Gamtos mokslų metodai: ar tai tik galimybė, ar ateities archeologijos būtinybė?

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Santrauka

Gamtos mokslų metodai yra taikomi archeologiniame darbe, tiriant aplinkos modelius, ir ateityje jie, matyt, įgis dar didesnę svarbą. Šiame darbe kalbama apie du bendradarbiavimo būdus: daugiadisciplininį ir tarpdisciplininį. Taip pat pateikiami kai kurie tokių bendrų projektų rezultatai, paminint ir šalutinį jų poveikį.

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The use of vertebrate fauna remains in the interpretation of subsistence strategy and settlement patterns, with emphasis on fish and bird bones. A case study from Kotedalen, Western Norway

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Introduction

The fact that Norway has a long coastline (Fig. 1) is reflected in the prehistoric settlement patterns of the country. Most stone age sites are found at the coast, especially close to narrow channels with strong tidal currents (Figs. 1 and 2). Given that they are coastal sites, bones of fishes and marine birds are frequent on these sites. In fact fish bones are often the most frequent vertebrates present at our stone age sites.

In Norway, zooarchaeological investigations have been undertaken for the last 70 years. However, the study of the small vertebrates, micro mammals, fishes and birds have played an important role in these investigations only since the mid seventies. This is mainly a result of the introduction of new excavation and sampling techniques.

The unique excavation of the Kotedalen site, which involved close co-operation between archaeology (Olsen 1992), botany (Hjelle 1992, Kaland 1992, Soltvedt 1992) and zoology (Hufthammer 1992) has produced some interesting results.

Material and methods

In most recent stone age excavations the soil is water sieved at the site, with 4 mm mesh and as a test 2 mm mesh (Fig. 3). These samples are both kept and analysed separately.

At the Kotedalen excavation, additional soil samples, usually 1 litre each, were taken from cultural sediments and features of special interest. These samples were brought back to the laboratory and stored. Some of these are sieved at the laboratory to help answering questions that were not recognised in the field. However in most cases they have been stored for future, and perhaps more sophisticated, generations of scientists.

