating of the grain mineral (partially XPL). (Photo V.Dufeu)

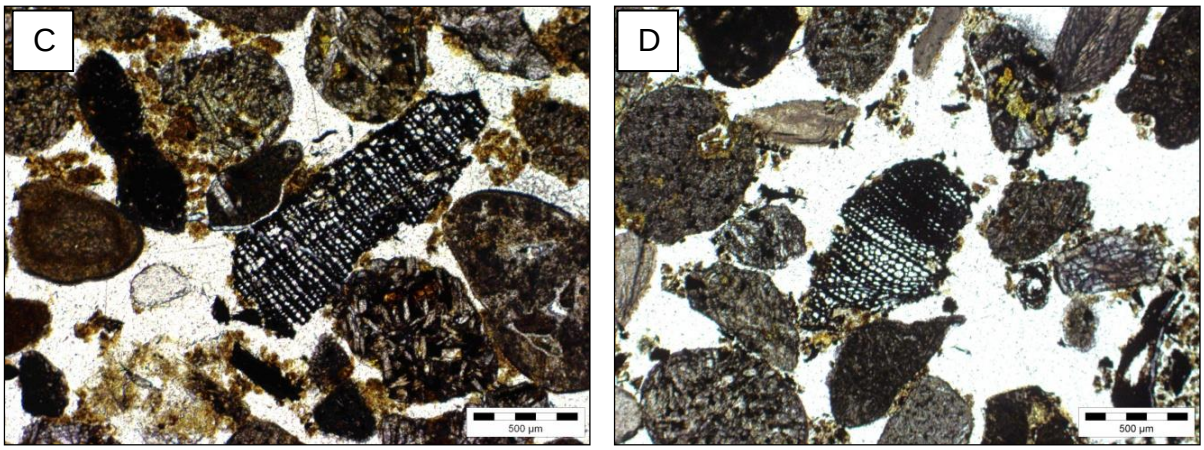


**Fig. 12.** Two fragments of charcoal. (Photo V.Dufeu)

With regards zooarchaeological assemblage (Norsec Laboratory Report 15), fish bones represent the largest part of the bone assemblage that coincides with Akurvík as being a fishing station (Fig.7). The presence of molluscs seems to be directly linked with the fishing activity and has been interpreted as bait for fishing rather than the fishermen diet.

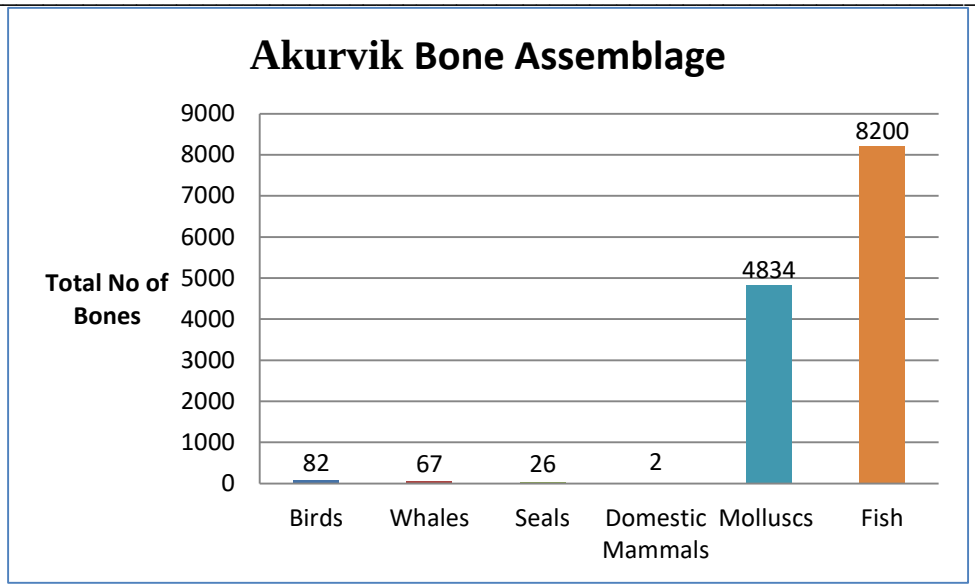


**Chart 4.** Akurvík bone assemblage per species. (Original data: Norsec Laboratory Report 15)

Seal bones can be interpreted as another activity of the station. Seal meat was highly prized, while the skin provided furs for clothing. Whale bone fragments are most probably the result of stranded animals whose bones might have been used to manufacture luxurious objects and common tools. The remaining mammal and birds bones have to be interpreted as dietary elements.

The presence of windblown sand horizons can be an indication of 'abandonment' phases and hence seasonality, as opposed to midden adding up continuous cultural deposits. However, the location of this fishing station, by a sandy beach and facing the North Atlantic with its strong wind currents, can explain these sand horizons rather than a seasonal occupation of the site. The proximity of Akurvík from Gjögur (3km) enabled fishermen to live in the main settlement with daily work at Akurvík (Map1). The presence of mammal, bird and seal bones is not contradictory with the occupation of the site as a work place rather than a living place; meals had to be taken by the fishermen.

In the archaeological report, it is mentioned that a structure, a fishing booth, was built above a deposit of mammal, bird and fish bones. More substantial fish bones were recovered from the various floor layers of the booth (Krivogorskaya, 2005). There are many indicators, like remains of turf walls, that there is probably more archaeological material on the site and there is a strong possibility that the midden has not been located yet. However, the rate of erosion leads to the thought that the midden might have fully disappeared. During the 2010 fieldwork, the structures were still visible, although very close to the eroded edge of the profile. Archaeological rescue investigations would enable recovery of anthropogenic features before their complete loss.

With regards to the settlements' chronology of Gjögur (AMS Radiocarbon Assay results, 2 sigma calibrated range, AD 1160 to 1470), and Akurvík (AMS Radiocarbon Assay results, 2 sigma calibrated range, AD 1030 to 1290 -midden deposit), the fact that Gjögur farm mound has not been fully investigated with unexcavated cultural deposits, one should be cautious with chronological interpretation.

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