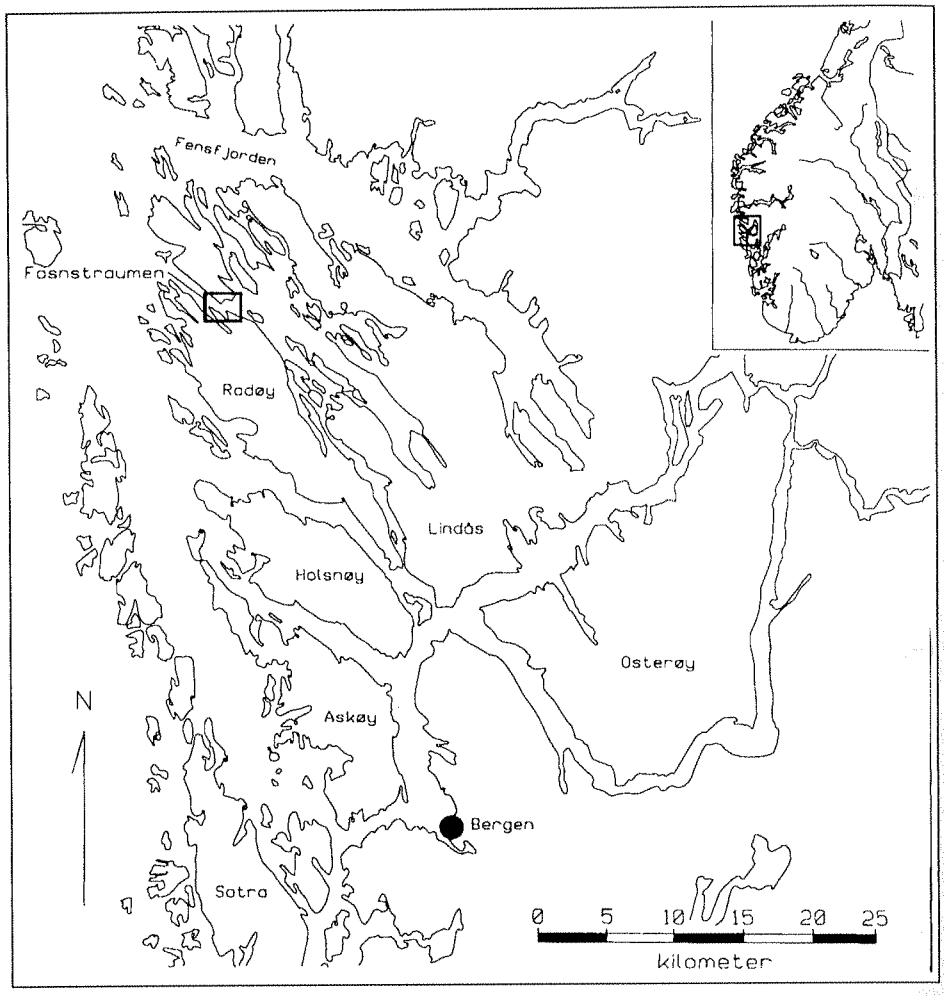

Fig. 1. Location of the Kotedalen site

During the Kotedalen excavation artefacts, macro-fossils and bones were collected from the same samples. Sediments were regularly washed in a special flotation system constructed for this excavation (Fig. 4). The botanist collected macro-fossils that floated into sieves with meshes of 4, 2 and 0.5 mm. Bones and artefacts were collected from the non-floating sediments.

Pollen and bones were sampled from the same features, for instance hearths. Naturally the frame around the excavation was the archaeological investigation. We tried, and I think succeeded, to maximise our sampling procedure.

Bones, especially those of smaller vertebrates, are frequently introduced secondarily into the cultural deposit, for example by predators depositing pellets as well as carcasses of their prey (Andrews 28:1996). In many cases it is impossible to distinguish these bones from the "culturally related" bones. Luckily most of the bones from Kotedalen are burned and thus highly likely the result of cultural activity.

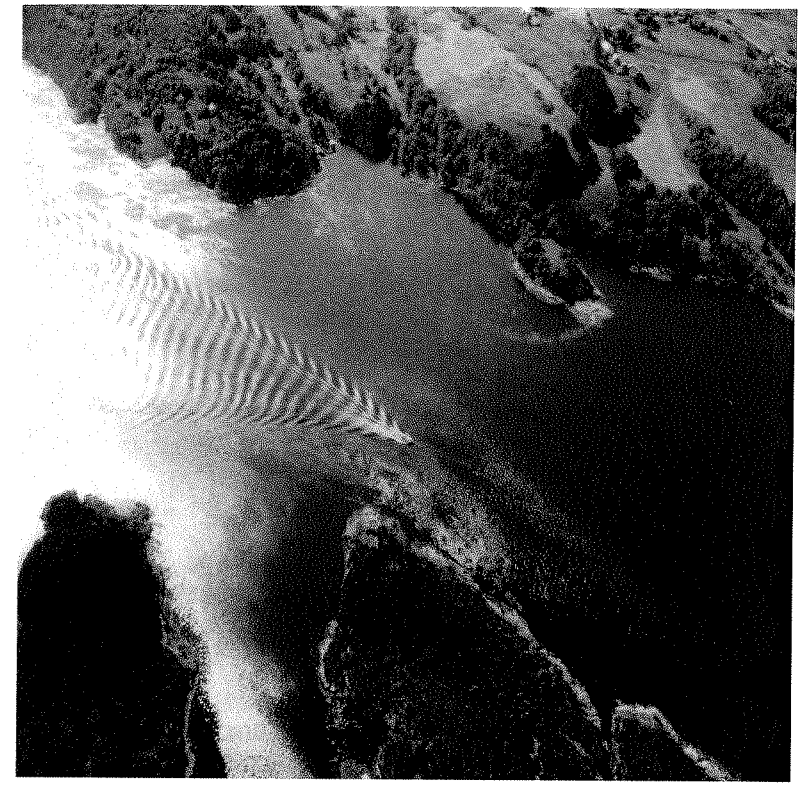

Fig. 2. The Kotedalen site and the Fosnstraumen channel. Photo Statensvegvesen

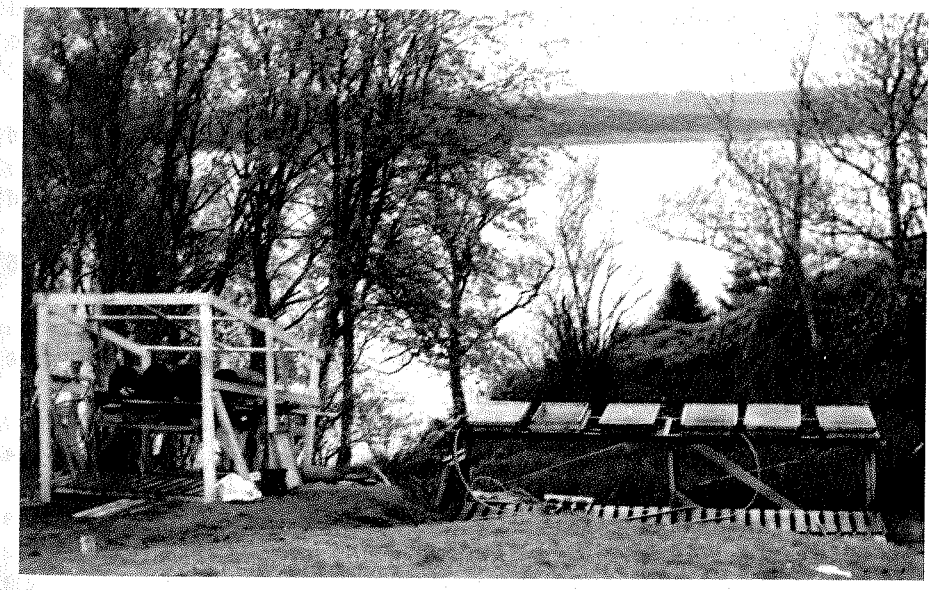

Fig. 3. The sieving system (right) and the flotation system (left). Photo David N. Simpson

Fig. 4. A closer look at the flotation system. Photo David N. Simpson

Due to the fact that the bones are burned they are very fragmented (Fig. 5). The bird and fish bones weigh on average less than 0.5 gram each. However, though the bone fragments are small and difficult to identify this material is of great value as it reflect more than 3500 years of cultural activity.

The Kotedalen site is situated on the west coast of Norway, close to the Fosnstraumen channel. A total of 30 586 fish bones and 904 bird bones were analyzed from the Mesolithic area of the site. Of those 5 549 fish and 43 bird bones were identified to species. The sediments containing the bones are radiocarbon dated to 7700 – 6800 BP, with a calibrated age of 6560-5650 BC (Hufthammer 1992:48).

From the Neolithic deposits a total of 47 062 fish bones and 15 870 bird bones were analyzed, of which 16 495 fishes and 1 180 birds were identified to species. The radiocarbon dates range from 5100-4200 BP, a calibrated age of 4040-2790 BC (Hufthammer 1992:48).

In addition 22 571 mammal bones from the Mesolithic deposits and 48 196 from the Neolithic were analyzed.

The fish resources of the nearby channel provide the Kotedalen area with a steady supply of food year round. There is reason to believe that this holds true for the nearly four thousand years that the site was in use.

In this paper I shall explain, why I do not think that the site was in permanent use throughout this entire period, focusing on when changes occurred and the nature of these changes.

In investigating changes it is useful to conduct comparative analyses. At the Kotedalen site we are lucky to have a Mesolithic area separated in time and space from a Neolithic area (Olsen 1992:39-47), which lends itself to a comparison of the two periods. The faunal picture that can be established from the Older Stone Age

(7700–6800 BP) is used to identify patterns and changes in the Younger Stone Age (5100 – 4200 BP), and vice versa.

My hypothesis is that there were no significant changes in the faunal community, from Older Stone Age (Atlantic times) to Younger Stone Age (Subboreal times). At least not changes that would have significantly influenced cultural activity at the Kotedalen site. Thus, any changes that are observed probably reflect changes in cultural activity.

First some general, and perhaps obvious statements as to how the results of a faunal analysis can aid in our understanding of prehistoric subsistence strategy and settlement patterns:

Subsistence:

One or few species in the sample: The culture which created the assemblage was probably based on a specialized strategy.

Many species: Probably a less specialized strategy.

When mammal bones are included one could also evaluate what kind of strategy, based on the type of bones found (meat or fur, or both?).

Settlement patterns:

Preservation conditions of recovered bones.

Seasonal indicators.

Species list. One or few species. Probably a short time occupation.

High diversity. Probably a longer occupation of the site.

Density of bones/frequency of bones per litre of excavated mass. In general: High density = high activity, low density = low activity.

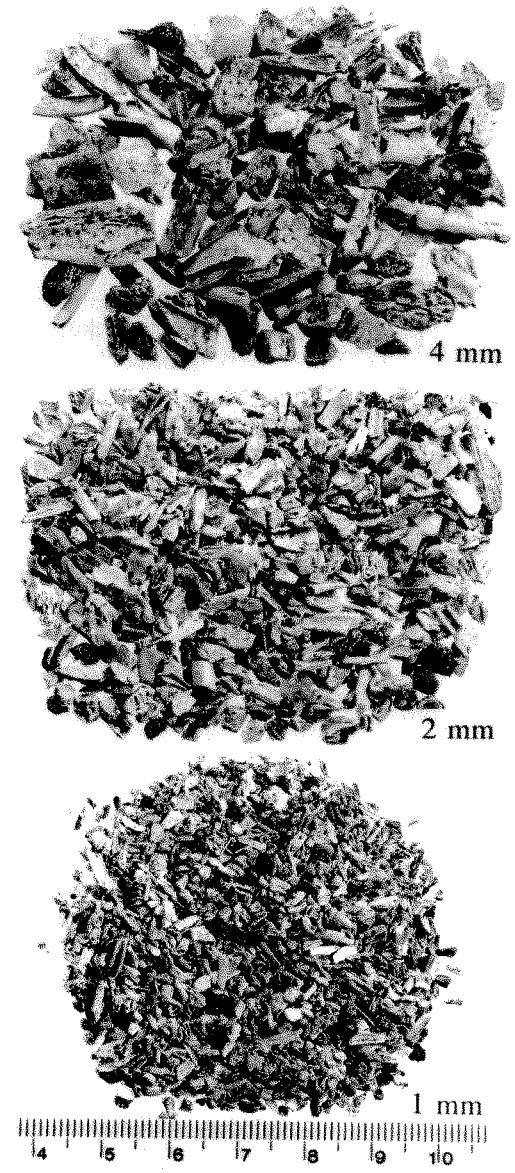

Fig. 5. Bones found in 10 litres of sediment and sieved with mesh of 4 mm, 2 mm and 1 mm respectively. Photo A.M. Olsen

There is a circular argument associated with the species list. If we have few species we both assume that we have a specialised strategy and that we also

have a short occupation. Whereas with many species we assume that we have a less specialized strategy and longer duration at the site. This is of course not a fruitful foundation for a discussion on either settlement pattern or subsistence strategy. We must look for other ways to solve these questions. Thus, in addition, seasonal indicators, both single species and groups of species are used to fill out the picture.

Primary seasonal indicators on a coastal site in southern Norway are listed below:

Indicators of summer occupation are:

Salmo salar (L.)/*Salmo trutta* (L.) salmon/trout
Anguilla anguilla (L.) eel
Scomber scombrus (L.) mackerel

Indicators of winter occupation are:

Clangula hyemalis (L.) long-tailed duck
Alle alle (L.) little auk

There are also groups of species that have greater density or were easier to catch in the Kotedalen area at certain times of the year – these are denoted as secondary seasonal indicators.

Seals in their breeding season.

Phoca vitulina (L.) common seal: early summer.
Halichoerus gryphus (Fabricius) grey seal: early winter

Auks: winter and early spring.

Discussion and conclusions

Settlement patterns

Based on the faunal list the following conclusions can be drawn.

Deposits with high frequencies of fish, especially codfishes (Gadidae) are found in the Mesolithic. In general saithe *Pollachius virens* (L.) is the most frequent species (Fig. 6). In phases 1, 2, 3 and 5 salmon or trout is identified. The number of bird bones is low, and only 43 (out of 904) are identified to the level of species, 15 of these are cormorant *Phalacrocorax carbo* (L.). In the Mesolithic deposits quite a large percent of the bones are unburned and the bone material is mainly found within a few square meters.

Based on the previous statements about seasonal indicators etc it can be concluded that during the Mesolithic, the Kotedalen site was probably a highly specialized seasonal settlement. This conclusion is based on the low frequencies of bird bones found at the site as well as the single dominant bird species. A high frequency of seals also support this conclusion.

The high percentage of unburned bones found within a small area might indicate that the so called "culture layer" in the Mesolithic, is in fact a midden. Middens can create very good preservation conditions. Such a situation would occur if corpses were being piled up in large numbers during a short period. The large amount of calcium and other agents in this midden might have led to the "survival" of more unburned bones than for example in the Neolithic cultural deposits. There are two indications that the Mesolithic part of the site was in use sometime between April and October. First, there is a low frequency of auks,

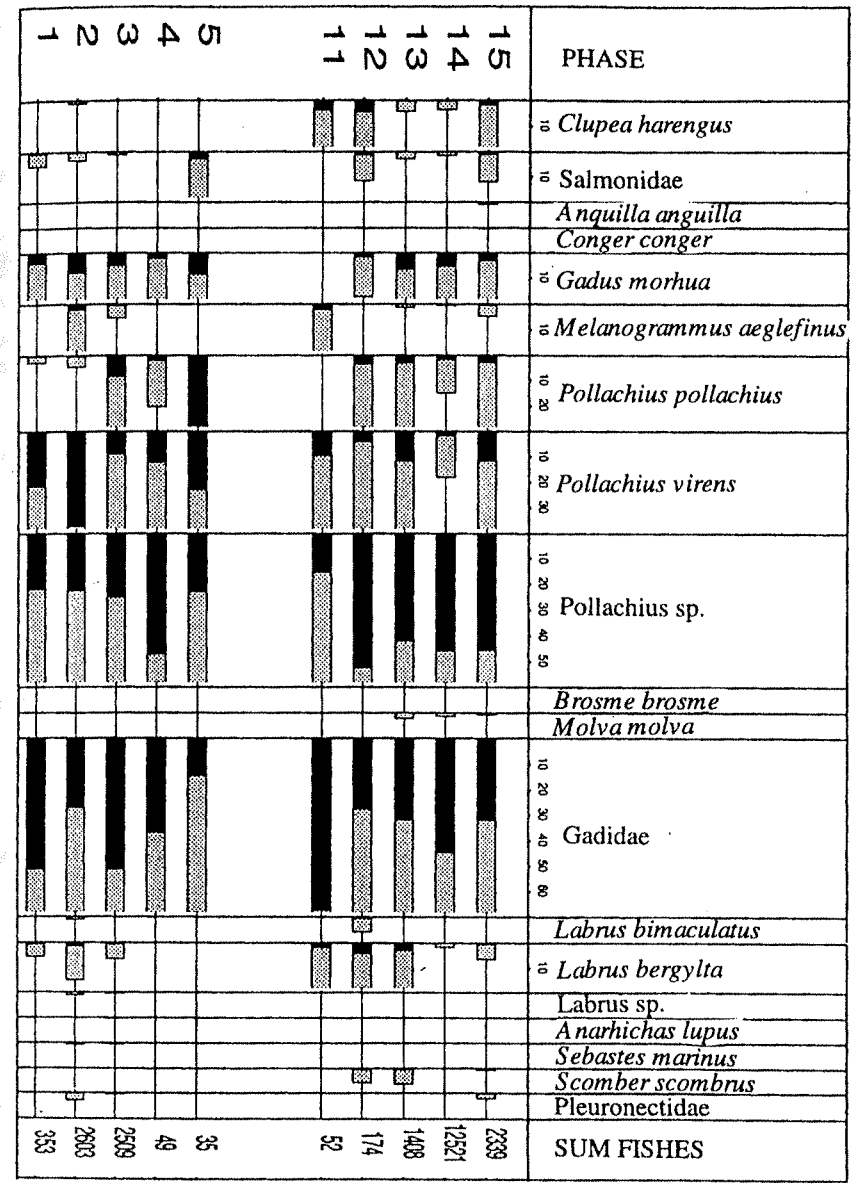

Fig. 6. Frequency of the different species of fish. Phases 1-5 are Mesolithic (7700 – 6800 BP) and phases 11-15 Neolithic (5100 – 4200 BP)

such as razorbill *Alca torda* (L.) and guillemot *Uria aalge* (Pontoppidan). These birds are usually present in high densities on the western coast of Norway in the winter and early spring. Secondly there is the presence of salmon or trout. These species are generally fished during the summer.

The bone samples found in the Neolithic deposits suggest a different picture. In these sediments, unburned bones are only found around and under the hearths.

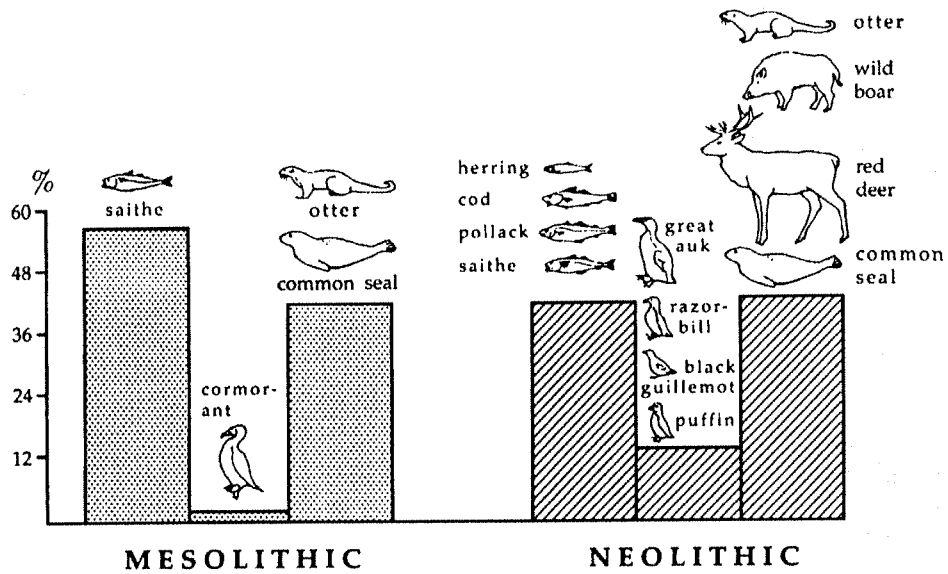

Fig. 7. A general picture of subsistence in the Mesolithic and Neolithic from Kotedalen

In the culture layers all the bones are burned. The frequency of birdbones is high, and auks are the dominant species. Primary seasonal indicators including salmon or trout, eel, mackerel, long tailed duck and little auk are found. In fact, in two hearths both the summer indicator salmon or trout and the winter indicator little auk are found.

The frequencies of seals are relatively low, except for the youngest settlement phase (15). It can also be mentioned that the percentage of meat-producing terrestrial mammals (boar *Sus scrofa* (L.), red deer *Cervus elaphus* (L.) and ungulata (species unidentifiable) is high, comprising 50% of the mammals identified to species. In the mesolithic deposits this percentage was 26%.

The faunal lists of fish and birds are more complex than in the Mesolithic. In the Neolithic 14 species of fishes are identified, compared to 12 species in the Mesolithic. A total of 18 species of birds are identified, compared to 8 species in the Mesolithic. However with regard to mammals more species are found in the Mesolithic material, 14 in the Mesolithic and 8 in the Neolithic. A very schematic graph of the differences in subsistence between the Mesolithic and the Neolithic is given in Fig. 7.

Interpretation of the Neolithic fauna list is based on the following conclusions. Unburned bones are only found in connection with hearths, not in the cultural deposits. The Neolithic culture deposits for each phase are greater in horizontal extent than in the Mesolithic. Based on these observations it can be concluded that the cultural activity in the Neolithic was probably less intensive but more continuous than in the Mesolithic. This is also indicated by the substantial presence of terrestrial mammals (ungulata).

The presence of both summer and winter indicators in two hearths indicates that the site, at least in periods during the Neolithic, was in use both in summer and winter.

Subsistence strategy

At the Kotedalen site we might have one of the few examples in Norwegian prehistory of humans hunting a species to near extinction in a given area. In the Mesolithic deposit, 15 bones of cormorant are found. It was concluded earlier that the Mesolithic site was used in spring/summer/early autumn. Thus the cormorants might have been preyed upon while breeding, or in their breeding colonies. In spite of a large bird representation in the Neolithic, only 5 bones of cormorants are identified. As far as we know there are no climatic changes at the time that might have influenced the cormorant population. So human use of the species during the Mesolithic might have exterminated a cormorant population that existed close to the Kotedalen site.

Based on topography as well as sea shore level curves it is unlikely that breeding places for auks existed close to the Kotedalen site during the Neolithic. Thus it can be concluded that these birds, which remain at sea except to breed, were probably hunted at sea. However, no indications are found as to how these birds were caught. Did they use nets, stones or arrows? It is, however, fairly certain that they had to use "boats" to get close to them. The high frequencies of fish and seal bones also support the conclusion of an extensive use of boats.

Fishes like saithe, cod *Gadus morhua* (L.) as well other species that could be found in the fish-rich Fosnstraumen indicate that the inhabitants of Kotedalen usually fished in the local channel. Fishing in open sea on deep waters occurred, but was not frequent. A small percentage of flounders etc. shows that they also had the technology to acquire bottom fish.

I am not going to evaluate capturing techniques much further, but it can be mentioned that a collection of equal sized herring *Clupea harengus* (L.) was found in one of the Neolithic hearths (NS 39, phase 15). This indicates that nets were used in addition to fish hooks, the latter being one of the most frequent artefacts found at the site (Olsen 1992).

The frequencies of terrestrial and marine mammals in phases 11, 12, 13, dated to 5320 – 4780 BP, are similar. But phases 14 and especially 15 are different. Nineteen dates exist from phases 14 and 15. Except for two, the dates of these sediments range between 4780 – 4220 BP. The frequency of seal is statistically significantly different between phases 12/13 and 15 (G=30.4, 3 degrees of freedom) (Sokal & Rohlf 1980). The frequency of seal increases in phase 14 (ca 4650 BP) and is especially high in phase 15 (4400-4200 BP).

It is not known if this increase in seal bones is of any cultural significance. It is, however, notable that it coincides with the introduction of cereals and is slightly later than the earliest indicators of grazing activity of domestic animals. Thus, one possible explanation could be that the increase in seal bones indicates that in the two youngest Neolithic phases Kotedalen changed from being a year round site to a seasonal or temporary site, as it was in the Mesolithic. Whether this is true or not can not be confirmed. It is, however, a fact that the increase in seal bones indicates that the subsistence strategy changed also in Late Neolithic. It should be mentioned that an increase in the frequency of seal bones is also found on other Neolithic sites in Norway. However, these are so far merely suggestions and it is still unclear whether this has anything to do with the introduction of cereals or animal husbandry.

In many zooarchaeological investigations from prehistoric sites we find conclusions about the amount of fish, bird and mammal meat in the diet (e.g. Smith 1975). These conclusions are often based on the use of elaborate statistical methods as for instance the estimation of minimum numbers of individuals (MNI) (e.g. Clason 1972, Casteel 1977, Lie 1980, Klein & Cruz-Uribe 1984) or measures of food value e.g. Modified General Utility Index (MGUI) (Binford 1978:74). The use of MNI is elegantly dealt with by for example A. Turner (1980) in the article titled "Minimum number estimation offers minimal insight in faunal analysis".

Issues such as preservation make the interpretation of faunal data from archaeological sites difficult enough to begin with. Any statistical manipulation of this kind only complicates the picture further. Does it make any sense for instance, to extrapolate from MNI, or any other method for that matter, that during 1000 years of settlement at least 1000 fishes were consumed compared to 200 for the next 1000 years? Is it of interest to know that in the first example that an average one fish was consumed every year compared to 0.2 fish in the last example?

In most cases it seems to be better to use "common sense" in evaluating the significance of the different meat producing vertebrates. In that way we do not pretend that we are able to substantiate our estimates by statistics.

The very fragmented bone samples from Kotedalen are encumbered by many unsolved methodological questions. For instance the difference between the bones that were originally deposited at the site and those that were recovered, and different taphonomic factors affecting fish bones and mammal bones. Thus, it is impossible and meaningless to make estimations of the amount of fish meat in the diet, compared to that of mammal and bird.

In material sieved with 2 mm mesh very large amounts of fish bones are found (Fig. 6), both from the culture layers and the features (hearths). Based on these results it is fairly safe to conclude that fish was a very important economic factor. It it not as obvious, but more a subjective personal view, that fish was always the most important food at this site.

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Stuburinės formos reikšmė akmens amžiuje Vakarų Norvegijoje (remiantis Kotedaleno medžiaga)

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Santrauka

Dabar analizuojama apie 165 tūkst. kaulų, rastų akmens amžiaus gyvenvietėje Vakarų Norvegijoje. Nuogulų, kuriose buvo rasti kaulai, amžius – 7700-6800 ir 5100-4200 m. pr. Kr. Pagrindinis dėmesys skiriamas žuvų bei paukščių kaulams. Dauguma kaulų priklauso smulkioms rūšims. Jie buvo sudeginti, todėl randami tik jų fragmentai. Kadangi tokių mažų fragmentų, labai daug, teko panaudoti kruopštaus surinkimo būdus, t.y. išplovimą ir sijojimą per 4,2 ir 1 mm sietus.

Remiantis osteologinės analizės rezultatais, pateikiamas išsimaitinimo bei gyvenviečių tipo modelis.

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